Separate regulation for wholesale and retail heat supply – a way to protect consumers and boost investment in the UK heat network sector.

A Report for the Heat Networks Industry Council

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Executive Summary.

This paper has been commissioned by the Heat Networks Industry Council (HeatNIC), which includes the heat networks industry and the Department for Energy Security and Net Zero (DESNZ). HeatNIC has requested a paper which will examine ways in which the future regulatory framework for heat networks can be designed in a way which boosts consumer choice, supports the realisation of the government's policy objectives, and enables investment in the sector.

There are a total of 14,000 heat networks supplying 480,000 consumers with about 10 TWh of heat. Of the 14,000 heat networks in the UK, 12,000 are communal networks and 2,000 are district networks. Only 2% of heat is provided by heat networks. A variety of business models are used to construct and operate heat networks and supply heat to customers. The UK government views heat networks as an essential means to decarbonise heat in buildings. The Committee on Climate Change estimated that 18% of UK heat will need to come from heat networks.

In 2018 the Competition and Markets Authority (the CMA) recommended that the sector be regulated.[1] It proposed the introduction of consumer protection similar to that of gas and electricity customers, and an increase in transparency in consumer bills alongside clear contracts between customers and heat network operators. The government has made proposals for regulation of the sector by Ofgem. It also has proposed the creation of heat network zones with requirements for some buildings within zones to connect to a heat network.

The following observations can be made:

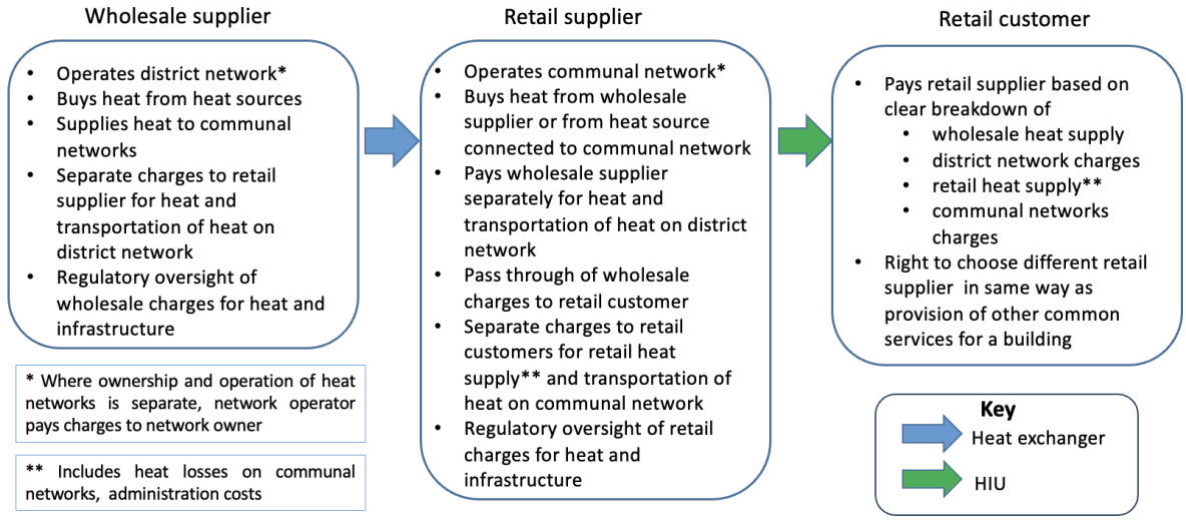
- The UK heat networks are small and fragmented compared to heat networks elsewhere, and the government's ambition is to increase the market share of heat networks by at least ninefold. This implies that most of the heat networks to which the new framework will apply do not yet exist.
- The small and localised scale of the UK industry suggests that the UK will need to deploy more and larger scale district heat networks.
- District networks potentially offer communal networks access to a wider range of low carbon heat sources at lower cost.
- Most of the problems causing customer dissatisfaction with heat networks appear to be associated with the operation of communal heat networks, and the supply of heat to end consumers.[2]
- The design, construction, financing, and operation of a large district heat network supplying heat from different sources to multiple buildings over a large area is fundamentally different from a single building / campus network reliant on a single heat source. A 'one size fits all' approach is unlikely to be appropriate.

[1] Competition and Markets Authority Press Release: Heat networks must be regulated, CMA study finds.

[2] For example, 90% of unplanned interruptions were caused by in property faults, and of these 73% were caused by problems with the HIU. Source: Heat Trust Annual Report, findings from year five 2020. Page 16.

- The operation and maintenance of a communal network in a single building appears to be a service similar to that of other building services provided by the freehold owners of a building to the tenants or leaseholders i.e. the maintenance or operation of the heat network is not necessarily undertaken by the landlord itself but the service is provided by other companies contracted by the landlord. Experience in other industries shows that a variety of regulatory unbundling models can be used to disaggregate vertically integrated supply chains.
- The heat exchanger or Heat Interface Unit (HIU) is an obvious point of separation between district and communal networks, and between communal networks and end consumers.
- It should be possible to split the costs of the various activities in a heat network according to function.
- The operation of a communal heat network does not have the same natural monopoly characteristics as the construction and ownership of the network since communal heat networks are not always operated by the original building developer or the building owner.

The proposed regulatory framework separates wholesale heat supply from retail heat supply and enables retail customers to choose their retail heat supplier.



Key elements of this approach are as follows:

- Companies may operate as both wholesale suppliers and retail suppliers. Companies may also be both owner and operator of district and communal networks. The framework does not require ownership unbundling.
- A key underlying principle is that all asset owners and operators should be able to earn a reasonable return on their investments and activities.
- Transparent charging and the avoidance of cross subsidies between different activities ensures that where end consumers wish to choose a different retail supplier, alternative suppliers can compete on a level playing field with the incumbent retail supplier.
- Transparent charging between the different segments of the chain (wholesale and retail) requires separate charges for different activities along the chain. The wholesale heat

supplier charges the retail supplier separately for heat supply and for the transportation of heat via the district network. In turn the retail heat supplier passes through the costs of both wholesale heat supply and district heat transportation to end customers. The retail supplier charges separately for retail supply of heat (e.g. taking account of heat losses between the wholesale network and the customer via the communal network, or the costs of any local heat supply solely to the communal network) and the transportation of heat via the communal heat network.

- Where ownership and operatorship of networks is separate, network operators pay network owners for the right to use the network to enable the network owner to earn a return on their investment. The charge that the operator pays to the asset owner is clearly identified.
- Retail customers on a single communal network may *collectively* choose a different retail supplier and hence a different operator for the communal network. This would be similar to the way tenants in a building can choose different facility management services.

