Department of Energy & Climate Change

HEAT NETWORKS INVESTMENT PROJECT

Capital funding for building heat networks

June 2016

HEAT NETWORKS INVESTMENT PROJECT CONSULTATION

Capital funding for building heat networks

The consultation can be found on DECC's website: https://www.gov.uk/government/consultations/consultation-on-the-heat-networks-investment-project-hnip.

Heat Networks Investment Project Consultation

Any enquiries regarding this publication should be sent to us at heatnetworks@decc.gsi.gov.uk.

Foreword

Providing reliable, affordable energy is central to the UK's economic success. In this country, we use more of our energy for providing heating and hot water in our buildings than for any other purpose. In order to meet our climate change targets, we also need the heat we use to become increasingly clean.

To clean up our heat supply, we need to consider ways to generate heat more efficiently, both within buildings and through the use of heat networks. Well designed and operated heat networks can cut bills for households and businesses, particularly in denser urban areas where heat networks are more cost effective. Also known as 'district heating', heat networks can already be found supplying heat to hospitals, universities, tower blocks and, increasingly, to new urban mixed developments of housing, commercial and public buildings. There are already over 2,000 heat networks in the UK in cities such as Sheffield, Nottingham, Coventry, Southampton and Birmingham, as well as in many London boroughs; some of which have been operating for over 50 years.

The heat for such networks can come from a variety of different sources; gas boilers, combined heat and power plants (which also provide electricity), recovered waste heat from factories or infrastructure, energy from waste plants, large water-sourced heat pumps, and in the case of Southampton, a geothermal heat source. Not only can heat networks enable carbon savings in the short term, they also allow us to increase these carbon reductions over time because the pipe infrastructure can utilise new lower carbon heat sources in the future. Just as we are making our electricity grid cleaner by decarbonising electricity generation, so we can make heat networks progressively cleaner.

The UK is a long way from fully exploiting the potential of heat networks. We are keen to accelerate the deployment of heat networks in the UK, as a cost effective way of cutting carbon emissions and providing reliable and affordable heat to customers. At the Spending Review over £300 million[1] of capital was announced to support investment in heat networks. This is part of our efforts to build an energy infrastructure fit for the 21st Century after decades of underinvestment.

Our aim is to support the development of heat networks and help create a market that will become self-sustaining, while providing the reliable, clean, and affordable energy we need.

Signed: (Lord Bourne)

[1] £320m

Contents

General information

Purpose of this consultation

This consultation is seeking views to inform the design and management of the Heat Network Investment Project (HNIP).

HNIP aims to provide £320m of capital support to increase the volume of heat networks being built, deliver carbon savings, and help create the conditions necessary for a self-sustaining heat network market to develop.

The Government is seeking views from current and potential heat network sponsors, investors, supply chain, and any other interested stakeholders, on how best to use the capital support funding to overcome barriers to investment in heat networks and achieve the aims of the project.

Issued: 29 June 2016

Respond by: 03 August 2016

Enquiries to:

Heat Networks Team
Department of Energy & Climate Change,
A Floor Area 1,
3 Whitehall Place,
London, SW1A 2AW
Tel: 0300 068 8125
Email: heatnetworks@decc.gsi.gov.uk

Territorial extent:

England and Wales only

How to respond

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 provide responses to the consultation via the secure e-consultation platform accessed via: https://econsultation.decc.gov.uk/decc-policy/decc-consultation-on-heat-network-investment.

If you are unable to use the e-consultation platform, please email your responses to: heatnetworks@decc.gsi.gov.uk, writing your views in the body of the email or in an attached word document.

All responses whether provided online or by email must be received by the deadline of 03 August 2016.

Additional copies:

You may make copies of this document without seeking permission. An electronic version can be found at https://www.gov.uk/government/consultations/consultation-on-the-heat-networks-investment-project-hnip. Hardcopies are not available.

Confidentiality and data protection

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 1998 and the Environmental Information Regulations 2004).

If you want information that you provide to be treated as confidential please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

We will summarise all responses and place this summary on the GOV.UK website. This summary will include a list of names or organisations that responded but not people's personal names, addresses or other contact details.

Quality assurance

This consultation has been carried out in accordance with the Government's Consultation Principles.

If you have any complaints about the consultation process (as opposed to comments about the issues which are the subject of the consultation) please address them to:

DECC Consultation Co-ordinator
3 Whitehall Place
London SW1A 2AW
Email: consultation.coordinator@decc.gsi.gov.uk

Executive Summary

Introduction and Policy Context

Heat networks are a distribution system of insulated pipes that take heat from a central source and deliver it to a variety of customers. These typically include public sector buildings, shops and offices, sport facilities, universities and homes. A well designed and operated heat network can be both cheaper and more efficient than traditional buildings-level heating solutions. For example, heating costs for flats can be more than 30%[2] lower on a gas-supplied heat network than using individual gas boilers.

Such networks also have significant potential to reduce carbon emissions for heating as the distribution system enables the use of low carbon heat sources that can only be used at scale. This means that carbon savings can be delivered more cost effectively than with individual building solutions. Use of combined heat and power generation, heat storage and electric heat (e.g. from heat pumps) on networks also offer significant electricity system balancing opportunities. Heat networks of any kind also support local economic regeneration and growth.

However, in the UK, only about 2%[3] of our heat is supplied via heat networks; one of the lowest levels in Europe. They are particularly prevalent in northern Europe, where 60%[4] of the Danish population is connected to district heating networks, so the potential for the UK is significant.

As a result, the Department of Energy and Climate Change's (DECC) Heat Networks Delivery Unit has been supporting local authorities to explore heat network opportunities since 2013. This Unit is already supporting over 200 development stage projects sponsored by over 100 local authorities across England and Wales.

Our economic and commercial analysis has shown that early stage development support alone will not bring forward the large amounts of capital investment required to see this infrastructure built. That is why in November last year the Government announced that over £300 million[5] of capital funding would be made available to contribute towards the construction costs of heat networks. This funding could leverage up to £2bn of additional capital investment. The Heat Networks Investment Project (HNIP) aims to bring about an increased and sustained build rate for heat networks and influence the types of heat network built, and help stimulate a self-sustaining heat networks market.

---

2 AECOM (2015) *Assessment of the Costs, Performance, and Characteristics of UK Heat Networks* https://www.gov.uk/government/publications/assessment-of-the-costs-performance-and-characteristics-of-uk-heat-networks. Compares estimated heat price for a small flat (10.24p/kWh) with average heat price from heat networks studied (6.43p/kWh) – pp. 35-36

3 Poyry (2009). *The potential and Costs of District Heating Networks*. http://webarchive.nationalarchives.gov.uk/20121205174605/http:/decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/distributed%20energy%20heat/1467-potential-costs-district-heating-network.pdf

4 Ibid.

5 £320m

There is also a need for new, innovative technologies to be developed, combining the latest in smart technology, storage, balancing and demand-management to optimise the efficiency of networks, reduce carbon emissions and increase the benefits that they provide to customers. In the last year, DECC has supported a number of projects through a heat networks demonstration competition[6], and these are now coming to fruition. Over the coming months, the competition winners will be launching new products and services to the market that can support a step change in performance. Through the innovation competition we have learnt much about what efficiency savings are achievable and how heat networks can work better for consumers.

Heat networks need to be properly designed and operated. They also need to make sound economic sense and contribute to our energy and climate change goals. That is why we are working to design a stable and enduring market framework for the long-term.

Already, we have brought in greater transparency around heat metering and billing[7]. The Association for Decentralised Energy (ADE) has established the independent Heat Trust[8], with DECC support, to improve protection for consumers. The ADE has also worked in partnership with the Chartered Institute for Building Service Engineers (CIBSE) to provide a comprehensive set of technical standards[9] for heat network construction and operation. Shortly we expect an open-source heat price comparator[10] to be made available on-line so that customers can check the price they pay for their heat against the alternatives. In addition to these initiatives, industry also needs to play its part by driving down costs, learning from elsewhere, and bringing innovation to the sector.

The Heat Networks Investment Project

In last year's autumn statement[11] the Chancellor announced that the Government will provide over £300m of funding for heat networks over the next five years (2016/17 – 2020/21). The specific funding allocation is £320m, and this is expected to draw in around £2 billion of additional capital investment and to lead to the construction of hundreds of heat networks in urban and rural areas that will generate enough heat to supply the equivalent of over 400,000 homes across England and Wales.

This capital funding is the subject of this consultation.

HNIP will deliver this capital investment, boosting support for new projects in development. HNIP specifically aims to do the following:

i. Increase the volume of heat networks built, by providing central Government funding which will draw in significant additional investment.

ii. Deliver carbon savings for carbon budgets across the lifetime of the infrastructure asset.

---

6 https://www.gov.uk/government/news/heat-network-innovation-competition
7 https://www.gov.uk/guidance/heat-networks
8 Heat Trust http://www.heattrust.org/
9 Chartered Institution of Building Services Engineers (CIBSE) and Association for Decentralised Energy (ADE) (2015) *Heat Networks: Code of Practice for the UK* http://www.cibse.org/knowledge/cibse-other-publications/cp1-heat-networks-code-of-practice-for-the-uk-new
10 http://heattrust.org/index.php/heat-cost-comparator
11 https://www.gov.uk/government/news/deccs-settlement-at-the-spending-review-2015

iii. Build capability among local actors (particularly heat network project sponsors) to develop optimised heat networks that will meet local needs. Seek to support the type of heat networks with the following technical, contractual and financial characteristics that would not have been developed without Government support:
   - will have explored a suitable range of technical options and are efficient heating and cooling systems that are technically future-proofed;
   - are commercially future-proofed; and
   - will operate with no customer detriment in comparison to the likely alternative heat supply.

iv. Alongside investment in innovation and development of the appropriate legislative framework, help to create the conditions for a self-sustaining heat network market that does not require continued Government funding after this programme of investment support has ended.

First funding round

We intend to run the first funding round as a Pilot. Independent evaluation of the project will be commissioned in parallel which will allow us to improve the design of the project and increase its effectiveness over the period to March 2021. To enable the proposed Pilot phase of funding to be deployed quickly, the Pilot is likely to be narrower in scope than the full scheme, for instance, in terms of who would be eligible for funding.

Aim of this consultation

The consultation asks a series of questions to gather stakeholder views on the deployment of the £320 million capital funding for both the proposed Pilot and the full scheme:

A. **Who should be eligible to apply directly for the capital funding?**
For the proposed Pilot phase, we will be aiming to simplify the scheme as far as possible while still obtaining valuable learning to inform full scheme design. Therefore, our proposal is to limit applications for the Pilot phase to local authorities and potentially some other public sector bodies. The full scheme is likely to have wider eligibility. The consultation seeks views on these issues, and in particular whether wider public sector, private sector, communities and not-for-profit groups that are heat network sponsors or owner-operators should also be eligible to apply directly for funding in later years.

B. **What should the Heat Networks Investment Project provide capital funding for?**
The consultation seeks views on what construction costs should be eligible for funding and whether funding for commercialisation transaction costs (technical, financial and contractual work prior to build) should be offered and, if so, via which funding mechanisms.

C. **Through which funding mechanisms should the capital funding being deployed?**
Our proposal is that the Pilot will be limited to grants and/or loans, for practical reasons of delivery. The consultation asks what combination of capital funding mechanisms should be offered for the remainder of the project; grants, soft loans, equity and/or guarantees.

D. **What decision-making criteria should be used to assess the capital funding applications?**
It is our intention that multiple criteria will be used to score the technical, financial,

contractual, environmental and social attributes of applications in relation to HNIP's aims. Views are sought on which criteria should determine eligibility, and for final decisions on which applications to support.

E. **Monitoring**

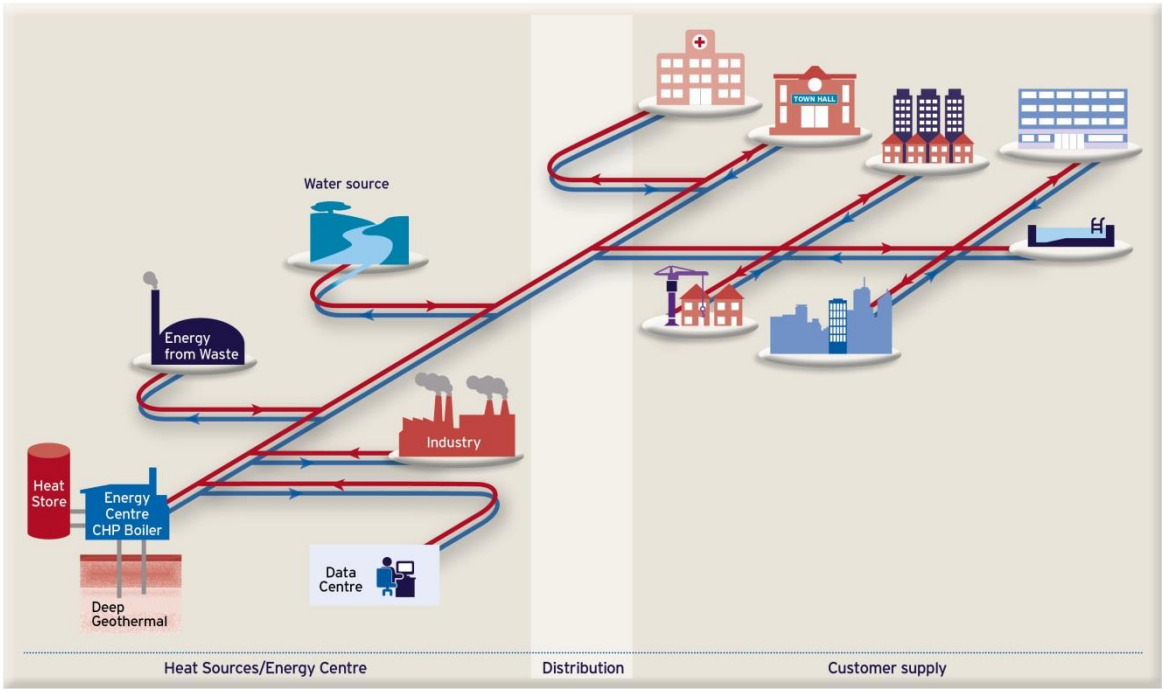
It is important that we monitor the impact of the project to determine if we are delivering our intended aims. The consultation seeks views on how we should monitor these impacts as well as seeking views on other factors that may affect the transition to a sustainable heat networks market.

