Department for
Business, Energy
& Industrial Strategy

HEAT NETWORKS: ENSURING SUSTAINED INVESTMENT AND PROTECTING CONSUMERS

December 2018

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Ministerial foreword

As the Prime Minister has made clear, clean growth is not an option but a duty we owe to the next generation. Heat is a major part of our economy and accounts for around a third of UK carbon emissions. To meet our carbon reduction targets, we must significantly cut our emissions from heat. This requires us to move to cleaner and more efficient ways of heating our homes, buildings, and industry. If we deliver this change in the right way we can seize substantial environmental and economic benefits while creating a system that delivers for the consumer.

Heat networks, also known as district heating, are an important part of this transition to clean growth and installing efficient heat networks now will allow us to make progress on reducing emissions from heating while we explore the options for decarbonising the gas grid over the long-term. Heat networks installed over the coming years can later be adapted to use low carbon fuels in the future, giving them a valuable role in the wider transition to low carbon heating.

As well as reducing emissions, heat networks can lower bills for consumers, provide opportunities for local growth through new investment. There are already thousands of heat networks in the UK supplying heat to hospitals, universities, businesses and people's homes. These numbers are rising, and we are committed to accelerating this growth whilst realising the benefits. I want to see a self-sustaining heat networks market: one which is attractive to investment; where innovation flourishes and costs are driven down.

Our £320m Heat Networks Investment Project, which I launched in October, is an important step towards this. The scheme will provide grants and loans to public and private sector projects: it will increase the number and quality of heat networks, drive up standards for consumers, and leverage in £1bn of private and local investment. This will deliver a real step change in the heat networks market, building on the HNIP pilot scheme, which is already funding several significant projects such as our pilots in Manchester and Camden. The Heat Networks Investment Project will build on this success and kick-start a new phase in the UK market. To ensure that growth is sustained and that we fully realise the potential carbon savings, we must put in place a market framework which provides the right signals to investors, while also ensuring that consumers are protected. Heat is vitally important to both households and businesses, and I recognise the importance of ensuring that consumers can heat – and cool – their homes and businesses reliably and affordably.

This publication considers how to establish this market framework. It builds on the Competition and Market Authority's important recommendations on how to protect consumers, made as part of its Market Study, and considers the helpful conclusions of the Association for Decentralised Energy's Industry Task Force Report. It is an exciting time for the UK heat networks sector, which is on the cusp of significant growth. We need to be ambitious as we consider how to deliver a market framework - that works for both consumers and investors - and build a thriving heat networks industry. This document sets out how we will take this forward.

The Rt Hon Claire Perry MP, Minister of State for Energy and Clean Growth

Executive summary

How we heat our homes and buildings in the future is critical to helping us achieve our ambitions for clean growth. In our Clean Growth Strategy, we set out a significant role for heat networks as a low regrets component of meeting our decarbonisation commitments. This requires a major increase in growth rates and investment in the UK heat network market, supported by effective consumer protection measures.

Investment and consumer benefits are mutually reinforcing and must be considered together to achieve our vision. In doing so, we will build on the work of our Heat Networks Delivery Unit (HNDU) and the Heat Networks Investment Project (HNIP) which are creating an exciting pipeline of projects, bringing new investment and expertise into the market.

480,000 consumers are spread across 14,000 heat networks in the UK. The majority of these consumers pay less than those on gas or electricity and industry has taken positive steps to improve the broader consumer experience. However, significant challenges remain. The Competition and Markets Authority (CMA)'s 'Heat Networks Market Study' into domestic heat networks makes a clear case for regulation.[1] Heat network consumers do not currently enjoy the same level of protection as found in the regulated gas and electricity sectors. In responding to the CMA, we agree that this disparity should be rectified. We think protection may also be required for non-domestic consumers.

In the region of £16 billion of capital investment is likely to be needed to deliver the level of heat demand supplied by heat networks in the Clean Growth Strategy 2050 illustrative pathways. This is a significant opportunity, but we know there are also challenges and risks affecting new project developments. An industry led task force, supported by the Association of Decentralised Energy (ADE), helpfully explored a number of these in their report, 'Shared Warmth'.[2] We are keen to understand these risks better to ensure we direct any government intervention where it is most beneficial and allow industry to take forward changes better suited to it. As well as driving new investment, we want the long-term market framework to be flexible enough to accommodate new service models and business innovation. We expect that any solution is likely to require a blend of measures across a range of areas such as data provision, planning, investment assurance, and statutory undertakings.

We are keen to hear stakeholders' views as we develop the heat networks market framework and have included questions throughout the document. Details on how to respond to these are included on page 36. We aim to consult on policy options for the framework in Summer 2019. Subsequent legislation would be subject to further consultation on the detailed requirements and introduced when Parliamentary time allows.

The wider policy context

For over 50 years, we have relied primarily on natural gas, supplied through the national grid, to heat our buildings. That will need to change fundamentally as we transition away from a reliance on fossil fuels towards low-carbon energy sources. There are a range of heating

[1] 'Heat Networks Market Study', CMA (2018): www.gov.uk/cma-cases/heat-networks-market-study#final-report
[2] 'Shared warmth', Industry Heat Network Task Force Report (2018): www.theade.co.uk/resources/publications/shared-warmth-a-heat-network-market-that-benefits-customers-investors-and-t

technologies with the potential to support our 2032 and 2050 decarbonisation commitments. Whilst we don't yet know which approaches will work best at scale and minimise costs to UK taxpayers, consumers and businesses, we remain committed to laying the groundwork in this Parliament to prepare for decisions in the first half of the next decade about the long-term future of heat. This includes continuing to invest in innovation and test different technologies and approaches which have the potential to decarbonise heat at scale. We are also continuing to take decisive action in the near term to decarbonise heat in areas less dependent on the long-term infrastructure decisions. This includes supporting the deployment of heat networks and the uptake of low-carbon fuels in off gas grid buildings.

Our Current Policy Approach

Decisive Near – Term Action

Targeted policies with near-term benefits, while supporting long-term options.

e.g. Heat Networks, Renewable Heat Incentive, Future Framework for Heat in Buildings, Buildings Mission

Energy Efficiency and Optimisation

Lower demand reduces emissions and fuel costs.

We are supporting e.g. smarter systems, more efficient buildings, increased heat recovery in industry

Development of Long Term Options

Decarbonising heat by 2050 will require a transformational change. Working with stakeholders to build the evidence base and identify the right solutions

Introduction

1. We are committed to developing a self-sustaining heat networks market which is attractive to investment, where costs continue to be driven down, innovation can flourish, and one which supports the decarbonisation of heat.[3] We also need to ensure that consumers, both households and businesses, are properly protected and benefit from reliable and affordable heating. Investment and consumer benefits are mutually reinforcing and must be considered together if we are to achieve our vision.

2. In this document we set out our priorities for establishing a market framework to deliver this growth in a way that protects consumers as well as maximising the potential economic and environmental benefits.

3. We are proud of our success to date in supporting the development of the heat networks sector. Heat network projects, like other major infrastructure, take several years to move from feasibility, through detailed project development, commercialisation and construction to delivery. Our Heat Networks Delivery Unit (HNDU), has provided expertise and over £17m in grants to local authorities across England & Wales. Our support has enabled the development of a pipeline of projects which will soon reach commercialisation and construction stages. It has also driven up the commercial and technical understanding we need for wider roll-out. The roll-out of up to £320m capital investment through our flagship Heat Networks Investment Project (HNIP) will deliver significant further investment and market growth.

4. The work of HNDU and HNIP are critical measures to create a stable basis from which the market can build. However, they are not intended on their own to resolve all the underlying challenges that may currently affect the speed of that growth. As we set out in 2016 when establishing HNIP, a self-sustaining market will also require development of an appropriate legislative framework.[4] This requires a more fundamental review of market and regulatory arrangements, building on our work so far.

5. An effective heat networks market framework must tie together an attractive investment proposition with robust consumer protections. We welcome the engagement and work of the heat network industry and investment community to date, particularly that of the industry-led Task Force. The Task Force, supported by the Association for Decentralised Energy (ADE), published a report earlier this year setting out proposals on how the UK might secure cost effective investment and provide more assurance to consumers. [5] We provide some initial views here on their recommendations and we look forward to developing our approaches with industry participants further.

6. We also welcome the Competition and Market Authority's (CMA) 'Heat Networks Market Study' into domestic heat networks published this summer. [6] This sets out a clear case

[3]Heat networks are a system of insulated pipes that connect multiple buildings to an energy source(s) providing heating and increasing the efficiency of the energy system. We define a sustainable market as one where a sufficient volume of strategic, optimised and low carbon heat networks are economically attractive without direct Government subsidy and are operated with no consumer detriment.

[4] BEIS, Government response: Heat Networks Investment Project consultation, June 2016 https://www.gov.uk/government/consultations/consultation-on-the-heat-networks-investment-project-hnip

[5] 'Shared warmth', Industry Heat Network Task Force Report (2018): https://www.theade.co.uk/resources/publications/shared-warmth-a-heat-network-market-that-benefits-customers-investors-and-t

[6] https://www.gov.uk/cma-cases/heat-networks-market-study#final-report

for sector regulation, which we support. Here we set out the government response to the CMA and present our initial views on their more detailed recommendations. This is the start of our wider engagement with stakeholders to establish market arrangements that maximise the economic and low-carbon potential of heat networks for the benefit of all. The document contains questions throughout and we are keen to receive responses to these as well as general comments on the content of this publication. Further information on how to send us your views by 1 February 2019 can be found in a separate section on questions on page 36.

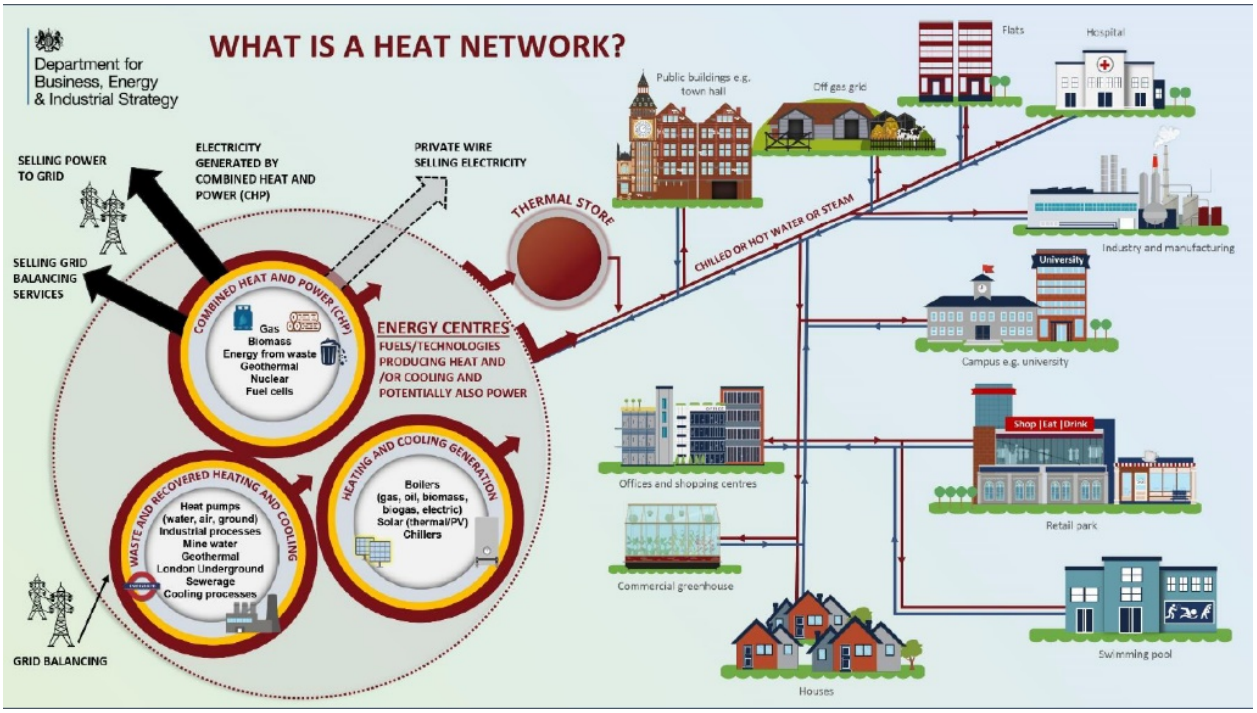
Context

7. How we heat our homes and buildings in the future is critical to helping us achieve our ambitions for clean growth. Heat is a major part of our economy and accounts for around a third of UK carbon emissions and almost half our energy usage. [7]

