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District Heating International and UK Case Study Selection

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1. Introduction

Heat and the City case studies will contribute to the development of a blueprint for "what works" in establishing and developing sustainable heating systems (SHS) in cities. While SHS can encompass a broad array of technologies and practices these case studies focus on district heating (DH) as a particularly challenging technology to deploy (particularly where it doesn't already exist) with significant potential impacts. This document describes the approach to selecting case studies and sets out the merits and disadvantages of various possible cases.

The case study work will involve review of archival and contemporary documentation, and interviews with key participants in the development of DH in the selected cities. Resource constraints (both financial and temporal) limit the number of cases we are able to investigate and their location – while looking beyond Europe, particularly to the USA, may have a number of advantages, it will not be possible to visit such distant cities. We intend not to ignore interesting examples outside Europe, but to rely more on existing work rather than conduct primary research into these cases.

DH may be pursued to achieve a number of different environmental, economic and social objectives so the question, "what works?," can be understood in various ways. While the successful establishment and financial viability of a DH initiative will be central questions it is important to bear in mind the range of criteria against which a DH initiative may be judged "successful".

Section 2 of this paper describes the selection criteria used in choosing case studies. Sections 3 and 4 draw out key relevant features of DH in European countries and UK cities respectively as options for first year case studies.

2. Selection criteria

Heat and the City case studies will illuminate a number of issues relevant to the development of SHS in cold climate cities. While we intend that the outputs of our research have utility outside the UK, the planned in-depth case studies in Glasgow and Edinburgh mean it is important to judge the suitability of first-year case studies to understanding SHS development in the UK.

There is a broad array of variables affecting the viability and consequences of a DH system, both contextual and internal to a particular initiative. No single model for development of DH network characterises approaches in the UK, and some aspects of the UK context (such as potential future regulation of DH) are not unequivocally established. Consequently, the following set of criteria do not uniquely determine whether particular cases are suitable or not, but are factors to consider.

2.1.Relationship to UK context

The degree to which the context for DH initiatives overlaps with that of UK cities currently will determine the degree to which case studies can provide lessons that transfer directly to Edinburgh and Glasgow. However, counterfactual reasoning about the UK context may be facilitated by case studies, so cases with different contexts may also be valuable. To ensure this form of reasoning is relevant (e.g. to UK and Scottish government policy makers), it should be limited to counterfactual scenarios which may reasonably be considered possible in the foreseeable future. Cases in contexts highly divergent from the contemporary UK context are therefore unlikely to be suitable.

Key aspects of the UK context for DH we should consider are

- **Dominance of natural gas** as established form of heating (network gas is used for around 80% of space and water heating). The UK recently changed from being a net exporter to a net importer of natural gas, raising energy security issues common to several countries with developed DH networks (though perhaps not currently as pressing in the UK). When comparing countries in which other energy sources dominate space and water heating (e.g. oil or electricity), differences between these forms and the UK gas network may be important. In particular, the sunk investments in gas distribution infrastructure contrast with delivery systems for oil-based heating; DH may be more of a threat to a gas network than to electricity systems as subscribers connecting to a DH network are less likely to disconnect from an electricity supply given the diversity of uses of electricity.
- **Local government powers, capacities and structures.** In contrast with many European countries, local government in the UK does not generally have experience in energy supply. Nationalisation of the gas and electricity industries removed these activities from local authorities, and under liberalisation they were prevented from engaging in energy supply in most circumstances.[1] UK local authorities, therefore, have relatively little commercial, technical or financial expertise in the field of energy (either in-house or in subsidiary companies) and limited control over competing or complementary energy systems in their areas. Local governance in the UK is generally relatively "fractured": many of local authorities' traditional activities have been either subcontracted or opened up/passed on to different organisations; local authorities are constrained by the *ultra vires* principle; and central government exerts relatively strong control over local government budgets.
- **Liberalised energy markets** limit the degree of state control over systems of energy provision and contrast with the forms of energy governance under which DH saw greatest expansion in some European countries. The UK model of energy liberalisation which emphasises the role of retail competition is challenging to the widespread development of DH. UK energy systems are dominated by six international companies which have much weaker ties to particular locations than municipal utilities.
- **Lack of skills and industrial capacity** due to limited deployment of DH and CHP contribute to higher costs in the UK than in countries with more

[1] Since the 1970s local authorities have been prevented from selling electricity which is produced other than in association with heat, though in 2010 this was expanded to allow local authorities to sell electricity generated from renewable sources in order that they could take advantage of the FiT also introduced in 2010.

established industries. In part, the lack of experience in the UK may be attributed to more general aspects of the UK's energy context (specifically, the narrow "spark spread" – the difference between the price of electricity and gas – since liberalisation/privatisation has limited the financial attractiveness of CHP).

