Department for
Business, Energy
& Industrial Strategy

HEAT NETWORKS INVESTMENT PROJECT CONSULTATION GOVERNMENT RESPONSE

Capital funding for building heat networks

October 2016

HEAT NETWORKS INVESTMENT PROJECT CONSULTATION GOVERNMENT RESPONSE

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

Heat Networks Investment Project Consultation Government response Government Response

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

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General information

Purpose of this document

This document is a Government Response to the consultation that was published in June 2016, on the design and management of the Heat Network Investment Project ("the Project" or "HNIP").

The Project 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.

This document summarises the 122 responses from a wide variety of interested stakeholders[1], on how best to use the capital support funding to overcome barriers to investment in heat networks and achieve the aims of the project. This document also presents the characteristics of the support which is going to be provided by the Project as part of its first phase which will be delivered as a pilot.

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[1] See Annex 2 for a breakdown of respondents

Section 1: Government's approach to district heating networks in the UK

The UK economy is strong and growing, and this Government's priority is to upgrade our essential infrastructure to ensure the country can continue to grow and is ready to tackle the opportunities and challenges of the 21st century. When it comes to energy, much of the existing energy infrastructure needs an upgrade; not overnight, but over time, in the most cost-effective way and harnessing the power of the markets and consumers.

In this document we describe our plans to drive investment in heat networks – a well-established system for delivering heat to multiple buildings using one central source – through a time limited programme of capital support. Our investment over the next five years will create the clean, efficient and affordable heating systems of the future. This will initially take the form of grants and loans to overcome the hurdles to investment that currently hold back the sector. This will act as the catalyst to build a flourishing and independent market for new heat network construction.

A heat network avoids the need for individual boilers or electric heaters in every building. They are sometimes described as "central heating for cities" which can be both cheaper and more efficient than traditional buildings-level heating solutions; better for the consumer and better for the environment. Heat networks are particularly attractive in high-density built-up areas such as city centres, and also work well for new build developments and campuses, and for some more rural off-gas grid communities.

Modern heat networks deliver a wide variety of benefits to the environment, to consumers and to the wider economy. In particular:

- A heat network is **one of the most cost-effective ways of reducing carbon emissions** from heating. And their efficiency and carbon-saving potential increases as they grow and connect to each other.

- They are an essential part of our future clean energy infrastructure. **Many of the cheapest sources of low-carbon heat can only be used if there is a network** to distribute the heat. Once the network is in place, heat that otherwise goes to waste can be can be harnessed and used: for example waste heat from industry, from power stations or from low temperature heat sources such as from data centres. Heat can even be taken from the rivers and canals that run through many town centres and from the warm mine-water left in old coal mines.

- Heat networks can mean **lower bills for consumers**. The Government will only support heat networks which can provide heat at prices no higher than the alternatives, and we will be specifically encouraging those that can show they will be able to cut bills. Bill savings of at least 30% have been achieved when replacing electric heaters in tower blocks. In this way heat networks can help in our battle against fuel poverty too.

- New infrastructure investment is a **catalyst for local growth**. Local authorities often incorporate heat networks – sometimes with Combined Heat and Power plants to provide local electricity too – to drive regeneration and attract new business.

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

For the last three years, the Government has been helping local authorities in England and Wales to plan and develop heat networks, through a specialised unit called the Heat Network Delivery Unit (HNDU). By providing funding for project development and their own expertise and support, HNDU has built up a pipeline of over 200 projects across more than 130 local authorities.

Heat network projects by their very nature are specific to local circumstances, and the projects currently being supported are therefore diverse, with different funding models, sources of heat and potential customers, all designed to benefit local communities. We are keen to encourage and expand this diversity through the Heat Network Investment Project. Some of the projects that are currently in the development stage around the country can be found:

- in Gateshead and Exeter, where town-centre schemes will be using combined heat and power to offer more affordable, lower carbon power and heat supply to local organisations;

- in Islington where an existing network is expanding to take waste heat from the London Underground;

- on Teesside where there are ambitious projects to connect industrial sites through heat networks to local developments so that factories can operate more efficiently and support the energy needs of the local community;

- in Crewe, Cornwall, Manchester and Stoke where there are plans to use geothermal heat from deep underground;

- in Wiltshire, Cumbria and Hampshire where there are developments to spread benefits to rural communities; and

- in the Bridgend Valleys where a heat network looking at taking heat out of mine water is being developed.

But we know from extensive research and consultation that support at the feasibility and development stage of current projects will not be enough to see them all get built. And those that do get built may not, without Government support, be built in the most optimised way for the future, with low carbon, strategically-connected and affordable heating. That is why the Government announced in November 2015 that it was making available **£320m of funding for heat networks over the next five years**, expected to draw in up to £2 billion of additional

capital investment. This should lead to the construction of hundreds of heat networks in urban and rural areas.

The remainder of this document explains how the Government plans to deliver this support, reflecting the response we have received to our public consultation over the summer. In summary:

- A Pilot Scheme is being launched now for applications this autumn, with all payments to be made by 31 March 2017. The budget available for the Pilot Scheme is £39m, split across two financial years (2016/17 and 2017/18).

- This Pilot will consist of one single competitive funding round and will inform the Main Scheme, which is expected to open in 2017 and run for four years.

- Detailed guidance for applicants is now available alongside this document and can be found on the Salix Finance website[2], who will be delivering the Pilot Scheme.

- The Pilot Scheme is open to local authorities and other public sector bodies excluding central Government Departments, noting that there are some restrictions on the type of finance that some public sector organisations can accept.

- Applicants can apply for grants or loans.

- Any efficient heating and cooling network in England and Wales – including those that also generate electricity – is eligible for support.

- Eligible costs include the construction, expansion, refurbishment and interconnection of heat networks, including works to access recoverable heat and upgrade of heating systems inside some existing properties as well as commercialisation phase costs (where they are capitalised).

- Multiple criteria will be used to score and rank applications with respect to their carbon savings, customer impact and social net present value.

The Government is confident that heat networks can become thriving commercial propositions that do not require tax payer subsidy to flourish. Both in project terms and in terms of the overall national interest, the case for heat networks is strong but a range of barriers are holding them back. It is crucial, therefore, that Government acts now to build confidence and to leverage in other sources of finance. The criteria for support under this scheme should ensure that good quality, efficient, low carbon and affordable heat networks are built. Alongside this, the industry also needs to play its part by driving down costs, learning from elsewhere, and bringing innovation to the sector.

[2] http://hnip.salixfinance.co.uk/

Section 2: Next steps for capital support scheme following public consultation

Introduction and Policy Context

In the UK, only about 2%[3] of our heat is supplied via heat networks; one of the lowest levels in Europe. 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 of capital funding would be made available to contribute towards the construction costs of heat networks. 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. On 29 June this year, the Government launched a public consultation about the design of this capital support. This document reflects the responses to that consultation and sets out our next steps.

The Heat Networks Investment Project

In last year's autumn statement[4] the Chancellor announced that the Government will provide over £300 million of funding for heat networks over the next five years (2016/17 – 2020/21). The specific funding allocation is £320 million. This is expected to draw in up to £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.

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.

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

[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] https://www.gov.uk/government/news/deccs-settlement-at-the-spending-review-2015

- 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 – the benefits of a pilot scheme

In line with good policy making the first funding round of the HNIP will be run as a pilot designed to build momentum, and gather important additional learning to help with the design and delivery of the Main Scheme expected to be launched in 2017.

Summary of decisions taken following the consultation

The consultation asked a series of questions to gather stakeholder views on the deployment of the £320 million capital funding for both the Pilot and the Main Scheme. Following the assessment of consultation responses this section sets out the key features of the Pilot. The complete Pilot scheme rules can be found in the HNIP Pilot Application Guidance[5]. The Government's next steps in respect of the Main Scheme will be published ahead of the launch of that scheme in 2017:

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

All **public sector organisations** in England and Wales, except central Government Departments, noting that there are some restrictions on the type of finance that some public sector organisations can accept.

For more details see Government response to questions 1 and 2.

B. What should the HNIP Pilot provide capital funding for?

Any networks providing **heating and/or cooling** and those that also generate **electricity** and meet the definition set out in the Heat Networks (Metering and Billing) Regulations 2014 will be eligible to apply for HNIP Pilot funding. These heat networks must be located in **England and/or Wales**.

The HNIP Pilot eligible investment costs include:

- The **building of new heat networks** (generation, distribution and customer supply), as well as **heat network expansions**, **refurbishment or the interconnection** of existing networks where additional carbon savings can be demonstrated (which can include refinancing or acquisitions);

[5] Available on the Salix Finance website: http://hnip.salixfinance.co.uk/

- **Commercialisation phase costs** that will be capitalised;
- **Works to access recoverable heat**;
- **Upgrade of heating and hot water systems** in some existing buildings.

Applicants will not be able to apply for Renewable Heat Incentive (RHI) and HNIP funding for the same cost elements (i.e. heat generation plant) however an applicant could apply for RHI to support their energy centre and for HNIP to support the rest of the eligible heat network costs.

For more details see Government response to questions 5 to 8.

C. What funding mechanisms should the Pilot offer to direct applicants?

The HNIP Pilot will provide funding through **grants** and **soft loans.**

For more details see Government response to questions 9 to 20.

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

Applicants will need to demonstrate that their projects satisfy the minimum eligibility criteria including:

- Is the organisation eligible to apply?
- Is the heat network of an eligible type (i.e. heat generated from 75% gas CHP or from 50% renewable, recovered heat or a combination)?
- Will the heat network meet the technical and customer requirements (including CIBSE ADE Code of Practice CP1:2015, Heat Trust, metering and billing regulations)?
- Are only eligible investment costs included?
- Can the heat network demonstrate carbon savings and will the heat price be no more than the counterfactual?
- Will the applicant be able to provide evidence of a funding gap at full application and pass one of the additionality tests?

If their projects pass the minimum eligibility test, applicants will be asked to demonstrate that their project would not have gone ahead without Government funding through one or both of the two 'additionality' tests below:

1) **Economic/financial additionality route (for new networks)**: 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.
2) **Technical/commercial additionality route (for existing networks)**: Funding for additional technical or commercial features where capital cost is currently a barrier to deployment.

The following scoring criteria will be used in the Pilot:

- **Carbon savings:** a combination of
  - **Shorter-term carbon savings**: This is a quantitative criterion assessing definite carbon savings from the initial heat source on the heat network; expressed as the volume in tonnes of carbon dioxide equivalent savings per pound of HNIP award.
  - **Longer-term carbon savings options value:** This is a criterion assessing future decarbonisation and expansion options.
- **Customer impact**: a combination of
  - **Heat price for domestic and non-domestic customers**: This is a quantitative criterion comparing the levelised heat price (including standing charge and variable) for each domestic and non-domestic customer group, compared to the counterfactual for each customer group.
  - **Quality of service:** This is a qualitative criterion allowing applicants to demonstrate where they have gone beyond minimum standards to avoid customer detriment or deliver additional customer benefits in comparison with the alternatives.
- **Project social net present value (NPV):** This is a quantitative criterion calculating the societal costs and benefits of the heat network in comparison to the counterfactual; expressed as social NPV per £ of HNIP award.

For more details see Government response to questions 22 to 26.

E. Monitoring of the HNIP Pilot

The following metrics will be monitored on a project-by-project basis to measure progress against the HNIP aims:

1. Actual carbon savings from HNIP-supported heat networks based on initial mix of heat sources;
2. Potential additional future carbon savings (option value) should heat networks expand or switch to a lower carbon heat source in the future;
3. Contribution towards a self-sustaining market for heat networks (see below);
4. Leveraging local and private investment;
5. Volume of heat delivered through HNIP-supported schemes;
6. Consumer bills on HNIP-supported heat networks;
7. Satisfaction of customers connected to HNIP-supported networks;
8. Grid scale energy system benefits (balancing, demand side reduction (DSR), storage).

The following metrics will be measured to monitor progress towards a self-sustaining market:

- Heat network sponsor capacity and capability;

- Number of consumer connections and satisfaction;
- Supply chain growth;
- Reduction in heat networks implementation costs, through contractual standardisation and cost-reducing innovation;
- Sufficient supply of finance, reduced perceptions of risk, and reduction in cost of capital;
- Conditions becoming more favourable for investment into heat networks, e.g.:
    a. Aggregation of heat networks into larger portfolios commensurate with institutional investor minimum investment thresholds;
    b. 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.

Section 3: What we were consulting on

The consultation was seeking stakeholder views and evidence on how best to utilise the £320 million of capital funding in order to achieve the Project aims. Respondents were asked to give their views on any of the issues raised in the consultation document and in particular on the following areas each of which were tackled in separate sections of the consultation:

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

B. What should the HNIP 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?

The consultation themes and proposals that were set out in the consultation are summarised in the table below. The summary of responses to the consultation and the Government response for each theme are detailed in the following section.

Table 1: Summary of the consultation questions and proposals

Decisions required before launch	Pilot-specific design proposals	Open design questions including those specific to the Main 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 Main 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 Main Scheme: grants, soft loans, equity and/or guarantees?
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

Section 4: Scheme Design Responses

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

Proposal set out in the HNIP consultation

Heat networks can be initiated by a variety of organisations. We refer to these organisations as project **sponsors**. Heat network **operators** are entities which have been contracted by the heat network owner to run the heat network. More details and background information are available in the consultation document[6] .

In the HNIP consultation, we proposed that:

- In the Pilot phase of HNIP, only local authority heat network sponsors or owner-operators, and potentially other public sector sponsors, will be eligible to apply directly for capital.
- Heat network owner-operators can apply directly for the capital funding. This would not apply to those that are operators only.
- Following conclusion of the proposed Pilot Scheme, eligibility to apply for capital funding could expand to a wider set of heat network sponsors or owner-operators.

Summary of HNIP consultation responses

Responses to question 1: Do you agree that the proposed Pilot phase should be aimed at local authorities?

There were 113 responses to this question. The majority (77%) of respondents to this question supported the Government proposal.

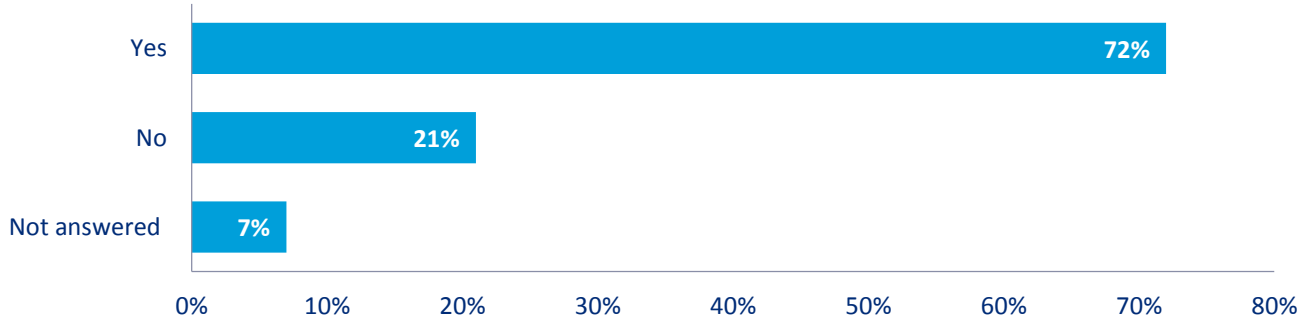

Figure 1: Respondent answers to question 1 of the HNIP consultation

[6] See page 22 of the HNIP consultation document https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532483/HNIP_consultation_vFINAL.pdf

Responses to question 2: Are there other public sector bodies that should be eligible to apply directly for support in the proposed Pilot and if so, why?