Benefits of this approach include:

- Retail customers will have the ability change their retail heat supplier in the event of unacceptable pricing or quality of service.
- Clear and transparent charging benefits consumers and addresses one of the main concerns of the CMA and the government regarding consumer protection.
- Companies can still operate in the different segments of the supply chain. The framework is therefore compatible with the different business models identified in the heat network sector.
- Clear definition and delineation of roles and responsibilities, and transparent charging, ensure that companies and investors are properly remunerated. This enables investors with different risk appetites and business models to invest in different segments which should widen the pool of capital available to the industry.
- The framework allows specialisation by enabling companies to focus on different activities, for example the construction and operation of district heat networks and related business to business activity, or the operation of communal networks (a business to consumer activity).
- The framework is consistent with the physical structure of the industry by using the heat exchanger or HIU as the boundary between the different activities (district heat networks, communal heat networks and retail customers).
- The framework is consistent with the likely future development of the heat network industry, namely more district networks connected to different heat sources and multiple communal networks.
- Separation of wholesale and retail supply enables Ofgem to apply sector appropriate regulation to the different segments of the supply chain.
- The ability of retail customers collectively to choose the retail supplier and communal network operator whilst remaining connected to the same network will increase public acceptability of the obligation for buildings to connect to district heating networks by reducing the concern of being locked into the same suppliers and network operators.
- The framework is compatible with the proposed heat network zoning, and situations where a district heat network operator is granted the exclusive right to operate in a particular zone.

Further work is required to decide how to treat existing heat networks and to develop clear definition of roles and responsibilities between the different activities in the supply chain. Agreement on technical standards is also required enable interoperability between district and communal networks, and to enable measurement of heat supplied.

Ofgem needs to develop its regulatory model in more detail. The proposed framework is compatible with different forms of regulation but greater clarity on the regulatory approach will enable investors to analyse better the risks and rewards of the proposed framework.

Introduction.

This paper has been commissioned by the Heat Networks Industry Council (HeatNIC), which includes the heat networks industry and the Department for Energy Security and Net Zero (DESNZ), formerly the Department for Business, Energy, and Industrial Strategy (BEIS). HeatNIC believes that lack of customer choice in the networks market makes heat networks less attractive to consumers and to government, and that this therefore hinders investment in the sector. HeatNIC wishes to improve the experience of customers, thereby making the sector more attractive. It also believes that aligning the investment offer in heat networks with other networked utilities will make it more investable. It is concerned that proposals in the Energy Security Bill, for example the obligation to connect, may make heat networks less attractive to consumers if they cannot change supplier. HeatNIC has therefore requested a paper which will examine ways in which the future regulatory framework for heat networks can be designed in a way which boosts consumer choice, supports the realisation of the government's policy objectives, and enables investment in the sector.

The paper is structured as follows. Section 1 reviews the current structure of the UK heat network industry, government aspirations for heat networks as part of the UK's net zero strategy, current and possible investment models for heat networks, and current government proposals for heat network regulation. Section 2 'Proposed Framework' examines how separate regulation for wholesale and retail supply of heat could be structured. Section 3 then looks at the benefits of the proposed structure, as well as potential weaknesses, based on the information and observations in Section 1.

Section 1. Context and Observations.

This section reviews the current structure of the UK heat network industry, government aspirations for heat networks as part of the UK's net zero strategy, current and possible investment models for heat networks, and current government proposals for heat network regulation.

Description of a heat network.

Typically, a heat network consists of several key elements:

- The heat sources.
- The primary or district network, to transport the heat from the source to the consumers' buildings.
- A heat exchanger between the district network and the communal or secondary network.
- The secondary or communal heat network, to take the heat from an onsite location to each individual unit / end consumer within a building.
- A Heat Interface Unit containing a heat exchanger between the communal /secondary system and the end consumer's tertiary network system / heating system.
- The end consumer's tertiary network system / heating system.

Some historic heat networks do not feature heat exchangers or HIUs, and may be 'direct' systems, whereby the water that flows around the district heat network flows directly around the buildings too.

Heat sources.

Various technologies can be used for the heat source including waste heat from industrial processes or waste to energy plants, renewable energy such as biomass boilers, geothermal, ground source and air source heat pumps, electric boilers, and solar thermal. Whilst some UK heat networks use more than one source of heat, it appears that many use a single heat source. Many heat networks use natural gas fired Combined Heat and Power (CHP) plants to supply both heat and electricity. Heat pumps and waste heat are increasingly used on more recent projects. Heat sources can be connected to either a district heat network or a communal network.

Pipeline networks.

The size and quantity of the pipelines depends on the expected demand and the distance from the heat source to the consumers. There is a distinction between pipelines that supply heat to several buildings (district heat network) and pipelines which supply the heat within a building (communal network). The district network is sometimes referred to as the primary network and the communal network as the secondary network.

Currently the Heat Network (Metering and Billing) Regulations 2014 defines them as follows:

- *Communal heating*: the distribution of thermal energy in the form of steam, hot water, or chilled liquids from a central source in a building which is occupied by more than one final customer, for the use of space or process heating, cooling or hot water;"

- *District heat network*: the distribution of thermal energy in the form of steam, hot water or chilled liquids from a central source of production through a network to multiple buildings or sites for the use of space or process heating, cooling or hot water"

The government has decided that the definition of heat networks should in future also include shared ground loop heat networks.[3]

Heat exchanger.
Where a communal network is linked to the district network to supply the heat, heat is transferred through a heat exchanger. It regulates the amount of heat that is transferred based on the communal network's demand. It also provides hydraulic separation between the district and communal networks, which means that the secondary network needs its own pumping, pressurisation, controls, water supply, water treatment and electricity supply. It therefore is also the point at which the heat used by the communal network can be measured.

Heat Interface Unit (HIU).
The Heat Interface Unit includes a heat exchanger and usually a meter. It transfers the heat from the communal heat network pipelines to the consumer's tertiary network system. It acts as the bridge between the heat network and the consumer. It regulates the amount of heat that is transferred based on the consumer's demand. It also provides hydraulic separation between the communal and the end consumer's system, which means that the consumer's system needs its own pumping, pressurisation, controls / thermostat, water supply, water treatment and electricity supply. These are typically integrated into the HIU, and the tertiary network would typically be the responsibility of the consumer to operate and maintain. The HIU is typically the point at which the heat used by the consumer can be measured.

It is recognised that some legacy heat network systems do not have HIUs, heat exchangers or heat meters.

Consumer or tertiary system.
The consumer's system consists of the heating system (pipes and radiators) and hot water system within a building or apartment which uses the heat from the heat network as the heat source, for example instead of an individual gas fired boiler or heat pump. The consumer is charged for the heat used instead of natural gas used to fuel the boiler or electricity to run the heat pump. The consumer's system may also be referred to as the tertiary network.

Current structure of the UK Heat Network Industry.