- **District heating is not specifically regulated in the UK**, so initiatives have to establish their own approaches to safety, consumer protection, etc. and run the risk that future regulations will require changes to their operation.
- **Central government support** for local DH and CHP initiatives in the UK takes various forms including (unpredictable) intermittent bursts of grant funding, tax exemptions for CHP, and guidance to planning authorities.

2.2. Character of DH development

Various characteristics of DH networks are relevant to their suitability as case studies.

- **Stage of development**. Establishing new DH networks and extending existing systems raise some different issues. In addition to the challenges of establishing a new organisation and contractual relationships, new networks may face more difficult geographic constraints than established networks. A growing established network may have more opportunities to coordinate the addition of new heat load (e.g. connecting subscribers at different points along the network) while a new network will require the coordinated connection of loads in close proximity. As case studies will inform our work in Edinburgh and Glasgow, the availability of informants and evidence related to the early stages of development in our case studies will be important, making the recency of network establishment a relevant factor. However, older networks could shed light on the consequences of certain variables (e.g. whether certain organisational forms are more likely to establish a network that remains static or grows) and on issues which may be difficult to foresee at the outset of a DH initiative.
- **Scale of development.** In light of the different approaches being pursued in Edinburgh and Glasgow, it is important the our case studies span a variety of scales. While heat networks often develop incrementally, their scales may vary even in their initial phases.
- **Subscriber base**. The subscriber base served by a DH system is an important variable, both as a factor in the viability of an approach to developing DH (as different categories of subscriber present different issues to the system builders) and as an aspect of the impact of a DH network (what alternative heat systems are displaced, how are costs and benefits of DH distributed within a city, etc.). Across the European countries considered here the domestic sector generally accounts for around 50% of DH heat delivered, industry around 10% and services/other sectors around 40%.
- **Heat sources.** The heat sources connected to a DH network determine (along with the displaced heat system) the environmental impact of a network. The cost and availability of different heat sources vary between countries.

2.3. Organisational forms

In addition to characteristics of DH networks, certain aspects of the organisational forms established to develop those networks are of central importance to this investigation. Case studies should aim to illuminate the reasons why certain organisational forms are adopted and what consequences different forms have. As no particular organisational form is clearly preferable over all others in the UK context, the

case studies should seek diversity in the following respects, while avoiding forms for which there are clear reasons for doubting their viability in the UK:

- **The different parties involved** in the design, development and operation of a DH network, the roles they play, the relationships between them (including the governance of those relationships) and the goals they pursue through involvement in the enterprise. A particularly important issue will be how decisions concerning the design and extension of a network are made.
- **The separation or integration of different activities** including designing, financing, building and maintaining a network, and generating, transporting and retailing heat.
- **The role of community engagement**, taking community variously to relate to municipal residents, businesses, public bodies and interest groups. How are subscribers recruited to the network? Do system builders engage with potential subscribers and/or with other members of the municipal community who may be affected by the development of a network (e.g. disruption during construction, or impacts on the costs of public services)? At what stage and in what form does this engagement take place, to what ends and with what outcomes? Note that in research for this paper, community engagement issues have been difficult to uncover.
- **Financing** for a DH network may be raised in various ways including debt financing, equity financing, public subsidy or internal financing (if the organisation has sufficient resources). Debt financing may be of various forms (e.g. bank loan versus bond issue), and equity financing may seek investment from various sources (e.g. pension funds, sovereign wealth funds, members of the municipal community, etc.). Finance may be used exclusively to develop a DH network or to fund a range of related activities, spreading risk and allowing initiatives with higher rates of return to subsidise lower return projects. Finance may be raised by different actors within the organisational form: under a concession-style arrangement, the company contracted to build and operate the network would usually also be responsible for raising finance, while under more traditional procurement models raising finance and installing infrastructure are separate activities taken on by different parties. Case studies should aim to illuminate the viability of different financing approaches and their consequences for the other variables listed here.
- **The business model** adopted for a DH initiative is likely to be closely linked to the organisational form and form of financing employed. Key parameters include the rate of return the initiative is required to generate, how net revenues are used (e.g. reinvested or returned to investors), the heat tariffs offered to (or negotiated with) subscribers, and the approach to setting heat tariffs in the long term.