There were 103 responses to this question.

Respondents supported the focus on local authorities in the Pilot phase due to their importance in leading heat network developments and encouraging a unified approach.

The majority of respondents also indicated that it would be beneficial for the pilot phase to include wider public sector bodies such as universities, NHS trusts and social housing providers to broaden the learning from the Pilot. Another reason given was that NHS and social housing schemes may be smaller and therefore have shorter construction periods than some larger and more complex local authority led schemes.

Respondents noted that:

- It would be important for these wider public sector bodies to demonstrate their engagement with their local authority and understand the extent to which the local authority supports their project.
- While engagement with local authorities has so far been successful, it was suggested that borough and rural council engagement with other public sector heat network sponsors could be improved in some instances.

The majority of stakeholders who answered “no” to question 1 argued in question 2 that the Pilot should be open to as many applicants as possible in order to maximise learning for the Main Scheme. However, stakeholders acknowledged that the Pilot may have to be restricted due to the short timescale available to set it up.

Some respondents also recommended that the HNIP Pilot should follow a model as close as possible to that already in place under the Heat Network Delivery Unit (i.e. providing funding and guidance, having more than one funding round per year, etc.) in order for the proposed Pilot to be delivered successfully expediently.

Government response: Who should be eligible to apply directly for the capital funding in the pilot phase?

As set out in the HNIP consultation and in agreement with the majority of the responses to the consultation, public sector organisations in England and Wales, except central Government Departments, are eligible to apply directly for capital support in the Pilot (noting that there are some restrictions on the type of finance that some public sector organisation can accept). Successful applicants can on-invest in a private sector heat network.

Applicants must be either heat network sponsors (initiators) and/or owner operators.

Examples of commercial structures that can be supported directly or indirectly through the Pilot therefore include:

1. Wholly public sector owned heat network operated as part of the public entity – can apply directly for support
2. Wholly public sector owned heat network managed through a separate public sector special purpose vehicle (SPV) - the public sector owner of the SPV can apply directly for support

3. Public sector controlled heat network managed through a separate SPV in partnership with the private sector - the public sector partner can apply directly for support

4. Private sector heat network - the public sector entity can apply directly for support and on-invest in a majority or wholly private sector owned heat network

Responses to question 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 Main Scheme? - Local Authorities, wider public sector, private sector, not-for-profit groups, and community groups.

A total of 109 respondents answered this question. The majority (92%) of respondents who answered the question agreed with the proposal.

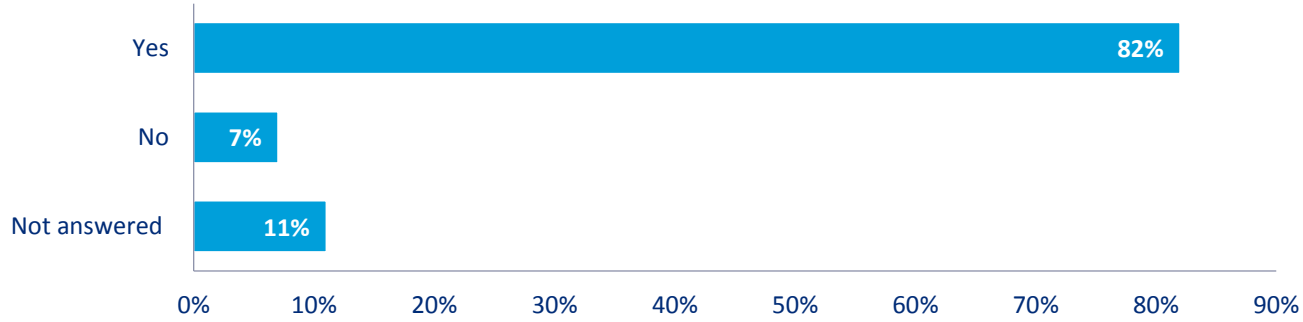

Figure 2: Respondent answers to question 3 of the HNIP consultation

Responses to question 4: Please set out who should or should not be eligible to apply directly for support in the Main Scheme and explain why?

There were 94 responses to this question.

The majority of respondents recommended that a diverse range of public and private heat network sponsors and owner-operators should be eligible to apply directly to the Main Scheme. They argued strongly that applications should be assessed on individual merits and that the best quality projects should be supported irrespective of the organisation type. This should include assessing the applicant's capacity to deliver their projects.

Respondents highlighted that:

- Private sector companies as well as community and not-for-profit groups have the ability to identify and bring forward projects that public sector organisations might be unable or not interested to develop. Allowing them to apply for capital directly in the Main Scheme would help to ensure the greatest diversity of scheme types and contracting structures come forward.
- In addition, private sector companies including energy and energy service companies which will usually take an owner-operator's role, can develop projects that can leverage ECO funding. Some respondents however stressed that HNIP funding should be combined with

ECO funding only up to a certain level to avoid supporting projects which are not viable in the medium to long term which would not constitute good models of future heat networks.

- Private organisations applying for HNIP funding should demonstrate they have considered local strategic opportunities, have local authority endorsement or justify why this is not the case and why the local authority is not the applicant. This would help prevent heat networks being developed in isolation where there is a wider ambition for delivery of a wider strategic heat network. This stems from a concern that the establishment of a series of networks operated by multiple different organisations in a given geographic area may limit future expansion and interconnection opportunities. Respondents noted historic cases where expansion or interconnection was resisted or slowed down by heat network owner/operators citing technical or commercial constraints as barriers.
- If private sector organisations are eligible to apply for HNIP funding, the HNIP should be designed to prevent the realisation of an excessive amount of profit if comparable exceptional benefits are not provided by these heat network projects.
- One respondent suggested that if an HNIP funding round was oversubscribed, an artificial cap on HNIP funding award could be used for different organisation types, to allow a range of projects to be delivered.

Government response: Who should be eligible to apply directly for the capital funding in the Main Scheme?

Eligibility criteria for the Main Scheme will be finalised before the Main Scheme launch, expected in 2017, taking into account the responses to the HNIP consultation, the learnings from the Pilot, alongside the consideration of any sector- or organisation-specific issues.

B. What should the HNIP provide capital funding for?

Proposal set out in the HNIP consultation

In the HNIP consultation, we were interested in views as to whether, in addition to funding being available for heat network build, HNIP capital funding should also be available to contribute towards 'transaction costs' incurred during **the second half of the commercialisation** phase which will be capitalised should the project go ahead. More details and background information are available in the consultation document[7].

We were also asking whether HNIP funding should be available for the refurbishment of heating and hot water systems inside existing end user premises. No proposal was set out in the HNIP consultation. Instead, open questions were asked to determine whether funding for

[7] See page 24 of the HNIP consultation document https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532483/HNIP_consultation_vFINAL.pdf

commercialisation and internal refurbishments to properties already on a heat network should be provided, and if so, in what format (grants and/or soft loans).

Summary of HNIP consultation responses

Responses to question 5: Should HNIP provide funding for commercialisation work where these costs are capitalised?

There were a total of 101 responses to this question. The majority (89%) of respondents having answered this question agreed that the HNIP should provide funding for commercialisation where costs are capitalised. 17% of respondents to the consultation did not answer this question.

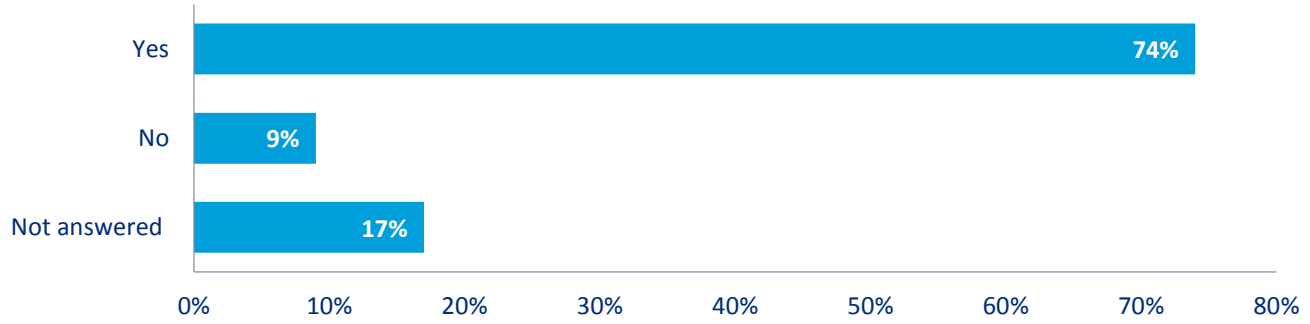

Figure 3: Respondent answers to question 5 of the HNIP consultation

Responses to question 6: Please set out why funding for commercialisation work that is capitalised should or should not be provided under the HNIP and whether it should be provided through grants and/or loans.

There were a total of 103 responses to this question.

The majority of respondents supported HNIP funding the commercialisation phase of heat network projects. Many respondents highlighted that commercialisation is the most risky stage of development and without support a large number of projects would be unable to move forward.

Respondents indicated that capitalised commercialisation costs are an integral part of the overall investment costs and so there would be no need to distinguish commercialisation from overall project costs.

A few other respondents highlighted that not all projects will progress past commercialisation to construction, due to unforeseen barriers, and that providing funding for commercialisation would result in wasting HNIP funding which could have been used to support further construction.

One respondent recommended that there should be a percentage limit of total CAPEX on the amount spent on commercialisation, suggesting that at least 85% of HNIP funding should be allocated to the construction phase and the remainder to the commercialisation phase.

Some respondents considered that the risk of some projects not progressing to construction would be more than offset by the projects that would otherwise have stalled if commercialisation funding was not provided.

The majority of respondents indicated a preference for grants as the main funding mechanism for commercialisation since they are easier to administer and help to de-risk projects:

- Respondents highlighted that local authorities often lack internal expertise to undertake complex and technical procurement exercises, and this presents a challenge in funding additional specialist support. To remedy this, it was suggested that a technical assistance grant could be provided to ensure that resources are available where local authorities face a skills or capacity gap.
- It was suggested that consideration should be given to how projects are assessed and funded (loan type or grant) with respect to the likelihood of a project proceeding. For example, applicants could be required to demonstrate the likelihood of their project proceeding. A project likely to proceed may be offered a grant. A loan may be available for projects that cannot provide the minimum evidence required for a grant. Therefore, the risk of accepting the funding is either taken by the applicant or deferred until such time they can provide enough evidence to receive a grant. This avoids the risk of speculative applications using up funding.
- Respondents agreed that a combination of loans and grants may be necessary for projects with different requirements to proceed.

Responses to question 7: Should the HNIP provide funding for refurbishment of heating and hot water systems inside existing end user premises (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.

There were 111 responses to this question. The majority (88%) of respondents having answered the question supported the provision of funding for refurbishment of heating and hot water systems inside existing end user premises that are connected to a new or refurbished heat network supported by HNIP.

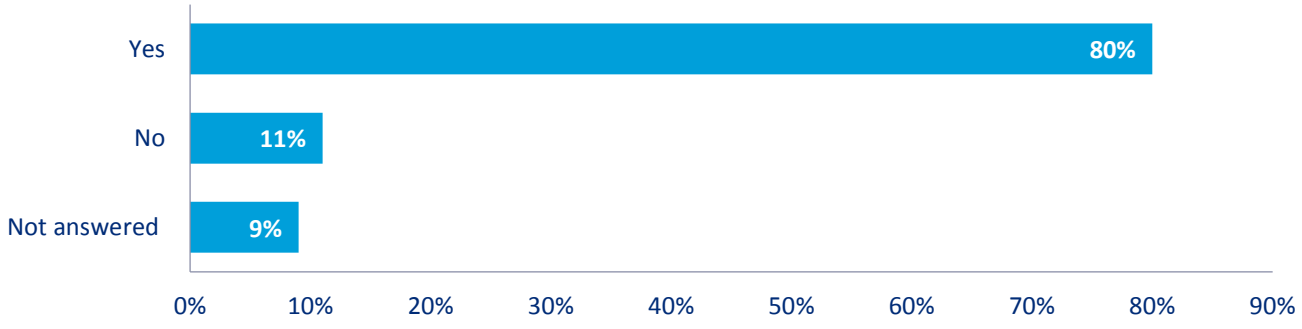

Figure 4: Respondent answers to question 7 of the HNIP consultation

Responses to question 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 HNIP and whether it should be provided through grants and/or loans.

There were 106 responses to this question.

Respondents indicated that refurbishment costs often present a barrier to heat network deployment and that HNIP funding would help to reduce this risk. Many advised that buildings should be built as efficiently as possible so that heat networks can operate effectively and serve the largest number of properties.

Respondents were particularly in favour of refurbishment funding to be provided for the following:

- Old secondary systems which, once refurbished, would improve the efficiency of the heat network system, thus lowering customer energy bills and helping to alleviate fuel poverty;
- Any project which would enable waste heat to be provided to a heat network;
- Non-domestic buildings since they are able to provide significant heat loads.

However, there were mixed opinions regarding refurbishment in domestic buildings:

- A few respondents favoured refurbishments to be undertaken in domestic buildings when existing infrastructure cannot deliver efficient affordable heating and hot water. They suggested that private renters or owner-occupiers who would otherwise be unable to afford necessary infrastructure upgrades should also be eligible for refurbishment support
- On the other hand, a few other respondents argued against HNIP funding for domestic and non-domestic building refurbishment explaining that this would detract from building more heat networks and should instead be provided through energy efficiency funding. There was nevertheless an acknowledgement that there may be a good case for retrofitting in some instances, so decisions should be made on a case-by-case basis.

Respondents also highlighted several conditions that need to be considered. Firstly, that refurbishment costs are not passed onto the end user. Secondly, that duplication of funding should be avoided, for example how ECO funding and HNIP funding might interact. Thirdly, that residents are properly consulted before refurbishments take place.

With regards to funding, the majority of stakeholders suggested that payments should be made via a grant, since it reduces the financial risk to the organisation. Grants were considered more appropriate than soft loans due to the added complexity of recovering the costs of works undertaken on the end user heating system.

Government response: What should the HNIP Pilot provide funding for?

Any networks providing **heating and/or cooling** and those that also generate **electricity** and meet the definition set out in the Heat Networks (Metering and Billing) Regulations 2014[8] will be eligible to apply for HNIP Pilot funding. These heat networks must be located in **England and/or Wales**.

As set out in the HNIP consultation and in agreement with the majority of the responses to the HNIP consultation, the HNIP Pilot eligible investment costs will include:

- The **building of new heat networks** (covering generation, distribution and customer supply), as well as **heat network expansions**, **refurbishment or the interconnection** of existing networks where additional carbon savings can be demonstrated (which can include refinancing or acquisitions);
- **Commercialisation phase costs** that will be capitalised (see details below);
- **Works to access recoverable heat** (see details below);
- **Upgrade of heating and hot water systems** in some existing buildings (see details below).

More details on the eligibility of costs are provided below and in the HNIP Pilot Application Guidance[9].

Commercialisation funding

As raised by many respondents, we recognise that attracting finance for the commercialisation stage of heat networks presents a challenge for many projects in the UK. Commercialisation costs are therefore included as eligible investment costs, under the HNIP Pilot, in order to bridge the funding gap and increase the number of heat networks that reach construction. However, commercialisation activities will only be supported where there is high confidence that the project will be completed. Funding will therefore only be provided for commercialisation as part of an overall 'commercialisation + construction' package.

Commercialisation activities will be eligible for HNIP Pilot funding if they are capitalised. This denotes that the project has reached a level of certainty sufficient to take a decision to capitalise any subsequent costs.