Background

What are heat networks and why do they matter?

A well designed and operated heat network can be both cheaper and more efficient than traditional buildings-level heating solutions and as such has a key role to play as part of decarbonisation efforts.

Figure 1: Heat network illustration



In order for the UK to meet its carbon objectives cost effectively, it is estimated that between 14% and 43%[12] of heat demand could be supplied by efficient heat networks by 2050, whilst analysis for the Committee on Climate Change's (CCC) Fifth Carbon Budget Report modelled heat networks serving 18% (81 TWh) of building's heat demand in 2050 and saving 15

[12] See DECC (2013) *The future of heating: meeting the challenge.* https://www.gov.uk/government/publications/the-future-of-heating-meeting-the-challenge and modelling by Poyry (2009). *The potential and Costs of District Heating Networks*. http://www.poyry.co.uk/sites/www.poyry.uk/files/A_report_providing_a_technical_analysis_and_costing_of_DH_networks.pdf indicated up to 14% of national heat demand could be served by heat networks if certain barriers are overcome whilst ETI (2013) *Macro Distributed Energy Key Findings*. http://www.eti.co.uk/wp-content/uploads/2014/03/Macro_Distributed_Energy_Project_Key_Findings_v_3.pdf modelling indicated 43% of the current British building heat market can be economically connected to macro district energy schemes.

$MtCO_{2e}$/year[13]. As heat networks currently only supply around 2% of heat demand, transformative change will be needed to deliver these potential carbon savings, both now and in the future, before a self-sustaining heat network market can be created.

A self-sustaining market would see a wide range of heat networks economically viable without direct Government support; evidenced by a sustained pipeline of heat network projects in development matched by a sufficient volume of appropriately priced finance so that a significant proportion are able to be built.

It is expected that higher and consistent build rates will lead to reduced costs through supply chain expansion, innovation and economies of scale[14].

Why this project is needed now

The heat networks that have been built in the UK to date have been funded by public sector sponsors and private sector owner-operators. If we are to see the increase in build rates required to realise heat network's cost effective carbon reduction contribution, we not only need the existing players to do more, but are likely to need a wider pool of finance through greater diversity of third-party investors.

Feedback from stakeholders has indicated that there is limited activity by third-party investors not involved in the operation of the heat network. Whilst new market entrants have indicated an interest in the UK heat networks market, very few have yet invested. Feedback has indicated this is for a combination of the following reasons:

- **Lack of visibility of investment opportunities (pipeline risk)** – Some investors indicated that identifying heat network investment opportunities was challenging and greater visibility of projects in development would be welcomed, particularly for larger projects that are more attractive for long-term investors (who would normally have investment thresholds closer to £100m than the £4m-£40m typical of heat network projects). DECC's Heat Networks Delivery Unit has worked to help create an identifiable pipeline of projects[15]. Further work is being undertaken by the Heat Networks Delivery Unit to support early stage projects and as such pipeline risk is not specifically addressed through the HNIP capital initiative, although the project can support some level of standardisation across a pipeline of new heat networks, providing replicability and scale.
- **Concerns over revenue certainty (particularly demand risk)** – Projected heat revenues can only be maintained where there is sufficient volume of customer demand over the lifetime of the network (40+ years). To alleviate this 'demand risk' investors seek contractual guarantees, often with an entity that can aggregate demand (e.g. local authority, industrial user, housing association etc). Local authorities already act as

---

[13] Element Energy (2015) *Research on district heating and local approaches to heat decarbonisation. A study for the Committee on Climate Change.* https://documents.theccc.org.uk/wp-content/uploads/2015/11/Element-Energy-for-CCC-Research-on-district-heating-and-local-approaches-to-heat-decarbonisation.pdf

[14] Poyry (2009). *The potential and Costs of District Heating Networks*. http://www.poyry.co.uk/sites/www.poyry.uk/files/A_report_providing_a_technical_analysis_and_costing_of_DH_networks.pdf report identified that the capital costs of heat networks in the UK are 20% higher than in mainland Europe, a significant proportion of which is the distribution infrastructure.

[15] *Heat Infrastructure Investment Pipeline* (quarterly publication) https://www.gov.uk/government/publications/energy-networks-in-the-uk-investment-opportunities

aggregators of demand bringing together their heat use from buildings such as council offices, leisure facilities or social housing. By drawing in new investors, Government funding could help investors accept demand risk uncertainty in the absence of a single off-taker, establish appropriate risk allocation and thereby establish a long-term understanding of how demand for heat, supplied through a heat network, operates.

- **Marginal project returns** – Heat networks tend to have high up front capital costs and relatively low, long-term returns. Historical Internal Rates of Return (IRR) for gas CHP-supplied heat networks fall in the range 6-9%[16] but investors such as infrastructure funds commonly look for returns in the range 12-15% pre-finance IRR[17]. It has been clear from DECC's engagement with potential investors that low returns need not in and of themselves be a barrier to heat network investment. If heat networks can demonstrate predictable long-term stable income, institutional investors would be more likely to invest if there is security over a minimum level of returns from these investments.
- **Lack of a secondary market –** Investors that have not previously invested in UK heat networks may choose to make their first investments in projects with a lower risk profile. Like many other types of infrastructure, heat networks commonly have a better risk/reward profile once the construction and initial operation risk has fallen away. Operating heat networks may seek investment in the form of debt; refinancing with cheaper capital to match the reduced risk profile. Alternatively investment may be in the form of equity through share purchase or acquiring whole networks. The market for investment in operating schemes is termed the 'secondary market'[18]. Government funding over this parliament may help to create the beginning of such a 'secondary market' in heat networks.

Heat Networks Investment Project scope

Like most infrastructure construction, heat networks will go through development and commercialisation stages before build and operation (see Figure 2: Development to delivery diagram). However, the subject of this consultation is HNIP capital funding for commercialisation and construction of networks.

The interaction between the grant funding and guidance offered to local authorities by DECC's Heat Networks Delivery Unit and the capital funding for building heat network in England and Wales is depicted in the illustration below. Grant funding and guidance are illustrated by the red lines at the bottom of the diagram, with blue lines indicating possible areas of capital funding on which we are seeking views via this consultation.

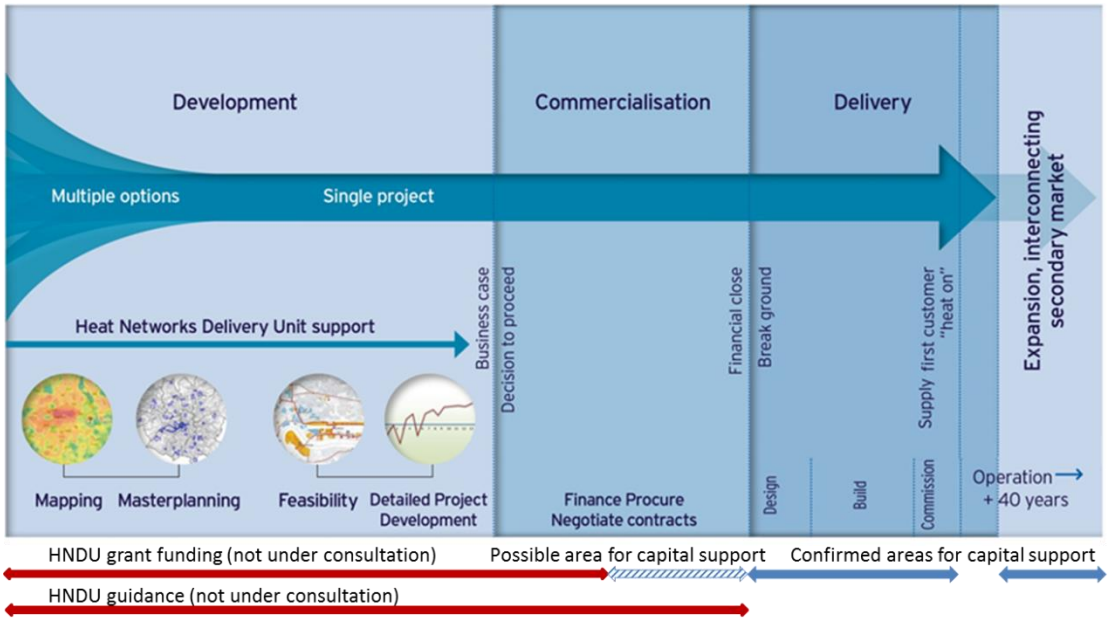
---

16 Poyry (2009). *The potential and Costs of District Heating Networks*. http://www.poyry.co.uk/sites/www.poyry.uk/files/A_report_providing_a_technical_analysis_and_costing_of_DH_networks.pdf

17 Cornwall Energy – Strategic Energy Market Intelligence (2015) Pre-finance IRR for wind, solar and biomass projects, with entry post-permitting.

18 A secondary market refers to the refinancing (debt provision) or acquisition (equity provision) of operational networks.

Figure 2: Development to delivery diagram



Heat Networks Investment Project parameters

There are a number of fixed financial and regulatory parameters within which HNIP must operate:

- Roughly half of the capital allocated at the Spending Review is non-fiscal and half is fiscal capital. Non-fiscal capital must pass the public sector boundary and return to the public sector, e.g. via a loan or an equity investment in a private sector owned network. Examples illustrating this distinction can be found in **Annex 3: Design Parameters**.
- Public sector accounting practices determine budget profiling, meaning that spend must be allocated to projects in specific years.
- State aid compliance[19] – the Government is obliged to ensure that awards made under this project comply with European Commission rules on State aid. DECC intends to utilise the General Block Exemption Regulation (GBER) initially, which covers a range of 'pre-approved' types of State aid, including for heat networks, not requiring individual approval from the European Commission.

Where funding in any form[20] is from Government, such as from central Government, devolved, local or EU budgets allocated nationally, there are parameters within which this funding must be mixed and matched as defined by State aid regulations. Further information on these parameters can be found in **Annex 3: Design Parameters**.

[19] Following the Referendum outcome there will be no immediate changes. The UK's rights and obligations of EU membership, including compliance with State aid rules, continue to apply until the UK's exit from the EU has been completed.

[20] This could include grants, loans, equity, guarantees, subsidies, tax reliefs.

Commercial structures in which Heat Networks Investment Project capital can be invested

Due to the fiscal and non-fiscal profile of the Heat Networks Investment Project, capital will need to be invested in heat networks with a variety of commercial structures:

- whole or majority public sector controlled heat networks; and
- whole or majority private sector controlled heat networks.

Where the successful recipients of HNIP capital are not the same entity that owns the heat network, the recipient may choose to on-invest capital into the commercial structure that owns the heat network (Special Purpose Vehicle, Joint Venture or subsidiary) in a variety of ways – grant, loan or equity investment.

Ensuring that additional investment is brought into projects to complement Heat Networks Investment Project capital funding

HNIP will only provide a proportion of the investment costs for heat network build to ensure value-for-money and in-line with State aid regulations (see Questions 21 & 22 on page 38 which ask about rewarding the 'right amount of funding'). Heat network sponsors will need to secure the remaining investment from other sources. This might include from their own reserves, from owner-operators or third-party investors. The onus will be on applicants to demonstrate at application where they intend to secure the remaining investment from and then confirm this has been secured before HNIP capital is released.

The ability to combine capital funding from HNIP with support from other Government schemes will be defined by the rules of those programmes and the design of HNIP following consultation. In particular, we will use scheme rules to ensure that where there is interaction with the Renewable Heat Incentive (RHI)[21] and Energy Company Obligation (ECO)[22] , there is no overlap or duplication of support:

- Heat networks utilising renewable heat sources may be able to access the RHI if operating by 2020/21, noting there are fixed annual budgets. It may be possible to combine this with HNIP capital where that capital funding is not used to support the heat source supported by the RHI.
- Heat networks addressing fuel poverty may be able to attract ECO funding. ECO is funded through energy bills and not by central Government. Consequently, ECO funding would not be counted towards State aid intensity thresholds and it may be possible to utilise ECO alongside HNIP capital funding.

[21] https://www.gov.uk/non-domestic-renewable-heat-incentive
[22] https://www.gov.uk/energy-company-obligation

Eligibility and Application Process

Eligibility for capital funding

Heating networks, cooling networks and heat networks that also generate electricity can apply for HNIP funding where they meet the definitions of energy efficient district heating and cooling systems set out below.

