Regulatory options for district heating in Scotland

Report to Scottish Government Working Group on District Heating

Ruth Bush, Dave Hawkey, Jan Webb – University of Edinburgh

1. Introduction

Scotland's ambition

Decarbonising Scotland's heat sector is central to meeting Scotland's Climate Change Act (2009) targets for reducing greenhouse gas emissions by 42% by 2020 and 80% by 2050. In addition, the Scottish Government has designated energy efficiency as a national infrastructure priority.

Scottish Government's key policy aims are to:

- Largely **decarbonise** heat systems by 2050, to reduce greenhouse gas emissions;
- **Diversify** sources of heat generation and supply to reduce reliance on fossil fuels, and therefore support a resilient heat supply;
- Reduce the pressure on household and business energy bills through **reducing heat demand** and providing **affordable** heat, in particular supporting the fuel poor; and
- Seize the sizeable **economic opportunities** that this transformation offers through development of new heat generation, distribution and demand reduction programmes.

District heating (DH) offers part of the solution, particularly in urban areas, by enabling delivery of low carbon heat using renewable and recovered heat sources, opportunities for flexible integration with the electricity sector, and affordable heat when combined with appropriate business models. The Scottish Government's Heat Generation Policy Statement recognises the potential of DH and sets an ambition **to achieve 1.5 TWh of Scotland's heat** demand to be delivered by district or communal heating from both renewable and traditional energy sources, and to have **40,000 homes connected by 2020**.

The regulatory challenge of district heating

New DH is challenging in the context of today's liberalised energy system. In most locations developers compete against existing gas infrastructure. The high upfront costs of DH infrastructure, and the fact that the technology is relatively unfamiliar to developers and consumers alike, increase perceptions of risk.

Therefore, the key purposes of any DH regulation are to ensure:

> *Optimum development in areas of highest heat load density and diversity, economic and effective use of resources and a secure market for suppliers and users.*

This document offers evidence to inform discussions about options for regulation. Each section explores specific 'challenge areas' for Scotland and considers solutions, using examples from the Netherlands, Norway, Sweden, and Denmark. The UK's regulated gas and electricity sectors are also considered for comparison.

- **Denmark and Sweden**: Denmark and Sweden have well-established DH sectors, after the 1970s oil crises acted as a catalyst for development. Denmark has a culture of cooperation between central planners and municipal authorities, as well as a culture of consensual politics that has enabled long term stability in national heat planning policy. DH regulation requires not-for-profit business models while creating powers to require customers to connect to systems. Swedish district heating development was largely underpinned by existing municipal planning powers and integrated with a wide range of municipal services; national subsidies and taxes influence choice of heat supply.
- **Norway and the Netherlands**: Both countries are at relatively early stages of DH development with heat supply acts introduced post energy market liberalisation. Regulations in the Netherlands focus on customer protection and price control. Norway has a licensing system, which covers customer protection, price, and rights over heat supply development over 10 years.
- **UK regulated energy sectors**: Private energy suppliers, distributers and transmission companies are regulated by Ofgem to protect customers, encourage efficient investment, innovation for cost reduction and development of a low carbon energy future.

Each of the following sections of the document considers one of four 'regulatory challenges':

- **Section 2 - Energy planning for growth and interconnection of district heating –** Currently less than 1% of Scotland's heat demand is delivered by DH. This section asks what forms of regulation will support development in optimum locations, and at sufficient scale to deliver wider system benefits?

- **Section 3 - Aligning local delivery with national strategic objectives –** Local actors delivering DH will not necessarily share national goals. What forms of regulation will ensure that national strategic objectives are delivered through local practice?
- **Section 4 - Low carbon supply of heat to networks. –** Low carbon heat sources are expected to supply DH systems by 2050. What forms of regulation will ensure transition from fossil fuels to renewable heat sources?
- **Section 5 - Customer protection: Pricing and service standards –** District heating schemes are invariably operated as supply monopolies. This can lead to concerns about customer exploitation, through high tariffs and / or poor service standards. What forms of regulation will ensure that customers receive an affordable, high quality heat supply and are treated fairly by their supplier?