Costs already incurred will not be eligible for HNIP Pilot funding.

Eligible commercialisation activities will be funded through grants or loans. Projects funded with grants that do not result in the construction and completion of a capital asset will have 50% of their commercialisation funding clawed back. Where loans are awarded, these will need to be repaid irrespective of whether the project progresses to construction or not.

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[8] '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

[9] Available on the Salix Finance website: http://hnip.salixfinance.co.uk/

Funding for the upgrade of heating and hot water systems inside existing multi-tenanted buildings

The Government acknowledges that the upgrade of heating and hot water systems inside multi-tenanted buildings can constitute a barrier for heat network deployment and are sometimes necessary to connect individual properties or where the existing infrastructure would negatively impact the efficiency of the heat network.

The following are therefore included in the definition of eligible HNIP Pilot investment costs:

- **Secondary systems:** These are defined as the part of the network which connects the primary network and the customer; up to and including the heat/hydraulic interface unit and customer heat meter and excluding any tertiary systems. Secondary systems in new build buildings are ineligible. Secondary systems that satisfy all of the following conditions are included in HNIP eligible investment costs:
  - Only in existing buildings and where they constitute an anchor load customer;
  - Eligible costs for secondary distribution systems are only the extra costs to enable the building to connect to the heat network and do not include the proportion of costs that would have been spent to make a like for like replacement of the existing distribution system.
- **Tertiary heating and hot water systems:** These are defined as the heating and hot water systems inside the customers' properties. Tertiary systems in new build properties are ineligible. In existing domestic buildings tertiary systems that satisfy all of the following conditions are included in HNIP eligible investment costs:
  - Only in properties that will join the heat network and which are part of an anchor load customer;
  - Only in properties where wet systems are being installed for the first time (i.e. replacing electric heaters with wet systems, not replacing old inefficient systems with the new ones or replacing smaller radiators with the large ones);
  - Only in domestic buildings where all properties are wholly publicly owned (local authority housing stock, public buildings, social landlords);
  - Only where the works are critical for connection to the heat network and for the heat network's efficient operation;
  - Eligible investment costs for tertiary heating and hot water systems are the extra costs to install wet systems for the first time, over and above the costs of a like for like replacement of the existing system.

Funding to support works to access recoverable heat (from industry, energy from waste etc.)

Works to access recovered heat are included in the HNIP Pilot eligible investment costs. Construction of heat sources where the primary function is not to supply the heat network is ineligible for HNIP funding. Such ineligible costs include the construction of an energy from waste facility and the construction of manufacturing, industrial or other pieces of infrastructure from which heat is to be recovered.

C. What combination of funding mechanisms should be offered?

Proposal set out in consultation document

Chapter C of the HNIP consultation sought views on funding mechanism options (e.g. grants, soft loans, central Government equity stakes and/or guarantees) for the Main Scheme.

Table 2 in the HNIP consultation described 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.

More details and background information are available in the consultation document on grants, soft loans, Government equity stakes and guarantees[10].

The proposal set out in the HNIP consultation for the Pilot was to offer grants and/or soft loans. This was to ensure there would be a simplified delivery model for the Pilot.

For the Main Scheme we mentioned considering what combination of financial mechanisms to offer, with an emphasis on loans rather than grants wherever possible, to help demonstrate that heat networks can service loans through their revenues and constitute valid investment opportunities in order to attract new investors to the heat network market.

Stakeholders were then asked to give their views on the impact of grants, soft loans, Government equity stakes and/or guarantees on heat network sponsors and investors as well as their respective advantages when compared between them.

Questions focusing on grants

Responses to question 9: Do you agree with the impact of grants on heat network sponsors and investors outlined in Table 2 of the consultation document?

There were a total of 87 responses to this question. The majority (87%) of respondents having answered this question agreed with the impact of grants on heat network sponsors and investors outlined in Table 2 of the consultation document. 29% of respondents to the consultation document didn't answer this question.

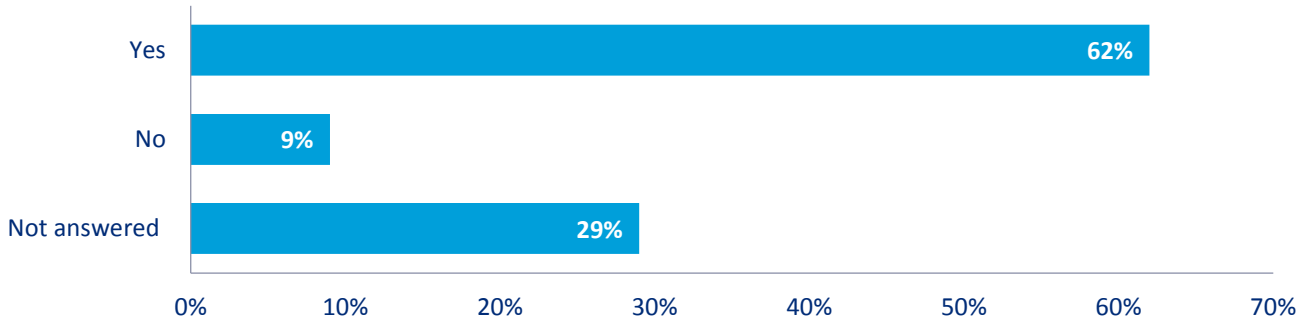


Figure 5: Respondent answers to question 9 of the HNIP consultation

[10] See pages 26-33 of the HNIP consultation document https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532483/HNIP_consultation_vFINAL.pdf

Responses to question 10: Please set out your views on the impacts of grant funding below.

There were 85 responses to this question.

Most respondents stated that grants reduce capital funding requirements which results in an improvement of the underlying project cash flows, credit worthiness, project IRR and post finance equity IRR. This in turn makes projects more attractive to investors, as soon as the grant is secured, and improves deliverability. Grants enable projects sponsors/owners to seek a smaller amount of investment from investors which could result in better terms.

Respondents supported the use of grant funding to:

- Support the commercialisation phase of heat networks
- Unlock heat network projects that would otherwise not happen, but will eventually be commercially viable once developed, where other soft finance is not sufficient.
- Support the addition of future-proofing characteristics to heat networks projects that would otherwise be less ambitious e.g. adding value by achieving greater carbon reduction, trialling innovative technologies, ensuring ability to enable greater future expansion, achieve other community goals, etc.

Respondents also noted that:

- Grant funding would best be provided where it is most needed rather than as a blanket approach for all schemes that bid for HNIP funding.
- The use of grants should be limited even if they may well pump prime the market, in the short to medium term, and start making heat networks ubiquitous, build investor confidence and incentivising the supply chain through an increase in the number of projects being implemented .The use of grants alone will not deliver the ambitions of the HNIP programme and an over reliance on them could undermine demonstrating that ultimately heat networks can be built without subsidies.
- Some respondents suggested grants could be at least partly repayable in the future once the heat networks generate sufficient cash flow to do so. If grants could be designed so that they could be provided to public sector organisations for them to on-invest them as re-payable grants, soft loans or local government equity stakes it would maximise access to the non-fiscal proportion of HNIP.
- If they are paid in relation to the achievement of milestones, grants should be designed so that they are not lost but their payment just delayed if those milestones are delayed (i.e. during commercialisation and construction phases) to avoid unnecessary project attrition, and reduce the risk premia applied to cost of capital by third party investors to account for the risk of losing the grant due to events outside of the reasonable control of the project.
- Some respondents suggested that grants should not be so large that they would crowd out third party investors who will not be interested in investing in deals below a minimum ticket size.
- There is a danger that grant funding will leak out of projects i.e. enable projects where the capital costs are higher than they should be to go ahead and, by implication, support inflated capital costs, and for example be passed onto developers through reduced connection charges.

- It is noted that since the provision of grants have the potential to increase the level of equity returns for investors, the use of a 'gain share' mechanism may be appropriate so that where a project benefits from 'excess' profits in future years part of these can be potentially recovered by the public sector.

Responses to question 11: Should grants be provided to contribute towards the costs of additional technical or commercial future-proofed characteristics only?

There were a total of 86 responses to this question. The majority (74%) of respondents having answered this question agreed that grants be provided to contribute towards the costs of additional technical or commercial future-proofed characteristics. 30% of respondents to the consultation document didn't answer this question.

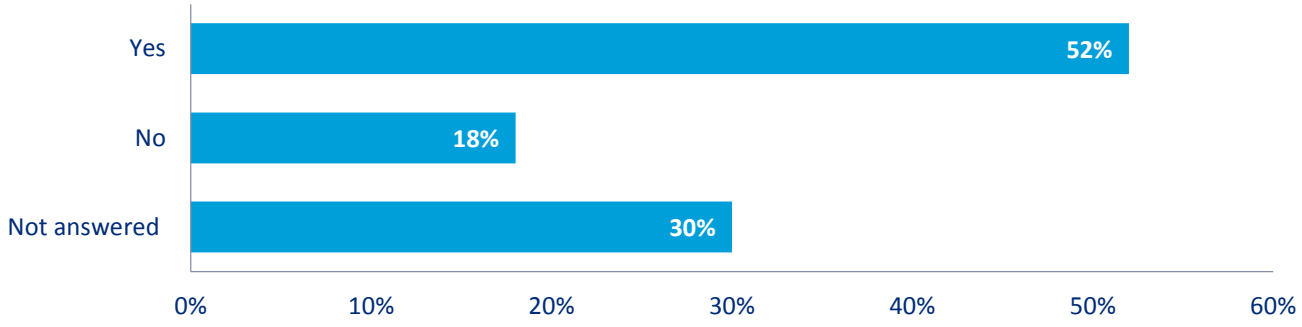


Figure 6: Respondent answers to question 11 of the HNIP consultation

It was stressed that grants can be beneficial in specific circumstances, one of them being to support future-proofing features. However, heat network developers should be encouraged, as much as possible, to future proof heat networks as a matter of course and not just because a grant is available. If this is not embedded as best practice, the development of a self-sustaining heat market may be limited.

In response to questions 10 and 12 some respondents also expressed that grants should not only be limited to supporting future proofed characteristics in the first years of the HNIP as some heat networks projects would most benefit from grants targeting the whole of the project cost base, rather than just future-proofing characteristics, to be implemented.

It was also mentioned that HNIP grants should not be seen as a mechanism to support major innovation, which would be better supported through other discrete programmes.

Some respondents suggested that it could be made a condition of grant award that project teams engage with researchers to provide information on schemes i.e. scheme monitoring data, etc. This would enable the build-up of data and information on best practice which in turn could be disseminated to benefit the industry as whole.

Responses to question 12: What advantages does grant funding provide over other capital funding mechanisms to heat network sponsors and investors?

There were 89 responses to this question. The majority of respondents suggested that the main advantages of grant funding over other funding mechanisms are:

- It is a simpler mechanism to understand, evaluate and administer both in terms of time and resources. This simplifies the funding structure of projects which in turn allows projects to proceed more quickly. For this reason grants are also more suited to smaller heat networks projects that could be implemented by smaller organisations such as community groups than other funding mechanisms.
- Grants, as they don't have to be repaid, are a risk free form of funding for the recipients and so significantly de-risk the funding of projects. As a result grants are more effective than other capital funding mechanisms in eliminating perceived risk premium when local authority heads of finance decide whether to invest in heat networks or other projects e.g. property.
- Grants provided at the beginning of project implementation are not discounted over time. As a result grants have a strong impact on Net Present Value, project breakeven and cash flow. Funding streams which occur over time are always discounted and, all other variables being equal have a lower ability to leverage other capital.
- In some instances, project sponsors do not have sufficient borrowing capacity left and therefore cannot benefit from loans whereas they can benefit from grants as these wouldn't be affected by the organisations' borrowing limit.
- Grants are more advantageous during the commercialisation and construction phases than other funding mechanisms, from a recipient and investor perspective, as they help bridge the gap between expenditure and income in a cheaper way than other funding mechanisms.
- Grants are more adapted to reduce build-out risk than other financial mechanisms if they haven't been designed to take on this risk as well. They can be particularly useful in supporting higher risk enabling works where there is a greater risk of abortive costs i.e. to fund the build of a portion of heat network, in advance of the full heat network scheme being fully approved or financially closed, that would secure the option to connect to an anchor load which would be lost to the project otherwise and potentially reduce the viability of the whole project.
- Social housing rents are determined by national policy and cannot be increased for improvements to heating systems. Without an increase in income, it is difficult to service loan repayments and a grant is preferable.

Respondents also highlighted that:

- The finance/investment sector needs to see that heat network projects are commercially viable and investable and consequently the use of grants should be minimised so that there is a real incentive to reduce the costs of projects right across the development cycle so that ultimately there is a large selection of heat network projects generating sufficient returns on investment, that can illustrate the investment opportunity that exists within heat networks.
- Project customised guarantees, may be preferable to grants, however, grants could mimic guarantees if claw-back clauses are included in the event that heat demand risks are resolved within a defined period i.e. there may be a risk over whether phase 2 of a project occurs in 3 years' or 6 years' time with a delay making the scheme un-investable – a grant could be provided to allow the scheme to proceed but if the second phase proceeds in 3 years, part or all of the grant could be repaid.

- Care must be taken that adequate application assessment criteria are put in place to avoid 'gaming'. This is where a project would be manipulated to make use of HNIP funding. For example if a certain IRR is deemed able to raise finance without HNIP support then changes to the project would be made to reduce the IRR to fit the scheme.
- Grants should be targeted towards the types of projects and applicants that will most benefit from them.

Questions focusing on soft loans

Responses to question 13: Do you agree with the impacts of soft loans on heat network sponsors and investors as outlined in Table 2 of the consultation document?

There were a total of 77 responses to this question. The majority (90%) of respondents who answered this question agreed with the impacts of soft loans on heat network sponsors and investors outlined in Table 2. 37% of respondents to the consultation document didn't answer this question.

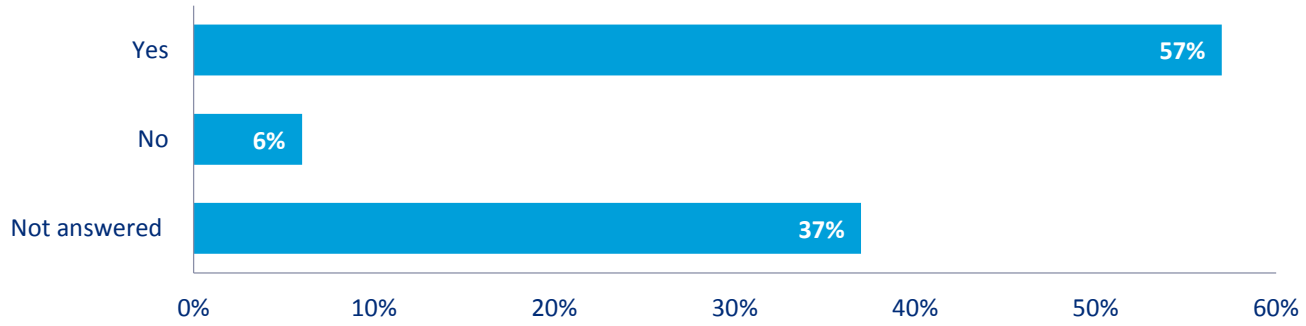


Figure 7: Respondent answers to question 13 of the HNIP consultation

Responses to question 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?

There were 72 responses to this question.

