DEVELOPING DECENTRALISED ENERGY SYSTEMS AT SCALE – CORPORATE AND COMMERCIAL STRUCTURES FOR DELIVERING HEAT

BACKGROUND

What do we mean by a heat network?

1. A heat network consists of more than the pipes that carry the heat. It comprises both the heat sources and the sources of heat demand (often called 'heat loads'). Although the heat generation plant, the individual heat loads and the heat network itself may be owned by different parties (see paragraphs 17 and 21 below) the three elements are dependent upon each other – the heat network is redundant without access to heat generation sources and connections to sources of heat demand. Similarly, the heat generating plant is redundant unless connected to a means of conveying the heat to where it can be used. So in planning and realising the development of heat networks, all three elements are involved, even though during the life of the network, the sources of heat and heat loads may change. For example, heat sources may over time change from gas fired combined heat and power systems to zero carbon sources of heat, such as biomass, energy from waste or recovered waste heat. As the network expands, the network may be connected to more than one heat source and there will be more heat loads, although individual ones may change over time as buildings change use or are re-developed.

Why is a contract delivery structure and an SPV needed?

2. For larger heat network schemes to develop that are not owned, financed and managed by the same party, the scheme has to be 'commercialised' – that is to say business relationships have to be formed and made legally binding to introduce investors and finance for the project, enable the installation work to be done and the risks associated with the establishment of the project and its subsequent management and operation to be arranged between the parties. This process will usually follow the point at which the technical and economic feasibility of the project has been established and a business case has been developed to show how the project can be developed, financed and operated.

3. In the case of other than the most simple projects, the arrangements for their commercialisation will involve a dedicated delivery vehicle (often known as a 'special delivery vehicle' (SPV)) to manage the construction and operation of the project and regulate the interests of the parties involved and a contract structure to secure the construction, operation and financing of the project.

4. In their simplest form heat network developments do not require any specialised delivery vehicle and no or very limited contract arrangements, for example a heat network installed in a social housing development by a local authority that owns it. The construction of the network may be integral with the housing development. It may be owned by the local authority, the heat source located on the same premises and in the same ownership and the occupiers of the housing all committed to taking their heat from the system. Under these circumstances there is barely any

commercial structure called for which is separate from the construction and use of the building itself.

5. That position changes however, where the heat networks involve more complex arrangements for the delivery of heat. As larger area wide heat network developments expand and become more common, understanding the corporate and contract vehicles needed to enable the interested parties to deliver and operate the project successfully is going to be increasingly important to delivery of their potential. There are a growing number of examples of that occurring in the UK, in England and Wales assisted by support from the Department of Energy and Climate Change Heat Network Delivery Unit.

Policy, not market driven

6. Currently, the development of heat networks is driven almost entirely by policy, both at central and local government level, rather than by demand in a market place. There are a number of reasons for this.

7. First, although in urban areas of dense heat demand heat networks are often the economic option for the future with the prospect of rising energy prices and the added cost of carbon mitigation measures, heat networks are a new form of heat delivery with which most consumers are unfamiliar. Second, heat networks at scale involve a collection of separate heat loads, so the demand for heat delivered through networks has to be co-ordinated and where the network extends beyond a single site, investment in it is not normally in response to demand from a single party. Third, although as said, there is the growing prospect of heat networks in many instances being the economic option, there are barriers to their development, both on the supply and demand side which government (and in particular local authorities) must have a central role in removing. The result is a policy focus initially in the form of master planning for their potential within an area. That is usually sponsored by a local authority.

The role of local authorities

8. The role of local authorities is central to the development of heat networks at scale. Through their own property holdings and their ability to ‘broker’ the delivery of heat loads by developers and businesses, local authorities can play an important part in collecting the sources of heat demand needed. Their planning powers and their role in many instances as highways authorities facilitates heat network development, in addition to their access to cheaper capital available to public sector sources. In addition, some local authorities will see the development of heat networks as part of their carbon mitigation agenda and possibly also as supporting their agenda for relieving fuel poverty, thus providing direct policy incentives for promoting heat networks in their areas.

The challenge

9. The challenge is to bridge the gap between the current reality and the potential for the development of heat networks. Bridging the gap involves their widespread growth at scale. Such is the size of the task that simply building more of the same and proliferating more, mainly small, isolated networks is unlikely to make the impact needed. So an important preliminary question is to ask what types and configurations of district heating scheme are likely to have the potential to develop and grow so as to deliver the scale involved. The technical configuration of the networks, as

derived from the master planning process, is fundamental to that and the commercial and corporate structures are substantially driven by it.

IDENTIFYING THE PROJECTS – ENERGY MASTER PLANNING

10. To enable decentralised energy networks to grow at scale, the challenge is to identify heat networks and energy sources that –

- have the potential to supply market competitive, low carbon energy to new developments and existing properties;
- are planned and designed where possible to be capable of extension or connection to other systems and to contribute to the future development of a wider network; and
- can start small, without exposure to large scale investment and expand according to a plan.