Applicants must therefore be able to demonstrate that they comply with the following minimum standards:

i. The system meets the definition set out in Heat Networks (Metering and Billing) Regulations 2014[23] for heat networks, currently set out as: 'district heat network (or cooling) means the distribution of thermal energy in the form of steam, hot water or chilled liquids from a central source of production through a network to multiple buildings or sites for the use of space or process heating, cooling or hot water.' Communal heating, where there is a single heat source within a single multi-tenanted property, does not meet this definition.

ii. The heat network has no technical or commercial impediment to supply additional customers, expand and/or interconnect in future.

iii. Consistency with Article 2(41) of the Energy Efficiency Directive[24]: 'efficient district heating and cooling' means 'a district heating or cooling system using at least 50% renewable energy, 50% waste (recovered) heat, 75% cogenerated heat (from combined heat and power (CHP)) or 50% of a combination of such energy and heat'.

iv. Article 2(42) of the Energy Efficiency Directive: 'efficient heating and cooling' means a heating and cooling option that, compared to a baseline scenario reflecting a business-as-usual situation, measurably reduces the input of primary energy needed to supply one unit of delivered energy within a relevant system boundary in a cost-effective way, as assessed in the cost-benefit analysis referred to in this Directive, taking into account the energy required for extraction, conversion, transport and distribution'.

v. Compliances with EU metering and billing requirements as implemented into domestic law by the Heat Networks (Metering and Billing) Regulations 2014 (as amended from time to time).

vi. Where CHP is used, that it is CHPQA[25] compliant.

---

[23] Heat networks legislation for metering and billing: compliance and guidance. https://www.gov.uk/guidance/heat-networks

[24] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance (2012) *Official Journal of the European Union* L 315/1 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32012L0027

[25] Combined Heat & Power Quality Assurance Programme. https://www.gov.uk/guidance/combined-heat-power-quality-assurance-programme

As well as building new heat networks, HNIP capital funding may also be used to support:

- Heat network expansions;
- Refurbishment of existing heat networks – will only be eligible where additional carbon savings can be demonstrated; and
- Interconnection of existing networks, where additional carbon savings can be demonstrated; in the case of interconnections the carbon savings would be calculated in comparison to the two networks operating separately. Speculative expansions would require a risk assessment on the probability of them proceeding.

Applicants will be able to apply for capital funding for whole or parts of heating and cooling networks, within the boundaries defined below.

- The (primary) heat network (distribution network and controls) up to and including the heat/hydraulic interface unit (HIU) and heat meters.
- Thermal stores.
- New low carbon heat sources, excluding the build of heat sources where the primary use is not the heat network; however connection to these sources could be eligible.

For example, the HNIP funding will not support the costs of construction of an energy-from-waste plant where the primary function of the plant is to process waste, but connection of a heat network to such a plant and the costs associated with enabling heat offtake would be eligible. Likewise, HNIP would not cover construction of industrial facilities from which heat can be recovered, but connection of the heat network to the facility would be eligible, as well as the coats associated with enabling heat offtake.

This is summarised below:

Heat source	Capital funding could contribute towards
Gas CHP	Heat source
Renewable CHP	Heat source
Renewable boilers	Heat source
Energy from waste CHP or incineration	Connection to plant (and related costs)
Recovered heat	Connection to source (and related costs)
Water/ground source heat pumps including deep geothermal	Heat source
Solar thermal	Heat source
Gas boiler (where peaking / back up plant)	Heat source

Views are sought on whether funding should also be provided for refurbishment of heating and hot water systems inside existing end user premises (connected to heat networks supported by HNIP) including distribution in multi-tenanted properties. This excludes heating and hot water systems inside new build properties.

We intend to allow sponsors to apply for funding for a portfolio of projects. These portfolios, however, must work within all our fiscal/non-fiscal, annual spend and State aid parameters. We

believe it will be challenging for these projects to provide a viable application unless the commercial structures, requested funding mechanism and timing is known across all projects within the portfolio. For example, where a combined authority applies directly for HNIP capital funding for a portfolio of projects and plans to pass this to individual local authorities to deploy, the combined authority must be clear at the point of application whether this money will pass the public sector boundary in the year in which it will be recognised as spent and whether loan repayments or equity dividends will return to the public sector.

Future-proofing

Technical and commercial future proofing is a key part of the HNIP aims. Heat networks are long-term infrastructure with lifetimes of over 40 years. Heat networks built in 2017 could be still operating beyond 2057 and will therefore need to deliver cost-effective carbon abatement as well as affordable, secure heat throughout their life.

A technically future-proofed heat network would be one that has the ability to deliver carbon savings now and in the future. In a scenario where gas CHP with a 15 year life was the initial primary heat source, a lower carbon heat source would be needed as a replacement where the electricity grid had decarbonised (unless renewable or low carbon gas were available for CHP).

Technically future-proofed characteristics may also include no impediment to future expansion or interconnection of more efficient heat networks at a variety of scales. Larger heat networks may include multiple heat sources and have a greater diversity of customers with varied heat demand profiles. These can provide heat at a lower cost than networks that do not exploit their full expansion potential.

Commercial features also play a role alongside technical characteristics. A commercially future-proofed heat network would seek to eliminate contractual and financial impediments to expansions and interconnections (aggregation) as well as accessing cheaper capital, possibly through refinancing or selling the network. This evolution in the life of the heat network may include contractual unbundling of generation and distribution to attract investors with differing investment strategies.

Applications and funding rounds

We propose to assess HNIP applications through a competitive process designed in such a way that it:

- Can prioritise applications where the aggregate requested funding is greater than capital funding available, and has the ability to utilise the full capital funding allocation in each year;
- Minimises the administrative burden on applicants, using project documentation that will be produced as a matter of course, so that the process does not deter applicants; and
- Is fair and equitable but can compare value-for-money across a variety of heat network and applicant types.

We understand that timing is an important issue for heat networks. Heat networks need to align the timing of construction with their anchor load customers' need for heat. This could either be when a new property is occupied or when an existing property's current heating system

reaches the end of its life. Consequently, it is important that HNIP's application process minimises impact on these timing issues and funding rounds will be held regularly.

To maximise its impact, HNIP capital funding would be allocated before all of the other investors have been secured. We therefore envisage a three-stage application process. Each stage must be satisfied before the applicant can progress to the next stage:

i. **Eligibility assessment**: This step seeks to identify ineligible applications with the minimum amount of administration by the applicants.

ii. **Full applications submitted and scored**: Application (application form and relevant project documentation listed below) scored and ranked based on multiple techno-economic criteria (see Section D. What criteria should be used to assess and decide capital funding applications?). Project documentation to demonstrate the following is likely to be required (see Figure 3):

   – Planned commercial structure;
   – Anticipated funding sources;
   – Heads of terms with anchor load customers;
   – Financial model;
   – Detailed technical design;
   – Carbon savings across lifetime of network; and
   – Delivery plan and procurement strategy.

   HNIP applicants must be able to define whether the capital funding sought will be classified as fiscal or non-fiscal and in what year it will be spent at time of application.

   A panel will then identify projects that should be offered funding and under what terms and conditions.

iii. **Conditions compliance**: A heat network project must have completed the commercialisation stage (except where this is a stage for which funding is being sought) and have met all conditions before the capital funding for build is released. This is likely to include having:

   – Secured remaining investment;
   – Evidence of agreement with anchor load customers
   – Evidence that Heat Trust[26] membership or equivalent has been sought;
   – Finalised financial modelling;
   – Procured and negotiated delivery contract; and
   – Final design has been completed at least in accordance with minimum standards identified in the appropriate sections of the CIBSE ADE Code of Practice CP1:2015[27].

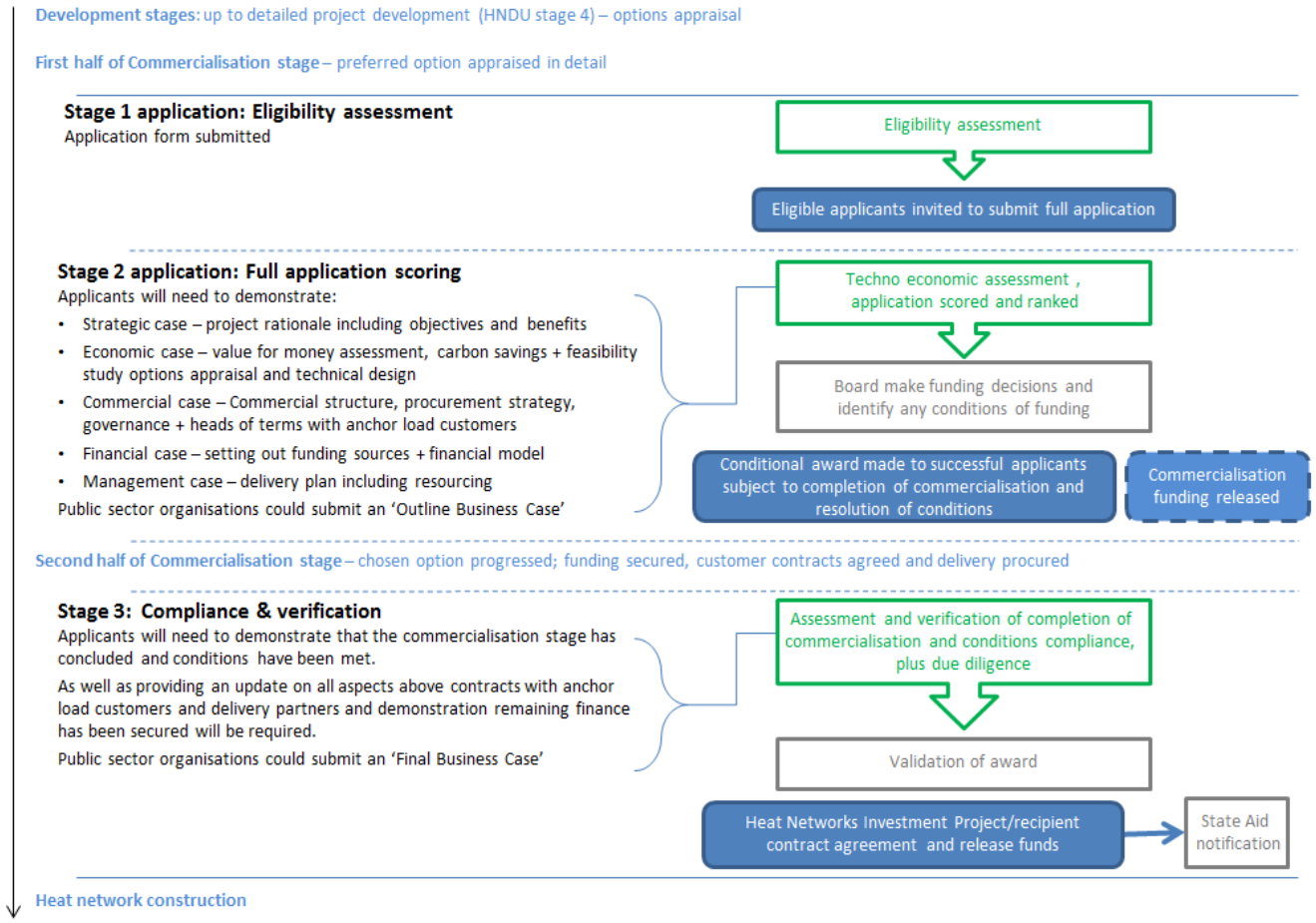
[26] http://heattrust.org/

– Committed to provide ongoing project monitoring information, e.g. construction and operational data, ongoing compliance with Code of Practice CP1:2015.

Question 20 on page 35 in the consultation seeks views on eligibility and scoring criteria.

Only after stage 3 has been completed could funds be released.

Figure 3: Application process diagram



[27] Chartered Institution of Building Services Engineers (CIBSE) and Association for Decentralised Energy (ADE) (2015) *Heat Networks: Code of Practice for the UK* http://www.cibse.org/knowledge/cibse-other-publications/cp1-heat-networks-code-of-practice-for-the-uk-new

Catalogue of Consultation Questions

The aim of this consultation

This consultation is seeking stakeholder views and evidence on how best to utilise the £320m of capital funding in order to achieve the project aims. Respondents should give their views on any of the issues raised in this document, but the consultation in particular seeks views on the following areas each of which is tackled in separate sections of this consultation:

A. Who should be eligible to apply directly for the capital funding?

B. What should the Heat Networks Investment Project provide capital funding for?

C. Which funding mechanisms should the capital funding be deployed through?

D. What decision-making criteria should be used to assess the capital funding applications?

E. How should HNIP be monitored to ensure it is delivering its intended aims?

What we are consulting on

The consultation themes are summarised in the table below. Where we are proposing a different approach for the Pilot, this is set out below. Independent evaluation of the project will be commissioned to run for the duration of the project. This on-going evaluation will allow us to improve the design of the project to increase its effectiveness, to March 2021.

Table 1: Consultation summary

Decisions required before launch	Pilot-specific design proposals	Open design questions including those specific to the full scheme
A. Who should be eligible to apply directly for the capital funding?	The proposal is that local authority sponsors and owner-operators, and potentially other public sector sponsors, will be eligible to apply for capital funding in the Pilot	Whether any wider heat network sponsor or owner-operator types (e.g. wider public sector, private sector, communities and not-for-profit groups) should be eligible to directly apply for support in the full scheme?
B. What should the Heat Networks Investment Project provide capital funding for?	Any efficient heating and cooling networks, including those that also generate electricity, that meet the conditions set out in this document	Whether funding for commercialisation should be provided, and if so, in what format (grants and/or soft loans)? Should internal refurbishments to properties on a heat network be covered by HNIP funding?
C. Which funding mechanisms should the capital funding be deployed through?	Grants and/or soft loans in the Pilot	What combination of the capital funding mechanisms should be offered in the full scheme: grants, soft loans, equity and/or guarantees?