8. We have legally binding targets to reduce greenhouse gas emissions by at least 80% by 2050 from 1990 levels, and by 57% over the 2028-2032 period (the fifth carbon budget). Doing so will rely on a significant contribution from decarbonising heat. [8] The best long-term options for decarbonising heat in the UK are not yet clear but this lack of longer-term certainty will not stop us from pressing ahead with action now in those areas of heat policy where we are more confident. Installing efficient heat networks in areas of high heat demand is a low regrets way to reduce emissions while we determine how best to move the rest of our heating away from fossil fuels and towards affordable low carbon energy sources. Heat networks supported with HNIP funding are expected to lead to carbon savings of a social cost of approximately £43/tCO2e. This is significantly lower than the equivalent for other carbon saving technologies.

9. In our Clean Growth Strategy, we set out three illustrative pathways for meeting our 2050 target. All of these envisaged a significant role for heat networks, for instance, providing 17% of heat demand in homes and up to 24% of heat demand in the non-industrial business and public-sector buildings.[9] This will require a significant increase in growth rates and investment in heat networks, which currently provide around 2.4% of heat for buildings in the UK.[10]

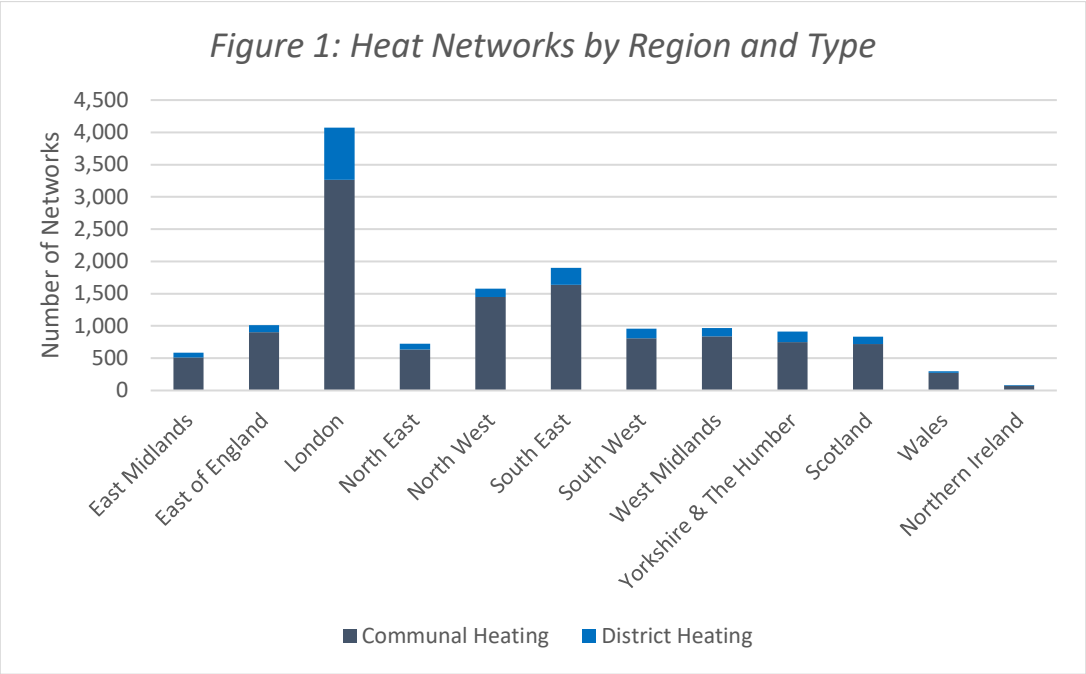
[7] Final UK greenhouse gas emissions national statistics, 1990-2015 (2017):https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2015
[8] The Clean Growth Strategy (2017): https://www.gov.uk/government/publications/clean-growth-strategy
[9] Ibid.
[10] Based on 'Energy Trends: March 2018, special feature article – Experimental statistics on heat networks' and 'Energy Consumption in the UK (ECUK) (2017)'. The experimental statistics may not wholly reflect the true position of the current heat network market due to networks not reporting or providing incorrect returns



10. In the right circumstances (particularly where there is high heat demand, a high proportion of non-domestic consumers, new buildings and/or proximity to low-cost, large scale heat sources), heat networks are a highly cost-effective and non-disruptive way to reduce emissions further in the future. Across the country there are strategic locations where heat networks can be built next to large sources of heat such as industrial plants, or 'anchor points' where substantial amounts of heat are used, like in urban areas. Heat networks developed in these locations should deliver cost-effective carbon savings and present attractive investment opportunities by providing access to a large consumer base and heat demand.

11. There are approximately 480,000 customers spread across around 14,000 heat networks in the UK. Of these, around 12,000 are communal heat networks (serving only one building) and 2,000 are district heat networks (serving multiple buildings).[11] District heat networks currently supply around 10TWh of heat demand.[12] While the numbers are rising steadily, we need a step change increase in the pace of rollout to meet our carbon reduction targets. This brings considerable investment opportunities for the UK.

[11] "District heat network" means the distribution of heat from a central source of production through a network to multiple buildings or sites. "Communal heat network" means the distribution of heat from a central source to multiple dwellings in a single building.
[12] Energy trends: March 2018, special feature article Experimental statistics on heat networks (2018): https://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-experimental-statistics-on-heat-networks



Source: Experimental heat network statistics[13]

12. In the region of £16 billion of capital investment is likely to be needed to deliver heat demand supplied by heat networks in the Clean Growth Strategy 2050 illustrative pathways. Additionally, the UK supply chain will need to grow significantly to meet increased demand.

13. We are helping to driving this innovation and flexibility. We will shortly publish the outcomes of our heat networks innovation demonstration competition. This competition highlighted an exciting market opportunity for companies in smart data optimisation to reduce costs and improve energy efficiencies in heat networks.[14] In addition, we have been exploring with the Department for International Trade the export potential for these products and services, given their possible use in addressing similar challenges in more mature markets.

[13] Energy Trends: March 2018, special feature article – Experimental statistics on heat networks, https://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-experimental-statistics-on-heat-networks

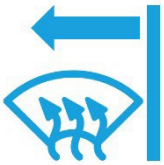
[14] https://sbri.innovateuk.org/competition-display-page/-/asset_publisher/E809e7RZ5ZTz/content/heat-networks-demonstrator/1524978

What are the benefits of heat networks?

Cost effective low carbon heat

A heat network can be one of the most cost-effective ways of reducing carbon emissions from heating. Their efficiency and carbon-saving potential increases as they grow and connect to each other. They are an important part of our future clean energy infrastructure. Many of the cheapest sources of low-carbon heat can only be used if there is a network to distribute the heat.

Utilising Waste Heat



Once the network is in place, heat that otherwise goes to waste can be harnessed and used: for example, waste heat from industry, from power stations or from low temperature heat sources such as from data centres. Heat can even be taken from the rivers and canals that run through many town centres and from the warm mine-water left in old coal mines.

Reducing Consumer Bills

Heat networks can mean lower bills for consumers. Bill savings of at least 30% have been achieved when replacing electric heaters in tower blocks. In this way, heat networks can help in our battle against fuel poverty too.

Catalyst for local growth

New infrastructure investment is a catalyst for local growth. Local authorities often incorporate heat networks to drive regeneration and attract new business.

Flexible Stable Energy System

The energy system, like the whole economy, is an integrated and complex system. Heat networks can have a beneficial impact on the stability and cost-effectiveness of the whole system. A large heat network system, especially when combined with a large thermal store (hot water tank), offers a cheap and easy way of storing energy until it is needed. This can include taking any surplus supplies of electricity and converting them to useable heat, to the benefit of the overall energy system.

Government support

14. We have a strong track record in supporting heat networks growth across the country. In 2013, we set up our Heat Network Delivery Unit (HNDU) to support local authorities in England and Wales through the early stages of heat network project development. **Through HNDU support we have invested over £17m in grant funding to more than 200 projects across 140 local authorities to act as the catalyst to build a thriving market.**[15]

15. **Through our flagship Heat Networks Investment Project (HNIP), which we launched in October, we are investing up to £320m in heat network projects to accelerate market growth to the levels needed to achieve our carbon targets.** We awarded £24m of funding to nine pilot projects in April 2017, which has provided valuable learning to maximise the effectiveness of the remaining government investment from the HNIP main scheme. This funding will be allocated from April 2019 for up to three years. [16] We expect that HNIP will leverage in around £1bn of private and other investment through capital grants and loans to support the commercialisation and construction of heat networks. This, combined with HNDU, is supporting a range of high-quality heat network projects across England and Wales.[17] In Scotland, the District Heating Loan Fund offers loans to support the development of district heating networks.[18]

16. HNIP will deliver a step change in the heat networks market improving skills and capability, demonstrating to banks and investors that heat networks are a viable investment proposition and reducing costs. Commissioned research from the Carbon Trust has highlighted several ways in which cost reductions can be achieved.[19] We expect an active and growing market to drive greater competition between developers.

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[15] Heat networks delivery unit: www.gov.uk/guidance/heat-networks-delivery-unit
[16] Heat network investment project: www.gov.uk/government/publications/heat-networks-investment-project-hnip
[17] Further details of the opportunities from heat networks in England and Wales are given in the Heat Network Investment Project: Case study brochure (2018)
[18] Further details are available at www.energysavingtrust.org.uk/scotland/grants-loans/district-heating-loan
[19] Carbon Trust, Estimating the cost-reduction impact of the Heat Network Investment Project on future heat networks (2018): https://www.gov.uk/government/publications/estimating-the-cost-reduction-impact-of-the-heat-networks-investment-project-on-future-heat-networks

Greater harmonisation of standards in the sector, supported by the market framework, will drive competition, reduce operation risks and give investors greater overall certainty. Combined, this will lead to a lowering of finance and investment costs and facilitate greater economies of scale from larger heat networks.