2. Energy planning for growth and interconnection of district heating networks

Smaller, stand-alone schemes have been the norm in Scotland. Developments focus on areas perceived as low risk (e.g. new housing developments, public buildings or social housing where there is potential for long term heat supply contracts) or as offering a higher return for the risk (e.g. large institutional customers in high density areas). However, **large-scale DH networks offer greater benefits** including cost effectiveness, affordability of heat and better environmental protection. What can regulation do to ensure that near-term investment results in technical and organisational systems which facilitate transition to larger systems?

	Issue	**How might this issue benefit from regulation?**	**What currently happens in Scotland?**
2.1	Energy planning for expansion & interconnection of schemes	Strategic expansion and interconnection of DH schemes delivers benefits to the network, and the wider energy system. A*d hoc* development in the absence of a local vision for future integration is likely to result in fragmented small and potentially incompatible systems. How could, for example, the drivers for the NHS, Higher Education, Local Government, etc. be changed to support schemes that go beyond campus boundaries? Regulation could support implementation of a strategic energy plan, and drive optimisation of schemes through interconnection; this would result in more extensive systems with greater flexibility and access to more diverse sources of heat.	Scottish Government's Heat Policy statement clearly states an ambition for DH growth. This is supported by development of **strategic energy planning capacities** for local authorities. The **National Planning Framework** and **Scottish Planning Policy** ask local authorities to use local plans to encourage DH in new developments; the **Scottish Heat Map** provides spatial data to inform energy and spatial planning; the **Heat Network Partnership (HNP) Strategy Support Programme** and **Stratego** project are building capacities for local DH strategic frameworks. The Scottish **District heating loan fund** offers easy access, affordable loans, typically up to £400,000 per project (but applications for larger loans are considered).
2.2	Enabling measures for practical delivery of schemes	The limited delivery of DH to date could mean that basic enabling powers to support installation of infrastructure under roads, across land and through buildings are lacking. Regulation could grant developers the necessary powers to speed up development.	The Local Government (Scotland) Act 1973 confers a discretionary function on a local authority to produce and supply heat and electricity, both inside and outside their area. For laying the pipe infrastructure, local authorities have **powers comparable with laying water pipes**. They can dig up roads, enter premises to install connections and meters, and create bylaws to allow third parties to provide this service on their behalf.
2.3	Securing revenues from heat supply	**Uncertainty** over revenues from future heat-sales (particularly in **retrofit** schemes) is challenging for DH business models oriented to financial returns. The public sector has the potential to act as an anchor load to make schemes viable, but procurement rules, existing contracts, and time scales of project development often make this difficult to achieve in practice. Regulation could offer a way to increase certainty about revenues, either through unlocking public sector heat loads, requiring user connections or guaranteeing minimum heat demand levels. In exchange for supporting revenue certainty, regulation could ensure benefits for the wider community, for example by minimising "cherry picking" of lucrative opportunities.	**Connection of new buildings:** Scottish Government building regulations and local authority planning powers invite developers to consider connection to a new or existing DH network. **Retrofitting connections:** Housing quality standards applied to registered social landlords have been cited as a driver for social housing connections to DH networks. The costs of individual house connections can be supported by ECO, HEEPS and the Home Energy Scotland Renewable Loans Scheme (e.g. the Lerwick scheme used loans from this scheme to connect customers). The potential of public sector buildings (e.g. hospitals, schools and councils) to serve as DH anchor loads has also been examined by Scottish Government through a piece of research by Ramboll. The HNP Strategy Support programme encourages local

			authorities to consider this within DH strategy development. Local authority procurement of DH infrastructure or heat supply must comply with public procurement rules; the HNP has produced DH procurement guidance.
2.4	Future-proofing for expansion	It is easier and cheaper for schemes to expand if they have 'future proofed' at the first phase by e.g. investing in larger pipes. This adds cost and under-used capacity at the first phase. Regulation could set out appropriate planning for future cost effectiveness and growth of schemes, as well as technical standards to ensure feasibility of scheme interconnection.	Infrastructure UK Supplementary Guidance to the Green Book: Valuing Infrastructure Spend (2015) references the value of future-proofing new energy infrastructures such as heat networks. There are currently **no regulations requiring future proofing** for expansion by DH developers.
2.5	Technical standards of operation	Inconsistent standards and inefficiencies in performance have negative reputational effects, preventing DH adoption and future growth (problems are highlighted in a report by Which? (2015)). Regulation could set out consistent technical standards for minimum performance of schemes.	The Heat Networks Code of Practice, developed by the trade associations CIBSE and ADE, provides **voluntary** technical standards for heat network developers . There are no mandated technical standards for DH in the UK, though the London District Heating Manual offers guidance to support scheme compatibility.