Decisions required before launch	Pilot-specific design proposals	Open design questions including those specific to the full scheme
D. What decision-making criteria should be used to assess the capital funding applications?		Multiple criteria that assess the technical, financial, contractual, environmental and social attributes of the heat network in relation to HNIP's aims.
E. Monitoring and evaluation		How HNIP should be monitored and success evaluated

Scheme Design

A. Who should be eligible to apply directly for capital funding?

In the Pilot phase of HNIP, **we are proposing that only local authority heat network sponsors or owner-operators, and potentially other public sector sponsors, will be eligible to apply directly for capital**. In order for the proposed Pilot to be delivered expediently, it is necessary to follow a model as close as possible to that already in place under the Heat Network Delivery Unit.

Following conclusion of the proposed Pilot phase, we are proposing to expand eligibility so that a wider set of heat network sponsors or owner-operators can apply for the capital funding.

Heat networks can be initiated by a variety of organisations. We refer to these organisations as project **sponsors**. Heat network **sponsors** could include the following types of organisations:

- **Local Authorities**[28] – A local authority may or may not decide to own or operate the heat network.
- **Wider public sector** – Including public health facilities, academies, public-sector schools and publicly owned social housing. By illustration these heat networks are commonly 'campus' heat networks where the heat network owner, customer and land-owner are the same entity. These projects can include a significant proportion of customers in existing buildings.
- **Private sector** – Companies in the private sector, such as property developers, commonly initiate heat network projects in new build developments. In the retrofit market private sector companies, including energy and energy service companies, also develop projects that can leverage Energy Company Obligation funding. Private sector sponsors will usually also take an owner-operator's role.
- **Community and not-for-profit groups** – Universities, charity and community groups, Industrial Provident Societies, Community Interest Companies (CiCs), Societies for the Benefit of a Community (Ben Coms) and community cooperatives may come together as not-for-profit organisations to initiate a heat network project.

Heat network **operators** are entities which have been contracted by the heat network owner to run the heat network. The heat network operator may also be the heat network owner. Although the heat network operator has the umbrella contract they may choose to sub-contract various aspects of operations or maintenance to other parts of the supply chain. **We are proposing that heat network owner-operators can apply directly for the capital funding. This would not apply to those that are operators only.**

[28] See definition from the Local Government Act 2000 http://www.legislation.gov.uk/ukpga/2000/22/section/1

Consultation Question

1. Do you agree that the proposed Pilot phase should be aimed at local authorities? *Yes / No*
2. Are there other public sector bodies that should be eligible to apply directly for support in the Pilot and if so, why?

3. Do you agree that the following types of heat network sponsors and owner-operators should be able to apply for capital funding in the full scheme? - Local authorities, wider public sector, private sector, not-for-profit groups and community groups. *Yes / No*
4. Please set out who should or should not be eligible to apply directly for support in the full scheme and explain why?

B. What should the Heat Networks Investment Project provide capital funding for?

The types of networks which will be eligible for capital funding were set out in the chapter on Eligibility and Application Process. We are interested in views as to whether HNIP capital funding should also be available to contribute towards 'transaction costs' incurred during **the second half commercialisation** phase which will be capitalised should the project go ahead. This would be in addition to funding being available for heat network build.

Where costs are 'capitalised' they are held on balance sheet and expensed over the life of the project in-line with basic accounting standards.

If HNIP provides capital funding for commercialisation, then capital will be deployed into these networks earlier, but this is likely to carry higher risk as not all projects will be able to complete the following commercialisation activities successfully:

- securing remaining investment;
- locking down contracts with anchor load customers;
- finalising financial modelling;
- procuring and negotiating delivery contract; and
- commissioning final design if procured separately to build/operate/maintain.

We are seeking views on whether a contribution to these costs could help to ensure that a greater number of heat networks are built. HNIP capital funding is a finite, time-limited pot of money and we are seeking to use this in the most effective way. There is inevitably a risk/return trade off if capitalised commercialisation costs are supported.

If capitalised commercialisation costs were supported by HNIP, we would welcome views on whether these should be supported by grants or soft loans (i.e. wrapped up into a loan for design and build).

Consultation Question

5. Should the Heat Networks Investment Project provide funding for commercialisation work where these costs are capitalised? *Yes / No*
6. Please set out why funding for commercialisation work that is capitalised should or should not be provided under the Heat Networks Investment Project and whether it should be provided through grants and/or loans. Please provide supporting evidence if available.

Consultation Question

7. Should the Heat Networks Investment Project provide funding for refurbishment of heating and hot water systems inside existing end user premesis (including distribution in multi-tenanted properties) that are connected to a new or refurbished heat network supported by HNIP? This will exclude heating and hot water systems inside new-build properties.
   Yes / No
8. Please set out why funding for internal heating and hot water system refurbishment as described in the previous question should or should not be provided under the Heat Networks Investment Project and whether it should be provided through grants and/or loans. Please provide supporting evidence if available.

C. What combination of funding mechanisms should be offered?

Our proposal for the Pilot is to offer grants and/or soft loans to a sub-set of heat network sponsors and owner-operators. This is to ensure there is a simplified delivery model for the Pilot phase.

We are considering what combination of financial tools (e.g. grants, soft loans, central Government equity stakes and/or guarantees) to offer in the full scheme, with an emphasis on re-payable loans rather than grants wherever possible, to help establish the case for heat networks as revenue-generating and commercial propositions. Mechanisms such as equity and/or guarantees will take longer to design than grants and soft loans, and therefore will not be on offer in the proposed Pilot. Not all of these mechanisms will necessarily be on offer, but we are keen to gather evidence on what combination of funding mechanisms could best support the short and long-term aims of this project. Design decisions for the full scheme will be informed by learning from the proposed Pilot along with stakeholder feedback.

Table 2 sets out descriptions of each category of funding mechanism that could be offered under HNIP and the expected impact each capital funding mechanism may have on the project economics and on other investors in the market place.

Table 2: Stakeholder analysis: how different funding types could impact project economics and investors

Mechanism	Description	Impact on **pre-financing** project economics	Impact on local authority or wider **public sector equity investors** (not central Government) Happening currently – public sector may want to reduce equity provision to spend on alternative local services or increase equity to generate revenue	Impact on private sector **owner-operators equity** providers	Impact on private sector **third party equity** providers Private sector equity seen currently through owner-operators but little third party equity investment	Impact on **private sector debt providers** Some private sector debt provision currently as corporate loans, but not as project finance
Grants	Funding provided without expectation that it would be repaid (other than in an unusual course of events)	No impact – if treated as a source of capital Would improve the pre-financing project economics – if accounted for by netting against the capital expenditure of the project[29]	Where grant reduces equity required: should improve equity returns as reduces amount of equity provided with no change in dividends.	Where grant reduces equity required: should improve equity returns as reduces amount of equity provided with no change in dividends.	Where grant reduces equity required: should improve equity returns as reduces amount of equity provided with no change in dividends.	Whether a grant, soft loan or equity is provided, third party debt may be relevant to the extent that a funding gap remains (Heat Networks Investment Project funding will not fully finance projects). However, total amount required would be reduced which may be a disincentive.
Soft loans	Funding provided and then repaid over a set period, with specified interest rate.	Limited impact – interest charge may be deductible for tax pruposes reducing tax obligations and thereby improve pre-financing project economics.	Where soft loan reduces equity required: should improve equity returns on the basis that less equity provided with no change in dividends and that the cost of debt (including tax shield) is less than the cost of equity. Therefore works on the assumption that soft loans provided would be on terms preferential to the public sector investor's hurdle rate.	Where soft loan reduces equity required: should improve equity returns on the basis that less equity provided with no change in dividends and that the cost of debt (including tax shield) is less than the cost of equity.	Where soft loan reduces equity required: should improve equity returns on the basis that less equity provided with no change in dividends and that the cost of debt (including tax shield) is less than the cost of equity.	Whether a grant, soft loan or equity is provided, third party debt may be relevant to the extent that a funding gap remains (Heat Networks Investment Project funding will not fully finance projects). However, total amount required would be reduced which may be a disincentive.

[29] *International Accounting Standard 20: Accounting for Government Grants* allows for two accounting treatments of government grants. Either they are netted against the capital expenditure to which they relate (i.e. reducing Property, Plant & Equipment carrying values on balance sheet and increasing project cash flows) or else held as deferred income on the balance sheet and shown as a financing cash flow (i.e. not part of operating or investing cash flows).

Mechanism	Description	Impact on **pre-financing** project economics	Impact on local authority or wider **public sector equity investors** (not central Government) Happening currently – public sector may want to reduce equity provision to spend on alternative local services or increase equity to generate revenue	Impact on private sector **owner-operators equity** providers	Impact on private sector **third party equity** providers Private sector equity seen currently through owner-operators but little third party equity investment	Impact on **private sector debt providers** Some private sector debt provision currently as corporate loans, but not as project finance
Central Government equity stake	Government owns a share of the heat network. This could be a different class of shares where the Government's shares are subordinated to the other investors.	No impact	Where central Government equity reduces public sector equity required and a separate class of shares is created: should reduce investment risk (but not improve returns) as a degree of downside risk is covered by central Government subordinating its investment to the other investors.	Where central Government equity reduces private sector equity required and a separate class of shares is created: should reduce investment risk (but not improve returns) as a degree of downside risk is covered by central Government subordinating its investment to the other investors.	As with owner-operator. Additionally there may be potential for aggregation of Central Government investments, which in turn could be sold when assets are operating. This could enable certain types of larger institutional investors with larger investment threshold requirements to enter the market.	Whether a grant, soft loan or equity is provided, third party debt may be relevant to the extent that a funding gap remains (Heat Networks Investment Project funding will not fully finance projects). However, total amount required would be reduced which may be a disincentive.
Guarantees	Options include: • Credit guarantees offered to investors • Heat offtake/ demand guarantees offered to operators so that they can provide a minimal return to investors • Construction period guarantees offered to operators	Guarantees should help lower the risks associated with project, which in turn should help lower the investment hurdle rates required for investment to be made.	May reduce the level of risk and therefore make approval of investment easier.	May reduce the hurdle rate for an investment (as risk is reduced).	May reduce the hurdle rate for an investment (as risk is reduced).	May enable lenders to lend at the project level and allow lenders to provide lower cost finance to projects (as reduced risks).

Grants

Stakeholder engagement to date has provided a range of views on the role of grant funding. Some public sector heat network sponsors have indicated that grant funding would be critical to deploying their heat networks, either because they envisage a lack of suitable alternative finance being available or are anticipating that the project economics will require a proportion of grant funding to meet the hurdle rates of the other investors.

Some potential private sector investors, on the other hand, have commented that grants will not transform the heat network market in the long-term as they do not demonstrate to new investors that heat networks are viable and able to provide stable returns. Others have indicated that grants could play a specific role; either increasing volume in the short-term or possibly being utilised for specific future-proofed characteristics. This is one aspect of 'additionality', which is explored in Section D.

Consultation Question

9. Do you agree with the impacts of grants on heat network sponsors and investors outlined in Table 2? *Yes / No*
10. Please set out your views on the impacts of grant funding below.

11. Should grants be provided to contribute towards the costs of additional technical or commercial future-proofed characteristics (see Future proofing as eligibility, scoring or additionality criteria section) only? *Yes / No*
12. What advantages does grant funding provide over other capital funding mechanisms to heat network sponsors and investors?

Soft loans

Loans are the provision of debt that requires repayment within agreed terms. Soft loans have design features that are more appealing to the borrower than conventional market offerings.

In engagement to date, most sponsors and potential investors have responded positively to the option of soft loans. One suggestion from stakeholders was the possibility of providing construction period soft loans that could be refinanced following commissioning of the heat network, when revenues are being received and construction risk has fallen away. To the extent that UK financial markets may struggle to provide project debt finance due to a lack of familiarity with heat networks, the provision of a construction period (bridging) soft loans may be a useful tool:

- to improve equity returns; and
- to help finance heat network construction thereby establishing case studies for future lenders.

Whether for the construction period or during operation, there are a number of design features that could make soft loans suited to the common financial characteristics of heat networks; high up front capital costs relative to the low but steady and long-term returns. We are seeking views on what combination of soft loan design features would have most impact on project economics and whether this varies across different heat network types. It is unlikely that all these features could be combined and so prioritisation of these features by respondents with supporting evidence would be particularly valuable.

Capital invested over long periods is sometimes referred to as ‘patient capital’. As would be expected with any large scale infrastructure, the commercialisation phase for heat networks can take over a year, as final contracts are agreed with anchor load customers, investment is secured and delivery then procured and negotiated. Depending on the size and complexity of the heat network, the first phase of construction can take up to three years. These lead times are then followed by an asset lifetime of over 40 years, defined by the heat network infrastructure life, where steel pipes are used for the primary network. This type of long-term infrastructure is ideally suited to patient capital.