17. However, our intention has always been that HNIP should inform the development of a longer-term market framework, including potential legislative changes.[20] As well as ensuring the environmental benefits of heat networks, this framework will ensure ongoing investment and protect consumers. These second two elements are mutually-reinforcing. Higher consumer protection standards are likely to improve the reputation of heat networks among consumers; this in turn will help to attract heat network developers and investors. Developers will be looking to supply a popular product and investors will have greater reassurance in the long-term viability of projects.

18. Strong consumer protection measures are critical to the long-term success of heat networks and, where the government is investing through HNIP, we are ensuring these are in place. We worked closely with industry and consumer groups to support the development of the UK-wide Heat Trust scheme, an independent consumer protection scheme designed specifically for heat network consumers. [21] It puts in place a common standard for the quality and level of customer service that is provided to domestic and micro-business consumers by their heat energy supplier. It also provides an independent dispute resolution service through an agreement with the Energy Ombudsman.

19. We have also worked with industry to establish minimum standards for the design, installation and operation of heat networks across the UK through the development of a Code of Practice. [22] These voluntary requirements are comparable to the quality and performance standards for regulated utilities such as gas and electricity and draw on legislation and industry best-practice. All networks receiving HNIP funding must meet the Heat Trust standards or equivalent and comply with the Code of Practice's technical standards.

20. Any regulatory intervention would only be introduced following detailed consultation. We also recognise that not all heat networks are at the same stage of development. There are those that are already in existence, those under development (including networks with HNIP funding) and those built after the market framework is in place. It is likely that each of these categories will have some distinct issues to consider within any framework that we develop.

The need for further intervention

21. While heat networks offer a number of benefits, they can struggle to compete against existing heating alternatives. There are significant advantages that conventional heating technologies experience due to their historic investment, existing scale and established regulatory environment. The work of HNDU and HNIP has and will drive forward new projects, building market confidence and understanding of best practice and standards.

[20] BEIS: Government response: Heat Networks Investment Project consultation, June 2016 https://www.gov.uk/government/consultations/consultation-on-the-heat-networks-investment-project-hnip
[21] Heat Trust: http://www.heattrust.org/
[22] Code of practice for heat networks: https://www.theade.co.uk/resources/publications/code-of-practice-for-heat-networks1

Alone, it cannot however, resolve the existing imbalance between dominant, established heating alternatives and the still nascent heat network market. Addressing this requires review of the longer-term market arrangements.

22. The long-lived nature of heat networks makes it more difficult for investors to manage the uncertainty around future costs and revenue streams. As investors price these uncertainties into their investment decisions, this may lead to consumer costs being higher than they might need to be. This may also discourage a strategic approach to building in options for future expansion of the network, limiting longer-term potential benefits.

23. Crucially the physical characteristics of heat networks mean that a consumer living in a building serviced by a heat network does not have the same opportunities to switch supplier as they would for most gas and electricity supplies. This can be due to a range of factors such as alternative heating options for consumers being possibly expensive, inaccessible and/or are not allowed contractually. This may lead to heat network consumers facing higher prices or lower quality service than if the heat supplier faced similar competitive pressures to those faced by gas or electricity suppliers.

24. These interlinked barriers and market challenges keep current growth at a steady but modest level. The market framework will look to address these and lift market growth to the scale required to meet climate targets. Given the complexity and multiple factors involved, we anticipate that a blend of measures is likely to be required. This is likely to require consideration of a number of areas such as planning, investment assurance, and statutory undertakings. It is important that we consider the range of options and interlinkages while we develop solutions. This is discussed in more detail later in the document.

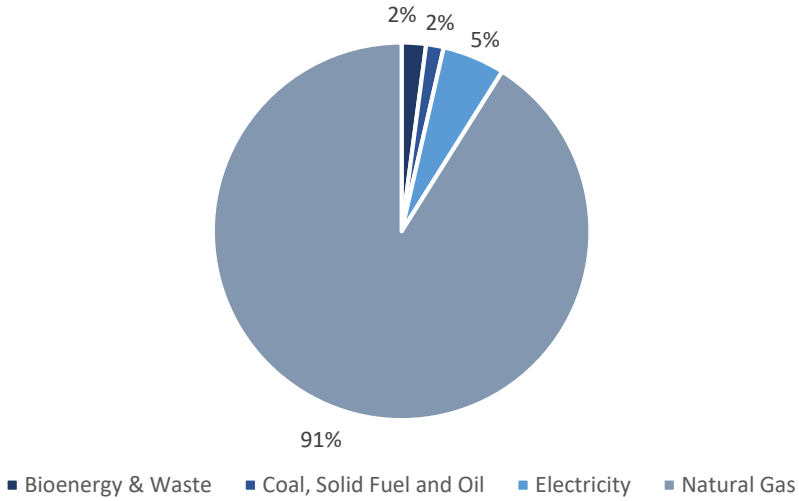
Decarbonisation

25. Generating heat for our homes and businesses accounts for around a third of the country's carbon emissions. The Clean Growth Strategy identified heat as the most difficult decarbonisation challenge facing the country. It recognises that to meet our 2050 commitment of reducing emissions by 80% on 1990 levels, we will need to decarbonise nearly all building heat and most industrial heat. In the long term, there is no clear consensus on the best pathway to decarbonising heat at the scale needed. There are a range of technologies with potential - heat pumps, hydrogen and biogas - but it is not yet clear which will work best at scale and at least cost.

26. The development of heat networks is complementary to the longer-term options on heating and therefore action should be taken now. They can deliver short-term carbon savings through connection to efficient gas generators and sources of waste heat. Like power networks, heat networks are not automatically low-carbon but they are a form of technology agnostic infrastructure to which lower carbon heat generation sources can later be readily plugged in with minimal disruption to consumers. Currently, heat networks mostly use gas generators (see Figure 2), but we envisage lower carbon energy sources, such as recovered industrial heat, energy from waste and large-scale heat pumps will increasingly be used as heat sources. We have designed the Heat Network Investment Project to encourage further lower carbon networks as well as carbon savings from expanding the existing network to new consumers. We want the

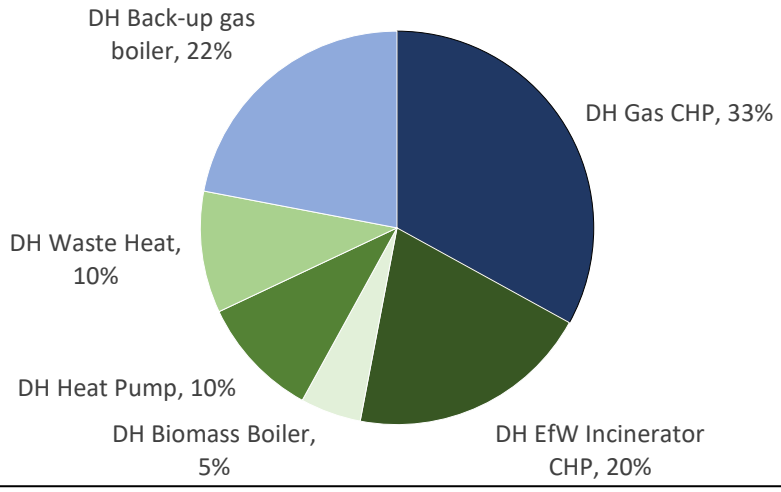
market framework that will succeed the investment project to further these trends (see Figure 3).

Figure 2: Fuel sources of heat networks (% of networks)



Source: Experimental heat network statistics[23]

Figure 3: Assumed heat network technology mix under HNIP (% volume of total heat demand)



Source: See technical annex

27. We have made considerable progress on decarbonising heat networks outside of HNIP. The Renewable Heat Incentive (RHI) and the Energy Company Obligation (ECO) have supported heat networks to install lower carbon heat sources and in certain areas, like London, reductions in carbon emissions have also been encouraged by local level

23 Energy Trends: March 2018, special feature article – Experimental statistics on heat networks, https://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-experimental-statistics-on-heat-networks

responses to the flexibility in planning policy. Additionally, the scoring approach for HNIP funding will reward evidence-based plans.

28. In the longer-term, if well designed and strategically located, heat networks can also be relatively easily extended to cover a wider population base and adapted to changing local needs, further enhancing their carbon savings. Encouraging heat network growth now will help to develop both the market and consumer confidence in the sector, so that it is better able to meet longer-term objectives.

29. We will be considering how the future market framework can accelerate decarbonisation in heat networks. As part of this we will look at the further development of heat networks in strategic locations where they represent good value-for-money and where their benefits can be maximised. Examples of this are where heat networks can be developed close to existing heat sources, like industrial parks or energy from waste plants, where the excess heat can be used to heat buildings. In addition, heat networks are most efficiently deployed close to where the heat is used, for example near to large housing complexes. As part of our development of the market framework, we will explore the potential to achieve this through the planning system or other measures.

Q1. Do you agree that a heat networks market framework should support the use of low-carbon heat sources? Please explain.

Q2. Which cost-effective approaches could be used to deliver low-carbon heat networks projects?

Devolution

30. We are working with the devolved administrations on how to ensure that heat network consumers across the UK benefit from similar levels of protection and strategic investment. The provision of consumer protection is a reserved matter for the UK Government across Great Britain.[24] However, in Scotland, the regulation of heating and cooling networks is devolved to the Scottish Government who have set out separately their own plans for regulating the sector.[25] We are keen to collaborate with the Scottish Government as we develop our proposals for strengthening consumer protection for heat network consumers, to ensure the measures we take are appropriate and work well within the context of the Scottish Government's own plans for regulating the sector. In Wales, heating and cooling networks are devolved, although the regulation of heat networks is reserved. We want to work closely with the Welsh Government to ensure the framework addresses appropriately the needs of heat customers and suppliers in Wales, and within the framework of broader Welsh policy. In Northern Ireland, the heat networks sector is currently small; however, both consumer protection and heat networks regulation are devolved. We will work with the devolved administrations to ensure any future development of the sector is appropriately protected.

24 Schedule 5 of the Scotland Act 1998 (section C7); Schedule 7A of Government of Wales Act 2006 (section C6)
25 Scotland's Energy Efficiency Programme: Second Consultation on Local Heat & Energy Efficiency Strategies, and Regulation of District and Communal Heating (2017): https://consult.gov.scot/energy-and-climate-change-directorate/lhees-and-dhr2/

Ensuring sustained investment into the sector

31. Heat networks across the UK represent a substantial opportunity for energy infrastructure investors. We are committed to realising this opportunity and heat networks' potential to utilise large-scale low-carbon heat sources such as recovered industrial heat, energy from waste and large heat pumps. They are particularly valuable as a route to decarbonising heat in dense urban areas. Heat networks represent a sizeable investment opportunity for the UK across distribution, generation, storage, controls and customer interface. Around £16 billion of new capital investment in heat networks could be needed by 2050 to achieve the level of deployment required to meet our carbon targets.

32. The supply chain alone for the known pipeline of projects to 2025 represents £3.2 to £6.4 billion of operations and maintenance contracts across the lifetime of these low-carbon energy infrastructure assets.[26] As heat networks deployment rates increase, we expect to see both current market participants expanding their operations and new players entering the market, including through partnerships and joint ventures.

33. As the heat networks sector is nascent, its visibility with investors has been low. However, over the last twelve months we have seen a significant increase in interest from both UK-based and international investors in the heat networks sector. Twenty investor organisations attended our heat networks investor conference in September 2018 to discuss the pipeline of opportunities and approaches to investing in heat networks. Heat network projects, with long-term contracted revenues, are similar to other core infrastructure investments and increasingly appeal to long-term investors.