What happens elsewhere?

2.1 Energy planning for expansion & interconnection of schemes

- Setting a clear expectation for companies to develop and interconnect systems: In Norway, the regulatory framework is used to set a shared expectation that DH should develop through investment for long term operation and interconnection. Where a DH operator does not fulfil these expectations the state can step in and require networks to interconnect, or take ownership of the scheme at the end of the licensing period at no cost.
- Building standards account for whole system impacts: Both the Danish Building Standards and the Danish Energy Company Obligation apply scaling factors to calculated final energy consumption to prioritise different technologies. For example, when a building is switched from gas to DH under the Energy Company Obligation its energy scaling factor is reduced by 20% to reflect the wider system benefits of district heating.
- Municipality heat planning to incentivise expansion: In Denmark, municipal heat mapping and planning, and the designation of heat zones, support DH companies in planning for expansion and interconnection.
- Nationalisation to rationalise networks: By 1945 in the UK, uncoordinated development of gas networks had led to over 1,000 network operator companies and a fragmented and inefficient system. Senior industry figures argued that, in the absence of network growth and rationalisation, the country would be left with a "limited and costly supply of gas". Nationalisation created integrated networks under public monopoly.

2.2 Enabling measures for practical delivery of schemes

- Combining planning with licencing. The Norwegian licencing system confers powers on licence holders to run pipes through the public realm. Administrative burdens are lessened, as DH companies do not need additional local authority permission; construction can usually start as soon as a licence is granted.

2.3 Securing revenues from heat supply

Implementation from the **national level**

- Licensing for sole right to DH development in a given area: The Norwegian Water Resources and Energy Directorate grants licenses for a DH scheme to be developed within a defined area which is set for the expected growth of a network over 5-10 years. Once this license has been granted, the DH developer has sole rights to the area for the duration of the license. License holders can also request the local authority to use their planning powers to require new buildings to connect and pay a service charge,

although it is not mandatory to buy the heat. This enables planning and technical specifications to allow for network growth with a lower risk to the developer.

- Subsidies for building owners (rather than DH developers): In Sweden, building owners were offered subsidies to switch from oil or electric heating to DH or other low carbon sources. Mainly housing organisations were targeted in the 1970s and 80s, while private households have also been targeted more recently. In 2006 two subsidies were introduced for replacement of i) oil heating in detached and semi-detached houses and ii) direct electric heating in all residential buildings. Options for replacement include district heating, ground-source heat pumps (bedrock, surface soil or lake/river water) and biofuel boilers. The subsidy covered between 9 – 21% of capital and labour costs.
- Making new homes DH-ready: In Norway, the Planning and Building Act sets a target for non-electric heating (today, the dominant heating system in homes is electric). Municipalities may require new developments to have wet heating systems, ready for connection to a DH network.

Implementation at the **municipal level** (in coordination with national government)

- Designated heat zones with an option to mandate connections: In Denmark, the national Heat Supply Act 1979 required local analysis and planning of heat supply, including zoning. Municipal authorities were required to identify zones where DH provided the most competitive solution based upon an options appraisal, and municipalities could force building owners to connect. Today, DH developers use the heat zones as the basis for identifying investment opportunities. The power to mandate connections still exists, but is not always used by municipalities. Electric heating can be banned in specified zones.
- Underwriting of schemes by municipalities: In Denmark, growth and new development of DH networks is made as low cost as possible by ensuring DH developers can access low interest rate loans (sometimes as low as 1%) through underwriting by the municipalities. This approach was also used in Rotterdam in the Netherlands, where the municipality underwrote an industry-led project to capture waste heat from industry (see the case study in section 4 for more information).

2.4 Future-proofing for expansion

- Costs of future proofing may be paid for or underwritten by the state. In Norway, 20% capital grants are available for network development on the grounds that systems may be difficult to finance in the near-term, but will achieve future scale economies. The licencing procedure and the socioeconomic cost benefit analysis (see section 3) support public oversight of this use of public funding.