The latest data shows there are a total of 14,000 heat networks supplying 480,000 consumers with about 10 TWh. Only 2% of heat is provided by heat networks.[4] This is an average of 34 customers per network, but this average number hides a large variation, ranging from networks in single buildings servicing a few consumers, to larger networks servicing several thousand consumers across several buildings. Of the 14,000 heat networks in the UK, 12,000

[3] Department for Business, Energy, & Industrial Strategy (2021). Heat Networks: Building a Market Framework. Government Response. Page 22.
[4] Department for Business, Energy and Industrial Strategy (2020). Heat Networks: Building a market framework.

are communal networks and 2,000 are district networks. The dispersion of heat networks in the UK is illustrated below:

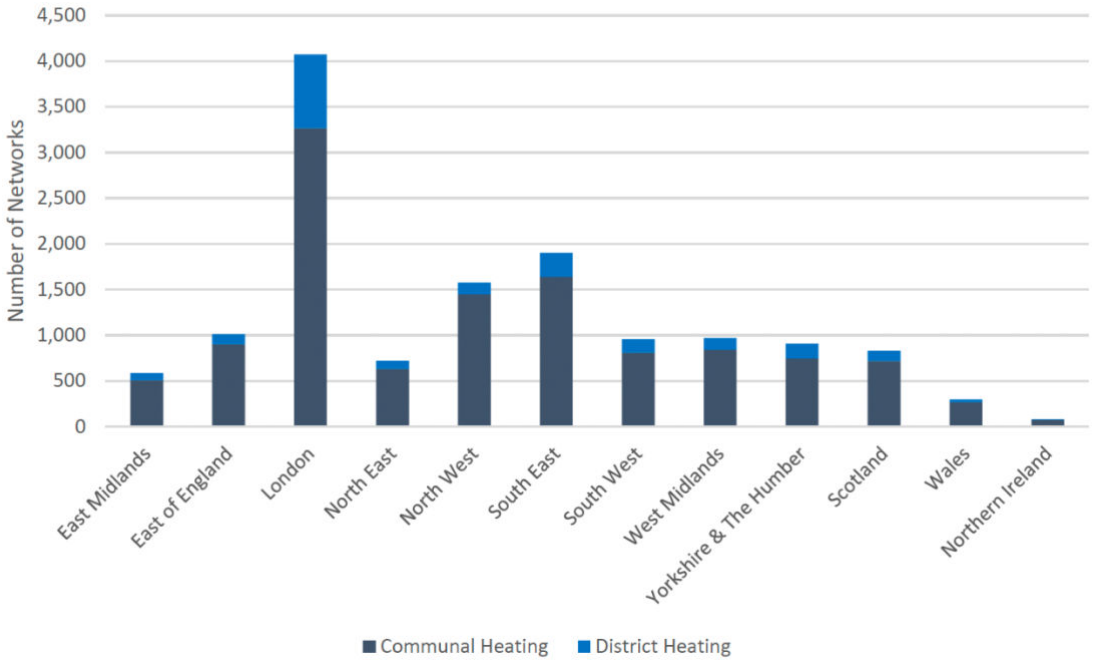


Figure 1 Source: Department for Business, Energy and Industrial Strategy (2020). Heat Networks: Building a market framework. Page 14.

Government ambition for heat networks.

The UK government has set a target of net zero greenhouse gas emissions by 2050. This would require "virtually all heat in buildings to be decarbonised, and heat in industry to be reduced to close to zero carbon emissions."[5] The UK government views heat networks as an essential means to decarbonise heat in buildings:

"Heat networks are a crucial aspect of the path towards decarbonising heat and achieving net-zero commitment. They deliver heating, hot water, and/or cooling from a central source or sources to a variety of different customers such as domestic residential units, public sector buildings, shops, offices, sport facilities, universities. *Heat networks are uniquely able to unlock otherwise inaccessible sources of larger scale renewable and recovered heat such as waste heat and heat from rivers and mines*." (*Emphasis added*).

The share of heating that heat networks provide in the future is uncertain but will be significantly greater than now. The Climate Change Committee estimated that 18% of UK heat will need to come from heat networks.[6] The government acknowledges that there is "significant potential for the number and scale of heat networks to increase dramatically."[7] The government's view of what heat networks could like in the future is illustrated below:

[5] Ibid. Page 10.
[6] Ibid. Page 10.
[7] Ibid. Page 8.

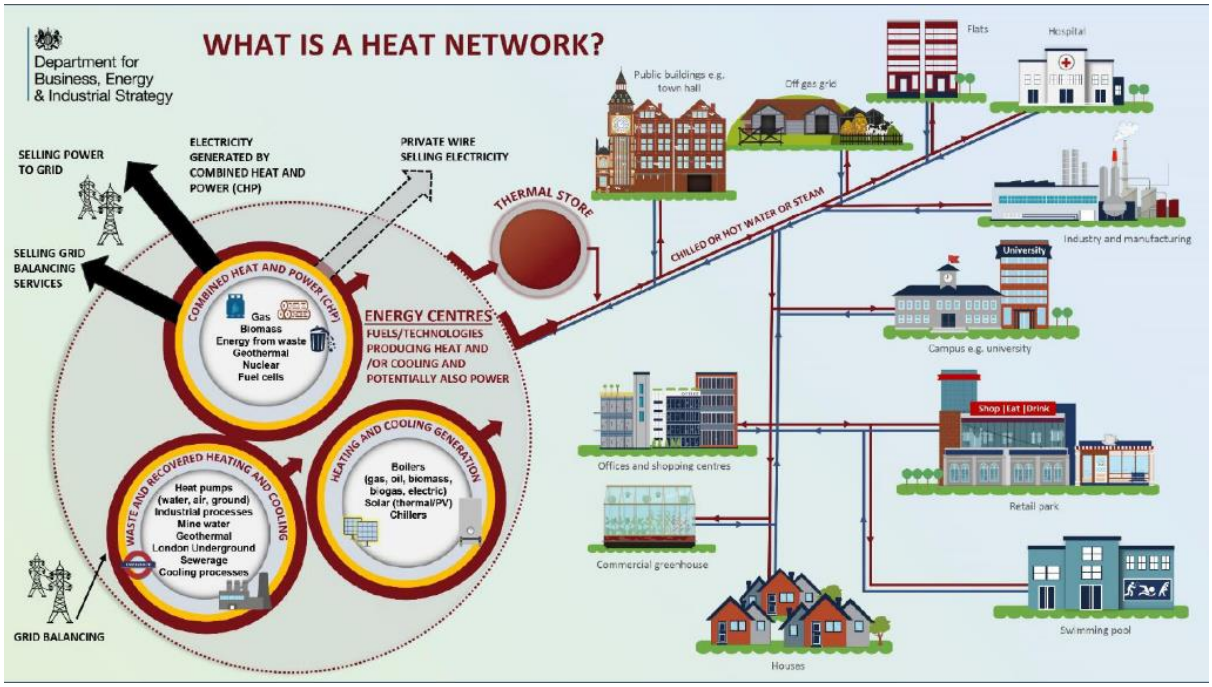


Figure 2 Source: [Department for Business, Energy and Industrial Strategy (2020). Heat Networks: Building a market framework.](#) Page 11.

Regulatory Framework.