A key tool for identifying networks with this potential is energy master planning. The District Heating Manual for London usefully explains the function of energy master planning –

'*The energy master planning process has been developed to identify opportunities for new networks in an area and to set out a long term vision for district heating development.*

The steps in the process are:

- *mapping energy demands in the area, considering ownership and control of these demands;*
- *mapping energy supplies in the area, including local heat and fuel sources;*
- *mapping existing and planned district heating schemes;*
- *mapping new development in the area;*
- *identifying suitable locations for energy centre(s); and*
- *identifying routes for potential district heating networks. '*

The Manual continues -

Energy master plans should outline existing, planned and proposed developments that may be of potential interest for future interconnection and therefore should play a key role in the considerations of a development's network design, such as placement of energy centres and the capacity of pipes to interconnect with other heat loads.'

(Chapter 2)

It should be added that the networks should from the consumer's perspective be cost competitive relative to the alternatives, (assuming an energy cost for example of 'business as usual' less 10 per cent) and also where appropriate, operate at temperatures consistent with the use of low grade waste heat.

11. Following the production of an energy master plan, the practicality and economics of an individual project or projects should be sufficiently identifiable to enable feasibility studies to be done to assess them in more detail. The energy master plan therefore forms the back bone to the planning of district heating at scale in a location.

12. There is a range of existing business models for heat network development (although few of them are yet available as 'off the shelf' industry tools), for example the installation and operation of networks in new commercial or domestic developments, retrofitting to a few large single heat loads, such as hospitals or universities and models associated particularly with heat supply to the housing stock of social housing authorities. London's vision of heat network growth does not marginalise or diminish the value of these existing business models – they are essential building blocks for growth, as illustrated below in both of the London projects taken as models in this chapter. However, if large scale growth is to be achieved, these existing business models need to fit within and be adapted to a wider strategic framework, borne out of the master planning process. That means new ownership and governance structures, to ensure that area wide potential for growth can be realised. It is the question of what those structures should look like that is at the core of this chapter.

13. Outputs from the energy master planning may also be included in spatial development planning documents.

DELIVERING SCALE – INTERCONNECTION AND THE TRANSLATION FROM SMALL TO LARGE

From small to large - '*Powering ahead – delivering low carbon energy for London'*

14. In October 2009 the Mayor of London, London First and London Councils published a study – '*Powering ahead – Delivering low carbon energy for London '.*The underlying theme of the study is the correlation between scale, density of heat demand and viability.

Common commercial models of schemes in London

15. The study saw decentralised energy schemes as typically falling within one of three types –

a) Single site schemes. (Type 1). These schemes have little or no district heating network, energy production being based upon small or medium combined heat and power units, typically gas fired engines. These schemes would typically supply a single type of consumer (mostly domestic) or a small amount of mixed use. They serve up to around 3000 residential units or equivalent load. Their commercial viability is typically underpinned by minimal district heating infrastructure and the ability to offset the import of electricity with their own onsite production.

In the past, Type 1 schemes have primarily been developed by the public sector, but are increasingly being incorporated in planning applications for major developments. Construction costs of single site schemes are typically up to £10 million. An example of a Type 1 scheme recently under development in London is the Cranston Estate regeneration in the London Borough of Hackney. This scheme connects over 500 residential units to a natural gas CHP engine, with a funding cost of approximately £6.5 million.

b) Multi-site, mixed use schemes (Type 2). These schemes are significantly larger than single site schemes and serve more than one site and user type. Such schemes may serve 3,000 to 20,000 residential units or equivalent load, along with a range of commercial, private and public sector consumers. Electricity generating capacity may be between 3MWe and 40MWe, based on a range of combined heat and power technologies. An example is the Olympic Site. The schemes are typically centred on a large regeneration site. Other examples of Type 2 schemes in London are the Kings Cross Central project and the Pimlico District Heating Undertaking.

c) Area wide transmission projects (Type 3). These larger schemes consist of extensive heat pipe networks, connecting multiple heat producers, the heat sources typically having differing characteristics such as energy from waste schemes, gas fired CHP and heat from power stations. These schemes may serve more than 100,000 units and a large range of mixed public and private commercial facilities.

Capital costs for the pipework and associated plant could exceed £100 million with paybacks in excess of 10 to 15 years, but with the potential for steady cash flow and utility type yields.

16. These three types of scheme are not isolated and potentially are all part of a continuous development. The Type 2 multi-site mixed use schemes can evolve through the connection of a number of existing single site Type 1 schemes as, for reasons already discussed, this can improve the economics and growth prospects of each participating scheme. The study observes that Type 2 projects would benefit from the operational and generating efficiencies associated with scale and diversity of demand, as well as lower unit fuel costs from volume purchasing.

17. The same potential economic advantages flow over between Type 2 and Type 3 schemes. Over time, large scale networks can develop by the interconnection of general multi-site schemes and the consolidation of energy production into fewer, larger and more efficient plants. Networks can grow and gain profitability through the interconnection of Type 1 and Type 2 schemes, ultimately enabling the networks to translate themselves into area wide systems. However, the potential for inter-linkage and growth influences both the contact structure used for the development and operation of schemes and the structure of their delivery vehicles. This is discussed below, in the context of contract and special purpose vehicle structures (see paragraphs 20-25 below).