2.5 Technical standards for operation

- Standards used as a shared resource for DH operators: In Sweden, the majority of DH companies were municipally owned (particularly pre-market liberalisation) and were not allowed to operate outside their area. There was therefore little competition between operators and information and data sharing was encouraged to push up standards and ensure value for money. The Swedish District Heating Association developed technical standards for the sector, in co-operation with international standardisation institutes. Poor manufacturers were quickly identified and avoided. The technical standards also improved compatibility between different DH components. The Swedish Government created the procurement agency 'Varmek' which aimed to reduce the cost of both procurement processes and supplying numerous small system developers by setting up OJEU compliant procurement frameworks. It maintains a list of products and prices for transparency. The Danish Energy Agency also maintains a technology catalogue for use in options appraisals.
- Assessment of technical quality during licensing: In the Netherlands, the technical capacity of applicants is assessed during the licensing process. Similarly in Norway, proposed schemes must demonstrate best environmental, social and economic standards, relative to alternative systems, in their licence application.

3. Aligning local delivery with national strategic objectives

DH can contribute to delivery of Scottish Government Strategic Objectives through sustainable economic growth. It can achieve multiple objectives from fuel poverty alleviation to enabling integration of renewable and low carbon sources of heat and electricity into the energy system. In the absence of strategic coordination of national and local objectives, however, the potential for such integration may be structurally limited. In addition, as exemplified by the consultation process to develop the Heat Policy Statement, the transition to low carbon heat supply will need to be delivered in partnership between national and local government and a wide range of public and private sector stakeholders. Resources such as heat maps and support for local DH strategies can enable coordination but need a regulatory framework to ensure their use.

	Issue	**How might this issue benefit from regulation?**	**What currently happens in Scotland?**
3.1	Balancing wider priorities with profit drivers	Focusing on financial performance and profitability at small scale could lead to cherry picking of stand-alone sites or use of low quality materials to reduce capital costs, rather than designing for delivery of wider benefits from DH scale economies or long term operation. Regulation could create an explicit driver for such long-term decisions and scale economies.	Energy efficiency measures such as ECO, Scottish Housing Quality Standards and Energy Efficiency Standard for Social Housing (EESSH) have a role in **encouraging use of DH for social benefit** as well as **carbon reduction**. However, currently <1% of ECO measures are related to DH (statistics from May 2015) and companies are free to choose how they comply with ECO targets. (ECO is supported until March 2017). The Scottish Government's Home Energy Efficiency Programmes (HEEPS) can support ECO eligible measures, including district heating. There are currently no regulations to support DH businesses to achieve broader social or environmental aims. The Heat Networks Code of Practice could play a role in driving up standards of schemes for long term, quality operation rather than short-term profitability.
3.2	Selecting an 'optimum' technology to meet low carbon objectives	Uncoordinated installation of technologies such as heat pumps in individual buildings may prevent viable DH development in that area, resulting in more expensive overall energy systems. The 'optimum' solution for a building or an area may depend on what solutions are adopted in neighbouring areas. Regulation could enable alignment between local developers' choices and local & national visions for the energy system.	The Heat Network Partnership offers advice to all sectors, including a 'strategy support programme' that guides local authorities through the process of developing a DH strategy. Although in its early stages, this has the potential to **strengthen the skills and knowledge of local authorities** helping them to shape development of their local energy system and to take an active role in delivery. However, at present there is no formal measure of what an 'optimum' technology choice might be for any particular energy system vision, nor are there powers to enforce that vision. Incentives for renewable and low carbon sources (e.g. RHI, FiTs), support a wide range of technologies but tend to encourage building-scale technologies rather than integrated systems.

What happens elsewhere?

3.1 Balancing wider priorities with profit drivers

- Using competition to drive delivery of wider benefits: In Norway, DH companies require licenses if they have over 10MW peak load. When there are conflicting license applications, selection is made based upon the scheme's customer base, costs, environmental effects including choice of fuel, and economies of scale achieved through interconnection.
- Local investment programmes to support municipal cooperation with industry: The Swedish government's Local Investment Programme (LIP) aimed to strengthen environmental initiatives at the local level whilst promoting employment. This resulted in cooperation between municipalities and industry to create revenue streams for industry through heat sales, and carbon and cost reduction for the DH scheme.
- Municipally driven companies: In the 1980s and 1990s in Sweden, DH companies were either wholly owned or majority-owned by municipalities (this has changed since market liberalisation). This

business model focused on technical standards for quality and long-term operation, as well as wider economic and environmental objectives such as security of supply following the 1970s oil crisis.