The Competition and Markets Authority (the CMA) concluded in 2018[8] that heat networks provided good levels of service and price for many customers. However, for some customers, "particularly those on certain private sector schemes," price and service outcomes were poor. The CMA identified three key drivers for poor outcomes:

- **Property developers, heat network operators and customers have different interests.**
    - Inappropriate choice and design of heat networks can be caused by property developers not providing solutions at lowest cost to consumers but in the most cost-effective way for developers to meet planning requirements.
    - Property developers fail to consider whole life costs but try to minimise up-front costs of design and installation which leads to higher ongoing operation and maintenance costs.
- **The monopoly supply of heat networks.**
    - Heat networks are natural monopolies where customers have no alternative heat sources but can be locked into long term contracts.
    - The detrimental impact of natural monopoly heat networks depends on the choice of delivery model and the rights and protection.
    - For most communal networks leaseholders have the right to use the network and the landlord or property management companies manage the network. In this case consumers' interests tend to be protected in the same way as all communal assets in multi-tenanted buildings as the network is being operated on a not-for-profit basis.

[8] Competition and Markets Authority (2018). Heat networks market study. Final report.

  - For privately operated district and large communal networks the right to use the network is often held by an Energy Services Company (ESCO) under a long-term agreement with the freeholder, typically for a minimum of 20 years. The ESCO operates the network and supplies heat to and bills consumers. Responsibility for replacement of the asset lies with the ESCO. Consumers interests are only protected where these are included in the original contract between the freeholder and the ESCO, for example definition of how tariffs are set or service standards. The ESCO needs to recover any costs it has incurred in winning the contract and access rights, for example a capital contribution.
- **Transparency.**
  - Consumers have low awareness of the type of heating in a building when buying a property, and even if they do, it is not a significant factor in deciding. They only focus on issues such as contract duration, exclusivity, and pricing after they have moved in.
  - There can be a lack of transparency about bills which means consumers are less likely to challenge suppliers. Also, there may be a lack of key information when the heat is supplied via a leasehold or tenancy agreement and not by a separate heat contract.

The CMA recommended that the sector be regulated.[9] It proposed the introduction of consumer protection similar to that of gas and electricity customers, an increase in transparency in consumer bills alongside clear contracts between customers and heat network operators. Developers should also be prevented from using cheaper design and build options which result in higher costs for customers over the long term.

In response the government consulted on a market framework for heat networks in 2020[10] and published its response in December 2021.[11] The government's regulatory approach is as follows:

- Ofgem has been confirmed as the heat network regulator with the Energy Ombudsman as the independent ombudsman service, and Citizens Advice as the consumer advocacy body.
- Domestic consumers and micro-businesses are to be protected by regulation on pricing, transparency, and quality of service. This will apply for customers supplied by both district and communal networks. Regulation will be outcomes based. Government believes that large consumers do not need consumer protection but are considering if protections may be extended in certain circumstances, for example the obligation to connect.
- A general authorization regime with the potential for the separate supply of heat and heat network operation with Ofgem responsible for enforcement in case of non-compliance, and potential for step-in arrangements. Where a single entity supplies both heat and operates the network then only a single authorisation will be required.

[9] Competition and Markets Authority Press Release: Heat networks must be regulated, CMA study finds. 23rd July 2018.
[10] Department for Business, Energy, & Industrial Strategy (2020). Heat Networks: Building a Market Framework.
[11] Department for Business, Energy, & Industrial Strategy (2021). Heat Networks: Building a Market Framework. Government Response.

- Ofgem will have powers to introduce guidance on cost allocation and mandatory price transparency. Ofgem will 'will also have powers to introduce rules and/or guidance on fair and consistent pricing, powers to take enforcement action against disproportionately high pricing, and the ability to set price comparison and benchmarking methodologies.'[12] The government currently does not intend to introduce price caps or direct profit regulation because of 'the nascent state of the heat networks market (requiring) flexible business and tariff models to encourage investment.'[13] Price regulation may be introduced in the future 'should there be evidence of widespread consumer detriment, or as a mechanism to incentivise innovation to reduce costs and encourage growth in a more mature market.'[14]
- Technical standards governing heat networks will be mandated and compliance with these standards required as part of the authorisation process.
- Heat networks can apply to become 'statutory undertakers' to use access rights, permitted development, linear obstacle rights and street works permits.
- The government will have powers to set maximum carbon emission limits for heat networks in order to ensure heat networks contribute to net zero targets.

Alongside the market framework consultation, the government consulted on heat network zoning in 2021.[15] In response the government concluded that it would:[16]

- Develop a standardised methodology to identify potential heat network zones.
- Local governments will be given the power to act as or establish a local Zoning Coordinator to establish heat network zones. Zoning Coordinators may also determine the business delivery model, veto developments of new networks within the zones and enforce requirements to connect to heat networks.
- Central government will have the power to direct local governments to designate a heat network zone or designate a zone on behalf of the local government and to fulfil the functions of the zoning coordinator.
- Specific buildings or groups of buildings will be required to connect to a heat network within a prescribed timeframe. Buildings may request exemptions if they have already installed low carbon heating.
- Potential low carbon heat sources will be required to cooperate with the Zoning Coordinator to assess the case for connecting to the heat network. Government will explore the possibility of introducing an obligation to connect for low carbon heat sources.
- Minimum carbon standards will apply to new heat networks and new heat source connections to existing heat networks.
- Zones will be subject to monitoring, reporting and review.

It is understood that government is currently working with Ofgem and stakeholders to design and then implement the necessary regulation.

[12] Department for Business, Energy, & Industrial Strategy (2021). Heat Networks: Building a Market Framework. Government Response. Page 44.
[13] Ibid.
[14] Ibid.
[15] Department for Business, Energy, & Industrial Strategy (2021). Heat Network Zoning.
[16] Department for Business, Energy, & Industrial Strategy (2022). Heat Networks: Proposals for Heat Network Zoning. Summary.

Business Models.

There are variety of different high level business models used to fund, construct and operate heat networks.

The business models for heat networks are changing, as new investment is coming into the market. In particular, private investment models are becoming more common. These models involve less or no procurement by local government and include Heat Supply Agreements and Joint Development Agreements.

Historically, business models in a procurement-led heat networks market have been one of the following:[17]

- **Third party Energy Services Company (ESCo).** The project sponsor signs an energy services agreement with the ESCo which is responsible for construction and operation of the heat network, and the supply of heat to consumers. The ESCo is both asset owner and operator.
- **Concession agreement.** The project sponsor signs a concession agreement with a third party ESCo. The project sponsor owns the asset and the ESCo operates it and supplies the heat to customers. Under this approach the ESCo may contribute to the funding of the asset whereby it pays a lump sum to the Project Sponsor for the right to use the asset. Alternatively, the ESCo may fund the project and receives payment from the Project Sponsor or off-takers per connection to the network. This is called the contribution or connection model.
- **Joint Venture (JV) ESCo model.** A joint venture ESCo is formed by the Project Sponsor and a partner to construct and operate the network and supply heat to customers. The JV ESCo both owns and operates the assets.
- **Project Sponsor ESCo.** The project sponsor forms its own separate ESCo to construct and operate the network and supply heat to customers, which is both owner and operator of the asset.
- **In house delivery.** The Project Sponsor itself constructs and operates the network and supplies heat to customers. Unlike the Project Sponsor ESCO model it does not establish a separate company to do this. The Project Sponsor is both owner and operator of the asset.