Unbundling the businesses

18. In most projects, the distribution and sale of the heat (either directly to consumers or in bulk to a management company or housing association selling to consumers) is part of the same business carried on by the distribution network owner or operator. Often the heat source is in the same ownership also, the network business in effect comprising three different operations, namely heat generation (possibly with electricity) heat distribution and heat supply. These are however separate and distinct business operations, carrying different risks and returns. As a network grows, it may be fed with heat from a range of different heat sources on sites owned by different parties. In the London prospectus '*Powering ahead*' referred to above, the unbundling of networks is envisaged as they grow in size and interconnect. For example, in fully developed form, a Type 3 network may involve separate vehicles for heat generation, heat transmission, heat supply and possibly heat distribution, the heat being provided to smaller scale local networks on individual sites through interconnection.

19. This implies a new level of business modelling for heat networks, of which there are few if any current examples in the UK. Such inter-related networks will often be in separate ownership and control. They will be established at different times within their own business models and business and social objectives. However, these inter-related networks have to be capable, at least in relation to their common interests, to operate as a single operation but in separate ownership. They must be a single operation, to optimise the economies of scale and risk management achievable and to realise the potential for future growth available through the heat transmission infrastructure installed to link them.

The implications for constructing efficient commercial structures to capture these requirements are examined below.

THE CONTRACT AND DELIVERY STRUCTURES

In deciding upon the appropriate structures for the contract mechanisms and delivery vehicle, (SPV) the first step is to identify the factors which will be the major considerations in shaping their design.

Development requirements shaping the design of the contract delivery structure

20. All or some of the following will shape the contract structure required to deliver them and are characteristic of the development of area wide heat networks in most circumstances –

- infrastructure may be installed at the outset which is 'future proofing' capacity planned for use following the initial network build out, thus ensuring that the network is capable of future extension in line with a known future strategy;
- connection of the area wide network to satellite networks, whether existing or developed as part of the strategy, involving the connection issues and commercial relationships;
- investment in heat transmission infrastructure to link networks, the transmission infrastructure carrying risk of heat loads not materialising when planned or at all or disappearing, particularly if relying substantially on retrofitted connections (see below);
- in the case of many planned area wide networks, a significant proportion (if not the main proportion) of the heat load being derived from retrofitted connections to existing premises. Retrofitting connections carries different risks, because occupiers of existing buildings tend to retain a choice between buying heat from a network or using their existing source of heat supply;
- a requirement in the future, if not initially, for arrangements between the owners of the assets and operators of the network to accommodate 'unbundling'. (see paragraph 22 below);

- the size of capital investment involved in building out the area wide network and the demands it places on the introduction of commercial debt or equity;
- greater need for access to installation space under highways, space occupied by other public utilities, including railways and canals and private land, on account of the reach of the transmission network between sites;
- ensuring a transition to stable and competitive long term heat sources that will reflect expectations of declining carbon content in the heat. It will be expected that the heat transmission assets have a long life (say 50 years and may be amortised over around half that period).

21. There are some established contract structures for the development of heat networks at smaller scale (typically 'Type 1' and 'Type 2' schemes described above) and there are a number of publications [1]containing forms of contract and structures for delivery vehicles. These are important both to support the replication of smaller projects and also as building blocks for large scale area wide projects. However, because of the different characteristics of these smaller projects, their development contracts and delivery vehicle structures will need to be adapted or fit within a broader framework, since they tend to reflect the commercial arrangements associated with networks more typical of 'satellite' networks.

Set out in Appendix 1.1 is a matrix of principal risks applicable to the development of area wide heat network schemes. In Appendix 1.2 is an illustrative contract structure which reflects the delivery considerations for such schemes, in particular the relationship between the owner of the heat network transmission system and the network clusters or satellites to which it is connected and from which it may receive heat, as well as delivering it.

Commercial and policy factors shaping the structure of the delivery vehicle (SPV)

22. The commercial and policy interests referred to below shape the structure of the delivery vehicle needed to manage the project and the interests of those involved. As in the case of the contract delivery structure referred to above, these influences are representative of those which apply to the development of area wide heat networks generally -

a) Local authority participation is an important ingredient in the development of most larger scale heat networks for a number of reasons, most notably because of the following –
   - securing and retaining heat loads. Local authority housing and other premises can provide the basis for initial 'satellite' networks and for securing initial heat loads to underwrite heat transmission infrastructure.

[1] An example is the London Energy Partnership – Making ESCOs Work: Guidance and Advice on Setting Up & Delivering an ESCO. The UK District Energy Association is also believed to be preparing a guide which may include suggested contract structures.