- Not-for-profit business models with consumer representation: In Denmark, all DH companies must be not-for-profit and have consumer representation at board level, either via municipal ownership, or through municipal or consumer representatives. This form of governance ensures accountability to customers, long-term stability and operation, as well as support for municipal objectives in relation to expansion, interconnection, and social and environmental benefits.

3.2 Selecting an 'optimum' technology to meet low carbon objectives

- Socio-economic assessment of schemes to ensure societal benefit: Both Denmark and Norway use a '**socio-economic analysis'** to assess scheme contribution to a **national** energy system vision or goal.
    - In Norway, the assessment is part of the license application process. It assesses whether the aggregate costs of the scheme are lower than alternatives, and is used to ensure that the license is granted to the economically optimal technology for that area. It is not primarily concerned with whether the system makes a return.
    - In Denmark, 1980s energy regulation established socio-economic accounting for projects, with only those calculated as providing a net benefit to society taken forward. DH companies and municipalities are only able to pursue projects that make a net positive socio-economic contribution (this is separate from the private cost benefit analysis that a company would use to inform investment decisions). The published process for socio-economic assessment is defined by the Danish Energy Agency and Treasury.
- Creation of a municipal vision for supply, distribution and use of energy: In 1977 the Swedish parliament passed a framework law requiring municipalities to develop **municipal energy plans**. This law clarified the role of municipalities in **implementing national energy policy**, but did not force municipalities to act or give them authority to influence the investment decisions of others. Today, this law still requires municipalities to plan energy supply, distribution and use, and to describe the effects on environment, health and natural resources. In 2006 27% of municipalities had no plan. The law has been criticised for lack of clear requirements on what the plan should encompass and lack of sanctions.

Differences of approach to cost benefit analysis (CBA):
It is worth noting the difference in approach to CBA between the UK and the other case studies. In Scotland, SEPA requires thermal generation plants to use CBA to consider feasibility of heat capture for DH (see section 4). This form of CBA asks whether the operator would receive a commercial return on the additional investment needed for heat off-take. It contrasts with the socioeconomic CBA used by Norway and Denmark, which asks whether a proposed project is the best use of society's resources.

The *practical* effects of the SEPA CBA method are as follows

- It tries to make operators aware of opportunities to make a (relatively high) return on investments in a scheme. There is no requirement on them to undertake the project.
- It factors in costs and benefits that the operator sees in transactions. It does not consider opportunity costs, or the costs to buildings that are not given a DH supply.
- It uses a commercial discount rate of 12%. The long-term DH benefits are therefore weighted less than the high upfront cost. DH is highly sensitive to choice of discount rate – as an extreme example, DEFRA calculated the potential for DH to be 630 GWh/year at discount rate of 9% but the same calculation resulted in a potential of 150,000 GWh/year at a discount rate of 6% – about 250 times greater. The choice of a 12% discount rate makes many schemes unlikely.

In contrast, socioeconomic CBA means Danish and Norwegian governments can justify creating additional powers for DH operators as a means of protecting a model for growth.

4. Low carbon supply of heat to networks

Future heat supply to DH networks needs to be low carbon, using renewable fuels, waste heat sources, and generation technologies such as large-scale heat pumps. New DH systems are an opportunity to start out with low carbon supply from day one, or to design for low carbon sources with minimal need for retrofitting later. Current development is frequently based on gas-fired CHP. This reduces emissions in the near term, but its carbon advantage will be eroded by electricity decarbonisation. Regulation could support the use of low-carbon sources and the transition away from gas CHP.