3. European cases

Work for this paper has considered European countries in which there is considerable district heating activity (either operation of existing networks or development of new ones). Former Eastern Bloc countries (some of which have considerable DH networks) have been excluded on grounds that the differences between the systems of government under which the majority of these networks developed and those of contemporary Europe are probably too great for clear, relevant lessons to be drawn.

The following subsections set out key aspects of the countries considered relevant to their suitability for individual city case studies. More detail on each country is provided in the accompanying Excel spreadsheet "Country DH matrix".

3.1.Austria

District heating in Austria has shown a steady growth since at least the early 1980s, in terms of numbers of subscribers, heat delivered and total length of DH piping installed. Currently the 550 DH networks deliver around 17% of the energy used for space and water heating (SWH). This growth is forecast (by the Austrian gas/DH industry association) to continue through to 2020 (Greissmair 2010). One distinctive growth area in Austria is in biomass district heating, much of which is installed in relatively small towns (rather than cities). District heating in cities (particularly Vienna, Salzburg, Linz and St. Pölten) has also been extended in recent years. Slazburg may be an interesting case as its campaign to expand the subscriber base for DH emphasised recruiting high-profile organisations as customers, presumably to enhance the legitimacy of the technology.

The Austrian energy industry was liberalised ahead of the market reform timeline set by the EU, and liberalisation appears not to have had a significant effect on the rate of growth of DH. The IEA is, however, critical of the degree to which these reforms have achieved competition and unbundling (IEA 2008). District heating networks are generally operated by utility companies which combine this activity with various combinations of electricity, gas, telecoms and public transport services. These companies are generally still owned by local authorities (at Länder and, in some cases, city level), though ownership is usually shared between several authorities and some private interests. Electricity utilities are, by law, required to be at least 51% publicly owned. Austrian DH networks are operated as vertically integrated businesses on a profit making basis. Different companies take different approaches to setting tariffs.

Austria depends on imports for 70% of its energy needs. In addition to DH, gas, oil and electricity are used for SWH, though no energy carrier stands out as dominant.

Various subsidies and regulations support DH: biomass heat generators are eligible for subsidy, €60m per year is available from the state for construction of DH networks, building regulations recognise, and can offer subsidies for, connections to DH networks as a means of achieving environmental performance. DH zones may be established within which subsidies for non-DH forms of heating are unavailable.

- Consistent growth in DH since the 1980s
- Some cities taking innovative approaches (Graz large scale solar thermal, Salzburg recruitment of high-profile subscribers).

3.2.Denmark

DH accounts for 45% of SHW demand, and 60% of dwellings are connected to a DH network. Prior to the oil crises of the 1970s Danish SHW demand was served by oil. Strong regulation (including requirements for local authorities to publish local energy plans, granting power to local authorities to establish DH zones in which connection is mandatory and restricting the use of electric heating) facilitated rapid expansion of DH in the 1980s and 1990s. Growth in DH is now considerably slower (though hasn't stopped). The strength of this package is unlikely to be mirrored in the UK, reducing the attractiveness of Denmark for case studies.

Danish law requires companies selling heat to be run on non-profit bases. Generally heat generation activities are separated from transport and retail activities, and generators compete to supply the networks. Networks are owned and operated by municipalities (usually through subsidiary companies) or (in the case of small networks) cooperatives. The record of success of DH and the mitigation of demand risk by the power to require connection mean that DH companies can debt finance their activities and so have not explored alternative organisational forms (e.g. Design-Finance-Build-Operate contracts).

Market reforms aimed at liberalising electricity markets have been introduced. municipal companies still dominate the distribution of gas and electricity. CHP, much of it connected to DH networks, accounts for 50% of Denmark's electricity production (IEA 2009).

- DH extensively deployed, but under strong municipal control which largely still exists.

3.3.Finland

In terms of population density, Finland is the most northerly of the countries considered here, making heating and lighting demand relatively high. These natural factors contribute to the success of CHP. Very little government support has contributed to the widespread deployment of CHP which makes up around 30% of electricity supplied and 75% of heat delivered to DH networks. Energy security is a pressing issue in Finland which is dependent on a single supplier (Russia) for natural gas and has limited indigenous energy sources (biomass and nuclear). The flexibility in heat source offered by DH is therefore part of its value in Finland.