With conventional loans, any debt borrowed during construction will be incurring interest and may even require repayment of principal when revenue is not yet being received. HNIP soft loans could be drawn down in tranches or on a facility basis (i.e. ‘as needed’). Interest may be provided at a rate lower than the equivalent interest rate set by the Public Works Loan Board[30] (for public sector bodies) or European reference rate[31]. Repayment and interest terms could be designed to help match the infrastructure asset lifetime and forecast project cash flows available for debt service.

Whilst these soft loans could be designed to meet the cash flows of a heat network project, it is anticipated that they will be corporate debt; meaning that the counterparty to the loan would be the HNIP applicant, an existing organisation with a suitable credit rating as opposed to the legal entity/commercial structure that owns the heat network itself; sometimes a newly formed company, Joint Venture, subsidiary or Special Purpose vehicle. The alternative to corporate

---

30 http://pwlb.gov.uk/index.aspx?page=PWLB/PWLB_Interest_Rates

31 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008XC0119(01)&from=EN

debt is project finance, where a loan is secured against the heat network assets and projected cash flows. HNIP applicants may apply for funding to on-invest into a Joint Venture, subsidiary or Special Purpose Vehicle.

Consultation Question

13. Do you agree with the impacts of soft loans on heat network sponsors and investors outlined in Table 2? *Yes / No*

14. Please set out your views on the impacts of soft loan funding below. Including what advantages soft loans provide over other capital funding mechanisms to heat network sponsors and investors?

Consultation Question

15. Please rate which of the following features, alone or in combination, would make soft loans <u>most effective</u> for heat networks?	No positive impact	Some impact	Very effective
• Loan drawn down in tranches over construction period • Low interest rate • Loan tenor aligned with pipe infrastructure lifetime • First repayments to be made after construction i.e. in initial years of operation • Sculpted repayments to match planned cash flows • Option for payment holidays • Subordinated debt, less senior than other loans			

If there are design features for soft loans which would have greater impact than those above or if you disagree with the features listed above please set your views out and indicate whether this varies across different heat network types. Please indicate whether soft loans across the construction period or into operation would be most beneficial.

Central Government equity investment

Equity investment is effectively the purchase of shares in a legal entity. In our informal discussions with stakeholders, sponsors and investors have expressed mixed views on the relative merits of central Government direct equity investments. Those stakeholders that supported did so because of their view that one barrier to a number of potential investors is the small size of the average capital cost of heat networks (£4-£40 million[32]) relative to medium to large third-party investor threshold for investment (often greater than £50-£100 million).

Central Government could invest directly in heat networks by taking a minority (i.e. <25%[33]) stake in the legal entity that owns the heat network. Were central Government to make equity investments, this would be as non-participating (i.e. not part of the day-to-day management of the business) minority interest shareholdings.

Consultation Question

16. Do you agree with the impacts of equity on heat network sponsors and investors outlined in Table 2? *Yes / No*
17. Please set out your views on the impacts of equity below including what advantages equity provides over other capital funding mechanisms to heat network sponsors and investors?

[32] UKTI & DECC (2015) *Investing in the UK's heat infrastructure: Heat networks* https://www.gov.uk/government/publications/investing-in-the-uks-heat-infrastructure-heat-networks

[33] EU (2014) *Manual on Government Deficit and Debt* http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-14-010 1.2.3 Concept of a government-controlled institutional unit which provides a list of the criteria for determining public sector control over an entity'.

Guarantees

We understand from stakeholders that one of the challenges heat network sponsors face in securing finance is the risk that there will be insufficient guaranteed heat offtake to repay the investment to develop and build the network. This is referred to as demand risk.

The risk profile of heat networks is likely to reduce over the lifetime of the project. Following development the most risky phase of the project is construction. Once operating, however, construction risk has passed and demand risk has reduced as the initial set of customers have connected and are under contract.

Although it is not normally the role of Government to provide guarantees, they could theoretically be used as a means to help create confidence for a wider pool of investors in a market currently dominated by a few specialised participants.

We are seeking further evidence on the scale of the demand-risk and construction challenge and whether there could be a role for guarantees of some sort, across the period of a project, in mitigating these risks.

Consultation Question

18. Do you agree with the impacts of guarantees on heat network sponsors and investors outlined in Table 2? *Yes / No*

19. Please set out your views on the impacts of guarantees below. Including what advantages guarantees provide over other capital funding mechanisms to heat network sponsors and investors? In particular, please set out whether construction period guarantees could help achieve the Heat Network Investment Project aims.

Consultation Question

20. Are there any other opportunities and challenges presented by potential funding mechanisms that Table 2 does not cover? Or are there other capital funding mechanisms that should be considered to support heat network deployment?

21. One of the aims of this project is to help create the conditions for a self-sustaining heat network market. Increased build rates of heat networks may require new investors. What would this project need to demonstrate to build awareness and confidence with new, private, third-party investors and draw them into the UK heat networks market?

D. What criteria should be used to assess and decide capital funding applications?

An application process with competitive tension allows comparison of value-for-money across a variety of heat network and applicant types. Decision-making criteria will be required to compare applications and assess 'additionality' – the extent to which the activity (building the heat network or changing its characteristics) would not have gone ahead without Government funding.

Decision-making criteria for HNIP will be used at three points in the application process:

i. Eligibility assessment – yes/no binary assessment, minimum requirement for all

ii. Full applications scored – techno-economic assessment including additional characteristics

iii. Conditions compliance and verification.

We are seeking views on eligibility and application scoring criteria. This section also seeks views on how to award the appropriate amount of capital funding in order to ensure the heat network is built, but avoid supporting ineffective heat networks or over-rewarding applicants.

Eligibility and scoring criteria

Our proposed eligibility and scoring criteria reflects the aims of HNIP and the parameters within which the project is operating.

Central Government is supporting heat networks in order to deliver cost effective carbon abatement, but we appreciate that this is not always the primary driver for building heat networks at a local level. More often when retrofitting heat networks to existing properties, heating bill reduction or local economic regeneration is cited. It is essential that the heat networks supported are suited to their locality and customers.

It is therefore proposed to use multiple criteria to assess both eligibility and score applications. Optimising the technical, financial and contractual aspects of a heat network and future proofing them should help to ensure that the network delivers cost effective carbon abatement as well as affordable, secure heat across the pipe asset lifetime.

Any assessment criteria should, where possible, use existing, published, common methodologies, datasets and units of measurement to reduce the administrative burden on applicants and ensure applications can be compared.

The heat networks industry has developed voluntary standards in two key areas and we are interested in whether a requirement to comply with these standards should be part of the assessment of applications.

The CIBSE ADE Heat Network Code of Practice CP1:2015[34] (the Code) is an industry-led initiative that comprises a set of non-binding technical standards developed for use by project sponsors, specifiers and engineers through heat network design, construction, commissioning

[34] Chartered Institution of Building Services Engineers (CIBSE) and Association for Decentralised Energy (ADE) (2015) *Heat Networks: Code of Practice for the UK* http://www.cibse.org/knowledge/cibse-other-publications/cp1-heat-networks-code-of-practice-for-the-uk-new

and operation. The Code of Practice aims to ensure high quality heat networks installations that:

- deliver energy efficiency and environmental benefits;
- provide a good level of customer service; and
- promote long-lasting heat networks in which customers and investors can have confidence.

The Code was launched in July 2015 and is supported by a training and registration programme. The Code has a number of sections and it is the initial three that would be relevant at the point of HNIP application; preparation and briefing, feasibility and design. A commitment to utilise the later sections of the Code could also be required; construction and installation, commissioning, operation and maintenance, customer expectations and obligations. The Code also contains illustrations of best practice which could be utilised as either scoring or additionality criteria.

Heat Trust[35] is a voluntary scheme set up in 2015 to establish a common standard in the quality and level of protection for residential and micro-business customers on heat networks. It sets out heat supplier obligations and performance standards, support for vulnerable customers and introduces an independent dispute resolution service using the Energy Ombudsman. Heat Trust has been developed with industry, consumer groups, local, national and devolved Governments. At present, Heat Trust is not suitable for all types of all heat networks; in particular, networks where customers do not have a specific heat contract and are not billed directly for their heat. Heat Trust is exploring how to expand the scheme to cover these customers. Individual heat networks, rather than operators, apply for membership and there is a fee for participation. At the point of submitting a HNIP application, a heat network sponsor may not have developed end user contracts but could be required to demonstrate that Heat Trust standards, or equivalent, are being developed. This would then be monitored as the heat network begins operation.

Heat Trust is unable to say anything on fair pricing. Being an industry led scheme its focus is rightly the assessment of whether contract terms are being met. In-line with the metering and billing regulations Heat Trust requires participants to set out how the heat price (standing and variable where relevant) is calculated, how it might change in the future and provides a price comparator against the gas boiler or electric heating alternative heating options. Fair pricing is however, critical to avoiding customer detriment and could be reflected in eligibility and scoring criteria. By way of example, this could include eligibility criteria that requires the heat price to be no more than the counterfactual, combined with scoring criteria that awards those networks delivering heat at a lower cost than the counterfactual. Clear definitions could be required as heat prices progress from aggregated across all (bulk/intermediary) customers to separation of connection, standing and variable tariff structures specific to end user types.

Question 20 below draws out each component of the HNIP aims and asks respondents to indicate which of these areas should be developed into eligibility criteria that set a minimum standard that all applications must satisfy. The right hand column then asks which of these should be developed into criteria which would facilitate scoring and ranking of applications.

---

[35] Heat Trust, http://www.heattrust.org/

Views on published, common methodologies, datasets and units of measurement are also sought.

Consultation Question	Eligibility **Minimum threshold criteria**	Competitive **Scoring criteria**
22. Please indicate which factors below should be used in combination as the minimum eligibility threshold which <u>all first stage applications must meet</u> AND which should be competitive factors that should be used to assess, score and compare applications at the second stage of the application process.		
Volume of carbon savings in short-term and long-term, traded and non-traded	(Assumed minimum)	
Will operate with no customer detriment in comparison to the counterfactual - heat price issues (including ability to generate consumer bill savings)	(Assumed minimum)	
Will operate with no customer detriment in comparison to the counterfactual - wider customer service issues	(Assumed minimum)	
That applicants have explored a suitable range of technical options		
Technically future-proofed (e.g. able to expand)		
Commercially future-proofed (e.g. the ability to refinance, consideration of legal structuring)		
Transformation of the heat network market through: raising awareness of this infrastructure opportunity with current and future investors		
Social Net Present Value (NPV)[36]		

[36] The Social Net Present Value (Social NPV) assesses the net value of a policy or project to society as a whole. It takes into account private costs and benefits, which accrue to those directly involved in the policy or project, and also external costs and benefits which impact wider society - for example the costs associated with carbon or air quality emissions. Costs and benefits are measured against a counterfactual where the proposed policy or project is not implemented i.e. only the costs and benefits which occur in addition to the "business as usual" costs and benefits are included in the Social NPV. The Social NPV is typically calculated using a discount rate of 3.5%, the social rate of time preference generally assumed in government cost-benefit analysis.

Please set out the reasons for your choices, including which if any you would prioritise, and indicate where there are existing, published, common methodologies, datasets and units of measurement that should be utilised.

Additionality – part of scoring and ranking

Government should not provide funding to projects that are uneconomic and unlikely to proceed or cause customer detriment. Nor should funding be provided to projects that are commercially investible (i.e. fully financed by the private sector) and likely to have proceeded without any Government intervention. To ensure value-for-money for the taxpayer, it is therefore important that Government strives to identify and support only those projects that pass an 'additionality' test. The two short-term aims of HNIP are to bring about an increased build rate for heat networks and influence the types of heat network built so that they are effective across the pipes' 40+ year lifetime.

These two aims may require differing additionality treatment. We therefore propose two additionality test options with applicants asked to demonstrate which type of additionality their project delivers. An assessment will be made of additionality to verify applicants' claims.

i. **Economic/financial:** Projects that would not have gone ahead without capital funding as the sponsor could not raise the capital, and/or the project financials (i.e. Internal Rate of Return), whilst positive, are not attractive enough to enable funding on the open market or through other available means alone.

ii. **Technical/commercial:** the project is able to proceed in its current form but there is an opportunity to include technical or commercial features that would deliver additional HNIP benefits, but at extra cost which would be passed onto heat customers. In this case capital could be used to fund these additional features that would not have happened otherwise (a list of these suggested characteristics is explored in Question 24).

An assessment of the declared economic/financial categorisation will be made at application. This assessment may include consideration of whether phasing issues (i.e. where multiple expansion phases are economic or commercially investible in aggregate but initial strategic phases, crucial to the development of the heat network, are not) are impacting the economic or commercial viability of the proposed heat network.

Table 3: Economic/financial categorisation

Economic / financial categorisation	Additionality category: Economic / financial	Additionality category: Technical/ commercial
Commercially investable – can attract third party private sector investors not involved in the operation of the heat network	Not eligible for funding	Not eligible for funding
Economic – attractive to public sector investors or private owner-operators	Not eligible for funding	Can apply for funding for future-proofed features
Socially-economic – the project can deliver valuable social / environmental benefits but either sufficient funding is not available or returns are not sufficient to attract finance	Can apply for economic/ financial funding	Yes if in addition to economic
Uneconomic – the project is not viable or should not progress for risk of customer detriment	Not eligible for funding	Not eligible for funding

Determining the appropriate amount of funding

Being able to award successful applicants with the amount of capital funding that will facilitate an investment decision will be critical to ensuring public money is used most effectively.