	Issue	**How might this issue benefit from regulation?**	**What currently happens in Scotland?**
4.1	Making use of heat recovered from industrial processes and Energy from Waste (EfW) plants	Industries that produce heat as a waste product do not necessarily want to be involved in supplying waste heat to district heating schemes. The activity is seen as outside core business and there are potential financial and resource costs and risks. From the perspective of DH operators, there are also risks associated with use of heat from industry that might fail or move away. A back up heat source is required, potentially adding costs. Energy from waste plants are a potential source of heat supply, although existing plants often regard heat supply as less financially attractive than generating electricity only. Scotland's waste regulations also restrict growth in the number of plants (with a 2025 target of 70% of waste recycled). Regulation could help to unlock use of heat recovered from industrial processes and EfW plants.	Article 14 of the European Energy Efficiency Directive requires all Member States to introduce regulations to promote efficiency in heating and cooling, through National Heat & Cooling Plans and by ensuring new or refurbished industrial and thermal electricity generation plants carry out a CBA on use of waste heat. In Scotland this is implemented through the Pollution Prevention & Control (Scotland) Amendment Regulations 2014. SEPA's Thermal Treatment of Waste Guidelines 2014 require Energy from Waste plants (EfW) to meet efficiency levels of at least 30-35% within 7 years (effectively requiring use of heat as well as electricity). However, the guidelines are relatively new and untested. There are no regulations affecting *existing* plants and industries that produce waste heat, unless they undergo significant renovations.
4.2	Driving a transition to low carbon DH	Technologies for *low carbon* heat sources are not always the cheapest option for DH operators. Regulations could incentivise or require use of low carbon heat sources.	There are no regulations to *require* use of low carbon heat. Use of such sources is driven by subsidies such as the non-domestic RHI (20 year term), exemption from the Climate Change Levy and Scottish Government targets.

What happens elsewhere?

4.1 Making use of heat recovered from industrial processes and Energy from Waste (EfW) plants

- Industry-led initiatives: The Netherlands has no formal national regulation; in Rotterdam however industry actors pre-empted government-imposed environmental protection against pollution and dumping of excess heat, sowing the seeds for a major DH initiative. Capital investment nevertheless relied on significant intervention from Rotterdam municipality. (See case study of Rotterdam below).
- Use of local investment programmes to support municipal cooperation with industry: In Sweden, the Local Investment Programme (LIP) introduced in 1998 aimed to strengthen environmental initiatives at local level and to promote employment. Municipalities were encouraged to co-operate with industry and organisations in environmental projects for which they could receive financial support. Subsidies under LIP (and successor programmes) encouraged utilisation of industrial waste heat by improving the economics of projects, and enabling longer connecting culverts between industry and DH systems.
- Third party non-discriminatory access to networks to enable direct sale of heat to customers: Investigation of Third-Party Access (TPA) to Swedish DH systems commenced with energy market liberalisation. TPA could offer more attractive profits to industries able to sell waste heat directly to customers via DH networks. This measure is controversial since although it could increase the utilisation of waste heat and increase supplier competition, it may increase costs by exposing heat generators to additional risk, as well as raising administration costs.
- Energy efficiency requirements on new EfW plants: In Norway, regulations require a minimum 50% recovery of useable energy from waste incineration, effectively prohibiting electricity-only design and necessitating heat use (note this is significantly higher than Scotland's requirement of 20% energy recovery with a plan to reach 35% efficiency). Waste is the largest component of Norwegian DH and

tends to provide base load heat supply. Norway has a DH licencing regime (discussed above) which institutionalises heat network development and appraisal; this can be contrasted with SEPA's approach under which operators exercise discretion over planning under thermal treatment of waste guidelines.

- Subsidies to industry for primary energy saving: In Denmark, heat supply is regulated as a not-for-profit activity. This extends to heat production where a Danish Energy Agency formula allocates the component costs of heat production from CHP or EfW. The Danish version of ECO offers industrial subsidies measured as primary energy saving (rather than end-use heat and carbon savings as in ECO).