They are also well placed to bring interested parties together to offer heat loads;

- local authority planning powers can facilitate the development of the networks through consenting to them expeditiously and with realistic conditions and by setting planning conditions which require connection to an exisiting or planned network;
- gaining highways consents will become a more heightened issue with larger scale networks, as a result of substantial lengths of transmission network being situated under the highways rather than, for example, confined to private land on development sites;
- some local authorities may have an environmental or social agenda, connected with targets for carbon reduction in their area and reduction of fuel poverty;
- local authorities have access to cheap capital (available at public sector rates) that may be important particularly at the earlier stages of network development before the stability of heat loads and volume of income streams can attract commercial sources of finance (see impact of risks and returns on sources of finance in paragraph 30 below – **Delivering a Bankable Internal Rate of Return – Bridging the Gap**);
- financial and political accountability and the deployment of the required capacity and political will within local authorities means that they need to create effective internal governance structures, to manage their interest in the delivery vehicle;
- larger heat network systems may cross local authority boundaries, involving synchronising all these activities between different local authorities;
- ensuring long term network objectives are realised, where the private sector may be less ambitious than the local authority.

b) The financing mechanisms are likely to need to accommodate the requirements of external finance. Although perhaps not initially when funding from its public sector promoters may be the mainstay of the development of a heat network, networks developed strategically are likely to involve sums in capital investment going beyond that which the promoters of the scheme are willing or able to accept on their own balance sheets. That means the providers of such finance will need to see a structure for the delivery vehicle capable of securing the cash flows of the scheme to finance their debt; and also management structures which provide for efficient operational arrangements and the necessary degree of accountability and control to the providers of external debt and equity. See paragraphs 26 and following below (delivering a bankable internal rate of return – bridging the gap).

c) The ‘unbundling’ of networks is likely to be a further influence in the development of delivery vehicles, in the medium to long term. London’s decentralised energy prospectus ‘Powering ahead’ (see paragraphs 14 to 19 above) refers to project structures which as the projects expand, unbundle themselves into their underlying constituent businesses. This may include a heat generation company or companies, possibly in different ownership from the network itself. That is already true for example, in the case of many networks served by energy from waste plants owned by local waste authorities and waste heat taken from industrial plants. The businesses and risks associated with heat transmission or distribution or both may be separated from that of heat supply. The result is the need for a structure of control which recognises the role of these parties as contractors, but at the same time accommodates their common reliance on the network’s operation and economics.

d) There is a choice of legal entity.The term ESCO (energy services company) is often used for commercial entities or companies delivering heat networks. However, the acronym is used in so many contexts as to be of limited use, if not misleading. It need not be a company formed and incorporated under the Companies Acts. It could for example be a partnership, trust or provident society. Any of these differing forms can be found although they are generally more suitable for smaller projects which are for example, community led and owned. In practice for the larger schemes described in this chapter the usual vehicle is a company limited by shares or in some instances by guarantee.

23. All four of these elements are going to shape the structure of the delivery vehicle. It should be noted that the form and structure both of the contract arrangements and the delivery vehicle are driven by the commercial, financial and policy requirements of these schemes, including in particular accommodating the requirements of the parties responsible for delivery, the distribution of risk and financial arrangements. For example, the contract structure for procuring delivery and operation of the project will be influenced, amongst other matters, by the nature of the planned heat loads and heat sources. If the heat loads are mainly ‘captive’ in the hands of one or more property developers or a local authority, more of the risk associated with their acquisition and retention of heat loads will stay with those parties, on the basis that they are best able to manage it. To the extent that the heat loads are not, the risk distribution is likely to be different and moderated more by the

delivery strategy for the network as a whole. In the case of heat sources, if the heat source is a well established technology (such as gas fired combined heat and power) risks associated with its operation and maintenance may well be accepted by the heat provider. If the heat is supplied using a new technology without a substantial track record, the heat provider may decline to accept any or much of the risk of its installation and operation giving rise to large scale loss to the network. In such a case, the risk may be shared with the network owners or heat supplers or both, to the extent the technology gives rise to a level of financial risk to the network which the provider and installer of the technology is unable to accept. Alternatively the heat network owner or heat supplier or their financiers may not accept significant reliance on higher risk heat generation technologies.

24. A decision to set up a special purpose vehicle or establish an energy services company is therefore not in itself a solution to the management of any of the risks and issues described above or others, because the purpose and structure of that SPV or ESCO will be driven by the decisions made about those management questions.

25. Set out in Appendix 2.1 is a summary in matrix form of principal issues which will drive the structure of the delivery vehicle. Appendix 2.2 contains in diagram form a corporate structure within which the commercial and policy interests involved in the development of the area wide heat network might be managed. Individual projects will not share a uniform corporate structure, but they will share important common features which are illustrated in this Appendix.

DELIVERING A BANKABLE INTERNAL RATE OF RETURN – BRIDGING THE GAP

Internal Rate of Return

26. A common method of measuring the potential of a project to attract finance, is the internal rate of return (IRR). This is used to measure the profit or return that can be made from an investment. IRR calculations are commonly used to evaluate the desirability of an investment or project. The higher a project's IRR, the greater the return or profit the project may offer. A project may be considered an acceptable investment if its IRR is greater than an established minimum acceptable rate set by the institution making it.