As described above a heat network involves different functions which may be disaggregated. For example, there can be an infrastructure-operation split whereby the assets and operations of the heat network are held by different companies, or an unbundled structure where the heat generation, heat distribution and heat supply elements are owned by different companies.[18] This may enable projects to attract investors with different risk appetites depending on the perceived predictability of revenues. The suitability of such disaggregation varies according to the type of business model.[19] Different assets have different investment

[17] Based on Grant Thornton (2018) Financing Heat Networks in the UK. Guidebook. Chapter 6.
[18] Grant Thornton (2018) Financing Heat Networks in the UK. Guidebook. Chapter 6.1.9.
[19] Ibid.

horizons and economic lifespans e.g. 15 years for a heat generation plant such as a CHP or heat pump or 40 years plus for a pipeline network.[20]

Observations.

The following observations are made in light of the information above and inform the structure of the proposed regulatory framework in Section 2 and the analysis in Section 3.

- The overall aim of a new regulatory framework for heat networks should be to benefit consumers. This can be achieved in several ways, for example enabling access to lower cost low-carbon heat than alternatives such as individual heat sources, enabling consumers to exercise choice so they can protect their own economic interests, and protecting consumers where choice may not be possible.
- The UK heat networks are small and fragmented compared to heat networks elsewhere, and the government's ambition is to increase the market share of heat networks by at least ninefold. This implies that most of the heat networks to which the new framework will apply do not yet exist.
- The small and localised scale of the UK industry (total of 10TWh of heat supplied in the UK compared to 8.5 TWh for the City of Copenhagen alone) suggests that the UK will need to deploy more and larger scale district heat networks (as opposed to communal or small district heat networks) if it is to scale up efficiently, reap the benefits of economies of scale and hence deliver low cost heat to customers. The government's proposals for zoning support this conclusion, for example the requirement for buildings to connect to networks.
- Most existing heat networks rely on fossil fuel-based heat generation (e.g. gas fired CHPs or boilers) although more recent examples also use low carbon heat sources. In future heat networks will not be able to use fossil fuel natural gas as the heat source but will need to access low carbon heat sources instead. District networks potentially offer communal networks access to a wider range of low carbon heat sources at lower cost. Connection to a district network also offers the benefits of greater security of supply, for example by connection to multiple heat sources and large-scale thermal storage, as well as the benefits of economies of scale.
- Most of the problems causing customer dissatisfaction with heat networks appear to be associated with the operation of communal heat networks, and the supply of heat to end consumers.[21] This can be caused, for example, by poor design of heat networks due to misaligned interests of building developers, heat network operators and end consumers, or by lack of transparency of billing. Any regulatory framework aimed at improving customer acceptance of heat networks therefore needs to be distinguish between the framework for communal heat networks and the supply of heat to end consumers on the one hand, and the framework for wholesale supply of heat (heat generation and district networks) on the other.
- The design, construction, financing, and operation of a large district heat network supplying heat from different sources to multiple buildings over a large area is fundamentally different from a single building / campus network reliant on a single

[20] Ibid.

[21] For example, 90% of unplanned interruptions were caused by in property faults, and of these 73% were caused by problems with the HIU. Source: Heat Trust Annual Report, findings from year five 2020. Page 16.

heat source. A 'one size fits all' approach which places the same regulatory burdens on future large scale district networks as communal or small-scale district networks (e.g. supplying a small number of buildings or a campus) is unlikely to be appropriate and may deter investors, for example by being too burdensome or poorly focussed.

- The current lack of regulation, both in terms of pricing and of technical standards, is unusual given that heat customers have no choice of supplier and therefore have minimal economic power vis a vis their heat suppliers. Other sectors such as gas, electricity and water are regulated.
- The government's proposals on price and service regulation rely on Ofgem to intervene in the event of unfair pricing or poor service quality. Given the current 14,000 heat networks (and the likelihood that this number will grow significantly), this potentially places a very high administrative burden on Ofgem if consumers have limited or no choice in their use of a heat network, and no other means of redress e.g. changing the operator of the communal network. An alternative approach would be to have stricter price regulation for all heat networks, but this would also be burdensome on both Ofgem and communal networks given the size and number of such networks.
- The operation and maintenance of a communal network in a single building appears to be a service similar to that of other building services provided by the freehold owners of a building to the tenants or leaseholders. i.e. the maintenance or operation of the heat network is not necessarily undertaken by the landlord itself but the service is provided by other companies contracted by the landlord. As such it may be covered by the Landlord and Tenant Act 1985 which requires that landlords must consult leaseholders before carrying out work above a certain value or entering into a long-term agreement for providing services.[22] This approach implies that it is possible to change operation and management of heat provision within a building.
- The requirement for buildings to connect to district heat networks means that occupants of those buildings will have limited ability to change how they buy heat in the event of unsatisfactory pricing or service. In the absence of a regime of competition between heat generation and third-party access to heat networks, end consumers will not be able to choose their heat source. Nor will they be able to switch to a different heat network (either district or communal) because of their natural monopoly nature. However, they may be able to choose who operates the communal network in the way that buildings can choose providers of other building services.
- Whilst vertical integration of all functions of the heat network appears common, (e.g. ownership and operation of both district and communal networks, ownership and operation of heat generation and the pipeline networks, and the supply of heat to end consumers) the functions are distinct and require different skills and risk management. This implies they can be disaggregated. The current vertical integration may be a function of the way the industry has developed but other approaches are possible and may be desirable from a consumer or investor point of view. Existing vertically integrated contractual structures will expire over time, whilst most of the heat networks required to meet government aspirations are yet to be built.

[22] Information accessed from the Leasehold Advisory Service website. Service charges and other issues. Website accessed 7th May 2023.

- Experience in other industries shows that a variety of regulatory unbundling models can be used to disaggregate vertically integrated supply chains. These include:
    - Accounting unbundling whereby costs for the different activities are clearly identified.
    - Management unbundling which requires clear separation of management and independent decision making of the different activities
    - Ownership unbundling where companies in one segment of the chain cannot own companies or operate in another segment of the chain.