4.2 Driving a transition to low carbon DH systems

- Licensing preferences: In Norway, environmental impacts including fuel sources are considered within the license application process. Where more than one operator is applying for a license in the same area, the proposed fuel source is taken into account alongside other criteria such as customer base, costs, capacity of applicant to implement initiative, and economies of scale (giving an advantage to operators with other facilities in vicinity).
- Funding for innovations: UK electricity and gas network operators can compete for funding in the Network Innovation Competition (NIC). Funding is provided for projects that help all network operators understand what they need to do to provide environmental benefits, cost reductions and security of supply for a low carbon economy. Up to £18m per annum is available through the Gas NIC and up to £81m per annum through the Electricity NIC. In addition, all network licensees receive a Network Innovation Allowance (NIA) that can be used for: (i) projects delivering financial benefits to the licensee and customers; and/or (ii) preparation of submissions to the NIC.
- Tax regime: In Sweden differential tax rates are used for different energy sources. In 1980, Swedish DH was almost entirely oil-fuelled. Since then, tax and subsidy regimes have led to significant diversity in heat sources, notably making use of local biomass resources and gas for cogeneration.
- Municipal planning and powers to specify fuel use: In Denmark, the 1976 Electricity Supply Act required all new electricity generation capacity to be CHP plants. Municipalities were then required by the 1979 Heat Supply Act to produce binding heat supply planning documents that identified DH zones. The Heat Supply Act still aims to promote DH networks that maximize CHP and, socio-economic and environmental benefits from reducing fossil fuel dependence. Municipalities continue to be the arbiters of which new heat network components are built or substantially altered, and may require heat suppliers to undertake certain projects or use certain fuels or technologies.

Case study: Rotterdam district heating scheme use of industrial waste heat

The Rotterdam Warmtebedrijf connects a large waste incinerator in Rotterdam Harbour with other DH networks in the city, via a 26km pipeline supplying a mix of public, commercial and domestic users. This addressed the environmental problem of excess heat being dumped into the harbour. Heat delivery commenced in 2013 with planned connections to the equivalent of 50,000 homes. Long-term visions for the scheme include heat off-take from multiple industrial sites and interconnection with regional networks including Delft and the Hague.

Although this connection to large scale industrial heat sources was achieved without formal regulation from government, the politics surrounding the scheme played a crucial role. Industry actors pre-empted the Government imposition of regulation by planning a DH scheme to utilise waste heat. However, project delivery went ahead only after the Rotterdam municipality made significant financial investment and underwrote the project risk. Responsibility for identifying sources of heat demand was initially placed on the waste heat producers. This contrasts with regulation that places responsibility on the DH network developer.

For more detail see Hawkey & Webb (2014)

5. Customer protection: Pricing and service standards

How might this issue benefit from regulation?

There are currently no enforceable forms of protection for customers of heat networks in the UK.

	Issue	How might this issue benefit from regulation?	What currently happens in Scotland?
5.1	Ensuring standards of operation	Inconsistent service standards could leave some customers receiving a poor service. Regulation could set technical standards to ensure that service quality is delivered.	UK customers are not protected by formal regulation for the sale of heat. However, a **voluntary** consumer code has been developed by industry: the Heat Trust code sets standards including customer service, transparency of billing, and service provision. However, there are gaps in this scheme: there is no 'supplier of last resort' protection to deal with schemes in administration. The Which? Report 'Turning up the heat' (2015) highlighted the **lack of information for customers** prior to their connection to a DH scheme (e.g. moving into a new-build house connected to DH). Finally, schemes where a third party is involved in heat sale are not suitable for the Heat Trust e.g. Housing associations and social housing run by local authorities.
5.2	Price protection for customers	DH systems are often operated as integrated monopolies. Customers cannot switch supplier in the same way that they may be able to with gas and electricity. In some cases they may also be signed up to long-term contracts. Regulation could ensure fairness and transparency of heat pricing.	There are no forms of price protection for DH customers in the UK, although the Heat Trust scheme provides customers with an online price comparator calculator to encourage competitive pricing.

What happens elsewhere?

All of the case study countries considered had forms of customer protection regulation passed into law.

5.1 Ensuring standards of operation

- Contract conditions for transparency and supply standards: In the Netherlands, the Heat Act (2010) requires that heat supply contracts comply with consumer information, and heat supply agreement requirements. The regulator has powers to judge if the terms of contracts are reasonable and transparent, or not.
- Independent dispute resolution: The Swedish Energy Agency district heating board mediates on disputes related to schemes.
- Compensation for interrupted service: Several countries' heat laws specify under what circumstances compensation must be paid to customers for faults or interrupted service.
    - In the UK gas and electricity industries, OFGEM recognises that gas distribution networks are natural monopolies and regulates them through licensing to protect against potential abuse of monopoly power. Licenses include standards of supply, which set minimum service levels in key areas. If these are not met, then customers are entitled to receive a compensation payment.
- Demonstration of long-term planning and viability: The Netherlands requires companies to demonstrate financial capacity to continue supply of heat (through submission of financial statements, etc.) as well as to forecast heat demand and how it will be met over the medium term (5-10 years) and longer term (>10 years).
- Supply continuity: In Norway, operators must obtain a permit to shut down their facility. Delays to construction of a scheme past a specified date require the heat supplier to provide an alternative temporary source of heat until the scheme is functioning.