27. However, a projects's IRR is not the only factor that investors take into account in determining the value or desirability of an investment. Another major factor is risk. The risk may lie, for example, in the volume and type of heat loads that are needed to provide the planned cash flow for a project, the continued availability of heat at an economic price and uncertainties that may arise in the costing of the construction of the network itself, including construction delays. All of these, unless reduced to acceptable levels and adequately managed, may create a barrier to investors, even if the IRR itself passes their test.

The challenge for heat network development

28. Both gaining an adequate IRR and keeping risk levels at an acceptable level are challenges for heat network projects, notably in their earlier years of development. Many networks with potential will be identified from a master planning process and subsequent technical and economic assessment which has indicated that, as they are developed to their full potential –

- the heat loads increase in number and diversity;
- long term heat sources are established, of which there may be several, spreading heat cost risks in some cases through gaining diversity of heat source;
- economies of scale are achieved, through the assets being used more intensively.

These factors and others mean that as an area wide heat network develops, its business model may change, with the potential for progressive improvements in IRR and progressive reduction of risk. A private sector investor or provider of loan capital may be looking for a project that has an IRR of at least 10 -12 per cent to ensure a return on capital or repayment of loans within an acceptable period. Since an IRR at that level is not regarded as good by most sources of external funding, the investor or lender may also be expecting a low level of risk, perhaps akin to that normally associated with utility investments such as gas or electricity distribution undertakings. Many area wide networks may expect to attain that level of bankability in time through the advantages of scale, but how do they get there?

Bridging the gap

29. The principal challenge in funding heat network development is therefore bridging the gap between the earlier stages of network development which may have lower rates of return and higher levels of risk and the middle and later stages when the network attains scale and diversity of heat load and with it, the features of a stable, profitable utility business. If, as in the case of other utility infrastructure businesses, the risks are low and the revenues and returns assured by a stable market for the heat, then heat networks have the potential to take on the features of investments attractive to institutions such as pension funds looking for stability rather than higher returns. One key to bridging that gap is to plan the growth of a heat network incrementally. Another is to plan for re-financing. As heat networks develop, they will require different sources of funding, at the outset relatively small levels of funding but available at lower rates and tolerant of higher risk; at later stages of development larger scale funding, at higher rates and less tolerant of risk. The former is hardly a commercial proposition, the latter is.

Funding sources

30. Attached in Appendix 3 are examples of decentralised energy funding options, starting with public sector sources and progressing to private sector debt and equity funding. Some of the examples are grant funding or ‘free’, such as revenue from Renewables Obligation

Certificates, Feed-in Tariffs and the Renewable Heat Incentive or proposed funding from 'Allowable Solutions'. Others are public sector debt or equity that may be available in acceptance of low initial returns and made available as part of a local authority's policy package for the development of a heat network in its area, perhaps fully or partially funded through borrowing from the Public Works Loan Board. It may be expected that developing area wide networks will tend to be reliant substantially upon such public sector sources of funding in the earlier years. Loans and equity investment provided during the earlier stages of network development are sometimes referred to as 'patient' equity or debt – a return is obtainable in the future, but when remains uncertain.

Designing the delivery vehicle to accommodate the funding mechanisms

31. As already indicated above (paragraph 22), the contract and corporate structures for delivering area wide heat network projects have to be designed around not only the ambitions of their promoters (including and in particular local authority promoters) but also the requirements of the providers of finance to secure their investment or lending. What those requirements are will change as the network develops and the delivery vehicle for the project must be flexible enough to accommodate that.