  The effectiveness of the models depends on the nature of the industry, the way it is regulated and the objectives of government policy. The clear distinction between different activities in the heat network market means any of the models could be applied.
- The heat exchanger interface between a district network and a communal network is an obvious point of separation between district and communal networks. Similarly, the HIU or heat exchanger between a heat network (district or communal) and end consumers is also an obvious point of separation between the heat network and the consumer's system. It is therefore possible to delineate clear roles, rights and responsibilities irrespective of the ownership and operatorship of the respective systems. The challenge is to set out these roles, rights and responsibilities in way that enables efficient economic outcomes. This approach has been successfully used in other network industries such as gas, electricity and telecoms.
- It should be possible to split the costs of the various activities in a heat network according to function. For example, recovery of the investment (capital costs) in the different assets (heat generation, district network, communal network) can be separated from the operational costs of the different assets. This in turn should enable greater transparency of billing to end consumers e.g. wholesale cost of heat supplied, retail cost of heat supplied including heat losses between the district and communal networks, and the costs of the networks, both district and communal. Such a split also enables the functions to be performed by different entities. For example, the operator of a heat network can reimburse the owner of the asset via a separate charge which it passes through to consumers, alongside separate charges for the operating costs and the heat source costs. The use of separate capacity (fixed) and commodity (variable) charges has been successfully used in other network industries such as gas and electricity to enable efficient recovery of costs and a similar approach should be feasible for heat networks.
- The operation of a communal heat network does not have the same natural monopoly characteristics as the construction and ownership of the network, as communal heat networks are not always operated by the original building developer or the building owner. Whilst it is impractical to duplicate communal heat networks, and the long asset lives and high up front capital costs of a heat network create a natural monopoly situation, it can be possible for the operation to be performed separately so long as the asset owner is compensated (e.g. by a separate charge as explained above) for the cost of the asset.

Section 2. Proposed Regulatory Framework.

The following section proposes an approach to the heat networks regulatory framework currently being designed by the Energy Department and Ofgem, which will enable consumer choice of heat supplier. This can be summarised in the following charts.

Figure 3 below illustrates how the framework would work where there is a district network connected to communal network(s).

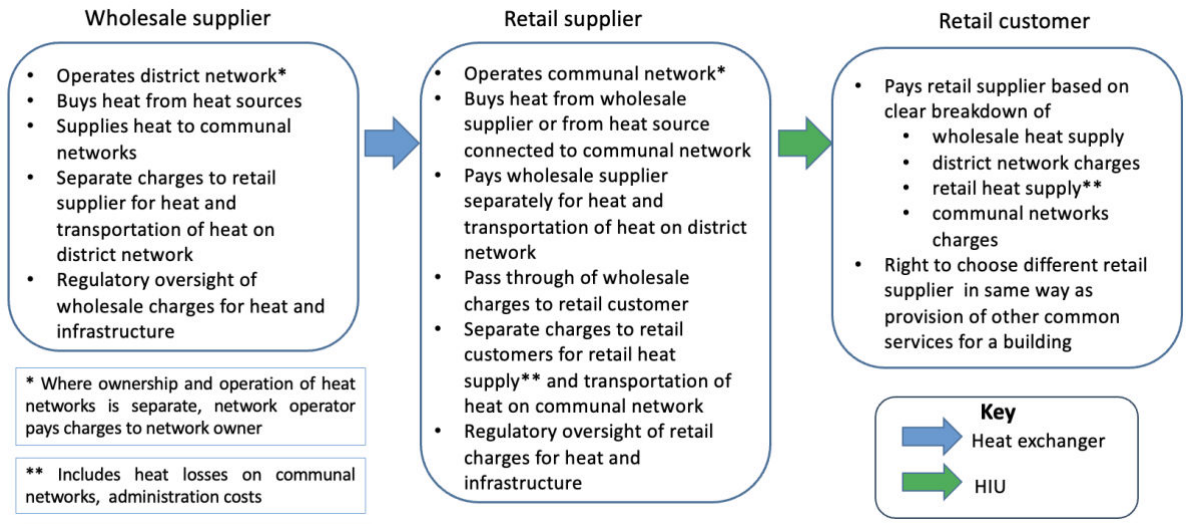


Figure 3 Regulatory framework showing separation of wholesale and retail supply.

Figure 4 shows how the framework would work where there is a stand-alone communal network.

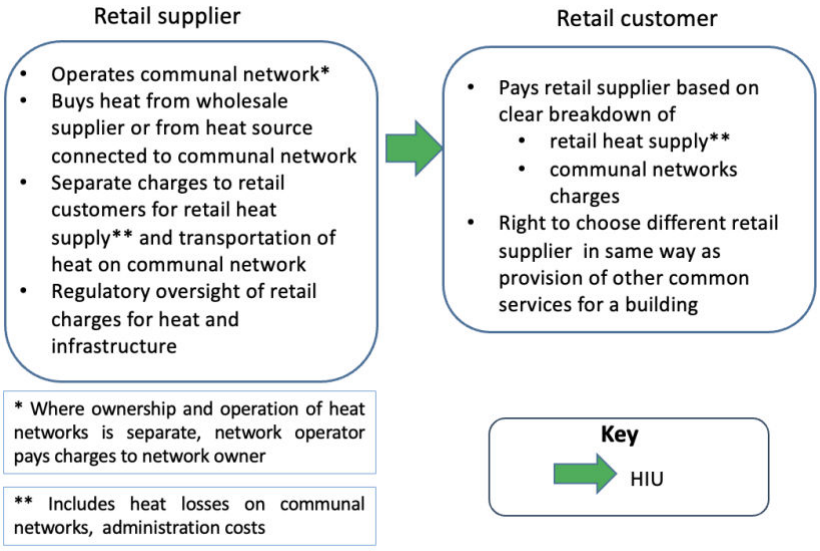


Figure 4 Regulatory framework for standalone communal networks allowing customer choice

Key elements of this approach are as follows:

- Companies may operate as both wholesale suppliers and retail suppliers. Companies may also be both owner and operator of district and communal networks. The framework does not require ownership unbundling. However, continued vertical integration is allowed

based on clear transparent charging and the ability of retail customers to choose a different retail supplier. This requires accounting unbundling across the chain and management unbundling of retail supply from the rest of the supply chain. For example, integrated operation of the communal and district network would still be possible but the management and accounting for the two activities would need to be separate.

- A key underlying principle is that all asset owners and operators should be able to earn a reasonable return on their investments and activities. This means that the charges related to owning a network (the return on the asset) should be separate from the charges related to operating a network and from the charges for supplying the heat. The total costs of the supply chain will not change, but the relevant costs will be properly attributed to the different activities. This in turn will ensure that a company which is both retail supplier and the asset owner for the communal network will not lose out if another company becomes the retail supplier.
- Transparent charging and the avoidance of cross subsidies between different activities ensures that where end consumers wish to choose a different retail supplier, alternative suppliers can compete on a level playing field with the incumbent retail supplier. Cross subsidies could prevent new companies from replacing the incumbent retail supplier where the retail supplier was also the network owner. The incumbent could charge more for the network (return on the asset) and less for retail supply, making its retail supply appear less expensive and ensuring that new entrants could not compete. The experience of the natural gas industry in the early stages of liberalisation bears this out.
- Management unbundling of the retail supplier function from the wholesale supplier function is also necessary to ensure that new entrant retail suppliers can compete. Otherwise, there is a risk the wholesale supplier will engage with its retail supplier on more favourable terms than with a potential competing retail supplier, thereby giving the affiliate retail supplier an unfair advantage. The experience of the natural gas industry in the early stages of liberalisation also bears this out.
- Transparent charging between the different segments of the chain (wholesale and retail) requires separate charges for different activities along the chain. The wholesale heat supplier charges the retail supplier separately for heat supply and for the transportation of heat via the district network. In turn the retail heat supplier passes through the costs of both wholesale heat supply and district heat transportation to end customers. The retail supplier charges separately for retail supply of heat (e.g. taking account of heat losses between the wholesale network and the customer via the communal network, or the cost of any local heat supplied solely to the communal network) and the transportation of heat via the communal heat network.
- Clear identification of roles and responsibilities between wholesale heat suppliers and retail heat suppliers ensures that costs are properly incurred and passed on to consumers by the entity responsible for the activities in question. It also enables different companies to act as the wholesale and retail heat suppliers.
- Where ownership and operatorship of networks is separate, network operators pay network owners for the right to use the network to enable the network owner to earn a return on their investment. The charge that the operator pays to the asset owner is clearly identified. Where heat generation is separately owned and / or operated from the operation of the heat network, the charge that the heat network pays to the heat generator is clearly identified.