5.2 Price protection for customers

- Price transparency: The Netherlands places a requirement on companies to provide "reliable, insightful information on total costs and revenues associated with the supply of heat and the performance of the connection" Governments in Norway, Demark, Sweden, and the Netherlands require information on heat prices to be publicly available
- Price cap or baseline alternative: In Norway companies can charge a connection fee, a fixed yearly charge and a heat charge. The heat charge has to be lower than the cost of electric heating in the area. Netherlands Heat Law specifies maximum heat tariffs (including the standing charge and connection fee) based upon a principle of "Niet-meer-dan-anders" (no-more than-otherwise).
- Cap on supplier returns: This was discussed in the Netherlands but not implemented in the Heat Act (2010). The proposal was to set a 'reasonable return' for the heat supplier, calculated in relation to other regulated infrastructure returns at between 5.1% and 7.6%.
- Price control: Revenue = Incentives + Innovation + Outputs (RIIO): In the UK, licenses are granted to energy network operators under the performance-based RIIO price control formula. RIIO aims to encourage companies to be "customer centred, invest efficiently, innovate to reduce costs, and contribute to development of a low carbon energy future".
- Heat supply must be not-for-profit: In Denmark, all forms of heat supply must be not for profit, including heat supplied from CHP plants and district heating operators. 'Cost reflective pricing' is used (a large proportion of bills are for the standing charge rather than the heat charge). Prices are kept as low as possible by ensuring companies can access low interest rate loans (sometimes as low as 1%) through municipal underwriting. The Danish Energy Regulatory Authority has the power to review heat prices and determine whether they are cost reflective.

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7. Appendix: Overview of questions for the working group

Section 2: Energy planning for growth and interconnection of district heating networks

2.1 How should responsibilities for coordination of DH growth and interconnection be divided between local authorities and national government?

2.2 What enabling regulations and policies are required? E.g. inclusion of DH strategies in Local Development Plans? Scottish / UK price index? Move from a voluntary to a statutory consumer protection scheme and licensing?

2.3 Should there be regulation to require connection? Or are policy (e.g. procurement / social housing standards / building standards), and incentives (e.g. restructuring the RHI to promote DH) more appropriate?

a) If regulation is preferred, who should be required to connect, e.g. public sector, third sector, developers, new builds, existing properties in designated areas?

2.4 How should any measures interact with gas network policy and regulation, particularly where displacement of the gas network is taking place?

Section 3: Aligning local delivery with national strategic objectives

3.1 Does Scotland need a form of socio-economic analysis for DH regulation?

a) What criteria should it consider?

b) What other strategies and objectives would it interact with?

3.2 Does the Scottish Government need to do more to enable non-traditional energy market actors to contribute to developing DH?

3.3 Are there regulatory opportunities to create stronger alignment between district heating policy and other strategic objectives such as fuel poverty reduction?

Section 4: Low carbon supply of heat to networks

4.1 Who should be responsible for enabling use of waste heat with DH?

a) Who should be the problem owner? E.g. Should it be the waste heat producers' problem if there is no existing network to feed into?

4.2 How do we achieve a balance between encouraging DH market growth and ensuring use of low carbon heat sources?

a) On what time scales should decarbonisation of heat supply to networks take place?

b) When is it still acceptable to install fossil fuel based systems?

4.3 Where might regulation of low carbon heat supply for DH fit within wider decarbonisation policies and regulations?

4.4 How could regulation ensure future proofing for new low carbon heat supply options as they become available e.g. hydrogen?

Section 5: Customer protection: Pricing and service standards

5.1 What would be the impact on DH developers of introducing Scottish customer protection regulation at this stage in market development for (a) standards of operation; and (b) heat pricing?

5.2 Should heat suppliers, now required to notify under Heat Network Regulations 2014, be subject to statutory licencing?

5.3 Does Scotland need to introduce its own customer protection regulations for the heat sector or should this be led by UK Government and OFGEM?