34. We are keen to see innovation in financing with debt and equity instruments available from a diverse range of investors. As well as ongoing investment from project sponsors and energy services companies, we anticipate more debt instruments from banks, and equity instruments from domestic and international infrastructure investors and pension funds. We are also interested in the role that lease financing and crowdfunding might play in the sector.

35. We know more work is needed to capitalise on these opportunities. We welcome the industry Heat Network Task Force Report, published in January 2018, which provided a helpful analysis of the challenges to investing in the sector and explored several proposals for how to tackle them.[27] The Task Force recommended a set of principles for further work as well as some more detailed proposals to be considered. The report is a very useful springboard for our further analysis and exploration of where and how de-risking current arrangements could be mutually beneficial to consumers and investors.

36. In order to both bring in more investment and lower the cost of capital, change is needed that lowers the risk profile of heat networks and reduces the level of return investors seek. This will, in turn, reduce the prices that consumers pay for their heat.

[26] Investing in the UK's heat infrastructure (2015): https://www.gov.uk/government/publications/investing-in-the-uks-heat-infrastructure-heat-networks
[27] 'Shared warmth', Industry Heat Network Task Force (2018): https://www.theade.co.uk/resources/publications/shared-warmth-a-heat-network-market-that-benefits-customers-investors-and-t

There are a range of factors that drive the risk profile of heat networks. Some are common to any large infrastructure project such as high upfront costs, inflation risk, or component failure. Our starting expectation is that project developers should manage these. Other factors are more specific to this sector. Some of these can be de-risked by non-regulatory government and industry actions, others may require regulatory measures. We set out below those areas which stakeholders have identified as barriers to investment and our initial assessment. Our approach to developing proposals to drive investment is to ensure that we are clear of the specific risks that exist in the sector, as interpretations vary. It is our view that any solution is likely to require a blend of measures. We anticipate that these may cause consideration of a range of areas such as planning, investment assurance and statutory undertakings. We will continue to conduct thorough appraisal of likely interdependencies and consequences which will inform our potential policy options.

Negotiating investment

37. There can be barriers to investors reaching financial close on projects. These include investor visibility and familiarity with the nature of heat networks, the small average size of heat networks projects, relatively fixed transaction costs, and lack of standardisation across the industry in a range of areas, including documentation. We have already undertaken important work to help address some of the concerns and to share learning across the sector. We will continue to provide this support as we develop the framework.

Our ongoing commitment to driving investment in heat networks:

a. Publishing a quarterly pipeline providing an overview of the projects that our Heat Networks Delivery Unit is directly working with, and which will be considering financing options[1]
b. Our delivery partner for the Heat Networks Investment Project (HNIP) has a dedicated investor relation team to engage with the investor community and raise third party finance for projects applying to HNIP, broadening the range of active investors in the sector
c. The delivery partner will also develop standardised sets of due diligence and sales, operation and maintenance documentation in consultation with stakeholders. This will make it easier for investors to both assess projects and aggregate them into standardised portfolios, and will therefore drive better value from transaction costs
d. With the Department for International Trade, we are promoting the opportunities from our Heat Networks Investment Project and the UK heat networks more broadly to international investors
e. We are organising annual heat network investor conferences to improve familiarity with the sector and to highlight the latest developments relevant to those making investments in the sector.

Demand risk and expansion

38. When assessing schemes, investors forecast the level of heat that the network's customers will use and how this will change over time as the network develops. The possibility that forecasts turn out to be incorrect was categorised by the Task Force as a '**demand risk**' and identified as a principal barrier for development of the market. This was a leading consideration in the Task Force's work. The Task Force defined successful management of demand risk as: "Having sufficient confidence about the future scale, timing, and use of heat network connections, to allow investment in the design and build of a heat network at sufficient scale to make a viable return on investment".[28]

Demand Risk:

Three contributing factors which we categorise as demand risk:

- Consumption risk – the possibility that, overall, heat is not used as much as forecast, and/or that heat generation is not aligned with when it is needed.
- Connection risk – a key uncertainty for projects being developed in a new area is how many customers will agree to connect to the network and when they will connect. In the current market, customers are unwilling to say they will connect before the project is certain to go ahead and projects can struggle to develop without these commitments. Lenders typically rely on legally contracted heat demand and consumers creditworthiness in deciding whether to provide debt.
- Counterparty risk – the risk that the network customers lack liquidity to pay for heat consumption. This is particularly important when considering consumers with large demand.

39. In forming this view of demand risk, we have drawn on both the Task Force's analysis and views from other industry stakeholders. As we develop our policy further, we will consider the spectrum of demand risks to ensure that we consider potential mitigation and impacts as holistically as possible. We will also ensure that risk is appropriately shared and that any regulatory system put in place to support investment is proportional, given that either consumers or taxpayers more broadly, would need to meet the costs of both the regulation and any liabilities arising from it.

40. We believe that commercial processes can mitigate all three demand risks although we believe that the effectiveness of doing so varies between them. Consumption risk, in particular, can be reduced by employing high standards in project development and forecasting of heat demand. Essential to this is having good data on heat demand and building characteristics. We think that in general industry is best-placed to collect and utilise this, but we are interested in whether there are opportunities for government to use its unique position to collect and distribute data in order to raise standards

[28] Shared Warmth: Industry Heat Network Task Force Report (2018), p22

throughout the industry. We will be considering what can be done to encourage better data provision. We are keen to work with industry on this issue.

Q3. To what extent do you agree with our characterisation of demand risk?

Q4. How could government and industry address demand risk, especially connection risk and consumption risk?

Q5. Are there particular areas where government can collect and distribute data that will effectively mitigate the consumption risk?

41. However, we do believe that there are limits to what industry can do and that in some areas there may be genuine market failures. For these we will investigate options for intervention. We agree in principle with the Task Force that the right interventions to de-risk demand uncertainty further could bring real benefits to investment and ultimately to consumers. We explore below some potential models.

42. The Task Force proposed a system for de-risking projects, called '**demand assurance**', which would partially underwrite connection risk for projects. In the Task Force's proposal this would require a heat network developer having a strategic plan approved by a regulatory body. The total final connected heat capacity set out in the plan would be awarded demand assurance. At a minimum this would cover the cost of capital for any demand shortfall for the primary pipe network and provide the investor contractual assurance over the life of the project. They also suggested further consideration should be given to applying this to other assets such as the secondary pipe network and heat generation assets. The developer would then be obliged to meet conditions "including minimum customer service requirements, and heat networks design and build standards. These conditions would be based on mitigating the other risks associated with a heat network, including the risks faced by customers".[29]

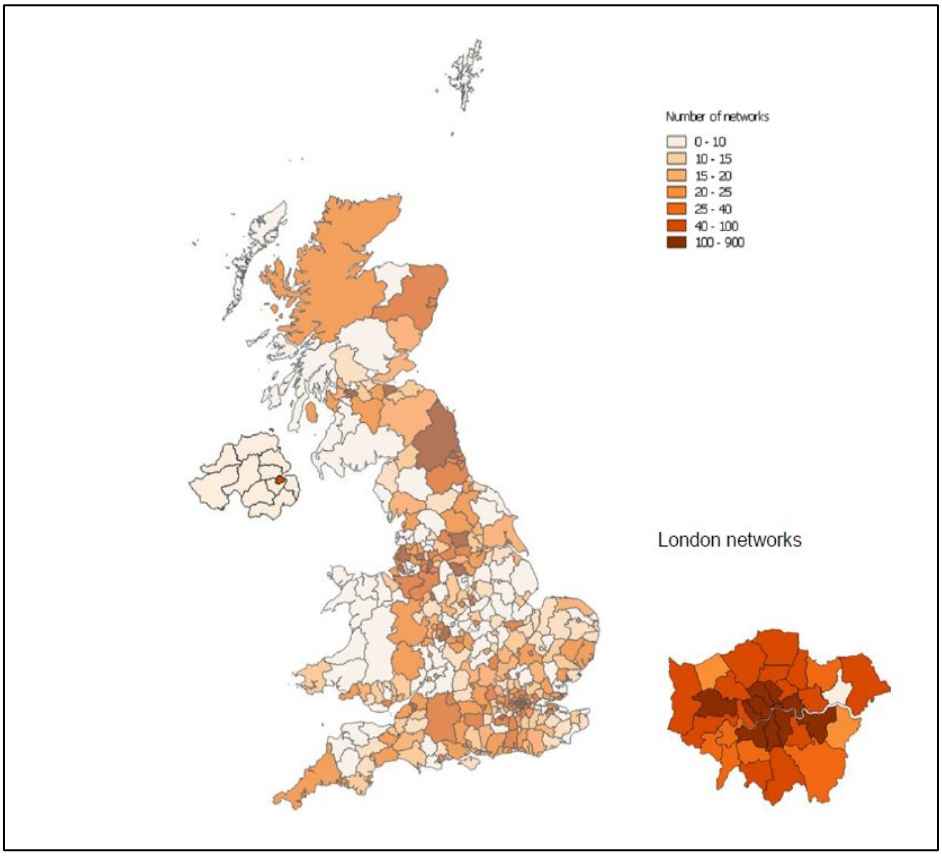
43. Such an approach would be a very substantial intervention in the market and therefore needs careful consideration of the wider implications for market participants' behaviours and effect on consumers. However, we think an approach which seeks to ensure networks are operating at an efficient capacity, deals with the consumption risk and enables expansion has many merits. We are interested, therefore, in exploring whether this proposal might work in practice. We want to understand better how managing costs and risks through demand assurance could be applied to individual projects. As the Task Force set out, further work is needed to establish whether the liabilities arising from such an approach would need socialising across a wider base than heat networks consumers and what effects this would have on the market. We also wish to consider further the different models that demand assurance could be provided through, for examples loans, and the incentives that each would create in the market, as well as any impacts on prices for consumers. As we discuss later, we think it is reasonable to expect all heat networks operators to meet certain minimum customer service requirements, regardless of any intervention to de-risk demand uncertainty.

44. We also want to explore other potential options for mitigating connection risk, such as **heat-zoning** areas. In this model local authorities are responsible for assessing the potential for heat networks and working with local communities to coordinate their development. This would mean that heat networks are considered for strategic locations

[29] 'Shared warmth', Industry Heat Network Task Force (2018): https://www.theade.co.uk/resources/publications/shared-warmth-a-heat-network-market-that-benefits-customers-investors-and-t

such as near to large public buildings. It would also ensure there is a group of customers willing to connect to the network, thereby mitigating some of the connection risk. The Scottish Government has recently consulted on proposals for local authorities to assess the potential for low-carbon heat in their areas through Local Heat and Energy Efficiency Strategies (LHEES), and we want to examine whether a similar model could be focused on developing networks elsewhere. This could be deployed through the planning system or through legislation connected to the market framework and would build on how HNDU support and the Heat Networks Investment Project has already encouraged many local authorities to consider heat networks in their area.