APPENDIX 1.1 DEVELOPMENT REQUIREMENTS – MATRIX OF PRINCIPAL OBJECTIVES AND RISKS

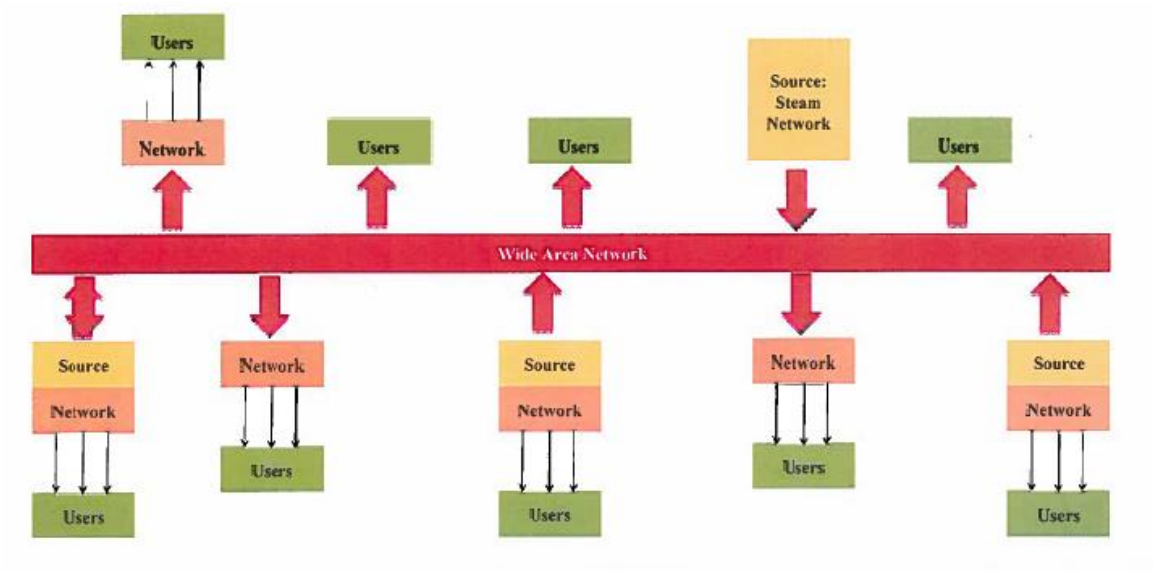
Objectives /requirements	Risks	Solutions / options
Heat sources – • availability long term • low / zero carbon • cost of heat compatible with market	• single sources of heat disappear • no access to low / zero carbon heat • alternative sources of heat may not track gas prices	• add heat sources to deliver security of supply • new heat sources include low/zero carbon fuels /waste heat • diversity of heat supply
Heat loads – • critical mass of heat load secured • risk of loss of heat load within acceptable margin	• owners of heat loads may lack incentive to commit long term • over long pay back period of heat networks future of heat loads unpredictable	• identify demand clusters or satellites with diverse heat loads • secure anchor loads / interconnections to expand range of heat loads
Installation of heat networks – • adequate access to private land and highways • supply chain costs economic	• access denied or delayed • construction /supply chain costs over budget	• secure access in contract terms with owners of land and premises servied by network / early arrangements with highways authority • pass construction cost risks to contractors best able to take it
Interconnection with other networks – • technical compatibility of networks • certainty of heat loads and heat sources available from connected networks • consumers on connected network are metered • heat supply agreements are assignable • connected network's heat source is capable of required control and efficiency	• different temperatures / physical compatibility of connection interfaces • small network may be open to loss through redevelopment of site / lack of income to finance cyclical refurbishment • consumers are not metered and do not pay for heat actually used • no clear option for connecting network to supply or permit supply by others than the existing satellite network owner /operator • the connected network operates inefficiently and cannot synchronise heat production / heat supply with larger network requirements	• early master planning to identify /secure compatibility of networks • retain and grow connections to satellite networks and multiple heat loads • retain consumer interface with existing network operator and supply operator bulk • secure option as a condition of interconnection with the network, retaining if need be the existing operator as the consumer interface as above • a management structure put in place for all the interconnected networks so that they are managed as a single operation
Electricity – prevailing market rates expected to be obtainable from sales of electricity from CHP units operated to supply heat.	The small packets of power exportable by the CHP scheme do not attract competitive offers from the market	Explore potential of 'licence lite'
Government financial support for other heat and local electricity production technologies do not create a competitive disadvantage	RHI / FiTs / ROCs available for other forms of heat and electricity production without the infrastructure costs of pipe systems make the heat provision uneconomic relative to supported competitors	Influence government policy and investigate sources of zero carbon heat which attract support

Appendix 1.2 – CONTRACT STRUCTURES

As described in paragraph 22 above, there are some commonly used types of contact structures for the development of heat networks at a smaller scale which can form important building blocks for larger scale area wide projects. The following is a representation of how such structures might inter-relate in the development of larger networks

Description	Characteristics	Contracts used
Single site schemes	An energy services company (ESCO) undertakes to supply heat to customers and for that purpose to build and operate a DH system. This is set up with a defined set of consumer buildings within a single site (either new development or exisiting)	• Master and Connection Agreement between ESCO and developer/landowner/landlord • Heat supply contracts with occupiers • Service level agreement to enforce standards • Property leases to grant ESCO asset ownership subject to terms
Multi – site schemes (mixed use)	Developers of a number (usually adjacent) sites contract with an ESCO to build and operate a DH network to serve the new developments and possibly also retrofitting some existing buildings with heat connections	• Design and Build Contract • Connection Agreements to premises • Operation and Maintenance Contract (possibly with same contractor) • Heat Supply Agreements between O&M ESCO and heat consumers • Service Level Agreement between O&M ESCO and developer • Property leases granted (possibly for a fixed conecession period to D&B contractor if also operating the network
Area wide network	A special purpose vehicle(SPV) promotes and secures the construction of an area wide heat transmission system, built out over time as heat loads justify it, extending through connecting with existing smaller scale networks (such as the networks described above), new developments and retrofitting connections to exisiting buildings, either operating the network itself or subcontracting to an ESCO	• SPV enters into design build and operate contract • ESCO/contractor design and build only • SPV or appointed ESCO operates the network and manages connections with other networks • SPV secures additional heat generation connections • SPV offers use of systems contracts to heat generators / suppliers to deliver heat to individual customers