Although a significant proportion of respondents indicated that instead of soft loans, grants should be prioritised since they are deemed to offer a simpler and greater possibility of de-risking the funding of projects, most respondents indicated that soft loans would offer a sensible addition to the funding package available under HNIP as:

- Soft loans can reduce the need to access costlier capital to bridge funding gaps which helps to improve project economics.
- Soft loans can be designed to match the characteristics of a heat network project e.g. repayment holidays, sculpted repayments, low interest rate, subordination, etc.
- Soft loans are more likely to encourage a self-sustaining heat network market than pure grants as they would demonstrate that heat network projects can service debt and are viable over their economic life. Respondents considered that having to service debt encourages discipline to achieve operational efficiency and aligns the heat network

management's interest with equity owners. This would help in increasing the confidence of investors unfamiliar with such projects and could attract third party investment into heat network projects.

- Soft loans provide capital whereas guarantees do not, however soft loans potentially do not de-risk projects to the same extent as appropriately designed guarantees unless the soft loans are designed to take on some project risks.

Respondents however stressed that to maximise their effectiveness, soft loans would need to provide an advantage to the borrower for example:

- a lower interest rate than currently available loan offers
- linking repayment schedules to the completion of specific project stages (i.e. commissioning), and allowing for repayment holidays if problems arise
- limited recourse or pure project finance
- subordination to senior debt
- flexible draw down
- being able to recycle soft loan repayments, principle and interest, into HNIP or a future programme to continue supporting heat networks

Some respondents also highlighted that:

- Soft loans will not be effective in supporting heat network projects when applicants to HNIP do not have sufficient borrowing capacity left e.g. local authorities close to or having reached their prudential borrowing limit.
- Consideration is needed whether some applicants (e.g. third sector) will be able to guarantee long term loans. Making soft loans, which aren't limited to corporate debt, available to SPVs would serve to further increase uptake. One alternative to this would be for soft loans to be considered for generation and grants to be focused on the pipework infrastructure.

Responses to question 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.

There were 86 responses to this question summarised in the table below:

Soft loan features	No positive impact	Some impact	Very effective	Not answered
Low interest rate	**1%**	**16%**	**47%**	**36%**

Soft loan features	No positive impact	Some impact	Very effective	Not answered
Sculpted repayments to match planned cash flows	2%	24%	38%	36%
First repayments to be made after construction period i.e. in initial years of operation	3%	26%	36%	35%
Loan tenor aligned with pipe infrastructure lifetime	4%	31%	29%	36%
Loan drawn down in tranches over construction period	3%	33%	26%	38%
Option for payment holidays	10%	31%	21%	38%
Subordinated debt , less senior than other loans	8%	31%	20%	41%

Table 2: Rating of soft loan features by the respondents having answered to question 15.

Low interest rates were identified as the most significant factor in the answers to this question. This feature also had considerably more responses than other features although as highlighted in the consideration of recourse in question 14, several respondents specifically identified that sharing risk has greater benefit than low interest rates.

Features which align repayments closer to project cash-flows were also assessed slightly more favourably than other features.

Some respondents highlighted that:

- Investors would want to see heat network projects to be able to adequately service debt and therefore payment holidays weren't a feature they rated that highly.
- The structure of the soft loans would also be very important for sponsors. A project financing type structure i.e. rather than corporate debt would be the preference as a corporate type debt could impact negatively on the sponsors credit rating and the project's cost of capital.
- The chances of securing commercial loans and of securing them on better terms would be increased if soft loans were subordinated to these commercial loans.

Questions focusing on central Government equity investment

Responses to question 16: Do you agree with the impacts of equity on heat network sponsors and investors as outlined in Table 2 of the consultation document? There were 72 responses to this question.

The majority (85%) of respondents who answered this question agreed with the impacts of equity on heat network sponsors and investors outlined in Table 2. 41% of respondents to the consultation document didn't answer this question.

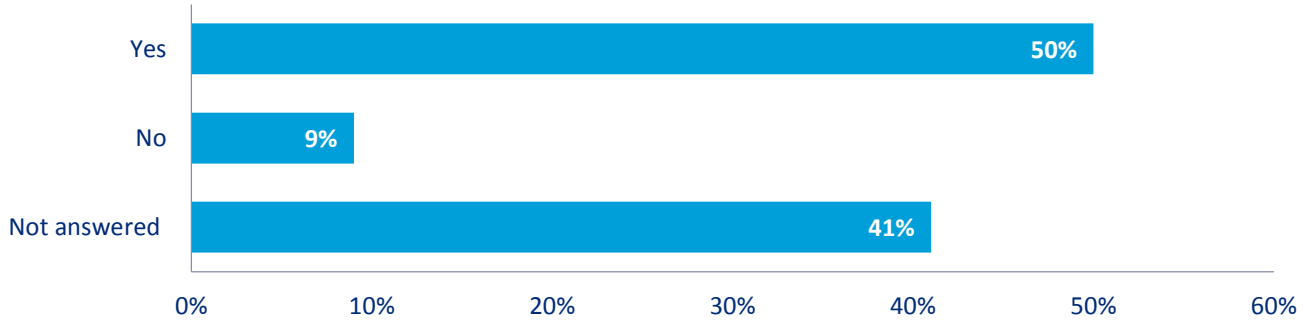


Figure 8: Respondent answers to question 16 of the HNIP consultation

Responses to question 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?

There were 72 responses to this question.

The main benefit highlighted by respondents is that the use of equity would send out a positive message about the industry being self-sustaining and would also provide confidence for investors of larger projects.

However, a considerable number of respondents thought that while equity would be a useful funding option, grants, soft loans and guarantees would offer Government sufficient flexibility to support the needs of all eligible projects. Therefore respondents advised that equity should be considered a lower priority funding stream. Indeed, there was a view that the most effective way to achieve the aims of HNIP in the short term is make its funding mechanism as simple as possible by providing grants.

A few respondents mentioned that Government equity stakes may be sold on at a profit in the future which could then be recycled to invest in other projects. This would help to establish a secondary investment market which will encourage additional project development investment.

Respondents mentioned the following disadvantages relating to the provision of Government equity:

- There was concern that equity would introduce unnecessary complexity. Although equity investment may prove to be a good way of carrying a heat network over to a successful contractual and financial close into construction, it is less attractive than grants or soft loans, as it would not increase project returns.

- Central Government equity is likely to come with numerous long term conditions as part of the shareholder agreement which might create barriers to other investors.
- Requiring market level rates of return may draw excessively on a project's cash flow which could negatively impact the project or require grant top up. Any chances of the equity investment approach being a success would be dependent on the expected levels of the return on the Government equity.

Questions focusing on guarantees

Responses to question 18: Do you agree with the impacts of guarantees on heat network sponsors and investors outlined in Table 2 of the consultation document?

There were 77 responses to this question. The majority (81%) of respondents having answered this question agreed with the impacts of guarantees on heat network sponsors and investors outlined in Table 2. 37% of respondents to the consultation document didn't answer this question.

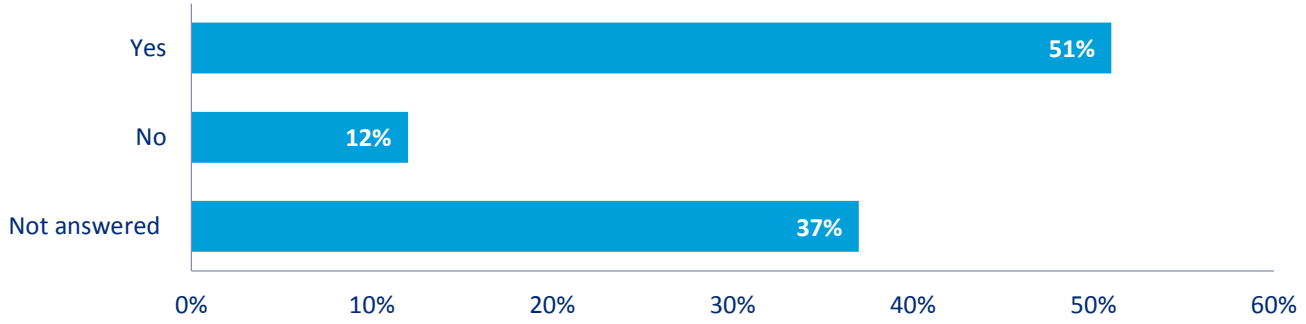


Figure 9: Respondent answers to question 18 of the HNIP consultation

Responses to 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 HNIP aims.

There were 71 responses to this question.

Respondents generally thought that, in theory, appropriately designed and priced guarantees would reduce risk for investors, in particular the uncertainty surrounding the timing and nature of new connections, on both a pre- and post- finance basis. Furthermore as guarantees are designed to achieve their objectives without ever being called upon they could constitute a low cost long term solution which would make investment at a lower return rate possible for investors specialised in infrastructure.

Respondents however stressed that:

- Guarantees would be complex to set up and less beneficial in the short term than providing grants and soft loans with sympathetic loan repayment terms to help reduce risk.

- Guarantees priced below market rate could ultimately have the effect of subsidising poor construction standards. Guarantees need to be appropriately designed to provide the right incentives to deliver efficient and good quality infrastructure.
- HNIP's five year timescale is not long enough to offer demand guarantees which would need to cover the full period of forecasted customer connections which, in most cases, would extend beyond 2020.
- A construction period guarantee would, by definition, expire at the end of the construction period, providing comfort over the successful commissioning of the project but no protections in the event of a loss of heat load and associated revenues. Even with the relative immaturity of the UK heat network sector it would be expected that normal commercial arrangements should provide sufficient protection to investors and lenders during the construction phase to reach commissioning. Hence construction period guarantees might be unnecessary. It was also mentioned that construction period guarantees would overlap with construction insurance already available in the market.
- Heat off-take/demand guarantees are potentially a more valuable facility than construction period guarantees. These could increase revenue certainty for operators which would help to draw in other investors who could be more certain of repayments or dividends and may therefore likely reduce the cost of capital. Depending upon how guarantees are structured, these could be analogous to capacity-based availability payments that are a feature of many successful PFI or PPP arrangements. This is an approach that is familiar to many investors. However, these arrangements would present the Government with an enduring liability which would appear to be outside of the scope of the present spending settlement for the HNIP.
- Credit guarantees on heat buyers so that lenders have greater certainty over the credit worthiness of heat network projects are likely to be more specific to the circumstances of particular heat off-takers than wider demand guarantees. This may provide for more accurate pricing of a guarantee.

One respondent suggested that HNIP funding support could be used to meet the whole life costs of an insurance scheme through a single premium payment to underwrite the risk of future connections not materialising. This would overcome the need for HNIP to provide funding during a limited (e.g. 5 year) period and help create a sustainable environment for public sector and commercial investors to develop and invest in heat networks.

Some concerns were raised as to the structure of the guarantees. For example:

- Would payments under a guarantee take the form of a grant such that they would not need to be paid back, with no fees or interest applicable?
- Would network owners be liable to repay some of the guarantee for any customers not connected after a certain point in time? (i.e. limiting Government's exposure to the timing of connections rather than non-connections).

Responses to 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?

There were 63 responses to this question.

Respondents mentioned, and at times reiterated, several opportunities and challenges which were not covered in Table 2 or that should be considered to support heat network development, in particular:

- Grants are already available via Local Growth Funds, but LEPs are struggling to allocate them due to the outputs required by DCLG. Work should be undertaken in partnership with DCLG to review the current funding conditions associated with LGF (i.e. funding judged purely on job creation outputs rather than wider social, environmental and economic benefits) as this would unlock a grant funding source which many LEPs and local authorities are keen to use to support capital projects. This could enable HNIP to focus more on providing loans rather than grants.
- Several respondents mentioned the need to address the lack of legal framework and regulation of the heat network market as a whole.
- One respondent suggested that income regulation of the heat market, as is done for electricity and gas networks, would help to attract long term and affordable debt finance by creating a predictable and stable investment environment.
- Legislation on private power networks would give rise to an opportunity for power revenues to subsidise heat networks.

Responses to question 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?

There were 86 responses to this question.

Respondents stressed that in order to increase investor confidence there should be a focus on ensuring that more heat network schemes are viable and that schemes which are not (and hence waste investors time) are not brought forward. Furthermore viable schemes need to be delivered in a manner which breeds increasing confidence in heat networks and therefore ultimately leads to a self-sustaining market. As such the HNIP should:

- Demonstrate how heat off-take and other similar time-dependent risks can be addressed.
- Demonstrate and publicise that there is a significant and steady pipeline of viable heat network projects.
- Result in projects being built and that once built these projects deliver the technical performance, the financial returns and heat revenues, CO2 savings, expansion possibilities that were expected during detailed project development.
- Result in a wide-scale recognition of the benefits that heat networks can deliver to investors, sponsors and customers through the implementation of a number of successful projects rather than bring about the emergence of new heat networks solely due to planning requirements which does not always result in efficient projects.
- Demonstrate and publicise that viable long term projects have been created through the monitoring and publishing of the learnings from the HNIP Pilot projects (including case studies). There needs to be a much greater focus on increasing learning on how to

commercialise heat networks and identify at an early stage those which should not be progressed, so that time, money and effort is not wasted on trying to deliver schemes which simply are not viable. This could include sharing detailed project risk profiles and the approaches used to mitigate them illustrating the different types of financing strategies that are required at the various stages of the project life-cycle.

- Demonstrate that the viable long term projects HNIP will help bring to fruition are scalable and implemented as simply as possible, become less bespoke and more standard in terms of the technical, commercial and customer service approach adopted so that greater economies of scale can be achieved. Being able to demonstrate how some heat networks could eventually be aggregated would prove very helpful in increasing investors' confidence and appetite in funding heat networks.
- Be presented to the market as the pre-cursor for continued expansion under a sustainable and simple commercial model.

Government response: Which funding mechanisms should the HNIP Pilot capital funding be deployed through?

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, larger local authorities and private sector heat network operators, 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. They however also 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.

Designing funding mechanisms such as equity and guarantees will take longer than for grants and soft loans due to their complexity and did not fit within the existing Pilot development and launch timetable. As such equity and guarantees will not be available under the Pilot.

HNIP funding under the Pilot has been designed to help bring forward projects in the short term but also help the development of a sustainable market in the longer term.

As proposed in the HNIP consultation and taking into account the feedback received from consultation respondents, funding will be made available both through grants and soft loans as part of the HNIP Pilot. Both grants and soft loans will be available for draw down at the point of need for a proportion of the eligible costs (see Section B).

The full details of the grants and soft loans available under the Pilot are detailed in the HNIP Pilot Application Guidance[11].

For Loans, it is intended that they will have the following characteristics:

- The term will match closely to the 'project life' (see definition in Pilot Application Guidance) up to a maximum of a 40 year term.
- A low interest rate below Public Works Loan Board (PWLB).
- An annuity repayment profile with the first principal repayments to start after construction; either the earlier of project operation or a fixed deadline.

Government response: Which funding mechanisms should the HNIP Main Scheme capital funding be deployed through?

Government is exploring which funding mechanisms to offer in the Main Scheme. This will be finalised before the Main Scheme launch, taking into account the responses to the HNIP consultation and the learnings from the Pilot. In addition, the Government will consider the costs and benefits of different approaches including the extent to which they contribute to the strategic objectives of the Heat Networks Investment Project over, and with due consideration to, the additional costs and risks associated with providing more complex support mechanisms.

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

Eligibility and scoring criteria - Proposals set out in consultation

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 would not have gone ahead without Government funding. Decision-making criteria for HNIP will be used for eligibility assessment, applications scoring and conditions compliance and verification.

More details and background information are available in the HNIP consultation on eligibility and scoring criteria[12].

In section D of the HNIP consultation, we were seeking views on eligibility and application scoring criteria. This section also sought 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.