Figure 4: Location of current heat networks by local authority



Source: Heat Networks Development Unit[30]

45. We also believe that this local assessment of heat demand could enable local authorities to grant **concession schemes** for heat networks. With concessions, local authorities identify appropriate areas for heat networks, gain support for the project in the local community and then grant an exclusive contract for a heat network supplier to operate in that area for a set number of years. Like with the previous example the benefit for investors is that concession agreements would be offered for areas with the highest interest in heat networks, which would reduce the connection risk. Further development of this option will be done in tandem with the consumer protection framework to ensure that consumers would feel confident in signing up to a long-term agreement with a heat network operator.

[30] https://www.gov.uk/guidance/heat-networks-delivery-unit

46. Finally, we want to consider other options such as how to encourage best-practice in heat supply contracts, and to what degree this could mitigate connection and counter-party risk for investors. We will look at whether different models of heat network ownership could play a role in reducing consumption risk by ensuring that those looking to develop the scheme are also those with an interest in using the heat. There are several models to de-risking investment applied in other UK utilities of which we, and the Task Force, have both done some comparisons.[31] Many of these models, such as a regulated asset base system or availability based revenue stream financing model, have been designed for more established industries. We will explore further whether there are components of them which could be applicable for the UK heat networks industry.

Q6. Which of the approaches set out to address connection risk (demand assurance, heat zoning, concession schemes) would you consider to be most effective and why?

Q7. What other approaches to addressing connection risk should we consider? Please provide details.

Separation of financing and third-party access

47. Typically, buildings and piping of a heat network can carry heat for up to 60 years. The heat source, however, has a much shorter life; a CHP generator, for example, can be expected to last around 15 years.[32] Because of these different time horizons, and the different operational risks they carry, there is potential to treat them as separate investments in projects of sufficient scale. This could attract a wider range of investors, lower the cost of financing overall and in turn could drive down the eventual cost for consumers.

48. The industry Task Force Report considered this idea alongside third-party access, where a separate heat generator is granted access to supply heat through an existing network. It was supportive of both ideas, while recognising they may not be appropriate for every network. We agree that future market arrangements should not prevent disaggregated heat network models. We can see advantages to potential future competition opportunities within the sector, and to widening possible investment models. We believe that in a nascent market these models can be difficult to employ commercially, particularly given the scale of the majority of current networks, but we hope to see examples being developed as the sector matures. We are interested in hearing from parties exploring such approaches to help us understand any specific challenges they face within current market arrangements.

Access, maintenance and development rights

49. Heat network developers currently do not have the equivalent rights of utility companies which are classified as undertakers. Undertakers such as gas, electricity and water companies do not have the same obligations to notify local authorities before carrying out public works. This enables them to respond more flexibly to carry out maintenance

[31] 'Shared warmth', Industry Heat Network Task Force (2018): https://www.theade.co.uk/resources/publications/shared-warmth-a-heat-network-market-that-benefits-customers-investors-and-t

[32] Heat Network Detailed Project Development Guidance (2018): https://www.gov.uk/government/publications/heat-network-detailed-project-development

work on their infrastructure and reduces the overall cost of operations. Undertakers typically also have greater ability to place infrastructure on private land than other companies and to use 'access rights' to reach their infrastructure in case of breakdown. These powers have a financial value as well. They give reassurance to investors that projects will be built cheaply and to schedule, as well as greater security that maintenance issues will be resolved quickly. This mitigation of 'project risk' enables them to offer lower-cost financing. Utilities have historically been given these powers because the provision of their services is considered essential to society and warrants greater flexibility to keep the system running.

50. We recognise that the lack of equivalent powers for heat network developers is a considerable frustration to the industry. We share the view that supplying heat through a network is an essential service and that there is an argument for it warranting similar powers. However, the heat network sector is less established than other utilities and involves a larger number of players; simply granting the same powers as the larger utilities may not be the optimal way to address these issues. As with the other utilities the benefits of granting these powers to heat networks must be balanced against the potential detriment to the public from issues like extra traffic disruption, noise from construction and the disruption from having to allow heat networks operators access to private property. We will work with other government departments, including MHCLG, and Defra to investigate the relevant pieces of legislation and assess what changes could be appropriate.

Q8. Do you agree that we should consider granting greater access, maintenance and development rights to heat networks?

Q9. What are the most important types of access, maintenance and development rights needed?

Ensuring consumer protections

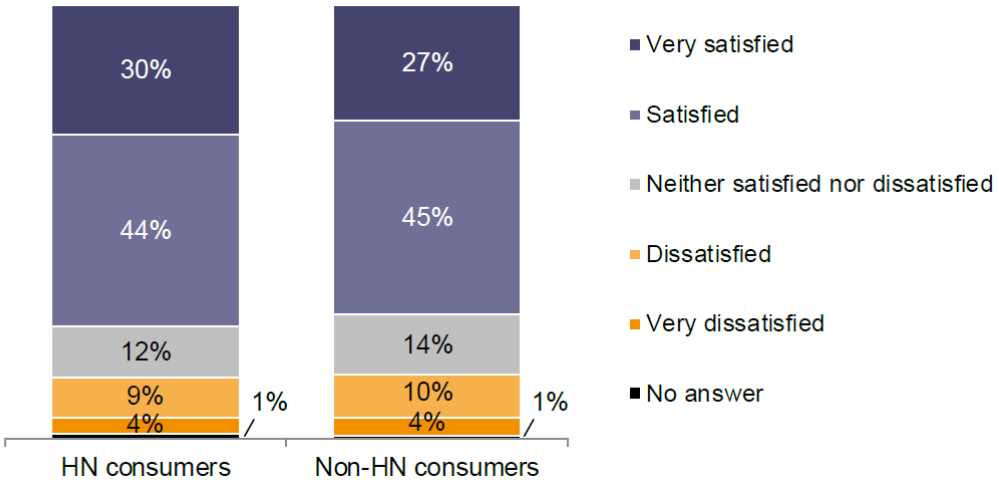
51. There are approximately half a million individual consumers on a heat network in the UK. They are spread over around 14,000 heat networks (of which around 2000 are district heat networks, and 12,000 are communal heat networks).[33] The majority of heat network consumers are classed as residential (92%), which is partly reflective of the much higher numbers of communal, rather than district, heat networks currently.[34] Although at present they represent only a small fraction of all heat customers (for example, there are approximately 23 million homes currently connected to the gas grid), we expect this number to grow rapidly. [35]

52. Our evidence shows that most heat networks consumers have positive experiences. Our 2017 survey found that on average heat networks consumers were as satisfied overall with their heating systems as non-heat networks consumers (74% of heat

[33]Energy trends, experimental statistics on heat networks (2018): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/712370/Energy_Trends_article_on_heat_networks_revised.pdf
[34] Energy trends, experimental statistics on heat networks (2018): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/712370/Energy_Trends_article_on_heat_networks_revised.pdf
[35] National Grid: https://www.nationalgrid.com/uk/gas

networks consumers and 72% of non-heat networks consumers were “very satisfied" or “satisfied”).[36]

Figure 5: Satisfaction with heating system overall



Source: BEIS Heat Networks Consumer Survey (2017)[37]

53. We also found that, on average, heat networks consumers were likely to pay less than non-heat networks consumers. This was supported by the CMA’s Market Study, which found many heat networks offer prices that are the same or lower than those paid by people on gas or electricity, and that consumers receive comparable levels of service.[38]

[36] BEIS Heat Networks Consumer Survey (2017): www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems
[37] BEIS Heat Networks Consumer Survey (2017): www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems
[38] CMA Heat Networks Market Study (2018): www.gov.uk/cma-cases/heat-networks-market-study

Table 1: Total annual cost estimates for heating and hot water

	Heat network	Non-heat network (domestic gas)
Base (all with a valid annual cost calculation)	*(1,797)*	*(918)*
Mean cost (to nearest £10)	£570	£640
Median cost (to nearest £10)	£450	£560
Standard deviation	£532	£421
Base (consumers with a valid annual cost calculation and their bill in front of them)	*(1,091)*	*(529)*
Mean cost (to nearest £10)	*£580*	*£600*
Median cost (to nearest £10)	£440	£540
Standard deviation	£578	£364
Base (consumers with a valid annual cost calculation but not their bill in front of them)	*(706)*	*(389)*
Mean cost (to nearest £10)	£550	£700
Median cost (to nearest £10)	£480	£590
Standard deviation	£453	£485

Source: BEIS Heat Networks Consumer Survey (2017)[39]

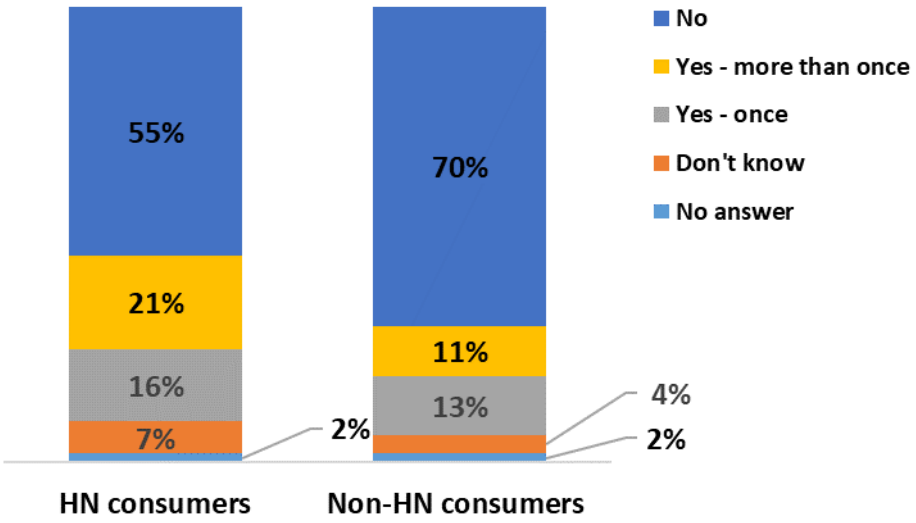
54. There is already a strong industry led movement, supported by government, to drive up standards for consumers through non-regulatory means. The 'Heat Trust' is a growing independent UK wide voluntary customer protection scheme that draws upon the terms of service offered to gas and electricity consumers. The industry, with government support, has also developed a voluntary Code of Practice, which establishes minimum standards for the design, installation and operation of heat networks. We welcome the work of industry to put in place these voluntary arrangements, which we will learn from and build on as we develop a longer-term framework.

55. Both our Consumer Survey and the CMA Report also found evidence of issues that need addressing, particularly in relation to some consumers getting poorer deals in terms of price and service quality. Our survey showed that a greater proportion of heat network customers had experienced a loss of heating in the last 12 months (37%) compared to customers not served by a heat network (24%). It also found that heat networks consumers were less likely to receive a bill, account summary or statement detailing how much they paid for heating and hot water (heat network: 62%, non-heat

[39] BEIS Heat Networks Consumer Survey (2017): www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems

network: 81%). This, however, partly reflects the high proportion of heat networks consumers who say they pay as part of a service or rental charge. On average, heat networks consumers who received a bill did so less frequently than non-heat networks consumers, and their bills, summaries and statements also tended to include less information compared with those of non-heat networks consumers.

Figure 6: Loss of heating in the past 12 months



Source: BEIS Heat Networks Consumer Survey (2017)[40]

56. In addition, as heat networks are in effect monopolies, similar to those for other household services such as water or sewerage, consumers typically have limited alternative sources of heat and in worst case circumstances may be locked into long-term contracts with limited protection or opportunity for redress.