One method may be to assess the level at which HNIP capital funding would sufficiently improve nominal pre-tax[37] equity returns to enable investors to invest. To make such an assessment it would be necessary to have a pre-determined annual equity hurdle rate that HNIP would be able to support – this may be different for public sector bodies and private sector investors – and thereby use that rate(s) as a target for assessing the size of support.

[37] By this we mean equity returns before investors pay income tax on their returns on investment but after corporation tax and other taxes (e.g. VAT and business rates etc.) have been paid.

Consultation Question

23. Do you agree with this high-level assessment methodology? *Yes / No*
24. If not, what would you propose instead?

25. For current or potential investors: What are / would be your typical nominal pre-tax hurdle rates for investment in comparable industries (although we understand this will be affected by the specifics of a particular heat network project including but not limited to its size, duration, customer base etc.) and what industries do you consider to be comparable to heat networks when determining your hurdle rate? If possible please split out how your hurdle rate has been built up (e.g. risk free rate assumption, construction risk premium). inflation premium etc.)

Future proofing as eligibility, scoring or additionality criteria

The concept of technically and commercially future-proofed heat networks is set out earlier in this document. Technical and commercial future-proofing is about removing impediments to future technical design or ownership and funding options. HNIP cannot fund innovation in the form of research, and deployment of innovation must have a proven impact on cost reduction to ensure that customers are protected in terms of heat price and continuity/quality of service.

We are seeking views on what characteristics would indicate a heat network is technically and commercially future-proofed. In addition we are interested in which characteristics are:

- happening consistently now and as minimum standards should be part of HNIP eligibility requirements;
- not happening consistently now but should be minimum standards for heat network construction and required as HNIP eligibility criteria; and
- are best practice future-proofing characteristics that should be used to score and rank HNIP capital applications.

Consultation Question

26. Please indicate for each heat network characteristic below, which should form part of a minimum eligibility threshold criteria, and which are best practice characteristics that can be used to demonstrate technical/commercial additionality.

Heat network characteristics	Are happening consistently to date and should be minimum eligibility	Not happening currently but should be minimum eligibility criteria	Best practice future-proofing characteristics that should be used as part of competitive scoring criteria

Consultation Question			
	criteria		
a. Suitable diversity of customers who demand heat at different times to flatten heat demand profile and optimise heat source utilisation or a wider scope of customers that would otherwise have been constrained (such as less profitable heat loads)			
b. Connecting (retrofitting) existing properties to heat networks			
c. Network future-proofed for later expansion or interconnection			
d. More than 50% renewable energy, 50% waste heat, 75% cogenerated heat (CHP) or 50% of a combination of average heat generated per annum across the lifetime of the pipe asset			
e. Ability to support electricity system balancing including CHP + electric heat source + thermal store			
f. Lower temperature primary heat network[38]			
g. Cooling networks and heat networks that provide cooling			
h. Use of multi-utility trenching			
i. Suitable heating and hot water systems and coordination between property developer/heat network developer or property owner/heat network owner			

[38] As defined by Objective 2.4 in the Code of Practice.

Consultation Question			
j. Smart controls, thermal store and/or modular approach to heat sources to optimise system			
k. Use of CIBSE ADE Code of Practice CP1:2015 technical standards (design, build, commission, operate)[39]			
l. Systems to obtain and utilise robust data[40]			
m. Deploying proven cost reducing innovation (including from SBRI[41])			
n. Metering and billing systems and processes over and above Metering and Billing Regulation requirements, including customer interface innovation or smart heat meters			
o. Local authority governance role in a majority private sector owned scheme			
p. Customer protection over and above Heat Trust equivalent standards. This could include heat prices lower than counterfactual, consumer advocacy including cooperatives/community shares/customers on Board or heat network supply competition			

[39] Chartered Institution of Building Services Engineers (CIBSE) and Association for Decentralised Energy (ADE) (2015) *Heat Networks: Code of Practice for the UK* http://www.cibse.org/knowledge/cibse-other-publications/cp1-heat-networks-code-of-practice-for-the-uk-new

[40] Ibid. Requirements and Best Practice as identified in Objectives 6.4/6.5 of the Code of Practice.

[41] Small Business Research Initiative (SBRI) Heat Networks Demonstrator: A £7 million heat network innovation and demonstration programme is being managed by DECC to stimulate innovation that will bring down heat networks costs and improve performance. There is a broad range of innovative projects being supported. Some are focussed on improving network efficiency by developing smart heating controls to manage domestic demand on the heat network, to reduce peak load or diagnose network performance issues. Smart technology is also being used to develop a heat network monitoring and billing application to make the full extent of metering data openly available to operators. https://www.gov.uk/government/news/heat-network-innovation-competition

Consultation Question			
q. Heat networks build time reduced or brought forward, reaching operation sooner and delivering carbon savings in earlier carbon budgets			
r. Bringing in private sector third party investment (not involved in the operation of the heat network) – debt or equity			
s. Contractual clauses that allow for future aggregation of multiple heat networks into a portfolio, unbundling (of generation and distribution) or future sale/acquisitions once operating			
Please indicate any other characteristics that should be considered minimum standards for all supported heat networks or any that could be deemed additional. Please provide evidence for your views or indicate how these characteristics could be demonstrated at application stage.			

E. Heat Networks Investment Project - measuring success

The scope and aims of HNIP are set out in the introduction to this consultation document but broadly seek to:

- Increase the volume of heat networks built;
- Deliver carbon savings for carbon budgets 4 and 5 (spanning the years 2023-2032) and across the lifetime of the infrastructure asset;
- Impact the type of heat networks built so that they are technically and commercially future-proofed; and
- By the end of this Parliament (2021) have helped the transition to a sustainable market - a sustained pipeline of heat network projects in development matched with suitable finance to ensure they go on to be built.

Heat networks deliver many local benefits, but at a national level Government is primarily interested in affecting the volume and type of heat networks built in order to increase the cost effective carbon savings delivered by this infrastructure. This section of the consultation seeks views on aspects of measuring success.

Direct measures of success

Government intervention in the heat networks market is seeking to deliver additional carbon savings in comparison to the counterfactual – commonly either individual gas boilers, electric heating and, where CHP is used on a heat network, electricity from the national grid. In rural settings this might include oil. It is proposed that carbon savings are the direct measure of success for HNIP, delivered from:

- Individual heat networks supported, based on the initial mix of heat sources; and
- Further carbon savings should they integrate or switch to a lower carbon heat source in the future.

A range of indicative carbon savings for this intervention can be found in **Annex 1: Cost-benefit Analysis, Chart 1, & Table 3**. The project will also contribute to wider carbon savings through creation of a self-sustaining market in heat networks. However, we do not propose to attribute this directly to the scheme, as there will be many other influences on market development.

Other outcomes to which the Heat Networks Investment Project contributes

There are other important **outcomes**, which need to occur to deliver carbon savings but which are also driven by other aspects of policy, and stakeholder activities:

- Bill savings for consumers on HNIP-supported networks
- Consumer satisfaction and willingness to connect to networks.
- The creation of a sustainable market for heat networks (see below for definition), spurred on by this investment project, which is expected to support construction of up to 200 heat networks by 2025; and

There are other **indirect outcomes** which are expected to arise:

- Ability to provide electricity system balancing; and

- Improved energy security.

How we measure and monitor progress

We will want to track indicators to understand progress towards these changes above. We will be commissioning an evaluation, and setting up monitoring processes as part of our scheme administration. Successful heat network sponsors will be asked to supply relevant data.

Wider monitoring and evaluation will include:

- Improving how the project is delivered – including learning from the proposed Pilot;
- Tracking progress towards outcomes, including understanding effects on the market;
- Providing accountability of impact from the project spend.

Indicators of transition to a sustainable heat network market

It will be important for us to define as far as possible, and monitor progress towards a **sustainable market** (where a sustained pipeline of heat network projects in development are matched with suitable finance to ensure they go on to be built). We think the following areas will be important components:

- Heat network sponsor capacity and capability (level and how widespread);
- Consumer connections and satisfaction;
- Supply chain growth;
- Costs falling, through contractual standardisation and cost-reducing innovation;
- Sufficient supply of finance, reduced perceptions of risk, and cost of capital falls; and
- Conditions becoming more favourable for investment, e.g.:
  - Aggregation of heat networks into larger portfolios commensurate with institutional investor thresholds
  - Contractual innovation which might include unbundling networks into separate generation and pipe distribution infrastructure businesses with broader appeal
  - Creation of a secondary market for heat networks – allowing refinancing and acquisition of operating heat networks when many risks have fallen away.

Consultation Question

27. Do you agree that these areas are important components of a sustainable heat network market (or transition towards such a market)? *Yes / No*

28. If applicable, please indicate what should be monitored instead / as well

29. Are you aware of existing evidence on what facilitates, or works against, the transition to a self-sustaining market (i.e. one that does not require government funding)?

30. Is the supply chain ready for accelerated deployment of heat networks? *Yes / No*

31. If you feel the supply chain is ready, what evidence do you have for this and what support do you think is needed to manage cost and quality as heat network deployment accelerates?

Glossary of Abbreviations

ADE	The Association for Decentralised Energy
CBA	Cost-Benefit Analysis
CCC	Committee on Climate Change
CHP	Combined Heat and Power
CHPQA	Combined Heat and Power Quality Assurance Programme
CIBSE	Chartered Institution of Building Services Engineers
DECC	Department of Energy and Climate Change
ECO	Energy Company Obligation
EfW	Energy from Waste
GBER	General Block Exemption Regulation
HMT	Her Majesty's Treasury
HNDU	Heat Network Development Unit
HNIP	Heat Network Investment Project
IRR	Internal Rate of Return
LRVC	Long-Run Variable Cost
RHI	Renewable Heat Incentive
NPV	Net Present Value

Annex 1: Cost-Benefit Analysis and Questions

1. Introduction

DECC has undertaken cost-benefit analysis (CBA) to assess the costs and benefits of supporting heat networks deployment through this funding scheme. The analysis compares the costs of meeting a given profile of heat demand over 2016-2050 by deploying a portfolio of heat networks with the costs of meeting the same heat demand through conventional fossil fuel heating – the counterfactual. Since the benefit (utility from heat) is the same for both the CBA reduces to a comparison of the costs involved in meeting the heat demand via each option.

The heat demand profile has been scaled to a level that represents full utilisation of the £320m support given assumptions around the heat network portfolio technology mix, technology capital costs, technology load factors and the amount of additional capital government support leverages from other sources. It has been assumed that £320m support represents 10-20% of the total capital expenditure on supported heat networks i.e. it will leverage an additional ~£2.2 billion capital expenditure.

The assumed heat network technology mix includes gas CHP, biomass boilers, recoverable heat from Energy from Waste incinerators and recoverable heat from industry (using heat pumps) as primary heat sources and gas boilers as backup/peaking plant – see Table 1. This has been chosen as a reasonably broad mix of different technologies; the scheme itself will assess applications from projects on their individual merits against the eligibility and assessment criteria.

The modelling assumes gas CHP networks replace their heat sources with lower carbon alternatives in 2030. This is desirable under scenarios in which the electricity grid decarbonises as gas CHP will then deliver lower net emissions savings over time – external analysis produced for DECC indicates that gas CHP may increase emissions after the early 2030s[42].

The counterfactual technology mix assumed in the modelling is 70% gas boilers and 30% electric heating though again this will of course vary on a project to project basis depending upon the geography of the network and customer base served.

Table 1: Heat Networks Technology Mix Used in CBA Central Scenario

Heat generation technology mix - % of total heat demand met by technology	2015-2030	2031-2045
Gas CHP	30%	0%
Biomass boiler	20%	30%
EfW incinerator CHP (recoverable)	10%	20%

[42] See Lane Clark and Peacock (2014), *Modelling the impacts of additional Gas CHP capacity in the GB electricity market* https://www.gov.uk/government/publications/bespoke-natural-gas-chp-analysis

Recoverable heat from industry (heat pump)	20%	30%
Gas boiler (for peak demand)	20%	20%

The analysis compares the costs (including social costs) of heat networks deployment with the costs of counterfactual technology deployment. The monetised costs considered are:

- **Capital costs.** For heat networks this includes the heat generation technology and network infrastructure (transmission and distribution pipes and building connections/infrastructure). For the counterfactual this is the up-front cost of boilers, electric heaters etc. Costs include replacement capital costs if equipment lifetimes expire within the appraisal period[43].
- **Operating costs.** This includes infrastructure maintenance costs for both the heat networks and counterfactual technologies. For heat networks it also includes the labour and network administration costs required to run them over their lifetimes[44].
- **Fuel costs.** For heat networks this includes the gas, electricity and biomass fuel costs required to generate heat[45] and for the counterfactual technologies gas and electricity fuel costs. Fuel consumption has been valued using the HMT Green Book Long-Run Variable Cost (LRVC) series.[46]
- **Carbon costs.** These are the emissions costs as a result of fuel consumption to generate heat. Emissions have been allocated to the traded and non-traded sectors:
  - Emissions from fuel consumption on gas CHP and biomass boiler networks and gas boilers have mainly been allocated to the non-traded sector, though a proportion (~20%) has been allocated to the traded sector to account for the fact that some networks generation capacity may be sufficient to qualify for participation in the traded sector.
  - Emissions from heat network technologies using electricity (recoverable heat from industry and EfW incineration) have been allocated to the traded sector. Electricity grid emissions displaced by gas CHP have also been allocated to the traded sector.