Government proposed that the volume of carbon savings and the extent to which a project will operate with no customer detriment in comparison to the counterfactual will constitute minimum eligibility threshold criteria.

[11] Available on the Salix Finance website: http://hnip.salixfinance.co.uk/

[12] See pages 34-35 of the HNIP consultation document: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532483/HNIP_consultation_vFINAL.pdf

Responses to question 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. Please also indicate where there are existing, published, common methodologies, datasets and units of measurement that should be utilised.

There were 105 responses to this question which are summarised in the table and comments below (Respondents were able to indicate their preference for a criteria to be both a minimum threshold and also a competitive scoring criteria hence rows do not necessarily add up to 100%):

Criteria	Eligibility Minimum threshold criteria	Competitive Scoring criteria	Not answered
Volume of carbon savings in short-term and long-term, traded and non-traded - **Assumed minimum eligibility threshold criteria**	**65%**	**41%**	**24%**
Will operate with no customer detriment in comparison to the counterfactual - heat price issues (including ability to generate consumer bill savings) - **Assumed minimum eligibility threshold criteria**	**69%**	**25%**	**22%**
Will operate with no customer detriment in comparison to the counterfactual - wider customer service issues **Assumed minimum eligibility threshold criteria**	**62%**	**25%**	**26%**
That applicants have explored a suitable range of technical options	**51%**	**30%**	**29%**
Technically future-proofed (e.g. able to expand)	**49%**	**48%**	**22%**
Commercially future-proofed (e.g. the ability to refinance, consideration of legal structuring)	**29%**	**46%**	**34%**
Transformation of the heat network market through: raising awareness of this infrastructure opportunity with current and future investors	**17%**	**46%**	**42%**
Social Net Present Value (NPV)	**26%**	**51%**	**35%**

Table 3: Respondent ratings of which factors should be used as minimum eligibility thresholds and which factors should be used as competitive scoring criteria.

Minimum eligibility criteria

The majority of respondents supported and commented on the Government's proposal of considering the following criteria as eligibility minimum threshold criteria:

- **Volume of carbon savings in short-term and long-term, traded and non-traded:** The majority of respondents recommended that carbon savings should be a minimum eligibility criteria
- **Operation with no customer detriment in comparison to the counterfactual - heat price issues (including ability to generate consumer bill savings):** Respondents considered simply that HNIP should support heat network projects which result in lower heating costs for end users when compared to the counterfactual.
- **Operation with no customer detriment in comparison to the counterfactual - wider customer service issues:** Respondents suggested that this criterion should include environmental and economic indicators such as air quality and health issues.

Respondents also considered that heat networks being **technically future-proofed** and **having explored a suitable range of technical options** should constitute an eligibility minimum threshold criteria and that evidence of technology best suited to tackle location-specific issues should be demonstrated.

Competitive scoring criteria

Respondents considered that the following criteria would be best suited as competitive scoring criteria. In some instances respondents indicated that some criteria would be well suited to be both used as minimum eligibility criteria as well as competitive scoring criteria :

- **Volume of carbon savings in short-term and long-term, traded and non-traded.** This criterion should be assessed as volume of carbon saving per pound of HNIP support instead of overall carbon savings as the latter approach could disadvantage smaller yet highly efficient schemes.
- **Social Net Present Value (NPV):** Respondents indicated that this should include impact on fuel poverty, comfort and health of end users, air quality and impact on jobs.

  However some respondents highlighted that social NPV assessment may prove too complex for some applicants to contend and that perhaps it would be more useful to ask for and assess a simpler NPV assessment of the total cost of the project to the end users over a set long term period e.g. 25-30 years.

  Commercially future-proofed: Respondents suggested this criterion should be used to assess the potential for refinancing. Some respondents highlighted however that while future-proofing is an important consideration a balance needs to be struck between future-proofing and over-engineering schemes to the point of threatening their viability.
- **Transformation of the heat network market:** Respondents suggested that there is a need to raise awareness and improve the skills and knowledge across the whole heat networks sector, including potential project sponsors and supply chain, and not just amongst investors. Respondents provided comments as to potential metrics for this criterion in response to question 28 of the consultation.
- **Technically future-proofed.** Respondents didn't provide comments on this criterion but indicated in Table 2 that it would constitute one of the most suited competitive criteria.

Respondents also highlighted that:

- Scoring criteria should be competitive to result in the best projects being supported.
- The scoring criteria should be simple, robust and transparent and not rely on too many minimum requirements or arbitrary thresholds. Some respondents proposed a 'traffic light' scoring system i.e. green, amber and red for the more subjective criteria.
- If multiple criteria are to be used, it is crucial that heat network experts review projects on a case-by-case basis. This would result in the best projects over a broad set of objectives being supported with HNIP funding.
- It is important that any criteria based around a heat network's ability to expand is considered in a balanced way, in order to avoid favouring larger, new heat networks over smaller but efficient heat networks.
- A good scoring criterion would be to assess the level of collaboration and partnership among the project sponsor and a variety of local stakeholders.

Scoring and ranking additionality- Proposals set out in consultation

To ensure value-for-money for the taxpayer, the Government proposed two additionality test options with applicants asked to demonstrate which type of additionality their project delivers e.g.:

i. **Economic/financial additionality:** 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 additionality:** Funding for additional technical or commercial features that would deliver additional HNIP benefits, but where capital cost is currently a barrier to deployment.

More details and background information on the Government's two additionality test options proposal are available in the HNIP consultation[13].

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.

In the HNIP consultation, the Government proposed to assess the level at which HNIP capital funding would sufficiently improve nominal pre-tax 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

[13] See page 36 of the HNIP consultation document https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532483/HNIP_consultation_vFINAL.pdf

and private sector investors – and thereby use that rate(s) as a target for assessing the size of support. Question 23 asked stakeholders whether they agreed with this methodology.

Responses to question 23: Do you agree with the high-level assessment methodology proposed in the HNIP consultation to determine the appropriate amount of funding?

There were 77 responses to this question. The majority (78%) of respondents who answered this question agreed with the high level assessment methodology proposed in the consultation document. 37% of respondents to the consultation document didn't answer this question.

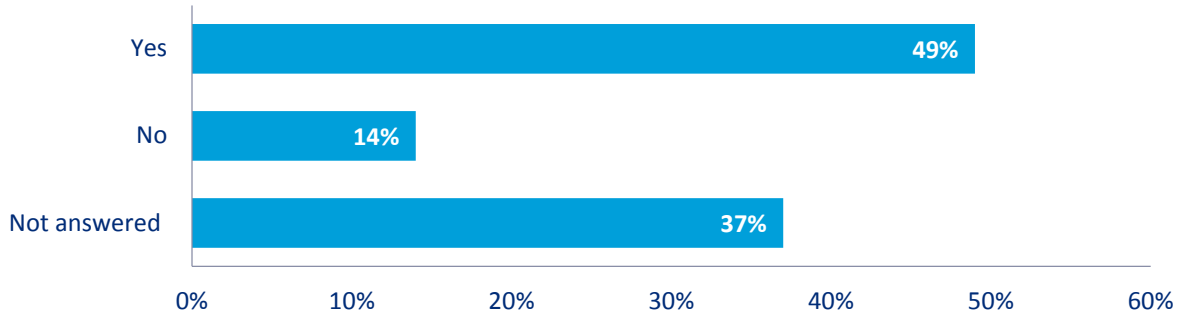


Figure 10: Respondent answers to question 23 of the HNIP consultation

Responses to question 24: If you do not agree with the methodology described in the previous question, what alternate approach would you propose for determining the appropriate level of funding for projects?

There were 40 responses to this question.

The majority of respondents supported the high-level methodology introduced in question 23 and mentioned that:

- Careful scrutiny of the applicants' financial models should be undertaken to prevent applicants from 'gaming' their IRR. It was suggested that HNIP should develop their own standard financial model to mitigate this and ensure returns across projects are assessed on a like-for-like basis. Such a model would need to be able to compare fairly new schemes, and the extension or refurbishment of existing schemes.
- A more simplified approach may be appropriate for smaller schemes that may not be quantifiable in the context of a wider scheme model.
- Public and private sector projects should be awarded funding in the same way. The level of IRR would need to be set fairly. It is not clear for example why a local authority-owned energy company using, say, PWLB funding for the balance should be assessed against a lower IRR hurdle rate than for a private sector led project, as this would therefore give preferential financial treatment to the private sector project (particularly, when it is expected that the project that the local authority will deliver will have greater governance and scrutiny, and potentially deliver wider benefits and future connections).
- There may be some challenges around setting different annual equity hurdle rates for public and private sectors to assess the size of support that is required. One respondent suggested that HNIP could use some indicative equity hurdle rates to guide the evaluation

of applications without having defined rates to reflect the variety of projects, stakeholders and types of finance that may be needed to fully fund a heat network project. The respondent then explained that they use as a guide an NPV at public sector discount rate for public sector financing at between 3%-6% and for private sector at 10%-12%. These ranges are used as a guide only in recognition that each project and funder is different, and project need tailored funding solutions.

- In addition to assessing nominal pre-tax equity IRR, negative cash flows in the early years, which may still prevent the project from progressing, would need to be considered as well.
- HNIP should make clear how the hurdle rate approach could be applied to public and private sector entities investing alongside each other in a partnership arrangement.
- Clear boundaries should be set around what HNIP funding can be used for to avoid abuses such as electricity distribution network operators (DNO) naming their price for grid reinforcement where they believe these monies could be met by HNIP.

A few respondents highlighted the challenges with assessing IRR and proposed some alternatives:

- Value for money is more than a measure of IRR. For example a project where the capex is well-controlled may exhibit a higher IRR than one where cost optimisation has not been undertaken. Furthermore IRR can be manipulated and therefore would not constitute the most appropriate criterion if used in isolation to assess applications to the HNIP. Instead respondents suggested that applications should also be assessed on how well they reduce carbon, protect consumers and deliver best-value strategic projects. For example a nominally higher IRR project might delivers far greater value in comparison to other projects, and the HNIP team should seek to support such projects. This could be done by requiring that each applicant provide a business model which would be compared to other applications by the HNIP team to determine if a given project has wildly optimistic or pessimistic expectations for returns in comparison to other projects. Generally those seeking less money and with lower yet credible returns would win out over those seeking high returns.
- One respondent advised against publishing minimum hurdle rates figures. Instead HNIP applicants should confidentially provide their business plans and compete blind against one another, creating a powerful driver for more competitive returns.
- One respondent suggested HNIP uses a percentage of the overall eligible project cost to determine the amount of HNIP support. This percentage would be determined within a well-defined and understood scope. Those percentages could differ for differing types of eligible project spend, for example 100% for heat network piping costs (these are close to be set costs and can be easily audited), 50% for civils works (these are more variable and open to manipulation) and 25% of professional fees (a necessary cost but which should be minimised where possible).
- One respondent suggested HNIP assess modified internal rate of return (MIRR) instead of IRRs which they deemed a more accurate measure and better suited for the evaluation of long-term infrastructure projects. MIRR would address several of the IRR flaws, including but not limited to the amplifying power of the reinvestment assumption and multiple IRR values for cashflows with multiple sign changes.

- Any applicant should be obliged to show how they, and the funders backing the heat network project, have sought to minimise the size of any funding gap together with seeking alternative sources of funding as part of the assessment.
- The public sector tend to make decisions on investing in projects in terms based on payback periods or positive net present values rather than hurdle rates.

A few respondents considered there is a risk of trying to spread the HNIP funds too thinly and that HNIP funding should aim to support a smaller number of heat networks and ensure that these are implemented well to undeniably lift the profile of heat networks, and improve customers' and investors' perception of them.

Responses to question 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.)

There were 53 responses to this question however few respondents provided quantified responses.

The few respondents who provided quantified responses indicated a wide array of pre-tax hurdle rates for investing in industries comparable to heat networks ranging from 5%-7% for community groups, 6%-9% for patient capital, 8%-12% for local authorities, 7%-12% senior debt finance, 12%-15% for private heat network operators, 8%-20% for equity providers and mezzanine project finance and up to 20%-25% for energy intensive industries.

Respondents considered that a fully mature heat network market with formal regulation and comfort on heat demands would encourage a reduction in hurdle rates.

Some respondents mentioned that heat networks should be compared to renewable energy, community energy, water networks and electricity transmission projects when determining their hurdle rate.

However, other respondents commented that they do not believe it makes sense to draw parallels with other industries as this is a very specific market which not only needs to secure its customer base, but also construct the energy infrastructure and energy generation equipment. This leads to a very different risk profile to other utility or construction projects.

Future-proofing as eligibility, scoring or additionality criteria

In order to decide how to score and rank technical and commercial future-proofing characteristics, the Government asked stakeholders in question 26 what characteristics would indicate a heat network is technically and commercially future-proofed.

In addition, question 26 asked which criteria would constitute the most appropriate:

- minimum eligibility threshold criteria irrespective of whether projects are applying under the economic/financial additionality or the commercial/technical future-proofing additionality routes and whether they are currently happening consistently or not

- future-proofing criteria to be used as part of the scoring under the future-proofing additionality routes

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

There were 95 responses to this question, the results of which are detailed in the table below.

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	Not answered
e. Ability to support electricity system balancing including CHP + electric heat source + thermal store	**4%**	**14%**	**40%**	**45%**
	Combined percentage: **18%**			
p. Customer protection over and above Heat Trust equivalent standards.	**2%**	**19%**	**40%**	**41%**
	Combined percentage: **21%**			
n. Metering and billing systems and processes over and above Metering and Billing Regulation requirements,	**3%**	**17%**	**38%**	**45%**
	Combined percentage: **20%**			
q. Heat networks build time reduced or brought forward, reaching operation sooner and delivering carbon savings in earlier carbon budgets	**4%**	**7%**	**38%**	**51%**
	Combined percentage: **11%**			
m. Deploying proven cost reducing innovation (including from SBRI41)	**2%**	**13%**	**37%**	**48%**
	Combined percentage: **15%**			
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	**4%**	**12%**	**36%**	**49%**
	Combined percentage: **16%**			
j. Smart controls, thermal store and/or modular approach to heat sources to optimise system	**11%**	**24%**	**34%**	**36%**
	Combined percentage: **35%**			

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	Not answered
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	**20%**	**11%**	**33%**	**41%**
	Combined percentage: **31%**			
b. Connecting (retrofitting) existing properties to heat networks	**17%**	**16%**	**33%**	**41%**
	Combined percentage: **33%**			
g. Cooling networks and heat networks that provide cooling	**3%**	**7%**	**33%**	**56%**
	Combined percentage: **11%**			
h. Use of multi-utility trenching	**6%**	**14%**	**32%**	**50%**
	Combined percentage: **20%**			
r. Bringing in private sector third party investment (not involved in the operation of the heat network) – debt or equity	**4%**	**7%**	**29%**	**60%**
	Combined percentage: **11%**			
f. Lower temperature primary heat network	**5%**	**21%**	**27%**	**47%**
	Combined percentage: **26%**			
o. Local authority governance role in a majority private sector owned scheme	**7%**	**21%**	**27%**	**46%**
	Combined percentage: **28%**			
c. Network future-proofed for later expansion or interconnection	**24%**	**25%**	**24%**	**32%**
	Combined percentage: **49%**			
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	**15%**	**18%**	**22%**	**47%**
	Combined percentage: **33%**			
i. Suitable heating and hot water systems and coordination between property developer/heat network developer or property owner/heat	**14%**	**29%**	**21%**	**41%**
	Combined percentage: **43%**			

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	Not answered
network owner				
l. Systems to obtain and utilise robust data	**11%**	**33%**	**20%**	**42%**
	Combined percentage: **44%**			
k. Use of CIBSE ADE Code of Practice CP1:2015 technical standards (design, build, commission, operate)	**25%**	**30%**	**18%**	**34%**
	Combined percentage: **55%**			

Table 4: Respondent ratings of the appropriateness of various criteria as either minimum eligibility criteria with respect to both the economic and futureproof additionality application routes and/or as competitive scoring criteria for the futureproof additionality application route.