57. The CMA's report has already provided important recommendations to address these concerns. In developing our proposals for a heat networks market framework, we will work with the CMA, consumer groups and wider stakeholders to ensure solutions protect consumers while enabling investment.

CMA market study into domestic heat networks

58. The CMA's final report into domestic heat networks set out a series of recommendations for the UK and Scottish Governments to take forward, some in partnership with other public bodies.[41] We welcome the CMA's report and agree with the majority of its conclusions.[42] We will be building on its recommendations as part of our ongoing work.

[40] BEIS Heat Networks Consumer Survey (2017): www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems
[41] CMA Heat Networks Market Study (2018): www.gov.uk/cma-cases/heat-networks-market-study
[42] This is the UK Government's response to the CMA report. The Scottish Government are responding separately to the CMA.

59. The CMA concluded that "*a statutory framework should be set up that underpins the regulation of all heat networks*." They recommended that "*the regulatory framework should be designed to ensure that all heat network customers are adequately protected. At a minimum, they should be given a comparable level of protection to gas and electricity in the regulated energy sector*."[43]

60. We agree with this recommendation. We share the ambition that consumer protection for heat networks consumers, whether served by communal or district networks, should be of a similar level to those afforded to gas and electricity consumers. We also agree with the CMA that these protections should cover customers on both new and existing schemes. However, we know that some existing schemes, and smaller ones in general, could face financial and practical difficulties in meeting increased standards. We will consider carefully the implications of introducing mandatory requirements on small and existing schemes and the extent to which the consumer benefit is outweighed by the implementation costs, which operators might seek to recover from their customers. We will look to take a proportionate approach in such circumstances, as long as consumers, particularly those who are most vulnerable, still receive an appropriate level of protection.

61. There are significant differences between the heat networks market and the gas and electricity markets, which may affect the nature of intervention required. Firstly, while there are currently around 70 electricity and gas suppliers, there are thousands of heat networks operators. These vary greatly in size and cover a range of models across public, private and third sectors, from small operators managing single communal networks to energy service companies (ESCOs) managing multiple large schemes.[44] This has implications for the practicalities of the regulatory arrangements required.

62. Secondly, while gas and electricity operators work within the context of well-established markets (with infrastructure assets deployed at national level and a large customer base amongst which to socialise costs), heat networks are local solutions and rely on securing a minimum number of customers. These consumers cannot usually switch to alternative heating solutions for the length of their contracts, unlike in the gas and electricity markets. On the counter side, heat network operators are less able to share their risks and enhancement costs over a large region or with other operators. Any regulatory intervention will need to reflect these differences.

63. We want to ensure that the sector works well for all consumers, including non-domestic ones, such as businesses, hospitals, universities and all other public sector buildings. It is important that heat networks encompass non-domestic consumers at scale if we are to achieve our long-term ambitions for the sector. The CMA's market study, and our own consumer survey, focused on domestic consumers. We therefore have less understanding of the potential issues affecting non-domestic consumers. We would welcome evidence on whether there are any specific issues affecting the non-domestic market that needs consideration. We are also interested in views on whether the introduction of further consumer protection measures designed for domestic customers could have unintended consequences for non-domestic customers.

[43] CMA Heat Networks Market Study (2018): www.gov.uk/cma-cases/heat-networks-market-study
[44] Ofgem: www.ofgem.gov.uk/data-portal/retail-market-indicators

Q10. Do you agree that the scope of the heat networks market framework should extend to non-domestic consumers?

Q11. Can you provide evidence of issues specific to non-domestic heat networks consumers?

CMA's recommendations

64. The CMA has recommended that "*the scope of regulation should include price, quality of service, transparency and minimum technical standards*." We agree with the CMA that there is a need for a regulatory framework and that interventions are needed to increase consumer protection. We set out below our views on each of the core recommendations from the CMA.

65. Where regulation is required, **we share the CMA's view that there are good reasons for Ofgem to take on the role of sector regulator**.[45] We consider Ofgem to have broadly the right set of capabilities to develop and enforce appropriate consumer protection measures within a market framework. Ofgem has extensive relevant experience to draw on from regulating the companies which run the gas and electricity networks. We and Ofgem recognise that a regulatory framework for heat networks is likely to be distinct from other regulated utility markets to account for the unique characteristics of the heat networks sector and that Ofgem would need to extend their expertise accordingly. We will continue to collaborate with Ofgem as we develop our detailed policy proposals for the market framework.

66. There are advantages in having a single regulator for all energy consumers, including avoiding unnecessary duplication and ensuring synergies across the different markets' interactions as they evolve. We anticipate that establishing an entirely new regulatory body would likely incur higher costs and require longer to set up. Nevertheless, a final decision on the sector regulator can only be made once we have a better understanding of what a potential regulatory framework will look like.

Quality of service

67. We agree that *measurable performance indicators and related minimum standards for service quality* are an important part of safeguarding consumers. We are keen to work with stakeholders to identify a balanced approach that will allow operators of new and existing schemes to report on, and meet, standardised requirements to protect consumers. It is likely that the ability to meet, monitor, and report against performance and quality of service standards will vary across different types of heat networks, particularly existing ones, and this will be reflected in our approach.

68. We recognise the importance of the work already done in this area by industry. The Heat Trust is a Code of Conduct scheme, established by industry with support from government. It sets customer service standards comparable to those afforded to gas and electricity consumers, including special provisions for vulnerable customers. It also

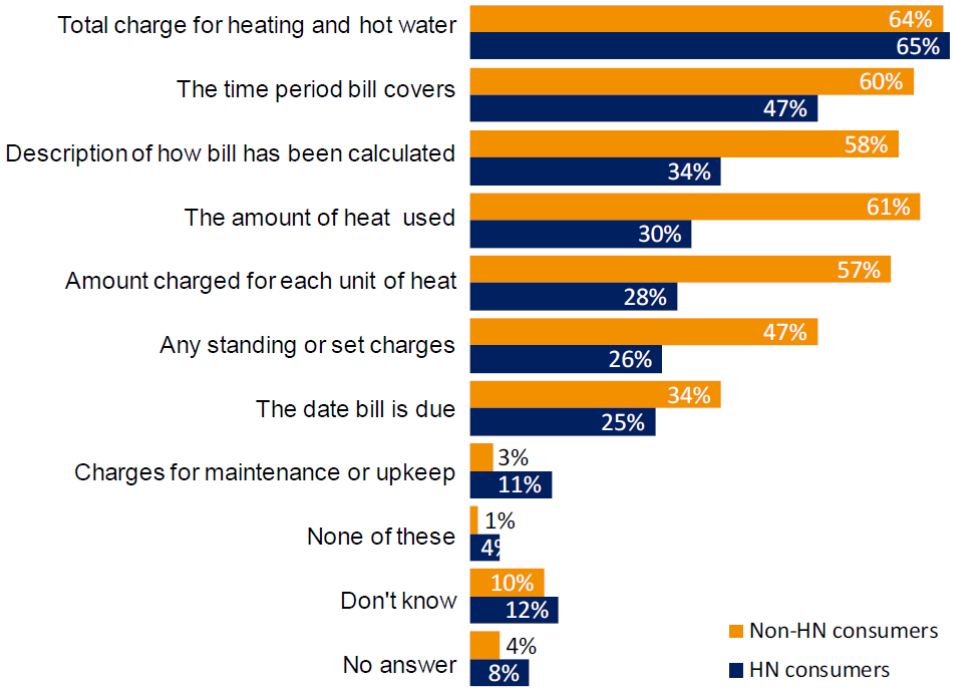
[45] Ofgem's current role is to protect the interests of existing and future consumers, including those who are most vulnerable, in the electricity and gas markets in Great Britain

provides access to the independent Energy Ombudsman. Any heat networks project that will receive support through government schemes such as HNIP or the Energy Company Obligation (ECO3, which will run from Autumn 2018 until March 2022), will be required to demonstrate Heat Trust, or equivalent, standards. While Heat Trust has made great progress in this area, it is a voluntary scheme; it does not apply to all networks and it does not come with enforcement powers as seen in equivalent arrangements for other utility consumers. We therefore plan to review and build upon the work already done by Heat Trust to identify how, and to what extent, minimum performance and quality of service standards should be mandated in both new and existing networks.

Q12. Do you agree that a minimum level of performance and quality standards should be mandated for existing networks as well as new networks? What would you expect this to include?

Transparency

69. We agree with the CMA that people need to be able to access enough information to allow them "*to make appropriate decisions when considering whether to live in a property with a heat network and information for heat network consumers to understand and act upon their bills*". We share the CMA's view that this could be managed through standards on quality of service. We agree that there should be specific requirements regarding the provision of heating bills and/or billing information and their frequency in new and existing heat networks. We expect these to go beyond the requirements of the current Heat Network (Metering and Billing) Regulations 2014. Additionally, there should be clear requirements or guidelines on the level of information to be provided in heating bills, such as heating consumption and breakdown of costs included in standing and variable charges.



Source: BEIS Heat Networks Consumer Survey (2017)[46]

70. We share some of the CMA's concerns about the type and quality of information provided at pre-transaction stage, before prospective customers move into a property on a heat network. Heat Trust already require their participants to provide specific information to prospective buyers or tenants, but we acknowledge that, in many cases, the information might not reach the consumers when it is needed, due to the number of players involved in the process. We will consider what actions are needed to raise general awareness about heat networks and other heating options more widely and will work across government to assess the need for reviewing and amending existing regulations to improve transparency.

Q13. How could information on heat networks and related services be better provided to relevant consumers, both during property transactions and through billing?

Technical standards

71. We agree with the CMA's recommendation that *mandatory minimum technical standards* are necessary to ensure heat networks are being built to a high quality and deliver good outcomes for consumers. We recognise the extensive work done by industry in this area already. In 2015, the Chartered Institution of Building Services Engineers (CIBSE) and the ADE produced the Heat Networks Code of Practice for the UK, which represented an important step towards improving the quality of the design, build and operation of heat networks, and has already raised standards right across the supply chain.[47] The Code of Practice covers all stages of the development cycle of a project, from feasibility through design, construction, commissioning and operation and its use can already be specified in contracts or tender documents, for entire projects or for specific stages.

72. With our support, CIBSE has developed training courses that provide an overview of the Code of Practice principles and requirements and has set up a register of heat networks professionals who have been assessed on their knowledge and understanding of the Code of Practice. In collaboration with the ADE, they are also in the process of updating the Code to facilitate monitoring of best practice.