DH serves around 50% of the SHW demand, though in cities and large towns this figure rises to an average of 80%. While new or extended DH networks are often installed for new developments, the DH market is unlikely to grow significantly in the near term due to saturation of opportunities.

DH networks were generally developed and are usually owned and operated by local authorities. The largest industries in Finland are based on forestry (e.g. pulp/paper manufacturing) and some DH networks are built around these factories. Natural gas and coal (both CHP), however, are the principal sources for DH.

- High penetration of DH. Saturation means unlikely to see expansion/new DH networks.
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3.4.Germany

DH followed different patterns of development in East and West Germany prior to reunification. Overall, the connected DH load has changed very little since 1990, though this is due to a balance of changes rather than stasis. DH in East Germany is generally declining as demographic changes and demolition of buildings reduces connected load. Networks which have increased (and are increasing) connected load generally do so by intensifying connection to existing pipes rather than construction of network extensions.

DH in West Germany was developed by municipal utilities (Stadtwerke), with significant growth in the late 1970s and 1980s stimulated by government subsidies aimed at energy efficiency, environmental quality and reliability of supply. The current

CHP law obliges network operators to purchase electricity generated by CHP, and offers subsidies to extension of existing and construction of new DH networks with CHP. The feed-in-tariff for biogas has led to a rapid expansion of biogas CHP. Building regulations include Merton-rule renewable heat requirements, but recognise DH (renewable or high efficiency CHP) as a solution.

CHP forms the bulk of heat provision (40% coal CHP, 40% gas CHP). Germany imports around 70% of its primary energy use. While this makes efficiency valuable, there are concerns that national efforts to reduce consumption of natural gas will limit increases in gas fired CHP.

- Recent developments based around intensification of existing networks rather than new/extended networks

3.5. The Netherlands

The Netherlands produces similar quantities of natural gas to the UK, though consumes much less and is a net exporter. The heat market, like the UK, is dominated gas which serves 96% of the residential SHW market (DH makes up 3.6%, i.e. the bulk of the non-gas residential SHW market). DH saw its greatest expansion in the 1980s, based around large-scale electricity generation and driven by forecast oil and gas prices which proved to be inaccurate. Due to this miscalculation, DH networks in the Netherlands have required considerable support from central government (de Jong 2006).

In most cases heat transport/retail is a separate activity to heat generation. Heat transport is usually undertaken by companies which have other electricity/gas transport activities. Heat generation is dominated by four large electricity generating companies, though there are some small scale initiatives which feed into heat networks.

Heat transport and retail are operated on a profit-making basis, and in the past there has been some concern amongst subscribers that they were being exploited. The Heat Law (introduced 2009) allows the government to set a "reasonable price" for DH (based on reasonable returns on investment) and a "maximum price" (based on the price of using gas for SHW) (Oxera 2009).

Generous support programmes for CHP in the 1990s resulted in excess capacity and temporary moratoria on new CHP. CHP accounts for 20% of the Netherlands' heat supply, though this is predominantly on-site industrial use rather than DH.

Current DH activities seem to focus on upgrading existing networks (some of which have quite poor performance) and switching heat supplies (e.g. to renewables).

- Similar to UK in terms of gas supply, low penetration of DH and pessimism around increased deployment of DH.
- Business model generally separates heat generation from transport/retail.
- Opportunity to follow impact of introducing DH tariff regulation.
- Doesn't appear to be much activity in developing new networks or extending existing ones.

3.6. Norway

Norway is the fastest growing DH market in the world (on a %/year basis) though DH penetration is low (accounting for around 5% of the heat market). The number of licenses to produce DH grew from 43 in 2004/05 to 124 at the beginning of 2011, so Norway is a promising location to look for new DH networks being established.

A 2003/04 white paper on energy security highlighted DH as an important technology to reduce Norway's vulnerability due to its heavy reliance on hydro electricity. Enova (company established by the Norwegian Government to promote energy saving) manages an investment subsidy system for DH infrastructure and renewable heat production plant.