- Retail customers on a single communal network may *collectively* choose a different retail supplier and hence a different operator for the communal network. This would be similar to the way tenants in a building can choose different facility management services. For example, the tenants could request tenders for retail supply for a given period of time. If the communal network was owned by the existing retail supplier, the new retail supplier would pay a charge to the communal network owner but that company would no longer also be the retail supplier.
- The separate charges for each activity along the value chain should ensure that the different activities are investable even if they are operated by different companies. This should avoid the need for cross subsidy between the different activities as the charge for each activity should be sufficient to cover costs and earn a return for each activity. As noted above cross subsidies are undesirable as they would inhibit competition and thereby the ability of customers to choose a different retail supplier.

Section 3. Analysis of Proposed Regulatory Framework.

This section analyses the benefits of the proposed framework whilst also looking at potential areas of concern or requiring further analysis.

Benefits.

- Retail customers will have the ability change their retail heat supplier in the event of unacceptable pricing or quality of service. This will encourage consumer acceptance of heat networks as they will not be locked into unsatisfactory retail suppliers. It complements Ofgem's regulatory oversight whilst at the same time ensuring retail customers have more than one way of addressing poor performance or unjustified pricing.
- Clear and transparent charging benefits consumers and addresses one of the main concerns of the CMA and government regarding consumer protection. It enhances consumer confidence and enables consumers and regulators to compare companies' charges for value for money. It provides Ofgem with the necessary information to undertake benchmarking-based regulation i.e. the comparison of charges from different providers to identify those which may be charging too much.
- Companies can still operate in the different segments of the supply chain. The framework is therefore compatible with the different business models identified in the heat network sector. Clear definition and delineation of roles and responsibilities, and transparent charging, ensure that companies and investors are properly remunerated. This enables investors with different risk appetites and business models to invest in different segments which should widen the pool of capital available to the industry. For example, infrastructure funds can invest in networks only, whilst energy supply companies can compete in the retail supply segment. Networks are lower risk because customers cannot change the network to which they are connected. However, networks require more upfront investment. Retail supply is higher risk because of the ability of customers to change supplier, but the activity requires less capital investment.
- The framework enables new business models to emerge, for example, businesses that want to be a specialised heat retailer, operating across multiple buildings in multiple locations. In future, when significant numbers of individual houses are connected to heat networks, heat retailers may wish to offer services to these buildings too.
- The framework allows specialisation by enabling companies to focus on different activities, for example the construction and operation of district heat networks and related business to business activity, or the operation of communal networks (a business to consumer activity).
- The framework is consistent with the physical structure of the industry by using the heat exchanger or HIU as the boundary between the different activities (district heat networks, communal heat networks and retail customers).
- The framework is consistent with the likely future development of the heat network industry, namely more district networks connected to different heat sources and multiple communal networks. It enables consumer choice at the retail supplier level whilst being compatible with the natural monopoly nature and long-term asset lives of district networks.
- Separation of wholesale and retail supply enables Ofgem to apply sector appropriate regulation to the different segments of the supply chain. It therefore avoids a 'one size fits all' approach. This should ensure that regulation is less burdensome and therefore makes

the sector more attractive to investors. This in turn should lower the cost of developing and operating heat networks.

- The framework is compatible with the proposed obligations on buildings or communal networks to connect to district networks and proposed low carbon heat standards for networks. The ability of retail customers collectively to choose the retail supplier and communal network operator whilst remaining connected to the same network will increase public acceptability of the obligation for buildings to connect to district heating networks by reducing the concern of being locked into the same suppliers and network operators. Retail suppliers will be incentivised to hold the district heat network to account if the district network is underperforming.
- The framework is compatible with the proposed heat network zoning, and situations where a district heat network operator is granted the exclusive right to operate in a particular zone.
- The framework is compatible with possible future regulation of heat networks. The government has decided not to introduce price regulation at this stage because of the embryonic nature of the market. Once the market is more mature the framework could enable regulation of heat networks similar to that successfully applied to gas and electricity networks (e.g. price cap, rate of return, third party access for heat sources and hence competition in wholesale heat supply).

Potential concerns.

The following section looks at potential concerns with the proposed framework, and possible future areas of work.

- **The devil is in the detail. Much will depend on clear definitions of wholesale and retail supplier.** Further work will be required on defining the rights, roles and responsibilities of the companies involved in the different activities. The exact form of accounting and management unbundling would also need to be defined. However, at this stage there does not appear to be any a priori reason why the above framework cannot work as it is based on the current physical structure of networks and the interface between them (i.e. district networks connected to communal networks via heat exchangers or communal networks connected to end customers via HIUs / heat exchangers).

  Other network industries such as gas and electricity have successfully disaggregated the supply chain and developed the rules to enable interaction between the different segments. In Denmark there is a distinction between district heating and so-called block heating (i.e. communal heat networks). Some heat network providers are involved in both district and block heating, and some are not. The key to successful separation of the activities is to ensure that commercial rules properly reflect the underlying physical nature of the system to ensure that decisions taken by the different companies are economically efficient, practical and safe.

- **The proposed structure may stop innovation.** The proposed structure does not prevent companies from operating in all the segments as now. It allows companies to offer both bulk supply of heat to communal networks and end to end heat services from wholesale to retail customers. Moreover, enabling clear delineation of the different activities allows

companies to focus on different sectors, which could encourage innovation. Greater transparency of costs and charges may also enable the focus of innovation on those sectors where most value can be created. Transparency will enable companies to demonstrate clearly to customers how companies can add value via innovation.

- **The proposed framework may disrupt existing long-term contracts e.g. ESCO contracts with many years left to run.** This paper does not specify how the right to choose a different retail supplier may affect existing long-term contracts. This would require further analysis. Several solutions may be possible, for example a requirement for the new retail supplier to pay a buyout fee to the current retail supplier or grandfathering of existing contracts until they expire. However, note that the number of retail suppliers affected by this concern will be relatively small given that most heat networks envisaged by government aspirations are yet to be built.