  Fuel emissions factors have been taken from the HMT Green Book Supplementary Guidance with the exception of grid emissions displaced by gas CHP which uses factors created through bespoke analysis for DECC[47]. The calculated emissions have been valued using the HMT Green Book traded and non-traded carbon price projections.[48]

---

[43] For evidence sources used for capital and operating costs see Section 4 in this annex.

[44] Ibid

[45] For recoverable heat from Energy from Waste CHP incinerator plants this is the electricity penalty from utilising the heat.

[46] DECC (2015) *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*. https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal. For biomass costs the ratio between retail and LRVC coal prices has been applied to a retail biomass cost assumption to proxy a biomass LRVC series

[47] DECC (2014) Bespoke natural gas CHP analysis https://www.gov.uk/government/publications/bespoke-natural-gas-chp-analysis

[48] DECC (2015) *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*. https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

- **Air quality emissions costs.** These reflect costs as a result of fuel consumption emissions that impact upon air quality (e.g. NO_x and SO_x). Fuel emissions factors and the valuation of the calculated emissions have been taken from Defra projections of air quality costs.[49]
- **Electricity generation costs.** Gas CHP sourced heat networks generate electricity as well as heat. Therefore the analysis accounts for the cost saving of producing that electricity from the grid (or equivalently the cost of producing the same amount of electricity under the counterfactual). These are also valued using HMT Green Book LRVC series[50]

There are various non-monetised costs and benefits excluded from the analysis. These include: learning effects/costs reductions from heat network deployment, electricity balancing benefits from gas CHP networks and any security of supply benefits from diversifying heat sources through heat networks.

The monetised costs have been profiled over the lifetime of the assets under heat networks deployment and counterfactual deployment[51] and have been discounted to 2016 at the Green Book social discount rate of 3.5%. The sum of discounted counterfactual costs minus the sum of discounted heat network costs then gives the social NPV of deploying heat networks rather than the assumed counterfactual. In addition, the CBA allows us to understand:

- the projected non-traded and traded carbon emissions savings over the appraisal lifetime and across specific carbon budgets; and
- the non-traded and traded carbon cost-effectiveness of deploying heat networks (using the Green Book definition of carbon cost-effectiveness[52]).

2. Cost-Benefit Analysis Results

The cost-benefit analysis results corresponding to the central scenario are presented below in Table 2. The social NPV of the project is +£277m under central carbon and energy price projections with a cost of saving carbon of £30/t CO2 (non-traded sector) and -£30/t[53] CO2 (traded sector). This compares with the HMG appraisal carbon price of approximately £80/t in 2030[54].

Table 2: Summary of Central Scenario Cost Benefit Analysis (2016-2045). 2016 prices

Social NPV (£m)	£277m
Traded Carbon Cost Effectiveness (£/t)	-£30/t
Non-Traded Carbon Cost Effectiveness (£/t)	£30/t
Heat Demand (2025)	4.9TWh

[49] Ibid
[50] Ibid.
[51] The appraisal period used is 30 years; capital replacement costs have been included for infrastructure with shorter lifetimes i.e. heat network generation technologies and counterfactual technologies
[52] DECC (2015) *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*. https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal See p.26 of Valuation of energy use and greenhouse gas emissions for appraisal
[53] i.e. there is a negative cost (benefit) associated with the traded carbon savings
[54] The traded and non-traded carbon price appraisal values converge in 2030

Table 3 shows the estimated NPV and potential carbon savings under the central scenario and also alternative technology scenarios in which the initial technology mix is either all gas CHP or contains no gas CHP[55]. An "all gas CHP" initial mix improves the social NPV of the project but potentially adds to non-traded emissions in carbon budgets (gas CHP reduces traded emissions but increases non-traded emissions). A "no gas CHP" initial mix (i.e. more of the other technologies in the initial mix instead) would deliver more substantive carbon budget (non-traded) emissions savings but at a reduced portfolio social NPV.

Table 3: CBA Technology Mix Sensitivities

Initial Technology Mix	Social NPV - £m	CB4 carbon savings - MtCO2			CB5 carbon savings – MtCO2			Post CB5 (to 2045) carbon savings – MtCO2		
		Traded	Non-traded	Total	Traded	Non-traded	Total	Traded	Non-traded	Total
Central Scenario	277	2.8	0.0	2.8	1.3	1.2	2.5	-0.3	7.5	7.2
All gas CHP initial mix	534	6.6	-5.0	1.6	3.1	-1.7	1.4	-0.4	7.8	7.4
No gas CHP initial mix	146	0.7	2.8	3.5	0.3	2.8	3.1	-0.3	7.2	6.9

3. CBA Results – Detail and Sensitivities

Table 4 shows a breakdown of the CBA results for the central scenario illustrating where key differences in costs lie; heat networks have higher capex and opex but fuel and carbon costs are lower (primary energy savings from heat generation technologies and lower carbon fuels) plus gas CHP produces electricity that would otherwise have to be produced by the grid.

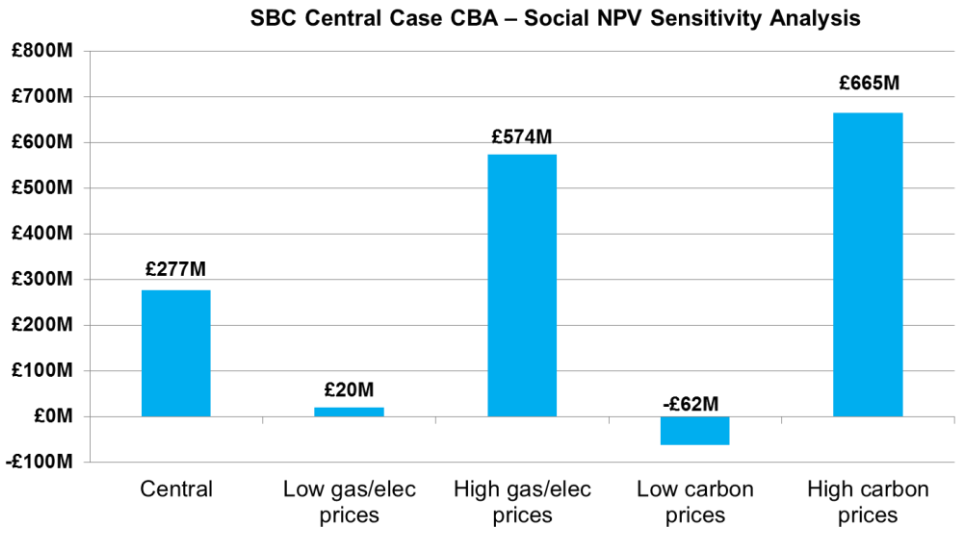
Table 4: Central Scenario CBA - Breakdown

	Heat Networks	Counterfactual
Capital cost	£2.6bn.	£0.9bn.
Operational costs	£2.0bn.	£1.3bn.
Fuel costs	£2.1bn.	£3.7bn.
Traded carbon costs	£0.1bn.	£0.2bn.
Non-traded carbon costs	£0.5bn.	£1.1bn.
Air quality cost	£0.3bn.	£0.1bn.
Electricity cost	£0.0bn.	£0.7bn.
Total	£7.7bn.	£8.0bn.

[55] The Central and All gas CHP scenarios assume gas CHP is substituted for lower carbon technologies in 2030 given that analysis project gas CHP could deliver reduced emissions savings in the 2030s if the electricity grid decarbonises. DECC (2014) Bespoke natural gas CHP analysis https://www.gov.uk/government/publications/bespoke-natural-gas-chp-analysis

Chart 1 illustrates the sensitivity of the social NPV to the government appraisal low and high energy and carbon price projections indicating the positive NPV of the project is resilient to these sensitivities with the exception of the low carbon price scenario.

Chart 1: Central Scenario CBA – Sensitivity Analysis



4. Additional Information on Evidence Sources

The capital cost, operating cost and performance evidence for heat network heat source technologies is taken from a number of sources. The original source for gas CHP evidence is a report by Ricardo AEA[56] though the analysis uses figures from Element Energy's report for the CCC[57] which are a transformation of the Ricardo data from electrical capacity to thermal capacity cost figures. Biomass boiler evidence is taken from non-domestic RHI data, heat pump evidence (for recoverable heat from industry) from Element Energy[58] and Energy from Waste data from a HNDU feasibility study on a potential EfW project.

Capex, opex and performance evidence for heat network infrastructure is taken from the report by AECOM[59] that assessed costs for seven recently built large networks. For network load factors the AECOM report (which indicated a range of 13%-28%) has been supplemented with additional sources: Frederiksen and Werner (2013)[60] estimate a load factor of 36% for heat networks whilst pre-build data for HNDU projects at feasibility stage suggests values in the range ~20-40%. The AECOM report indicated best performance on network thermal losses is

[56] Ricardo-AEA, (2014) *Bespoke Gas CHP Policy -Cost curves and Analysis of Impacts on Deployment* https://www.gov.uk/government/publications/bespoke-natural-gas-chp-analysis

[57] Element Energy (2015) *Research on district heating and local approaches to heat decarbonisation. A study for the Committee on Climate Change.* https://documents.theccc.org.uk/wp-content/uploads/2015/11/Element-Energy-for-CCC-Research-on-district-heating-and-local-approaches-to-heat-decarbonisation.pdf

[58] Ibid. and Element Energy (2015) – *Element Energy, Heat Pumps in District Heating, for DECC* https://www.gov.uk/government/publications/heat-pumps-in-district-heating

[59] AECOM (2015) *Assessment of the Costs, Performance, and Characteristics of UK Heat Networks* https://www.gov.uk/government/publications/assessment-of-the-costs-performance-and-characteristics-of-uk-heat-networks

[60] Frederiksen, S. and Werner, S. (2013), *District Heating and Cooling.* Studentlitteratur AB. Lund, Sweden.

~12% (for non-bulk schemes) though this requires excellent pipeline and within building network infrastructure insulation. The CBA central scenario assumes a load factor of 40% and thermal losses of 12% to reflect best performance/network design.

Counterfactual technology capex, opex and performance evidence is based upon RHI data on gas boilers and electric heating for the non-domestic and domestic sectors. An average of non-domestic and domestic costs is taken i.e. this assumes HNIP supported heat networks supply a roughly equal proportion of domestic and non-domestic consumers.

A summary of technology cost and performance assumptions is given in Table 5 below.

Table 5: Technology Assumptions. Note: assumptions have been updated to 2016 prices using the HMT Green Book GDP deflator series

Technology	Assumption	Assumed Value	Source
Gas CHP	Capex	£732/kW	Element Energy (2015)[61]
	Opex	£51/kW	Element Energy (2015)
	Thermal Efficiency	47%	Poyry (2009)[62] – average of small and large gas CHP
	Electrical Efficiency	33%	Poyry (2009) – assume total efficiency of CHP is 80%
Biomass boiler	Capex	£276/kW	Non-domestic RHI data
	Opex	£17/kW	Poyry (2009)
	Thermal Efficiency	75%	Non-domestic RHI data
Recoverable heat from industry (via heat pump)	Capex	£1,067/kW	Element Energy (2015)
	Opex	£5/kW	Element Energy (2015)
	Heat Pump Efficiency	350%	Element Energy (2015)
Recoverable heat from Energy from Waste CHP plant	Capex	£1552/kW	HNDU Pipeline Data (2016)
	Opex	£34/kW	HNDU Pipeline Data (2016)
	Z-factor	10	Element Energy (2015)
Gas boiler	Capex	£77/kW	Non-domestic RHI data
	Opex	£3/kW	Poyry (2009)
	Thermal Efficiency	90%	-
Network Infrastructure	Capex	£153/MWh	AECOM (2015)[63] – average of bulk and non-bulk schemes

[61] Element Energy (2015) *Research on district heating and local approaches to heat decarbonisation. A study for the Committee on Climate Change.* https://documents.theccc.org.uk/wp-content/uploads/2015/11/Element-Energy-for-CCC-Research-on-district-heating-and-local-approaches-to-heat-decarbonisation.pdf

[62] Poyry (2009). *The potential and Costs of District Heating Networks*. http://www.poyry.co.uk/sites/www.poyry.uk/files/A_report_providing_a_technical_analysis_and_costing_of_DH_networks.pdf

[63] DECC (2015) *Assessment of the Costs, Performance, and Characteristics of UK Heat Networks*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/424254/heat_networks.pdf

	Opex	£0.6/MWh	AECOM (2015)
Network Connections	Capex	£25/MWh	AECOM (2015) – average of bulk schemes
	Opex	£12/MWh	AECOM (2015)
Network Ancillary Plant	Capex	£25/MWh	AECOM (2015) – average of values
Network Administration & Business	Opex	£11/MWh	AECOM (2015). £6/MWh business tax deducted from AECOM figure
Network	Load Factor	40%	Evidence sources (AECOM, Frederikson and Werner[64] and HNDU studies) indicate ranges between 20-40%
Network	Thermal Losses (% heat generated)	12%	AECOM (2015) – minimum figure for non-bulk schemes
Counterfactual: gas boiler	Capex	£117/kW	RHI data – average of domestic and non-domestic
	Opex	£15/kW	Poyry (2009)
	Thermal Efficiency	85%	RHI assumption
Counterfactual: electric heater	Capex	£162/kW	RHI data – average of domestic and non-domestic
	Opex	£19/kW	Poyry (2009)
	Thermal Efficiency	90%	-
Counterfactual	Load Factor	10%	-

Technical annex question

Technical Annex Question

32. Do you have any comments on the evidence/assumptions DECC has used in its cost-benefit appraisal of the scheme? We would welcome any supplementary evidence on the cost and performance of heat network or counterfactual technologies that you are able to provide as part of your response to this consultation[65].