Norwegian energy industries were liberalised in the 1990s, and a variety of combinations of public and private ownership of energy utilities exist. Usually local authorities have some stake in an energy company, though this may be shared with other neighbouring authorities, regional and state levels of government and private interests. DH is often developed, owned and operated by the energy companies with municipal ownership (rather than the wholly privately owned companies) who sometimes establish a subsidiary company dedicated to DH. DH is run on commercial profit-making business models, though a licensing conditions require that tariffs (and tariff changes) are reported to the energy regulator, and that tariffs do not exceed the equivalent costs for electric heating. Along with a license, a DH company may also be granted a local 'access requirement' under which new developments in the area can be required to connect to a network (though connected premises are not required to use DH).

Norway (like the UK) has fewer multi-dwelling blocks than the Sweden or Denmark and so the built environment doesn't offer the same combination of heat density and diversity. This may be a factor in the unusual distribution of DH subscribers in Norway, which are predominantly industrial[2] (65%), with only 15% of heat delivered to residential subscribers. Electricity is used for about half Norway's space and water heating demand (biomass, oil and heat pumps accounting for most of the rest).

- Rapid growth in DH.
- Some similarities to the UK – a preferred, indigenous SHW source (hydroelectricity), a low base of DH, a mixture of approaches to DH development.
- Financial commitment from central government.
- Liberalised energy market, though less concentrated than the UK and a more mixed model of ownership.

3.7. Sweden

Development of DH dates back to the early 1950s, though the most significant expansion occurred during the 1970s and 1980s under policies designed to reduce the countries dependence on imported oil. Networks were initiated and largely developed by municipally owned companies which were able to integrate several activities (e.g. DH and electricity provision). Municipal authorities could coordinate DH networks expansion with their activities (particularly the expansion in housing between 1965 and 1975 which municipal authorities led).

Swedish DH takes almost 50% heat from biomass (including 20% biomass CHP) and serves over 50% of the SHW market. DH dominates in municipal centres and current expansion is to lower heat-density suburbs.

[2] Note that in the EuroHeat & Power (2009) report, "industrial" is not clearly defined. It isn't clear whether the focus on "industrial" heat users is likely to be a permanent feature of Norwegian DH or reflects a growth strategy focusing on large heat users first and extending to smaller ones later.

Prior to liberalisation, municipal DH companies were required to operate on non-profit bases, were prevented from operating DH networks in other municipalities, and were required to treat all citizens equally. Liberalisation (1996) led to private companies buying shares in some municipal companies and changes to business models. DH networks with private involvement generally charge higher heat tariffs than those still under full municipal ownership. In Stockholm, for example, Fortum expects a 12% rate of return on its low-risk investment in the established DH network (Rutherford 2008). However, concerns that private companies may slow the rate of investment in network infrastructure are not supported with clear evidence (Ericson 2009).

- Most significant developments in cities in 1970s and 1980s so perhaps difficult to access now, and strong position of municipalities prior to liberalisation may limit the applicability of lessons from those developments
- The introduction of private capital post liberalisation appears to have led to changes to the operation of DH networks, so case study may be able to illuminate effects of, and responses to, liberalisation.

4. UK cases

4.1.Aberdeen

- Aberdeen Heat and Power (AH&P) company established as Arms-length non-profit company from Aberdeen City Council. In addition to council representatives, board includes individuals with experience of delivering energy initiatives and community representatives.
- Gas CHP engines serving multi-storey residential buildings. Predominantly council tenants, so heat is sold to the council who then charge for heat with rent. Some private arrangements in flats bought under the right-to-buy.
- Scheme received grant funding under the Community Energy Programme. Council financial commitment to the project (the annual budget for improving the heating system), enabled AH&P to get a bank loan to finance the project.
- Private companies contracted to design, construct and install the system.
- The Scottish Government recently announced a grant of £1 million which will be used to lever in additional finance to extend the heat network and undertake other related initiatives in Aberdeen.

4.2.Birmingham

- Feasibility studies in 2003 identified two potential schemes based around Birmingham City Council buildings and large heat loads (hospital, university, hotel, International Convention Centre).
- Both schemes developed by Birmingham District Energy Company, a subsidiary of Utilicom (now taken over by Cofely)
- Private company design/finance/build/own/operate the scheme on 25 year basis. First scheme agreement signed at the end of 2006, and operational late 2007.
- Grant obtained under the Community Energy Programme.
- Partnership model with Birmingham City Council, similar to Southampton arrangements.
- Plans to connect the schemes and possibly to serve nearby regeneration areas.