- **Changing the retail supplier cannot address problems of poor design in the communal network.** The current situation and government proposals for regulation also do not fully address this problem, as it is difficult to re-engineer a communal network already in place. However, the clear delineation of activities, costs and charges between the different segments will enable retail customers to have a much better idea of the costs of communal networks compared to other segments. For existing networks this should better inform them when making decisions about future investment or operation of the network. For future networks the clear delineation of activities, costs and charges should complement proposed technical standards, and enable better comparison and benchmarking of costs between different communal networks' design and operation.

- **The retail supplier activity may be unattractive to companies because of low margins if it becomes more like a facilities management activity. The ability of retail customers to change their retail supplier may prevent investments in improvements of communal networks which incur a capital cost, but which reduce delivered heat costs in the long term.** Clear delineation of activities, costs and charges between the different segments will enable retail customers to have a much better idea of the costs of communal networks compared to other segments. For existing networks this should better inform them when making decisions about future investment or operation of the network. Customers will therefore be able to choose between longer contract periods or shorter ones, depending on the costs or benefits of each. Unlike the current situation, they will not be locked in based on an agreement between a building developer and a heat network operator.

  Clear delineation and transparency of costs may increase charges for operation of the retail network and the retail supply of heat, but this should be compensated by lower charges for other activities if previously there has been an element of cross subsidy across the supply chain. If charges for operation of the retail network and the retail supply of heat increase but other costs do not reduce, this could be either because the companies have been unable to recover their justifiable costs, or there Is an element of monopoly pricing power at play resulting in unjustifiably higher overall costs.

- **Investment in communal heat network infrastructure by third parties (i.e. not the landlord) may be made unattractive, because investors can only make a return on use of**

system charges and not on operation and billing to customers. Separate charges for retail supply (e.g. operation of the communal network, procurement and supply of heat, metering and billing) should ensure that companies are properly remunerated for those activities. Separate charges for the activities do not change the costs of performing them, but instead ensures that the costs of each activity are properly identified and separately remunerated by the relevant charges.

- **It is not clear how much benefit consumers will derive from their ability to change retail supplier.** As many of the complaints about heat networks concern the operation of communal networks, the ability to change retail supplier increases the collective economic power of retail customers connected to a communal network. Without this a more interventionist regulatory approach would be required to make up for the lack of consumer choice. For example, retail customers will be able to compare their communal network and retail heat supply costs with other retail suppliers. Without the ability to change, or threaten to change retail supplier, retail customers have no way of incentivising an inefficient retail supplier to lower its prices or resolve the issues causing high prices. The only way to do this would be enforcement by Ofgem. Given the very large numbers of communal networks and hence retail suppliers, this seems impractical.

  The natural monopoly nature of pipeline networks means that customers cannot choose to switch networks, only to connect or disconnect. The proposed framework does not change this. However, it is compatible with further disaggregation in the future, for example the separation of heat generation from network operation, and this could provide further choice for customers in the future depending on emerging business models.

- **The approach will result in higher administration costs.** There may be higher administration costs because of new interfaces between different companies compared to one single integrated company across the supply chain. Some of the proposals around price transparency, accounting and data are already being considered by Ofgem, and may therefore not constitute a material addition to the existing proposals. However, against this will be the potential for competition to encourage specialisation, innovation, and lower costs in the operation of communal networks and customer service. Capital costs may also be lowered by enabling companies to focus their investments on different segments of the supply chain, making the industry more attractive to investors, and thereby increasing competition between investors. In addition, the potential for different business models, for example vertically integrated versus disaggregated activities, will provide retail customers and Ofgem with the ability to compare and benchmark costs of different companies.

- **Heat networks are different from other network industries as it involves a two-way process (supply of heat and then return of cooler fluid to be reheated). This makes separation of activities more complicated.** This issue requires further investigation and any rules defining the rights, roles and responsibilities of the companies involved in the different activities will need to reflect the physical realities of the system. However, these issues should already be addressed by the operational rules and procedures governing the management of the interface between different physical systems (e.g. district and communal networks, communal networks and consumers' systems) as well as any

commercial rules relating to measurement and billing for heat used. It should be possible for the new framework to build on these rules and procedures. This will enable commercial rules to reflect properly the underlying physical nature of the system to ensure that decisions taken by the different companies are economically efficient, practical, and safe. It should be noted that other network industries such as gas and electricity which also have their own specific challenges have managed to do this, and also ensure that their rules change as the physical nature of their networks change. This has been achieved by close cooperation between the different companies in the supply chain and regulators.

- **This model does not work for individual houses connected to a district network as there is no provision for changing wholesale supplier.** Houses connected to the district network would still benefit from the transparency of charges and the improved regulatory oversight that the framework enables. In future, as more houses are connected to district heating, the model would allow for energy as a service or heat retailers to aggregate supply to houses around the country and provide retail services.

- **Introducing a new regulatory framework now may slow down the build out of new networks as it creates an additional burden for developers.** Most of the heat networks required to meet government ambitions are yet to be built. It would therefore be better to agree a workable framework now than 'move the goalposts' later. Government has in any case proposed regulation. If customers have less choice, and therefore heat suppliers have more monopoly power, it is both desirable and likely that regulation, including pricing and service levels, will need to be stricter to protect consumers' interests.

Conclusions and Recommendations.

The analysis above demonstrates that separation of wholesale and retail heat supply is not only possible but desirable as a means to introduce consumer choice. Without consumer choice heat networks will be monopolies which implies stricter price regulation to protect consumers' interests. The framework benefits customers through choice of supplier, facilitation of better regulation (e.g. via benchmarking) and competition between retail suppliers, and by making the heat network industry attractive to a wider pool of investors.

However, further development work and analysis will be needed to implement the framework successfully. This includes:

- Consideration of how to treat existing networks, in particular communal networks. The large number of communal networks with a variety of commercial arrangements means that it will be difficult to predict how applying the new framework will impact the companies and customers involved. As the number of existing networks is only a small percentage of the expected heat network market in the future, it may be more practical to allow existing networks to operate as they do now until current contracts expire or allow a phased implementation of the framework. The advantages of this approach should be weighed against the potential adverse consequences for the customers of those networks.

- Ofgem needs to develop its regulatory model in more detail. The proposed framework is compatible with different forms of regulation but greater clarity on the regulatory approach will enable investors to analyse better the risks and rewards of the proposed framework. Ofgem may also find that different regulatory approaches are required for the different activities depending on how they decide consumer interests can best be protected.

- Work will need to start on defining the rights, roles and responsibilities of the companies involved in the different activities. For example, this could include rules governing the interaction of the district and communal networks, and their respective operators. The exact form of accounting and management unbundling would also need to be defined. This will enable companies to develop business models to invest in new heat networks.

- Agreement on technical standards is also required to enable interoperability between district and communal networks, and to enable different companies to interact along the value chain. Metering of heat is important to ensure clear and transparent charging for heat to retail customers as well as for network use by wholesale and retail suppliers.

- Government, Ofgem and the industry need to agree a programme and timeline for the development and implementation of the new regulatory framework.

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