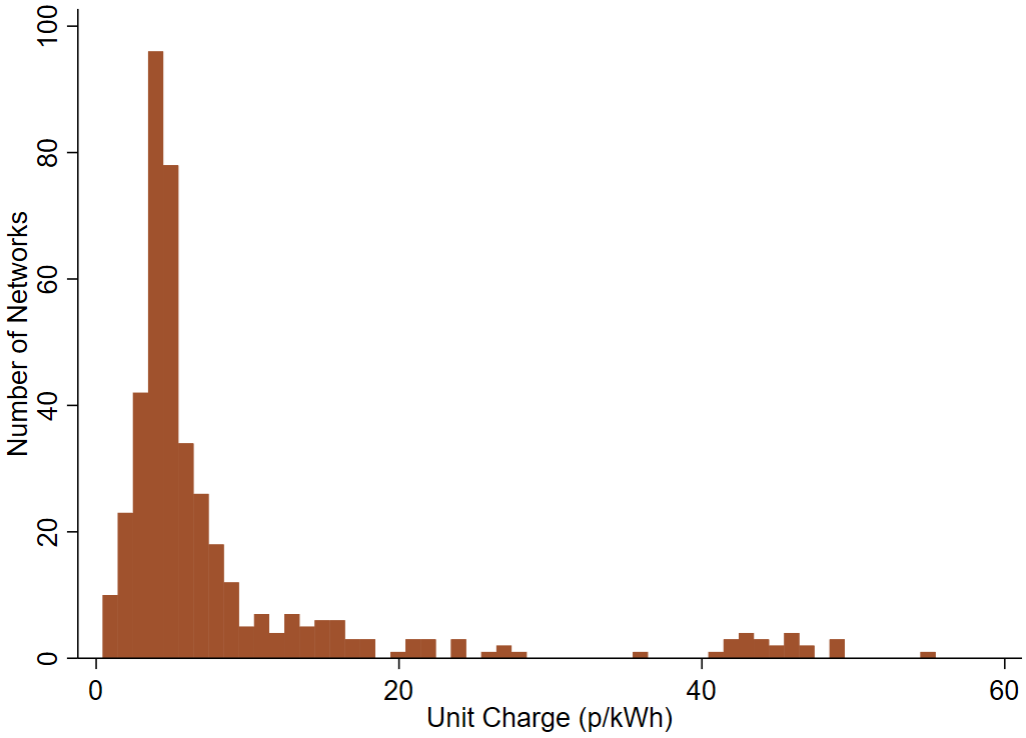
73. We are working with the ADE and the Investor Confidence Project (ICP) in developing a voluntary Quality Assurance Scheme to ensure that heat networks are built to minimum standards based on the Code of Practice and to provide formal certification. We believe industry should continue to lead on technical standards and training, and we will engage extensively with industry in developing proposals on how technical standards should be mandated.

[46] BEIS Heat Networks Consumer Survey (2017): www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems
[47] Heat Network Code of Practice: https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q200000090MYHAA2

Pricing and whole life cost considerations

74. The CMA recommended that "*the future regulator should require all heat networks to comply with 'principles-based' rules or guidance on pricing*". We agree in principle with this recommendation, but we will need to consult further with interested stakeholders to understand how best to implement this in practice. Our 2017 Heat Networks Consumer Survey showed that heat network consumers paid, on average, around £100 less for their heating and hot water compared with non-heat networks consumers, based on median annual prices.[48] However, both our survey and the CMA's analysis found evidence of great variation in pricing in the heat network sector, with pockets of consumers paying high annual prices. We therefore need to adopt measures to tackle the drivers for these specific situations where heating bills are higher.

Figure 8: Distribution of price per unit across CMA questionnaire sample



Source: CMA Heat Networks Market Study Appendices (2018)[49]

75. We think it is likely that a principle-based approach is preferable at this stage of the market's development. It would allow the regulator to consider the fact that heat prices in the heat networks sector are calculated using several different methods and allow flexibility in handling specific circumstances where pricing was an issue and be responsive to the quite different sizes and maturity of the many heat network operators.

76. The CMA has also recommended that "*the framework should require heat networks to give due consideration to whole life costs, and how this is likely to impact prices for*

[48] Heat Network Consumer Survey (2017): https://www.gov.uk/government/publications/heat-networks-consumer-survey-consumer-experiences-on-heat-networks-and-other-heating-systems
[49] CMA Heat Networks Market Study, Appendices (2018): https://assets.publishing.service.gov.uk/media/5b5596e6e5274a3fd4524406/heat_network_annexes.pdf

consumers" and "*where the whole life cost for consumers of a new heat network exceeds that of alternative fuels, the additional cost should be met by the developer*." While we understand the rationale behind this recommendation, further work is required to understand if and how this approach could work in practice, and any potential consequences on the market.

Protecting all heat consumers

77. There is growing evidence that consumers value the experiences they get from energy, such as a well heated home, more than how they are delivered, for example whether through a gas boiler or a heat network.[50] This suggests there are opportunities for new business models to evolve, in which consumers buy outcomes, such as a warm home heated to a specific temperature at certain times of the day, rather than paying for kWh of fuel or heat. A service-based approach would work irrespective of the specific heating system used to produce and/or deliver heat and therefore it would not be limited to the provision of heat through heat networks. Service-based business models would also be particularly attractive for increasing deployment of individual heating technologies which require high initial capital costs (e.g. heat pumps), as these costs could be offset by loaning the technology to consumers on a heat supply contract and providing them with a level of heating. Such models could benefit consumers by increasing their satisfaction, they could provide a route to market for low-carbon heat technologies, and they would enable heat providers to benefit from monitoring and reducing heat demand (including by promoting the adoption of energy efficiency measures). The government is particularly supportive of new solutions that contribute to cutting bills and increase comfort and well-being in the coldest, low-income homes, as set out in the government's Fuel Poverty Strategy.[51]

78. As we expect and encourage service-based business models to develop in the UK, we acknowledge that some consumer protection measures might be required to protect these new heat consumers. There are likely to be several similarities in the issues faced by consumers on heat networks and those served by these new "heat as service" models. For example, both might rely on heat meters (and use of heating data more widely) to accurately monitor and demonstrate that properties are being heated to an appropriate level. Both types of consumers would also benefit from clear guidelines on the contract and services provided, measures to ensure transparency on how tariffs are calculated (particularly in relation to maintenance costs) and minimum standards on quality of service.

79. We want the long-term market framework to be flexible enough to accommodate new service models and business innovation. We think this is important for attracting ongoing investment in the sector, reducing capital costs and in delivering heat arrangements which meet consumers' evolving needs and priorities at lower cost.

[50] Domestic Heat Energy Services: https://es.catapult.org.uk/publications/domestic-energy-services/ https://es.catapult.org.uk/publications/domestic-energy-services/

[51] Cutting the cost of keeping warm (2015): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408644/cutting_the_cost_of_keeping_warm.pdf

Next steps

80. We are committed to enabling a self-sustaining heat networks market, which is attractive to investment, where costs continue to be driven down, innovation can flourish, and one which moves towards low-carbon heat sources. We also want to ensure consumers – both households and businesses – are informed and protected and can benefit from reliable and affordable heating. This is an evolving and growing market and it is essential that any regulatory intervention enables future innovation and development.

81. Developing an effective heat networks market framework that works for investors and consumers now and in the future will require close working with a range of parties. We will continue our engagement with the CMA, Ofgem and the devolved administrations, as well as working in partnership with utility regulators, the heat networks industry, investors and consumer groups. We look forward to seeking input from a wide range of stakeholders over the coming months.

82. We also recognise that there is considerable learning for us from other countries where the heat networks sector is more developed. In much of Europe, heat networks are already very widespread and well accepted by consumers. 60% of the Danish population is connected to a heating network (1.5m households), for example, with 98% of Copenhagen's heat supplied by these systems. We are keen to understand better the lessons the UK can take from international experience, to learn more about best-practice and how it can be implemented in the UK.

83. We welcome feedback from stakeholders on the priorities we have identified and the questions we have asked in this publication. We are particularly keen to learn more about emerging heat services and specific issues affecting them and the experiences of non-domestic consumers on heat networks. We would encourage comments by 1 February 2019. For details on how respond please see next section.

84. We aim to consult on policy options for the framework in Summer 2019. Subsequent legislation would be subject to further consultation on the detailed requirements and introduced when Parliamentary time allows.

We are interested in your views

How to respond

Respond online at: https://beisgovuk.citizenspace.com/heat/heat-networks-ensuring-sustained-investment-and-pr

or

Email: heatnetworks@beis.gov.uk

Write to:

Heat Networks Team
Department for Business, Energy and Industrial Strategy
1 Victoria Street
London
SW1H 0ET

When responding, please state whether you are responding as an individual or representing the views of an organisation.

Your response will be most useful if it is framed in direct response to the questions posed, though further comments and evidence are also welcome.

Please submit your responses by 1 February 2019.

Confidentiality and data protection

Information you provide in response to these questions, including personal information, may be disclosed in accordance with UK legislation (the Freedom of Information Act 2000, the Data Protection Act 2018 and the Environmental Information Regulations 2004).

If you want the information that you provide to be treated as confidential please tell us, but be aware that we cannot guarantee confidentiality in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not be regarded by us as a confidentiality request.

We will process your personal data in accordance with all applicable UK and EU data protection laws. See our privacy policy.

Questions

Decarbonisation

Q1. Do you agree that a heat networks market framework should support the use of low carbon heat sources? Please explain.

Q2. Which cost-effective approaches could be used to deliver low carbon heat networks projects?

Ensuring Sustained Investment into the Sector

Q3. To what extent do you agree with our characterisation of demand risk?

Q4. How could government and industry address demand risk, especially connection risk and consumption risk?

Q5. Are there particular areas where government can collect and distribute data that will effectively mitigate the consumption risk?

Q6. Which of the approaches set out to address connection risk (demand assurance, heat zoning, concession schemes) would you consider to be most effective and why?

Q7. What other approaches to addressing connection risk should we consider? Please provide details.

Q8. Do you agree that we should consider granting greater access, maintenance and development rights to heat networks?

Q9. What are the most important types of access, maintenance and development rights needed?

Ensuring consumer protections

Q10. Do you agree that the scope of the heat networks market framework should extend to non-domestic consumers?

Q11. Can you provide evidence of issues specific to non-domestic heat networks consumers?

Q12. Do you agree that a minimum level of performance and quality standards should be mandated for existing networks as well as new networks? What would you expect this to include?

Q13. How could information on heat networks and related services be better provided to relevant consumers, both during property transactions and through billing?

Technical annex

1. This annex outlines the methodology for the cost-benefit analysis (CBA) used to estimate the carbon cost effectiveness of the heat networks that will be funded by the Heat Networks Investment Project (HNIP).

Introduction to HNIP CBA and key methodology approach

2. The HNIP model appraises the costs and benefits of the portfolio of projects, based on the assumption that all the HNIP funding is awarded and is less than the capital expenditure on projects.

3. Total volume of heat demand met by the HNIP-funded projects is determined by the HNIP capital spend profile, the leverage ratio (defined here as the proportion of HNIP's funding, relative to total capital expenditure on HNIP heat networks) and the average capital cost per MWh of heat networks energy source. Once heat demand has been calculated, the social cost of delivering this volume of heat is compared against a counterfactual portfolio of technologies which would otherwise meet the demand (e.g. domestic gas boilers). In this way, the modelling works from a top-down approach starting with total heat demand which is met through deployment of either heat networks or counterfactual technologies, rather than attempting to forecast individual projects which may come forward under HNIP.

4. The social net present value (SNPV) is calculated as the difference in the total social cost of meeting the same heat demand in the heat network and the counterfactual scenarios. The total social cost includes capital and operational costs, fuel use and emissions of greenhouse gases and air quality pollutants.