Respondents indicated that the **most appropriate minimum eligibility threshold criteria** irrespective of whether projects are applying under the economic/financial additionality or the commercial/technical future-proofing additionality routes would be (criteria presented in decreasing order of preference):

- **k. Use of CIBSE ADE Code of Practice CP1:2015 technical standards (design, build, commission, operate).** Some respondents considered that such a criterion would benefit from being more prescriptive than 'just meet the CIBSE ADE Code of Practice' for example by providing a method to prove compliance (i.e. evidence pack including the project design parameters and considerations, use of an independent assessor, etc.).
- **c. Network future-proofed for later expansion or interconnection.** Some respondents advised that a plan describing how it is envisaged the project could be expanded (e.g. examining fuel sources, demand and system capacity, evidence of co-ordinated strategic approach) should be required along regular updates.
- **l. Systems to obtain and utilise robust data.** Respondents indicated that this criteria would need to be more specific, e.g. requiring 3G or similar network connection and to share data (perhaps through a third- party such as the NMRO as they are already administrating the Heat Networks Metering and Billing legislation)
- **i. Suitable heating and hot water systems and coordination between property developer/heat network developer or property owner/heat network owner**. [14]

[14] Respondents did not provide any comments beyond supporting the background provided in the Consultation Document in relation to this specific criteria

- **j. Smart controls, thermal store and/or modular approach to heat sources to optimise system.** Whilst recognising the benefits of smart controls, some respondents highlighted that getting the basics of heat networks design and commissioning right will deliver far greater benefits than putting smart controls on poorly set-up new systems.
- **b. Connecting (retrofitting) existing properties to heat.** Respondents commented that only existing properties meeting minimum thermal standards should be connected to a heat network.
- **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.** Respondents commented that achieving more than 75% of heat from CHP can be tough to achieve initially, and highlighted the importance of thermal stores. Some respondents recommended the adoption of a sliding scale and designing this criteria so that heat networks that will not achieve these heat targets in their first phase but will realise them when fully built-out are not unnecessarily excluded.

  Some respondents also questioned the value of including CHP in this criteria given that BEIS predictions indicate that CHP systems is not expected to save CO2 from 2020, due to the decarbonisation of the grid.
- **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.** One respondent commented that the benefits of having a wider and diverse base of customers should naturally flow through in cost-effectiveness metrics without needing to be specifically assessed.

Respondents indicated that the most appropriate future-proofing criteria to be used as part of the **scoring under the future-proofing additionality** routes would be (criteria presented in decreasing order of preference):

- **e. Ability to support electricity system balancing including CHP + electric heat source + thermal store**. Some respondents indicated that battery storage could also be included in this criterion.
- **p. Customer protection over and above Heat Trust equivalent standards.** Respondents agreed that this could include heat prices lower than counterfactual, consumer advocacy including cooperatives/community shares/customers on board or heat network supply competition.
- **n. Metering and billing systems and processes over and above Metering and Billing Regulation requirements, including customer interface innovation or smart heat meters.**[21]
- **q. Heat networks build time reduced or brought forward, reaching operation sooner and delivering carbon savings in earlier carbon budgets.** [21]
- **m. Deploying proven cost reducing innovation (including from SBRI).** [21]
- **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.** [21]
- **j. Smart controls, thermal store and/or modular approach to heat sources to optimise system.** [21]

- **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.** [21]
- **b. Connecting (retrofitting) existing properties to heat.** [21]
- **g. Cooling networks and heat networks that provide cooling.** Respondents commented that this criterion should only be applicable where appropriate cooling loads exist or will exist. It was also commented that cooling networks might have more difficulties achieving the minimum renewable/CHP efficiency target (i.e. criteria d).

Respondents also mentioned that:

- If used, the lower temperature primary heat network criteria should be applied and assessed on a case–by-case basis as it could be detrimental to schemes making use of recovered heat from a power station, for example, which would not necessarily be considered to be of low temperature but would be wasted if not used.
- Performance monitoring at plant, building and user level, although mentioned in passing in the Consultation Document, should be a minimum eligibility or scoring criteria.
- The HNIP should be wary of setting overly strict minimum criteria to prevent an overly burdensome application process.

Government response: What criteria should be used to assess and decide capital funding applications?

This section presents an overview of the application process, eligibility criteria, additionality tests and scoring criteria for the HNIP. More details are provided in the HNIP Pilot Application Guidance[15].

Application process

As highlighted in the responses to the HNIP consultation, the competitive HNIP application assessment process needs to:

- Be a **fair, transparent and consistent** way of comparing a variety of heat network project and applicant types;
- Decide which projects to fund by identifying **applications that best demonstrate value for money** in delivering the benefits of interest;
- Be able to **prioritise** projects where aggregate requested funding is greater than available capital;
- **Award the right amount of funding** (not under or over rewarding) through the right funding mechanism;

[15] Application Guidance published on the Salix Finance website: http://hnip.salixfinance.co.uk/

- Mitigate/minimise **gaming** and check for **errors** in application data; and
- Be **proportionate** and suited to the available assessment resources.

Considering the above, the HNIP Pilot application process has been designed to identify which projects are deliverable and of sufficient quality so that only these are scored. The application process has two stages:

- **Pre-qualification:** self-declaration of eligibility, those projects that are eligible are invited to submit a full application
- **Full application:** self-declaration is verified, quality of documentation checked, deliverability assessed and then applications scored.

Eligibility criteria

The initial eligibility self-declaration includes the following areas:

- Is the organisation eligible to apply?
- Is the heat network of an eligible type (i.e. heat generated from 75% gas CHP or from 50% renewable, recovered heat or a combination)?
- Will the heat network meet the technical and customer requirements (including CIBSE ADE Code of Practice CP1:2015, Heat Trust, metering and billing regulations)?
- Are only eligible investment costs included?
- Can the heat network demonstrate carbon savings and will the heat price be no more than the counterfactual?
- Will the applicant be able to provide evidence of a funding gap at full application and pass one of the additionality tests?

Additionality test

As part of the HNIP Pilot application process, applicants will be asked to demonstrate that their project would not have gone ahead without Government funding through one or both of the two 'additionality' tests below:

1) **Economic/financial additionality test (new networks)**: 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.
2) **Technical/commercial additionality test (existing networks)**: Funding for additional technical or commercial features where capital cost is currently a barrier to deployment. These features include:
    - Network future-proofed for later expansion or interconnection;
    - Deploying best practice identified in CIBSE ADE Code of Practice CP1:2015;
    - Thermal store and modular approach to heat sources including the ability to provide electricity system balancing;

- Customer service innovation (including smart customer meters and controls) and smart system management with robust monitoring strategy;
- More than 50% renewable heat, 50% waste heat, 75% cogenerated heat (CHP) or 50% of a combination of renewable, waste and cogenerated heat;
- Lower temperature primary heat network;
- Other features are eligible provided the applicant demonstrates that the additional feature is something a) not happening commonly currently and b) helps to achieve one of the HNI Project aims.

For each of the tests above the applicant will have to provide evidence of a funding gap through their project financial model and evidence that the IRR does not meet the hurdle rate of investors for this project's risk profile without Government support.

Heat networks will also need to demonstrate additional features above and beyond the minimum required to comply with planning requirements.

Scoring criteria

Government will assess Pilot applications using three scoring criteria designed to (a) ensure value for money on an absolute basis; and (b) on a relative basis, enabling applications to be compared and ranked. These three scoring criteria were recognised as the most important criteria by respondents to the HNIP consultation and are as follows:

- **Carbon savings:** Carbon savings will be assessed in two ways:
  1) **Shorter-term carbon savings**: This is a quantitative criterion assessing definite carbon savings from the initial heat source on the heat network; expressed as the volume in tonnes of carbon dioxide equivalent savings per pound of HNIP award.
  2) **Longer-term carbon savings options value:** This is a criterion assessing future decarbonisation and expansion options.
- **Customer impact:** Applicants' commitment to customer protection will be assessed in two ways:
  1) **Heat price for domestic and non-domestic customers:** This is a quantitative criterion comparing the levelised heat price (including standing charge and variable) for each domestic and non-domestic customer group, compared to the counterfactual for each customer group.
  2) **Quality of service:** This is a qualitative criterion allowing applicants to demonstrate where they have gone beyond minimum standards to avoid customer detriment or deliver additional customer benefits in comparison with the alternatives.

Project social net present value (NPV): This is a quantitative criterion calculating the societal costs and benefits of the heat network in comparison to the counterfactual; expressed as social NPV per £ of HNIP award

E. Heat Networks Investment Project - measuring success

Proposals set out in consultation

Chapter E of the HNIP consultation sought views on measuring the success of the HNIP, which was divided into direct measures of success (i.e. carbon savings) and other outcomes to which the HNIP contributes. Some of these other outcomes need to occur to deliver carbon savings (i.e. consumer satisfaction and willingness to connect to networks, the creation of a sustainable market for heat networks) whereas other indirect outcomes are expected to arise (i.e. ability to provide electricity system balancing and improved energy security).

The Government proposed that 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.

The Government also put forward a range of indicators to define and monitor progress towards a sustainable market.

More details and background information on the Government's suggestions to measure the success of the HNIP[16] are available in the HNIP consultation document.

Summary of HNIP consultation responses

Responses to question 27: Do you agree that these areas are important components of a sustainable heat network market (or transition towards such a market)?

There were a total of 91 responses to this question. The majority (97%) of respondents who answered this question agreed that the areas mentioned in the HNIP consultation are important components of a sustainable heat network market or of a transition towards such a market.

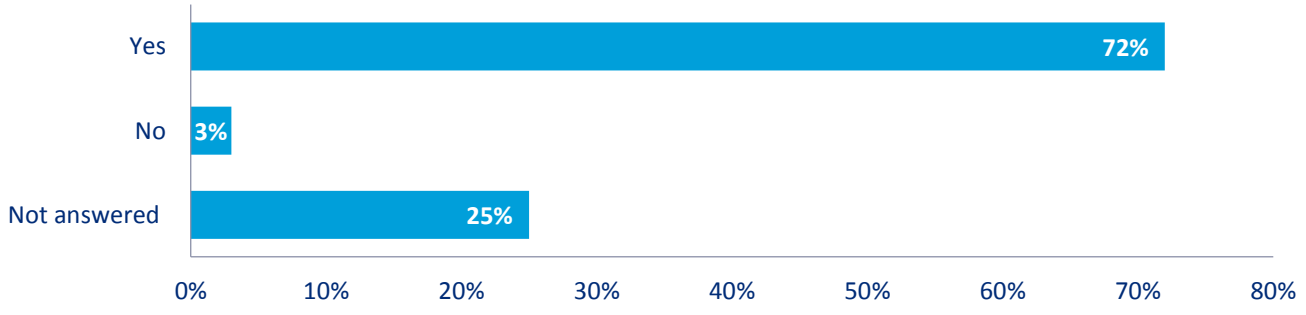


Figure 11: Respondent answers to question 27 of the HNIP consultation

[16] See pages 43-44 of the HNIP consultation document https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532483/HNIP_consultation_vFINAL.pdf

Responses to question 28: If applicable, please indicate what should be monitored instead / as well?

There were 56 responses to this question.

Respondents proposed that the following indicators could or should also be monitored to measure the success of the transition to a self-sustaining heat networks market:

- **length of installed pipework** per annum/customer connections/heat to assess the extent of heat network delivery (quantitative indicator);
- **volume of heat** delivered against investment cost over network lifespan (quantitative indicator);
- **level of customer and sponsors acceptance** of heat networks as a delivery mechanism for heating in urban areas whether planning requirements exist or not; and how informed they are (qualitative indicator);
- **number of skilled contractors, manufacturers and other organisations** operating to deliver schemes at scale compared to current levels (quantitative indicator);
- **extent of the training offer** in place to deliver the capacity, knowledge and skills to be able to deliver and operate heat networks (qualitative indicator);
- **customer heat demand profiles:** This would enable the publication of up-to-date benchmarks thus facilitating a comparison between heat networks and the counterfactual (quantitative indicator);
- **project development timescales** from initial feasibility to the start of construction as it is expected that, over time, the mark of an evolving market is that these would reduce (quantitative indicator);
- **coherence of heat networks** in dense urban areas (qualitative indicator).

Respondents also suggested that:

- whilst monitoring heat network sponsor capacity and capability, it will be important to understand the drivers that make heat sponsors willing participants;
- a ‘district heating portal’ could be created to report on the successes and best practices of the HNIP Pilot for future schemes to learn from.

Responses to question 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)?

There were 63 responses to this question.

Respondents mentioned a number of reports, documents and examples providing evidence. They also suggested that the following measures would facilitate the transition to a self-sustaining heat networks market:

- Stable Government policy maintaining a clear direction for the new build sector on the step changes in carbon emissions which would be expressed in a low carbon strategy, building regulations and planning conditions;

- A more formalised regulatory and commercial framework that will offer appropriate protections to investors and consumers. This should be accompanied by fair business rates and a national energy policy to help heat networks compete fairly with other heat supply systems. This should also include a standardisation of wayleaves and access rights, to install, repair and maintain heat networks, in the same way as for other utilities;
- Increased availability of low cost and preferably flexible capital;
- Improved communication (e.g. with the help of an appropriate detailed engagement plan) between heat network projects stakeholders to speed up the development and improve the implementation of heat networks projects;
- Encouraging secondments from district heating suppliers into local authorities could reduce the need for training of non-specialists for a time limited role in delivering anchor schemes, before moving onto another local authority project;
- To have a team of HNIP advisors on hand, built on a similar model to the HNDU, whose help was described as invaluable by several respondents;
- More standardisation in the specifications (including commissioning), designs and equipment installed as well as increased post construction monitoring and analysis would lead to lower construction and operational costs;
- Lessons from comparable programmes led a respondent to advise not to overly rely on quantitative indicators. It was also found that grants produced largely temporary market effects, while loans were slower and more complex to develop, but tended to have a better potential for market transformation. Research in this area also emphasised that:
  - Market transformation, almost by definition, cannot be achieved by a single programme, particularly not a temporary stimulus. Regulatory changes must accompany/follow the programme, remove the worst performing products and services, and also incentivise forward looking designs that exceed current benchmarks;
  - Using grants will be useful to a point, but should be done with caution. The aim should be to maintain a consistent demand not flood the market with as much activity as quickly as possible. This will make appealing results against short term indicators but will be counterproductive towards long term market transformation unless investors can be convinced this level of activity will be maintained after the funding support expires;
  - Market transformation programmes must carefully consider the gaps in the supply chain, particularly skills gaps and what the role of the program must be in addressing these. The boundaries of the program's involvement in the market are subtle. Some gaps may be addressed through natural market forces when there is clear and consistent demand but this will likely not happen in the programme timescales without specific and dedicated effort.
- Referring to the experience of the development of the PFI / PPP pipeline in different infrastructure sectors, one respondent indicated that the following elements should facilitate the transition to a self-sustaining heat networks market:
  - unambiguous Government support for the programme;
  - a legislative framework which is stable i.e. clarity about any specific consumer protection in relation to heat networks;

- a clear pipeline of deals with an understanding from the market as to the different stages of deals;
- clarity around the Government's assessment process with clear deadlines for when decisions will be made;
- a standardised procurement process with bids passing through the stages quickly;
- standardisation of contractual terms where possible;
- an advisory community who understand the commercial drivers and can add real value;
- an understanding of how funders will price deals and the sources of finance;
- regular collated feedback on deals and information sharing.