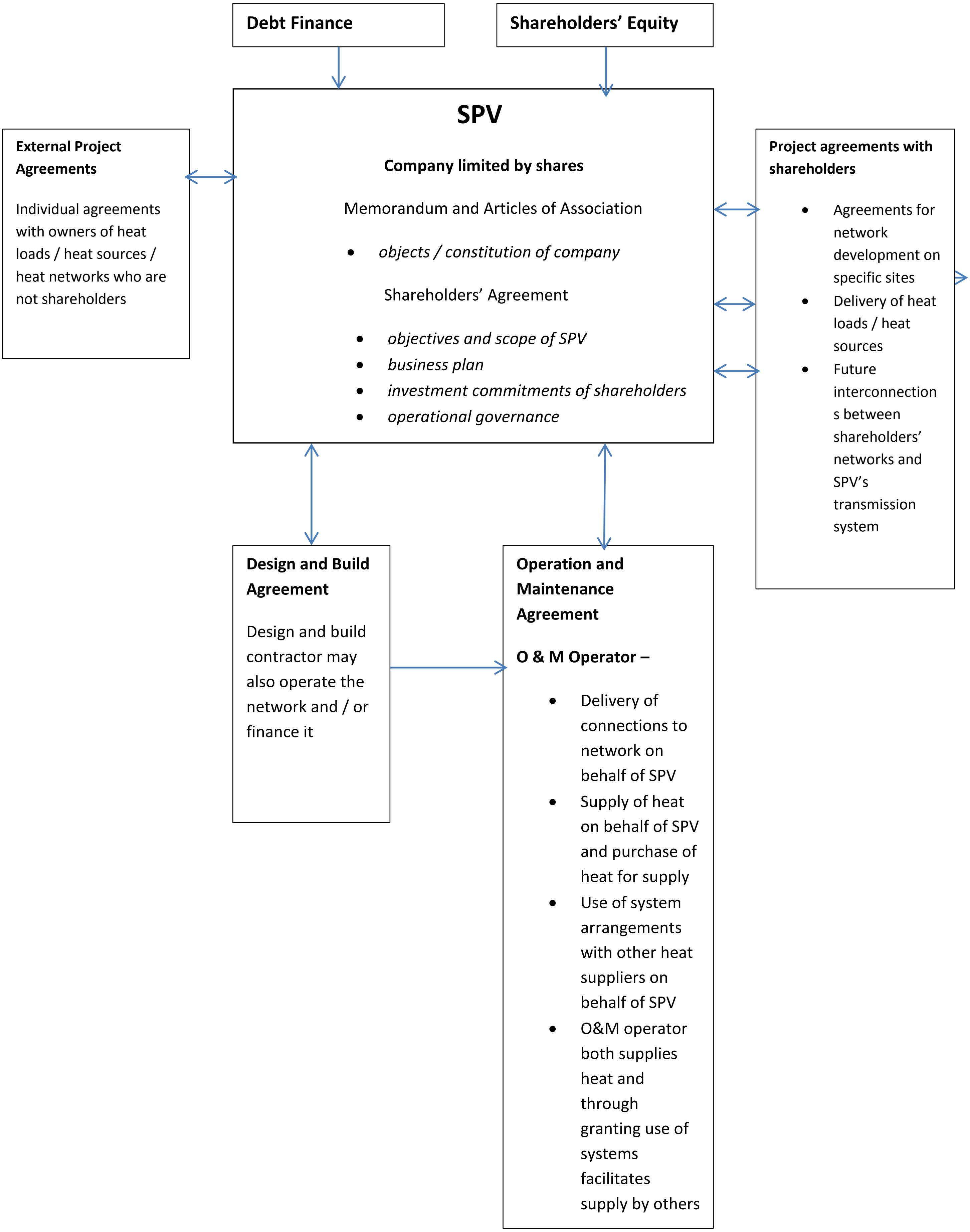
Set out below in diagram form is how the operation of an area wide network might work, such as for networks described as ‘Type 3’ in paragraph 15 above–



APPENDIX 2.1 DELIVERY VEHICLES (SPVs) – MATRIX OF PRINCIPAL OBJECTIVES AND RISKS

Objectives / requirements	Risks	Solutions / options
Securing progressive growth of area wide network	Commercial decision making in the SPV is too short term and does not take account of long term strategic objective	Secure acceptance by the SPV of a long term business plan with milestones / thresholds for future investment stages
Delivery of competitive service provision and price despite lack of consumer choice	Network operator offers terms of heat supply that compare unfavourably to options available outside the network	Secure price transparency and adherence to available industry /consumer codes
Rights of access by heat suppliers who are not owners /managers of the network to customers connected to it	Provision of heat by multiple heat providers connected to network is discouraged through lack of access to consumers and their premises	Connection of exisiting and new satellite systems made conditional upon competing suppliers having access to heat consumers, subject to arrangements to support stranded assets
The SPV has efficient systems of management and control	The split interests of different shareholders in the network (notably between local authority involvement as sponsors/ facilitators / direction givers for future development and private sector investors) creates ineffective management	Shareholders' Agreeement must separate commercial from political / social objectives and apportion costs to the owners of those objectives
SPV has a long term business plan adopted by shareholders sufficient to satisfy external financiers which is not abnegated by conflicting policy or political ambitions of public sector owners /controllers	Conflicting policy or political ambitions compromise agreement to or execution of business plans to the extent of making them unbankable	Separate commercial from political and social obectives and cost separately as above
Long term agreements are reached between local authority interests and investors to ensure that revenue shortfall caused by fuel poverty programmes is made good	Revenues are compromised by heat prices charged and revenue earned being depressed by the fuel poverty objectives of individual local authorities	Fuel poverty objectives should be separately costed as above
Long term concession to a private sector party to whom the future development of the network is outsourced does not compromise SPV's control over network growth and delivery of business plan	The contacted outsourcing partner / energy company will not commit to a pre-planned chain of projects and investment.	Subcontracting to ESCO or other delivery contractor delivery of network business plan must not commit SPV to retaining that delivery contractor outside activiites for which the delivery contractor will contract to deliver from the outset.
Connections of satellite networks to the principal network can occur effectively, despite their being under different ownership	The operational and financial potential of connecting networks is frustrated by conflicting commercial or politiacal ambitions	The SPV to adopt a network delivery plan which the owner of a satellite network must agree to prior to the connection being made