4.3.Caithness (Wick)

- DH scheme based around distillery and innovative biomass gassification plant.
- Organisational form modelled on Aberdeen example – Arms length company which contracts for design, construction and installation but operates the system itself.
- Heat network initiated and a number of residential buildings connected, but procured technology could not be commissioned successfully.
- Audit Scotland highly critical of the project, citing failings in authorisation by the council, project risk management, and weak governance.
- Highland Council took direct control of the project to ensure heat is supplied to connected homes and to seek an alternative long-term solution.

4.4.Milton Keynes

- Gas CHP serving almost 1,000 residences (flats), a supermarket, an office block and additional retail/commercial premises.
- Constructed in 2007. Developed by Thameswey Energy (a company owned by Woking Borough council) and the Homes and Communities Agency (who own the land)
- Local planning authority requires developers to undertake feasibility studies to assess DH connection against alternative heating options. This requirement is seen as crucial to the scheme's success.
- Serves new build rather than retrofit.

4.5.Nottingham

- Largest DH network in the UK
- 4,500 domestic customers plus several large commercial and public sector heat loads
- Plans to expand the network and install additional heat generating capacity. Extension due to commence in 2013.
- Network established in 1953 around Boots' pharmaceuticals manufacture. Converted to waste incineration in 1972, and operated by National Coal Board.
- Energy from Waste CHP, selling around half electricity generated via private wires, with excess "spilling" to the grid.
- Operated by Enviroenergy Ltd since 1995 (company wholly owned by Nottingham City Council).
- Anecdotal reports of dissatisfaction of domestic subscribers with temperature of heat delivered.

4.6.Sheffield

- City centre retrofit initiative established in 1988
- Scheme developed by Sheffield Heat and Power (a joint venture between Sheffield City Council and EKONO, a Finnish engineering group).
- Heat predominantly generated by waste incineration
- Development began with residential blocks, expanding to commercial heat load
- Sheffield Heat and Power dissolved in 2008 and ownership of incinerator and heat network transferred to Veolia

- It is rumoured that some within Sheffield City Council would like to return ownership of the network to the city in order to (a) expand it and (b) bring in competition in heat generation.

4.7.Southampton

- Department of Energy dug a geothermal well, but abandoned the project before constructing a heat network.
- Southampton City Council (SCC) keen to see project developed (particularly Executive Director, Mike Smith)
- Utilicom (now taken over by Cofely) contracted under partnership agreement to design/finance/build/own/operate network around geothermal source.
- Under the agreement, SCC commit to purchase heat for their own buildings where practical, to help promote the scheme to potential subscribers, provide land at nominal rent for an energy centre, grant Utilicom ownership of geothermal heat, and grant Utilicom rights to lay and maintain heat network.
- Utilicom undertook to develop the scheme around the geothermal source, to develop gas CHP as the network expanded, to sell heat to the council with guaranteed savings, to adopt open book accounting, and to share profits with the council.
- Project has received two grants under the Community Energy Programme.
- Serves forty commercial and public sector subscribers and around 300 private dwellings.
- Second network proposed by city council based around biomass. Preferred model mirrored the original, but failed to secure a commercial partner.

4.8.Tower Hamlets

- Borough Council investigated CHP/DH when renewing heating systems on the Barkantine housing estate (four high rise and several low rise blocks).
- Initial idea of a joint venture abandoned as council did not believe it had appropriate powers to engage in the sale of electricity.
- Pursued a PFI approach, supported by DETR as a demonstration of a new application of PFI (DETR gave grant of £6 million). PFI process was found to be lengthy.
- Some potential subscribers chose to refuse a connection
- Heat is metered in council properties (so tenants pay for heat used rather than a flat heat with rent charge).

4.9.Woking

- Innovative and successful integration of DH and private wires network. Heat and electricity generated by gas CHP delivered to mixture of public, commercial and domestic customers.
- Scheme's scale makes it eligible for electricity generation license exemption, but this limits the number of domestic customers which can be supplied with electricity.
- Grew out of Woking Borough Council's recycling energy efficiency fund when council was advised that it would have to establish companies to deliver certain sorts of project.
- Two degrees of separation established – council established an ESCo which in turn established a public/private venture (Thameswey Energy Ltd, TEL) with a Danish company. Structure designed to keep council's shareholding below

the threshold at which TEL's finances would have to be treated as part of the council's.

- Introduction of prudential borrowing made this irrelevant, and council took full ownership of TEL in 2004, though a contractual relationship with the Danish company remains.