- Increase carbon taxes on fossil fuels or reduce what was described by one respondent as the subsidy on domestic oil and gas to establish a level playing field.

Responses to question 30: Is the supply chain ready for accelerated deployment of heat networks?

There were 70 responses to this question. 43% of respondents to the consultation didn't answer this question. The majority (57%) of respondents who answered this question considered that the supply chain is not ready for an accelerated deployment of heat networks.

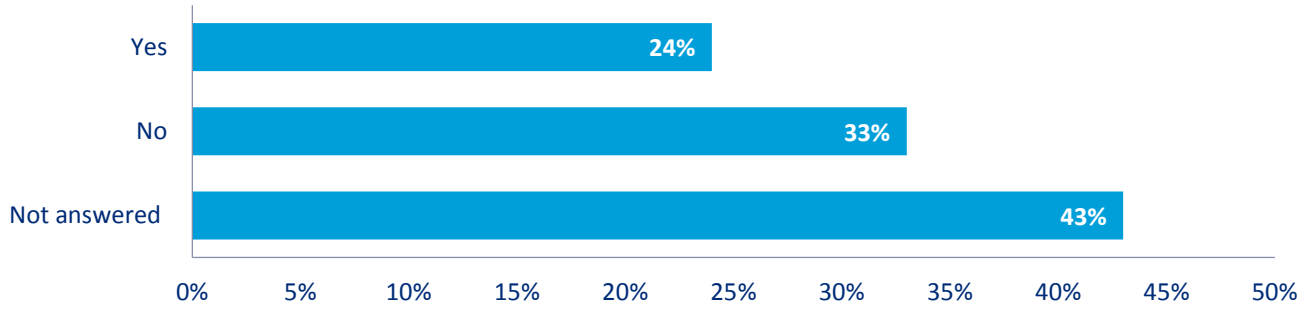


Figure 12: Respondent answers to question 30 of the HNIP consultation

Responses to question 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?

There were 58 responses to this question.

The majority of stakeholders considered that some parts of the heat networks supply chain are ready for acceleration whereas others are not e.g. there is some weakness in the civil contracting market for trenching, consultancy, delivery capability (e.g. project managers, quantity surveyors and estimators), and related works for heat networks installation that would benefit from additional providers. There are also not enough vertically integrated companies in the UK capable of feasibility, design, build and operation. Local authority respondents indicated

that major suppliers are currently struggling to meet current demand with contractors picking and choosing projects due to a lack of competition.

It was highlighted that the procurement process is currently expensive, slow and inefficient, making it harder to attract larger delivery players into the market. It was suggested that mechanisms such as the District Energy Procurement Agency (DEPA) should continue to be supported as a way to address this.

There was also concern among private sector heat network operators that rapid deployment will exacerbate the current problems with the quality of design and implementation of heat networks in the UK (i.e. the quality of schemes in Europe is consistently better), and will bring in new UK based contractors who in reality need some time and training to build up their expertise and knowledge to deliver successful schemes.

It was suggested that the UK has much to learn from European countries that have been successful in developing heat networks such as Sweden and Denmark. However, stakeholders were confident that practices in the EU could easily be transferred to the UK if the Government gives long-term signals to support investment such as helping to increase the number of qualified professionals to design, build, and maintain heat networks. A variety of solutions were suggested by different stakeholders including: developing relevant modules in universities, training consultants to follow the CIBSE ADE Code of Practice CP1:2015, providing apprenticeships for heat networks design/installation and establishing a national centre for heat networks excellence or equivalent.

Respondents considered that the supply chain will develop and grow in reaction to the opportunities in the UK market place. As the projects start being developed and delivered, larger construction companies will see these as sustainable forms of income and should react accordingly. This will also help to drive costs down as these construction companies develop their supply chain and open up partnering opportunities with smaller suppliers in Europe who are present in mature markets but who have been unable to enter the UK market on their own due to not delivering turnkey solutions.

Respondents also stressed that as part of developing the supply chain it is important to educate the customers of the supply chain so that they are able to specify the requirements for their heat network projects well. This will also drive learning in design, specification and construction that will ultimately improve the overall quality of projects.

Government response – Measuring success

The following metrics will be monitored on a project by project basis to measure progress against the HNIP aims:

1. Actual carbon savings from HNIP-supported heat networks based on initial heat sources;
2. Potential additional future carbon savings should heat networks expand or switch to a lower carbon heat source or mix of sources in the future;
3. Contribution towards a self-sustaining market for heat networks (see below);
4. Leveraging of local and private investment;

5. Volume of heat delivered through HNIP supported schemes;
6. Consumer bills on HNIP-supported heat networks (lower than counterfactual);
7. Satisfaction of customers connected to HNIP-supported networks;
8. Grid scale energy system benefits (balancing, demand side reduction (DSR), storage).

The following metrics will be measured to monitor progress towards a self-sustaining market:

- Heat network sponsor capacity and capability (level and coverage);
- Number of consumer connections and satisfaction;
- Supply chain growth;
- Reduction in heat networks implementation costs, including through contractual standardisation and cost-reducing innovation;
- Sufficient supply of finance, reduced perceptions of risk, and reduction in cost of capital;
- Conditions becoming more favourable for investment into heat networks, e.g.:
  a. Aggregation of heat networks into larger portfolios commensurate with institutional investor minimum investment thresholds;
  b. 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.

Glossary of Abbreviations

ADE	The Association for Decentralised Energy
BEIS	Department for Business, Energy & Industrial Strategy
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
LEP	Local Enterprise Partnership
LRVC	Long-Run Variable Cost
NPV	Net Present Value
PWLB	Public Works Loan Board
RHI	Renewable Heat Incentive
SPV	Special Purpose Vehicle

Annex 1: Cost-Benefit Analysis and Responses

Summary

Cost-benefit analysis (CBA) has been undertaken to assess the impact of the capital expenditure support provided to projects through the Pilot Scheme. This updates the CBA published in the HNIP Consultation document technical annex for the whole scheme.

The updated analysis for the Pilot Scheme reflects:

- the approximate scale of the Pilot Scheme. The analysis is based upon an assumption that £27m of capital support is provided. The actual amount provided, up to the available budget of £39m, will depend upon the level of demand from applicants and the outcome of the assessment process;

- an updated view of the assumed costs, performance and technology mix of heat networks, using additional information from project feasibility studies and consultation responses;

- an appraisal of the potential for avoided future heat network deployment costs as a result of HNIP. This assesses HNIP's contribution to reducing the costs of future networks through learning by doing and economies of scale effects.

This updated analysis assesses the social NPV of the Pilot Scheme at £24m, made up of £5m from the deployment of networks supported by the Pilot Scheme and an additional estimated benefit of £19m due to reduced costs of future heat network deployment. The Pilot Scheme is projected to deliver 0.7 MtCO2e total carbon savings over the appraisal period (2017-46).

Across carbon budgets 4 and 5 (2023-2032) it is projected to reduce traded emissions by 0.5 MtCO2e but add 0.4 MtCO2e non-traded emissions. This reflects an assumption that the generation technology mix is weighted towards gas CHP, which generates traded savings but increases non-traded emissions according to the method by which carbon savings are currently scored. This assumption is without prejudice to the projects that are awarded Pilot Scheme funding.

For the whole scheme, these figures scale up to £365m, made up of £141m from the deployment of networks supported by HNIP and an additional estimated benefit of £224m due to reduced costs of future heat network deployment. The carbon savings scale up to 6.5 MtCO2e of total carbon savings over the appraisal period (made up of +9.8 MtCO2e traded savings and -3.2 MtCO2e non-traded savings).

CBA Methodology

Cost-benefit analysis has been carried out to appraise the social costs and benefits of the Pilot Scheme. The CBA compares the costs of meeting a given profile of heat demand[17] in domestic and non-domestic buildings over 2017-2046 by either deploying heat networks or by deploying conventional heating (gas boilers and electric heating) – the 'counterfactual'. Since the same heat demand is met under both heat networks and the counterfactual, the benefits of heat to consumers are assumed to be the same under both and the CBA essentially reduces to a comparison of the costs of meeting that heat demand.

The monetised costs are profiled over 2017-2046 and are discounted to the start of 2017 using the HMT Green Book social discount rate of 3.5%[18]. The social NPV of the HNIP Pilot Scheme is then determined as the present value of the costs and benefits of meeting the heat demand by deploying the counterfactual technologies minus the present value of the costs and benefits of meeting the heat demand by deploying heat networks i.e. if the social costs of deploying heat networks are lower than for the counterfactual, heat networks have a positive social NPV.

Scaling and technology mixes

The heat demand profile has been scaled to a level that represents full utilisation of the £27m HNIP capital budget for 2016/17. The CBA assumes this £27m leverages total network capex of £210m in 2017, with network operations commencing in 2018 delivering ~0.25TWh heat per year.

The degree to which HNIP support will leverage in other sources of funding is a key assumption to be tested through the pilot scheme as this will determine the scaling of costs and benefits to be delivered through the project. Replacement capex is also included in the CBA where equipment needs to be replaced within the appraisal period.

The assumed heat generation technology mix for the Pilot Scheme has been informed by a review of projects known to BEIS that could potentially apply, though this is only for the purposes of conducting the CBA i.e. it is without prejudice to the outcome of the Pilot Scheme application assessment. This review suggested a generation mix weighted towards gas CHP and some Energy from Waste (EfW) schemes as well – see Table 1. The CBA assumes that future policy encourages substitution of gas CHP as a heat source once CHP engines installed in 2018 reach the end of their life (assumed to be 15 years). The rationale is that electricity grid decarbonisation will potentially reduce/eliminate the carbon savings realised by gas CHP by the mid-2030s.

[17] This heat demand has been scaled in accordance with the expected level of investment in Heat Networks as a result of the assumption that the Pilot Scheme provides £27m of support in grants and loans.

[18] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

Table 1 – Assumed Heat Networks and Counterfactual Technology Mix for HNIP Pilot

Heat networks technology mix % of total heat demand met by technology	2018-2032	2033-2046
Gas CHP	55%	0%
Biomass boiler	0%	40%
EfW incinerator CHP heat	20%	30%
Recoverable heat from industry	20%	15%
Gas boiler (backup and peak heat demand)	25%	15%
Counterfactual technology mix % of total heat demand met by technology	2018-2032	2033-2046
Gas boilers	70%	70%
Electric storage heaters	30%	30%

On the counterfactual side it is assumed that 70% of the heat demand is met from gas boilers and 30% from electric storage heating. It is assumed that new boilers and electric heaters are installed in 2018 and are replaced within the appraisal period when they reach the end of their lives.

Costs and benefits included in the CBA

The costs and benefits considered in the CBA are:

- **Capital costs.** For heat networks this includes the costs of heat generation technology, thermal storage, network infrastructure (transmission and distribution pipes) and building connections/retrofit costs. For the counterfactual this includes the cost of gas boilers and electric heaters. The appraisal includes replacement capital costs if equipment lifetimes expire within the appraisal period and also accounts for the residual value of capital costs where their economic life extends beyond the appraisal period.

- **Operation and maintenance costs.** This includes operation and maintenance costs (for both heat networks and counterfactual technologies) and also the network administration required to run heat networks[19].

- **Fuel costs.** On the heat networks side this includes the gas, electricity and biomass fuel costs for heat generation and the electricity costs of pumping hot water and steam

[19] It is assumed that the heat network administration costs are those *incremental* to the counterfactual. Under the counterfactual there would be administration costs for provision of gas and electricity (assumed dual-fuel) by energy suppliers. Under the heat networks scenario it is assumed that these counterfactual admin costs would remain as buildings would still need to be supplied with electricity. Therefore the incremental admin cost under the heat networks scenario vs. the counterfactual scenario is the additional admin cost of operating the heat network.

around the networks. On the counterfactual side this includes the gas and electricity fuel costs for generating heat through boilers and storage heaters. Energy consumption is valued using 2015 Long-Run Variable Cost (LRVC) energy cost series taken from the data tables supporting "HMT Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal" (adjusted to 2016 prices)[20].

- **Carbon emissions.** This covers the carbon emissions associated with the fuel consumption to meet the assumed heat demand. These are valued using the 2015 traded and non-traded carbon price series (adjusted to 2016 prices) taken from the data tables supporting "HMT Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal" depending upon whether the emissions occur in the traded or non-traded sector.

- **Air quality.** Air quality impacts as a result of fuel consumption are valued using Defra projections of air quality costs for fuel use as provided in the data tables supporting "HMT Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal".

- **Electricity generation.** Gas CHP sourced heat networks generate electricity as well as heat. Therefore the analysis accounts for the cost of producing the same amount of electricity under the counterfactual. This cost is monetised using the Long-Run Variable Cost (LRVC) energy cost series taken from "HMT Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal".

In addition to the above, the CBA for the pilot has considered the impact of HNIP in terms of reduced costs of future heat network deployment. Two impacts have been assessed – a reduction in future network capital costs as a result of "learning by doing" arising from HNIP supported projects and secondly, a reduction in future costs due to economies of scale gains as a result of HNIP encouraging deployment of larger networks than would otherwise occur. These cost savings have been assessed on the basis of potential heat network deployment in the second half of the 2020s and discounted to 2017. A more detailed explanation of this assessment is given below.

Non-monetised costs and benefits

A number of potential costs and benefits of heat networks remain un-monetised and are not included in this analysis. These include:

- the option value of delivering a self-sustaining market in heat networks i.e. the value of being able to deploy networks in greater volume in the future and utilise the infrastructure to exploit low carbon sources of heat that cannot otherwise be accessed;

- potential electricity system balancing benefits from networks with thermal storage. Larger heat networks are the most strategically important in making a low carbon power supply sector more resilient, by delivering an option to store intermittent peaks in

[20] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

electricity generation in the form of hot water. If taken up, this could provide cost effective energy storage and offer security of supply benefits;

- avoided infrastructure costs of maintaining the gas grid – once heat network deployment reaches critical mass in a given area.

3. HNIP Pilot CBA Results

The CBA results for the HNIP pilot are presented below in Tables 2 and 3. The social NPV of the project is £24m under central carbon and energy cost assumptions. Table 3 illustrates that heat networks have higher capital and operating costs than under the counterfactual but that the use of gas CHP and waste sources of heat deliver fuel and electricity cost savings.

Table 2: HNIP Pilot CBA (2017-2046). 2016 prices.

Social NPV (£m)	**£24m**
Heat Demand Met (2025)	0.25 TWh

Table 3: HNIP Pilot CBA - Breakdown

£2016 prices, discounted to end 2016	Heat Networks	Counterfactual	Difference (Total = Social NPV)
Capital Equipment	£225m	£56m	-£169m
Operation & Maintenance	£116m	£71m	-£45m
Fuel	£170m	£235m	£65m
Traded carbon	-£17m	£10m	£27m
Non-traded carbon	£76m	£67m	-£9m
Air quality	£14m	£5m	-£9m
Electricity	N/A	£146m	£146m
Sub-total (Direct NPV from Pilot Scheme projects)	**£584m**	**£590m**	**£5m**
Learning by doing (avoided future cost)	-£4m	N/A	£4m
Economies of scale (avoided future cost)	-£15m	N/A	£15m
Total (Including reduced cost of future deployment)	**£565m**	**£590m**	**£24m**

Note: Totals/sub-totals/differences are subject to rounding

Sensitivity testing has indicated how sensitive these results are to variations in key assumptions. Chart 1 below shows the social NPV is most sensitive to high carbon prices and high capex values. All factors shown vary the social NPV by between £10m and £20m around the central estimate of £24m giving a range of £7m-£44m.