5. The key assumptions in this calculation are:

a. The leverage ratio (HNIP funding as a share of total capital spent on heat networks)

b. The technology mix for the portfolio of heat networks

c. The technology mix for the counterfactual

d. Share of HNIP projects that are extensions (which have a lower average cost)

e. Capital and operational costs for the components of the heat networks (e.g. pipes, pumps, building connections) and heat generation technologies (gas-CHP, biomass boilers, etc)

f. Fuel prices, carbon values and air quality damage costs

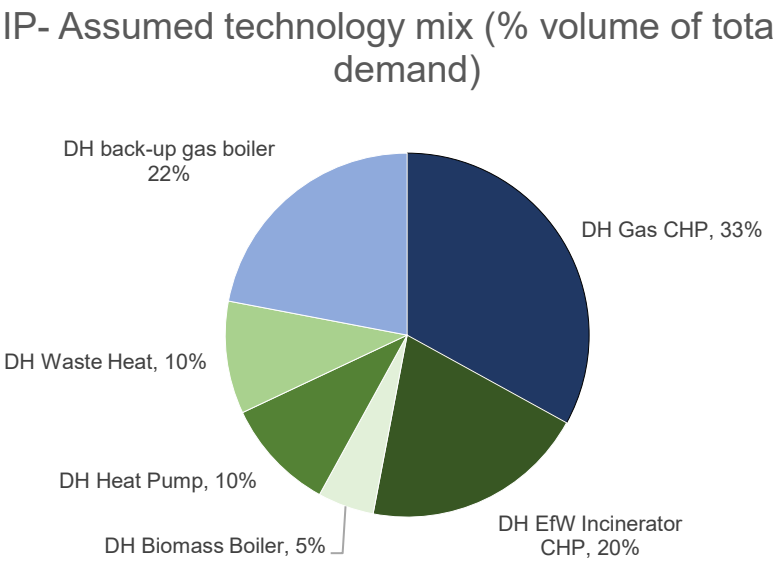
6. The sources of these costs and benefits along with general assumptions are outlined in the following section.

Key assumptions and evidence

Technology mix

7. The technology mix assumed has been informed by HNIP pilot data and a survey of the heat network sector pipeline of projects. The pilot projects were dominated by gas-CHP, high temperature waste heat and back-up gas boilers. It is considered that this offers a conservative, but realistic representation of the projects that are likely to come forward in the main scheme. Figure 1 demonstrates the technology mix which has been assumed for heat networks.

Figure 1: Assumed heat network technology mix



8. Additionally, the technology mix profile is dynamic. It is assumed that once the original gas CHP plants have reached the end of their operational life, they will be replaced by lower carbon technologies such as energy from waste, biomass boilers and heat pumps. Thus, after the last CHP plant retires no heat network will be supplied by gas CHP.

Counterfactual technology mix

9. A number of assumptions are made in the counterfactual scenario technology mix:

a. Total heat demand is to be delivered by current technologies, predominantly by gas with a 90% share and with electricity making up the remaining 10%.

b. 40% of total head demand is from domestic properties and 60% from non-domestic properties.

c. 25% of the heat demand is for new builds and 75% for existing properties.

10. This profile is evidenced from the pilot projects and the HNDU pipeline data of those projects likely and very likely to go ahead. This profile is kept constant throughout the appraisal period.

Share of HNIP projects that are extensions

11. It is assumed that the costs of heat network extensions are significantly lower per MWh than new networks. Pilot and pipeline data suggest that between 12% and 47% of projects could be extensions[52], measured by share of heat demand. Individual extension projects are likely to score well in the application process due to low costs, leading to a potentially smaller funding gap required and a better SNPV. The central assumption for extensions is that they will constitute 30% of heat demand, which would be equivalent to around 20% of the total capital investment being spent on extension projects.

Costs and performance of heat network technology

12. The costs and performance of heat networks and counterfactual technologies are taken from various publications, outlined in Table 1. These are based on the best and most recent data available. It is hoped that over the lifetime of HNIP, the evidence base on installing heat networks is improved.

Table 1: Sources for data on costs and performance of heat networks

Source	Provides evidence for
AECOM (2015) – 'Assessment of the costs, performance and characteristics of UK heat networks'	Heat network connection costs Costs of energy centre ancillary plant and thermal store
Real data collated from HNIP Pilot applicants	Costs and performance of heat generation technologies Development/Civil costs Heat network infrastructure costs Thermal losses Costs of extension projects relative to new networks
Poyry (2009) – 'The potential and costs of district heat networks'	Lifetimes and performance of heat generation technologies

[52] The 47% figure is from pilot data and the 12% is the low estimate from the pipeline data

Element Energy (2015) – 'Research on district heating and local approaches to heat decarbonisation'	Operational cost of gas-CHP Transmission pipe costs
Ricardo AEA (2015) – 'National Comprehensive Assessment of the Potential for Combined Heat and Power and District Heating and Cooling in the UK'	Size for waste heat and Energy from Waste plants
HNDU Feasibility studies	Costs and performance of heat generation technologies
Green book supplementary guidance: valuation of energy use and greenhouse gas emissions	Fuel costs, carbon values & air quality damage costs

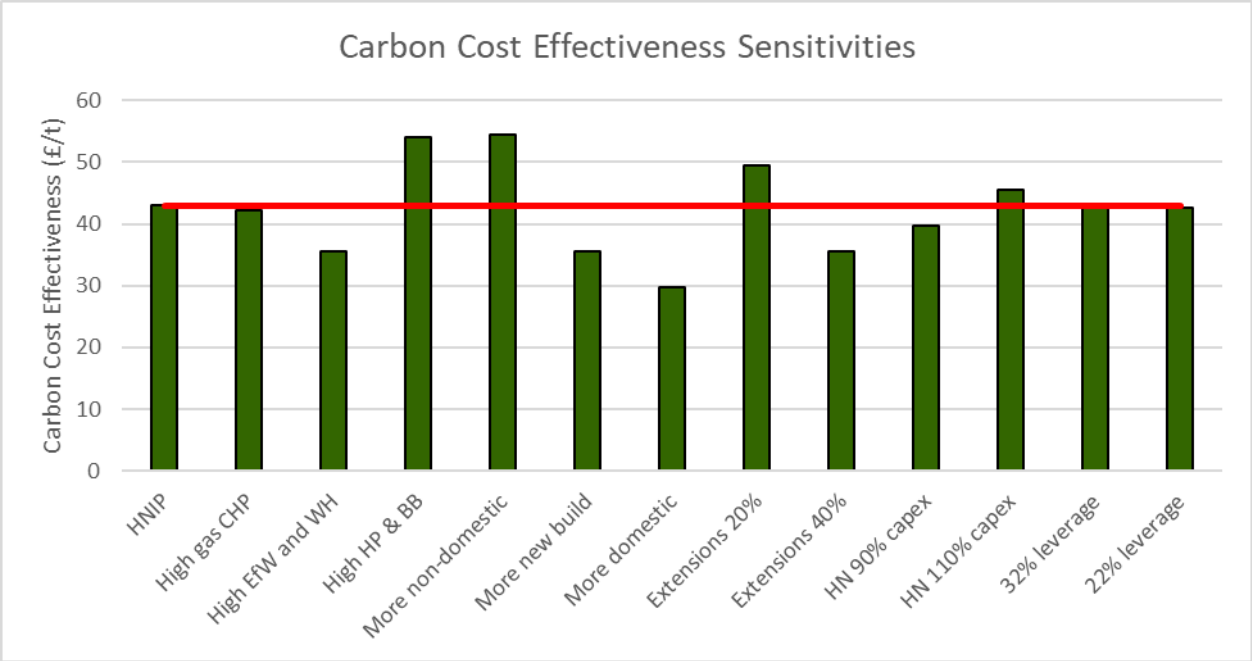
Carbon cost effectiveness of HNIP

13. The carbon cost effectiveness (CCE) is calculated as the cost per tonne of carbon saved, following Green Book supplementary guidance. Figure 2 illustrates how the (non-traded) carbon cost effectiveness (£/t) for HNIP varies depending on different modelling assumptions. These are indicative estimates only and should not be seen as a representation of our expectations of HNIP – whilst they are based on our most up-to-date evidence available, there is significant uncertainty around which projects will come forward for HNIP funding.

14. The sensitivity analysis shows the HNIP funded heat networks are likely to provide cost effective relative to the benchmark value of carbon for a wider range of different modelling assumptions.[53] The details of the different modelling assumptions used are set out below.

[53] For more details on the benchmark value of carbon saving please see the *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*

Figure 2: Carbon Cost Effectiveness for various sensitivities



15. The technology mix which make up the various heat network scenarios is shown in Table 2.

Table 2: Heat network technology sensitivities

	Central assumption	High gas CHP	High EfW & High temp waste Heat	High HP & Biomass
Gas CHP	33%	48%	23%	25%
EfW CHP	20%	13%	28%	15%
Biomass Boiler	5%	3%	3%	13%
Low Temp Waste heat and other Heat Pump	10%	7%	7%	18%
High Temp Waste Heat	10%	7%	18%	8%
Gas Boiler (back up)	22%	22%	22%	22%

16. The mix of new builds and domestic and non-domestic split for the counterfactual sensitivities is shown in Table 3.

Table 3: Counterfactual make-up sensitivities

	Central assumption	More Non Domestic	More New build	More domestic
Proportion of gas	90%	95%	82%	85%
Proportion of electric	10%	5%	18%	15%
Proportion of domestic	40%	20%	40%	60%
Proportion non-domestic	60%	80%	60%	40%
Proportion new builds	25%	25%	45%	25%
Proportion existing	75%	75%	55%	75%

Methodology for the investment required for potential heat networks 2050 illustrative pathways

17. This section sets out the methodology for estimating the investment in heat networks needed to meet the illustrative 2050 pathways set out in the Clean Growth Strategy. The Clean Growth Strategy illustrative pathways show heat networks could contribute 17% of heat supplied for the domestic sector and 24% of the non-domestic heat supplied in 2050.

18. We have estimated the total volume of heat consumed in 2035 using: projected final UK energy consumption in 2035[54] and the share of domestic and non-domestic heating in final energy consumption in 2016.[55] We have assumed that final UK energy consumption stays constant from 2035 to 2050 and the share of final consumption used for domestic and non-domestic heating also remains constant between 2016 and 2050.

19. The total heat and cooling supplied by heat networks is estimated based on the analysis presented in the CGS. Heat networks currently supply around 14TWh of heating and cooling per year.[56.] It is estimated that the additional heating and cooling supplied will be roughly 85TWh.

[54] BEIS (2018) Updated Energy and Emissions Projections 2017
[55] BEIS (2018) Digest of United Kingdom Energy Statistics 2018
[56] This data includes notifications submitted up to December 2017, however, the majority submitted in 2015. Heat networks are only required to submit once every 4 years therefore we do not have any more up-to date data and

20. AECOM were commissioned by BEIS in 2015 to establish the cost of heat networks.[57] Costs for average heat connections and heat networks for bulk schemes are summed together to find the average capital cost of a heat network (£175/MWh) and inflated to 2018 prices. The extra heat supplied (85TWh) is multiplied by the average cost for a heat network to find the total potential investment required (£16bn) to meet the 2050 heat network illustrative pathways.

do not know if these networks have expanded/ceased operation/decreased in size. There are known data quality issues with this data overall including coverage. We do not know the extent of coverage issues. OPSS received around 17,000 notifications of which around 3,000 were not included in this analysis as the data quality was too poor. This doesn't necessarily represent the total number of notifications as these 3,000 include duplicates for the same network.

[57] AECOM (2015) Assessment of the costs, performance and characteristics of UK heat networks

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