APPENDIX 2.2 SPECIAL PURPOSE VEHICLE STRUCTURE



APPENDIX 3 ILLUSTRATIONS OF FUNDING SOURCES

Funding Source	Description	Suitability
Local Authorities		
LA internal resources	LAs can fund projects using their own internal resources	Simple and cheap finance but unlikely to be available in the quantity to finance large projects
Public Works loan Board	LA ownership of assets could be funded through borrowing from the PWLB	Source of low cost capital for projects owned or jointly owned by local authorities
CIL	Community Infrastructure Levy from new developments	Flexible but unlikely to be able to support the cost of a whole project
Housing Revenue Account	LAs are allowed to retain housing revenue locally	Can be used in energy efficiency an regeneration projects at low cost
Business Rate retention	Business Rate retention can be made against hosting renewable generation projects	Projects have to conform to the prescribed renewable technologies
Municipal Bonds	LAs can issue bonds for capital projects	Attractive but may not be cheaper than PWLB finance
Government Sponsored Funding		
Green Investment Bank		
• waste investment	GIB has committed £80m to waste investment, on the basis of mobilising matching sums from the private sector.	Potential for waste projects
• Aviva REaLM Energy Centres Fund	GIB has committed £50m to the Aviva fund with matching private sector funding	Projects would need a non domestic focus
• Other		

Energy Savings Investments Fund	ESI is focussed on small scale low carbon infrastructure	Potential for retrofit heating technologies including small scale district heating and CHP
FiT	Feed in Tariff for support of small scale (< 5MW) low carbon electricity generation	Availability of FiT should be factored into the initial financial appraisal of projects
RHI	Renewable Heat Incentive scheme to support renewable heat generation	Availability of RHI also to be factoed into initial project financial appraisal
ROCs / CfD FiTs	Renewables Obligation and then the CfD FiTs scheme to support renewable electricity generation	
Green Deal	Green Deal financing energy saving improvements through energy bill savings	Small scale – micro CHP
ECO	Energy Companies Obligation is a government energy efficiency scheme obliging energy suppliers to deliver energy efficiency to housholds	Small scale
European Union Funding		
European Investment Bank	EIB gives medium to long term loans to renewable and energy efficiency projects	Loans will finance to 50% of project cost with adequate security and other conditions
London Green Fund	The relevant part of the fund is the London Energy Efficiency Fund which can guarantee, lend or provided equity to decentralised energy projects	Finite budget available, in competition with other projects not decentralised energy focussed
EEEF	The European Energy Efficiency fund can invest in energy saving and efficiency projects including CHP and district heating networks	Suitable for funding DE projects, but subject to availability
Specialist Financiers		
Climate Change Funds	There are climate change funds with a specifc remit to invest in energy efficiency and renewable energy projects	Generally specialist financiers are likely to be interested in aggregating projects into larger financing propositions. Returns and scale of DE projects may in many cases be too small for this funding, since large scale may be needed
Carbon Offsetting Funds	Where new developments cannot achieve their carbon reduction target they can be offset by funding other offsite low carbon projects, for example Allowable Solutions	Potentially very suitable for DE projects if the Allowable Solutions regime is implemented
Pension Funds	Pension funds are attracted to the infrastructure market to diversify their portfolio into stable assets	Unlikely to be suitable until assets are operational and the project is a long term stable business, because initial risk is too high for these funds
Commercial Debt and Equity		
Senior debt		

	Senior debt (meaning lending having priority over other debt) secured on the project	Not suitable initially because of higher risk and cost, but potential for established schemes on re-financing. Aggregating projects may be necessary to achieve the required scale
Corporate debt	Includes lending provided by an energy service company to fund a project	Potentially suitable, but might not finance whole project
Mezzanine debt	Junior debt (over which senior debt has priority) attracting a premium interest rate	Potentially suitable but cost may make it the less attractive option
Private equity / venture capital	This is equity and participates in profits or losses after all creditors have been paid	Expectation of high financial returns may make it unsuitable for most projects, other than as a small proportion of total financing