[64] Frederiksen, S. and Werner, S. (2013), *District Heating and Cooling.* Studentlitteratur AB. Lund, Sweden.

[65] Evidence submitted will be handled in accordance with the Confidentiality and Data Protection statement set out in the General Information section at the start of this consultation document.

Annex 2: Respondent Details

Providing respondent details will allow us to better understand whether we have reached a cross section of stakeholders and to understand whether views differ between stakeholder groups.

Question	Answer
Respondent name	
Organisation name	*If you are not responding on behalf of an organisation please enter 'personal' here*
Email	
Organisation type	*Please select one of the following:* Local authority, higher/further education provider, social housing provider, NHS trust, other healthcare provider, community group, charity/not-for-profit, property developer, private sector heat network operator, heat network supply chain (other than operators), debt provider, equity investor, individual heat network customer, advisory, umbrella bodies/observers, heat generators, other [please specify]
Is your organisation defined as?	Public sector, private sector or third sector: *please delete as appropriate*

Question	Answer
Have you been active in the UK heat network market to date?	Yes/No *please delete as appropriate*
Do you consider any of the information that you provide through this consultation to be confidential? For more information on how confidential information is handled through this consultation process, please see the confidentiality and data protection disclosure on page 5.	Yes/No *please delete as appropriate*
If you have indicated that some of the information you are providing is confidential, please provide full details here.	

Question:	**Answer:** *Please tick as appropriate*						
What has been your organisation's activity in the UK heat network market to date? (not relevant for individual respondents)	Project sponsor	Owner-operator	Third party equity investor	Third party debt provider	Supply chain	Advisory	Non-domestic customer
Previous involvement							
Current participation							
Possible future involvement							

Annex 3: Design Parameters

There are a number of financial and regulatory fixed parameters within which the Heat Networks Investment Project must operate. These design parameters determine the combinations of how the capital funding is deployed (e.g. grants, loans, equity and/or guarantees) and indirect recipients (i.e. the commercial structures in which capital funding can be invested) that can be offered as part of the Heat Networks Investment Project.

Non-fiscal capital spend

The £320 million capital has an annual spend profile over this parliament. In each of the five years a proportion of the annual spend must be 'non-fiscal' capital. Non-fiscal capital must pass the public sector boundary **and** return to the public sector at some point . Worked examples below illustrate this definition.

iii. **Fiscal**: Central Government grant to a public NHS hospital trust. This capital has not passed the public sector boundary as the public hospital owns the heat network.

iv. **Non-fiscal**: Central Government loan to a majority private sector owned heat network. The capital passes the public sector boundary and comes back to the public sector via loan repayments.

v. **Non-fiscal**: Central Government grant to a local authority that uses the capital to take an equity stake in a majority private sector owned heat network. This money passes the public sector boundary, from the local authority to the private sector, and it then crosses back into the public sector when the local authority receives dividends and/or sells its equity stake.

Therefore, it is the combination of the commercial structure in which the Heat Networks Investment Project capital is invested and the way in which it is passed to these commercial structures that defines whether this spend will be classified as non-fiscal. This categorisation also implies that the Heat Networks Investment Project capital support must be invested in a combination of public sector and private sector owned heat networks.

Scoring spend annually

The annual profile requires that capital spend must be allocated to specific years to ensure the yearly budget is met. Capital is 'scored' in the year funding is transferred. Some heat networks successful in securing Heat Networks Investment Project funding will spend the capital in the year it is awarded. We understand that larger more complex heat networks can take a number of years to progress through commercialisation and construction. Whilst we envisage any capital funding awarded, i.e. a proportion of capex, will be spent first by the recipient before other sources of funding, we envisage a Heat Networks Investment Project application process that could allocate awards across future annual budgets up to 2021 if required, as illustrated below.

- **2017/18** Funding round: A Heat Networks Investment Project application is received and the project is successful in being allocated capital funding for heat network build in years 2019/20 and 2020/21.

- **2018/19** Project commercialisation continues: Match investment is secured, anchor load contracts are signed, delivery is procured and documentation to demonstrate these three elements is submitted to Heat Networks Investment Project.
- **2019/20** Construction starts: Heat Networks Investment Project capital part 1 is released to support the initial stage of construction.
- **2020/21** Construction continues: Heat Networks Investment Project capital part 2 is released to support ongoing construction.
- **2021/22** Construction is complete: Commissioning is successful and first customers are supplied.

State aid compliance

As the Heat Networks Investment Project is central Government (the 'State') intervention ('aid') in the heat network market, DECC is obliged to ensure this activity complies with European Commission rules on State aid. Following the Referendum outcome there will be no immediate changes. The UK's rights and obligations of EU membership, including compliance with State aid rules, continue to apply until the UK's exit from the EU has been completed.

In order to provide funding, below market rate, in a way that is compliant with these rules on State aid, DECC intends to apply the General Block Exemption Regulation (GBER)[66]. This covers a range of 'pre-approved' types of State aid not requiring individual approval (which can take up to 18 months) from the Commission in advance of being granted. Instead, individual capital awards will be logged online by central Government within 20 working days of granting the aid award.

There are three General Block Exemption Regulation articles that may be used to cover aid granted through Heat Networks Investment Project activities:

a) Article 49 – Aid for environmental studies (relevant to development stage studies)
b) Article 46 – Investment aid for energy efficient district heating and cooling (covering investment provided via grants, loans and guarantees)
c) Article 21 – Aid for access to finance for SMEs (covers equity investment)

Use of the GBER to ensure State aid compliance has some implications for the design of the capital support scheme:

a) It defines the type of projects that can be supported.
   For example, Article 46 can only be used for funding 'energy efficient district heating and cooling' systems, as defined by the Directive 2012/27/EU (the 'Energy Efficiency Directive')[67].

---

[66] Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (2014) *Official Journal of the European Union* L 187/1 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0651&from=EN

[67] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance (2012) *Official Journal of the European Union* L 315/1 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32012L0027

b) It sets individual aid ceilings for recipients, and also defines the amount of aid that can be given as a proportion of the total eligible costs of a project.
For example, Article 46 determines the maximum percentage of capital costs (capex) that could be provided from any 'State' sources. This 'aid intensity' must include all State aid, not just that from the Heat Networks Investment Project. As a general rule funding, subsidies or tax allowances administered at a national level will count towards this threshold whereas monies directly from the EU will not.

> *Article 46 GBER requires that*
>
> ***Production plant:***
>
> *The eligible costs for the production plant shall be the extra costs needed for the construction, expansion and refurbishment of one or more generation units to operate as an energy efficient district heating and cooling system compared to a conventional production plant. The investment shall be an integral part of the energy efficient district heating and cooling system.*
>
> *The aid intensity for the production plant shall not exceed 45 % of the eligible costs. The aid intensity may be increased by 20 percentage points for aid granted to small undertakings and by 10 percentage points for aid granted to medium-sized[68] undertakings.*
>
> *The aid intensity for the production plant may be increased by 15 percentage points for investments located in assisted areas fulfilling the conditions of Article 107(3)(a) of the Treaty and by 5 percentage points for investments located in assisted areas[69] fulfilling the conditions of Article 107(3)(c) of the Treaty.*
>
> ***Distribution network:***
>
> *The eligible costs for the distribution network shall be the investment costs.*
>
> *The aid amount for the distribution network shall not exceed the difference between the eligible costs and the operating profit. The operating profit shall be deducted from the eligible costs ex ante or through a claw-back mechanism.*

Further to this, where any HNIP capital is awarded to Local Authorities, then each local authority (the 'State') must also decide how it will put this money plus any additional capital ('aid') it provides into the market place in a State aid compliant way. Demonstration of this will be a requirement of funding.

---

[68] Annex 1, of Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (2014) Official Journal of the European Union L 187/1 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0651&from=EN

[69] Article 2, Paragraph (27), of Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (2014) Official Journal of the European Union L 187/1 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0651&from=EN and Department for Business Innovation and Skills (2014) An introduction to assisted areas. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/365657/BIS-14-1152-An-introduction-to-assisted-areas.pdf

Annex 4: Question List Summary

Number	Question
1	Do you agree that the Pilot should be aimed at local authorities?
2	Are there other public sector bodies that should be eligible to apply directly for support in the proposed Pilot phase and if so, why?
3	Do you agree that the following types of heat network sponsors and owner-operators should be able to apply for capital funding in the full scheme? - Local authorities, wider public sector, private sector, not-for-profit groups and community groups.
4	Please set out who should or should not be eligible to apply directly for support in the full scheme and explain why?
5	Should the Heat Networks Investment Project provide funding for commercialisation work where these costs are capitalised?
6	Please set out why funding for commercialisation work that is capitalised should or should not be provided under the Heat Networks Investment Project and whether it should be provided through grants and/or loans. Please provide supporting evidence if available.
7	Should the Heat Networks Investment Project provide funding for refurbishment of heating and hot water systems inside existing end user premesis (including distribution in multi-tenanted properties) that are connected to a new or refurbished heat network supported by HNIP? This will exclude heating and hot water systems inside new-build properties.
8	Please set out why funding for internal heating and hot water system refurbishment as described in the previous question should or should not be provided under the Heat Networks Investment Project and whether it should be provided through grants and/or loans. Please provide supporting evidence if available.

Number	Question
9	Do you agree with the impacts of grants on heat network sponsors and investors outlined in Table 2?
10	Please set out your views on the impacts of grant funding below.
11	Should grants be provided to contribute towards the costs of additional technical or commercial future-proofed characteristics (see Future proofing as eligibility, scoring or additionality criteria section) only?
12	What advantages does grant funding provide over other capital funding mechanisms to heat network sponsors and investors?
13	Do you agree with the impacts of soft loans on heat network sponsors and investors outlined in Table 2 (p.26)?
14	Please set out your views on the impacts of soft loan funding below. Including what advantages soft loans provide over other capital funding mechanisms to heat network sponsors and investors?
15	Please rate which of the following features, alone or in combination, would make soft loans most effective for heat networks? If there are design features for soft loans which would have greater impact than those above or if you disagree with the features listed above please set your views out and indicate whether this varies across different heat network types. Please indicate whether soft loans across the construction period or into operation would be most beneficial.
16	Do you agree with the impacts of equity on heat network sponsors and investors outlined in Table 2 (p.26)?
17	Please set out your views on the impacts of equity below including what advantages equity provides over other capital funding mechanisms to heat network sponsors and investors?
18	Do you agree with the impacts of guarantees on heat network sponsors and investors outlined in Table 2 (p.26)?

Number	Question
19	Please set out your views on the impacts of guarantees below. Including what advantages guarantees provide over other capital funding mechanisms to heat network sponsors and investors? In particular, please set out whether construction period guarantees could help achieve the Heat Network Investment Project aims.
20	Are there any other opportunities and challenges presented by potential funding mechanisms that Table 2 (p.26) does not cover? Or are there other capital funding mechanisms that should be considered to support heat network deployment?
21	One of the aims of this project is to help create the conditions for a self-sustaining heat network market. Increased build rates of heat networks may require new investors. What would this project need to demonstrate to build awareness and confidence with new, private, third-party investors and draw them into the UK heat networks market?
22	Please indicate which factors below should be used in combination as the minimum eligibility threshold which all first stage applications must meet AND which should be competitive factors that should be used to assess, score and compare applications at the second stage of the application process. Please set out the reasons for your choices, including which if any you would prioritise, and indicate where there are existing, published, common methodologies, datasets and units of measurement that should be utilised.
23	Do you agree with this high-level assessment methodology?
24	If not, what would you propose instead?
25	For current or potential investors: What are / would be your typical nominal pre-tax hurdle rates for investment in comparable industries (although we understand this will be affected by the specifics of a particular heat network project including but not limited to its size, duration, customer base etc.) and what industries do you consider to be comparable to heat networks when determining your hurdle rate? If possible please split out how your hurdle rate has been built up (e.g. risk free rate assumption, construction risk premium).

Number	Question
26	Please indicate for each heat network characteristic on pages 38-41 those that should form a minimum eligibility threshold criteria, or those that are best practice characteristics that can be used to demonstrate technical/commercial additionality. Please indicate any other characteristics that should be considered minimum standards for all supported heat networks or any that could be deemed additional. Please provide evidence for your views or indicate how these characteristics could be demonstrated at application stage.
27	Do you agree that these areas are important components of a sustaintainable heat network market (or transition towards such a market)?
28	If applicable, please indicate what should be monitored instead / as well.
29	Are you aware of existing evidence on what facilitates, or works against, the transition to a self-sustaining market (i.e. one that does not require government funding)?
30	Is the supply chain ready for accelerated deployment of heat networks?
31	If you feel the supply chain is ready, what evidence do you have for this and what support do you think is needed to manage cost and quality as heat network deployment accelerates?
32	Do you have any comments on the evidence/assumptions DECC has used in its cost-benefit appraisal of the scheme? We would welcome any supplementary evidence on the cost and performance of heat network or counterfactual technologies that you are able to provide as part of your response to this consultation.

Department of Energy & Climate Change
3 Whitehall Place, London SW1A 2AW
www.gov.uk/decc