Chart 1: HNIP Pilot CBA – Sensitivity Analysis

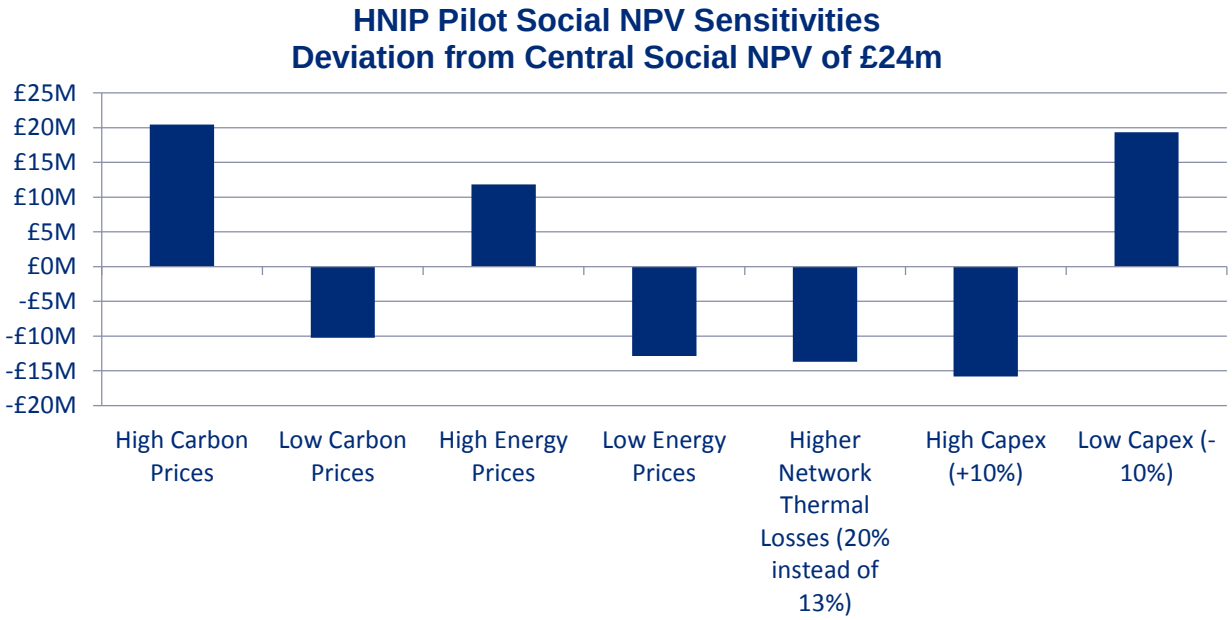
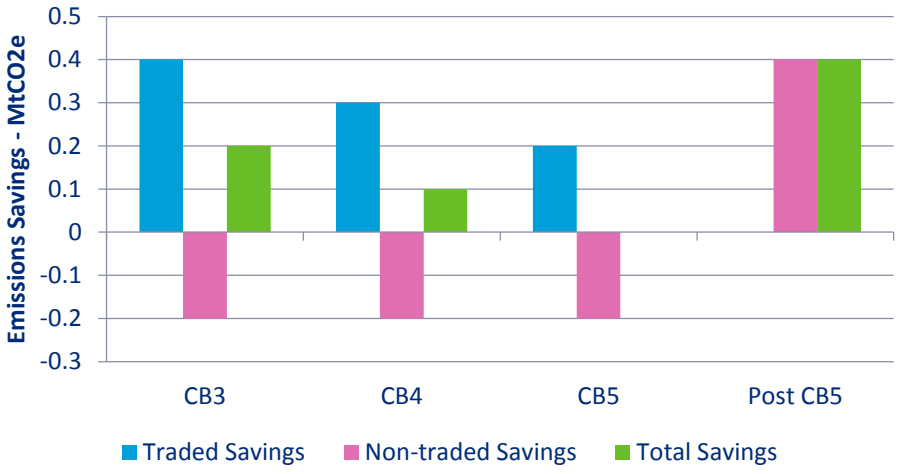


Chart 2 shows the projected carbon savings for the HNIP pilot. The pilot is projected to deliver overall carbon savings of 0.7 MtCO2 though with different impacts on the traded and non-traded sectors. This is due to the prevalence of gas CHP projects in the potential project applicant pool. Gas CHP networks operating in the non-traded sector reduce traded sector emissions by displacing electricity grid emissions but add to non-traded emissions as they have lower thermal efficiencies than building level gas boilers.

Beyond the early-mid 2030s, gas CHP networks are expected to be replaced by lower carbon heat source technologies as they reach the end of their operational lifetimes, at which point significant (non-traded) carbon savings can be realised.

Chart 2: HNIP Pilot – Projected Carbon Savings



4. CBA changes since the Consultation

For the HNIP as a whole, the CBA analysis for the Pilot Scheme would scale up to £365m and 6.5 MtCO2e of total carbon savings over the appraisal period – Table 4. However, this assumes the same generation technology mix; later tranches of HNIP support may attract a more diversified mix, affecting the projected social NPV and carbon savings for the whole scheme. These figures compare to £277m and 13.5 MtCO2e of total carbon savings as assessed at consultation stage. The differences result from updates to the evidence and assumptions underpinning the CBA, including some based upon consultation responses, summarised below.

Table 4: HNIP Scheme CBA – Scale-up of Pilot

£2016 prices, discounted to end 2016	Heat Networks	Counterfactual	Difference (Total = Social NPV)
Capital Equipment	£2,333m	£570m	-£1763m
Operation & Maintenance	£1,192m	£724m	-£468m
Fuel	£1,825m	£2,463m	£638m
Traded carbon	-£231m	£111m	£342m
Non-traded carbon	£844m	£719m	-£125m
Air quality	£137m	£51m	-£86m
Electricity	N/A	£1,603m	£1,603m
Sub-total (Direct NPV from Pilot Scheme projects)	**£6,101m**	**£6,242m**	**£141m**
Learning by doing (avoided future cost)	-£44m	N/A	£44m
Economies of scale (avoided future cost)	-£180m	N/A	£180m
Total (Including reduced cost of future deployment)	**£5,877m**	**£6,242m**	**£365m**

Note: Totals/sub-totals/differences are subject to rounding

Responses to the HNIP consultation and a review of project data from the HNDU pipeline have informed various changes to the costs and performance assumptions for heat networks.

Key changes include: an increase in the assumed costs of retrofitting domestic buildings to enable them to join a network[21], lower average network load factors, inclusion of development costs and improved thermal efficiencies/reduced costs of counterfactual heat technologies. These were partially offset by the change in the heat source mix to include more gas CHP as informed by project pipeline data, reductions in the capital costs of utilising heat from EfW plants and industrial heat sources and modelling adjustments to account for the residual value of assets whose lifetimes extend beyond the appraisal period.

[21] Significant costs are incurred when installing pipework, heat interface units, heat meters and wet systems in order to convert domestic buildings from using gas boilers or electric storage heaters to become heat network ready.

The increase in the assumed costs of heat networks also partly explain the reduction in total carbon savings achieved from the fixed £320m HNIP support. That reduction is also explained by the improved counterfactual thermal efficiency assumptions and also a correction to account for the fact that gas CHP engines have a 15 year lifetime so are likely to be substituted later than 2030.

Additional benefits arising from HNIP deployment of heat networks have been monetised in this assessment. These concern reduced costs of future heat networks deployment as a result of learning by doing through HNIP and realising scale economies through an increased average size of networks. The present value of these avoided future costs attributable to HNIP have been estimated at £44m and £180m for the scheme respectively. The method for estimating these avoided costs is set out below.

Estimation of Learning by Doing and Economies of Scale benefits

Learning by Doing benefits

It is well established that building more assets will, over time, become cheaper through learning by doing effects. In a nascent market this is particularly true. The heat networks market is relatively well established compared to other, less mature markets, but the composition of these networks is skewed heavily towards the smaller end.

BEIS expects learning by doing benefits to come from HNIP delivering larger, lower carbon and more efficient heat networks that have not been deployed at significant scale to date in the UK, and are more strategically important to the country's future energy management and carbon targets.

These learning by doing benefits have been quantified by determining which types of network schemes are likely to come forward as a result of HNIP, based on the Heat Networks Delivery Unit's pipeline of projects. It is assumed that these will be representative of projects that will be delivered over the second half of the 2020s, once HNIP has been able to impact the wider market. From this information, around 15% of projects are significantly larger (in terms of their installed heat capacity) than networks already in place throughout the country.

For the purposes of this analysis we assume an additional 10TWh of heat per year will be met from heat networks in 2030 versus 2025[22]. We estimate approximately 5TWh per year of this would be delivered by the 15% of larger projects in the mix.

A learning by doing rate has been applied to the cost of deploying these additional, larger heat networks, based on the Low Carbon Innovation Coordination Group's Technology Innovation Needs Assessment (TINA) for Heat[23]. This publication suggests a likely cost reduction of 3% by 2025 from learning by doing effects, with a further 5% possible from research and development. Although the HNIP will be incentivising more efficient and higher performing

[22] This is within external estimates of potential increases in deployment in the 2020s. For example, Element Energy's central scenario for the Committee on Climate Change projects an increase in heat supplied by networks from 13 TWh in 2020 to 42 TWh in 2030. Research on District Heating and Local Approaches to Heat Decarbonisation – A Study for the Committee on Climate Change (Element Energy, 2015)

[23] http://www.lowcarboninnovation.co.uk/working_together/technology_focus_areas/heat/

networks to come forward (e.g. driven by best practice in technical standards and implementing efficiencies demonstrated by the £7m Heat Networks Innovation Programme), it is not an R&D programme. For this reason, we limit the assumed cost reduction to 3%.

Applying this learning rate to the capital costs of the larger networks delivering the additional 5TWh per year by 2030 from larger networks delivers an additional present value benefit of £44m from HNIP as a whole. For the Pilot Scheme this benefit has been apportioned according to its share of the total investment in networks projected to be delivered by HNIP.

Economies of Scale benefits

In addition to the learning by doing effect, there is value in shifting the market's delivery of heat networks to those with larger installed heat capacity, as these experience economies of scale. If as a result of HNIP, the size of the average heat network required to deliver the additional 10TWh of heat per year between 2025 and 2030 was just 1MWth larger, we estimate the capital costs would be around 4% lower. Therefore, realising such economies of scale could deliver a present value benefit of £180m for HNIP as a whole. For the Pilot Scheme this benefit has been apportioned according to its share of the total investment in networks projected to be delivered by HNIP.

Annex 2: List of consultation respondents

122 consultation responses were received; 44% of which were from public sector stakeholders, 39% from private sector commercial respondents, 13% from private sector not for profit respondents and 4% from individuals.

The bulk of responses were from Local Authorities (34%), advisors/consultancies (13%), private heat network operators (8%), heat network supply chain companies (7%), not for profit organisations and umbrella bodies/observers (7% each) as detailed below:

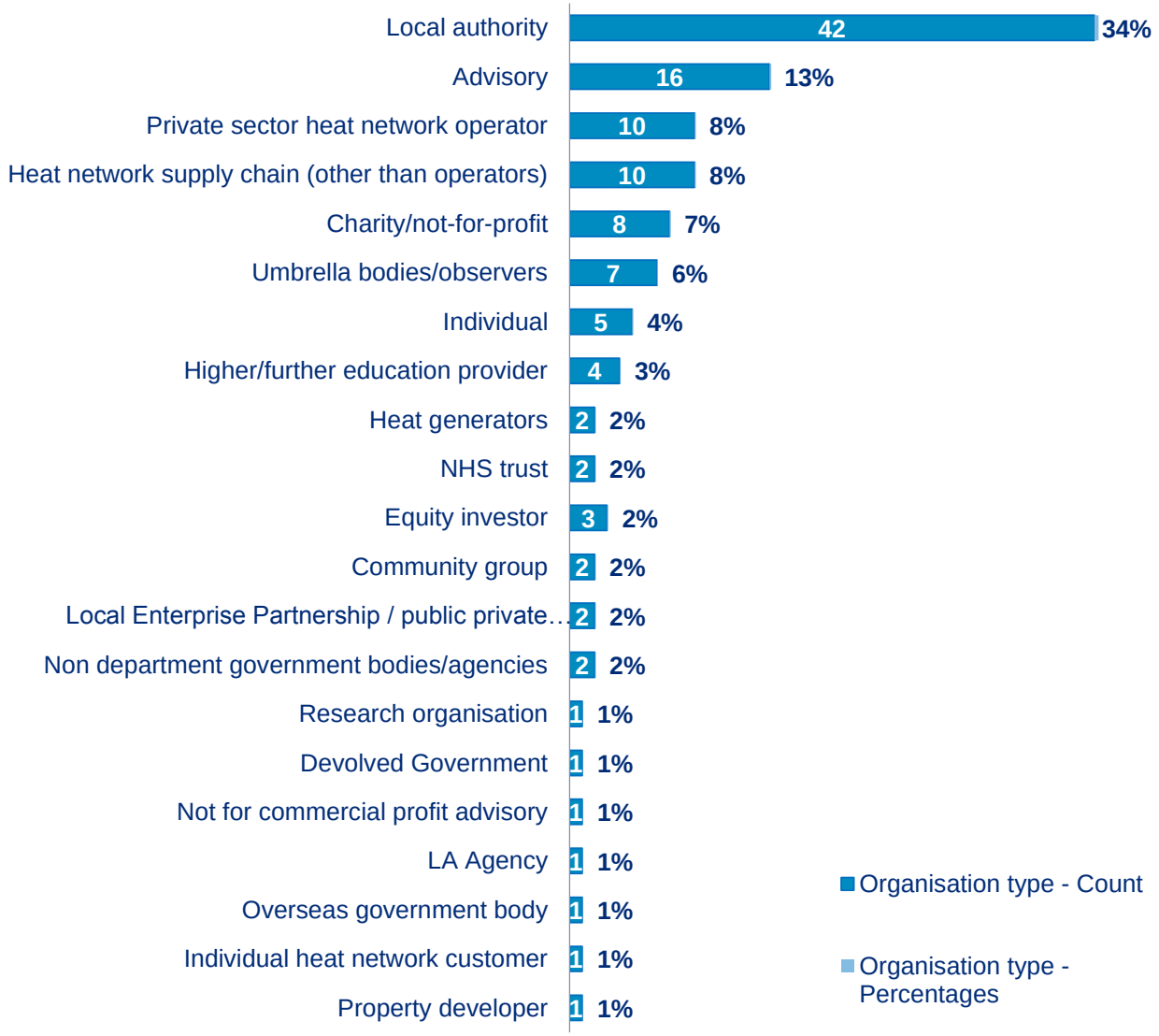


Figure 1: Proportion and number of respondents to the consultation per organisation type.

The organisations listed below were identified from their consultation responses. However, it was not clear in every circumstance if an individual was responding in a personal capacity or on behalf of the organisation attributed to their name. Individual responses are not listed.

Table 1: List of organisation having provided a response to the HNIP consultation.

ADBA - Anaerobic Digestion and Bioresources Association	Cenergist Limited	Edf energy
Allerdale Borough Council	Cherwell District Council	Encraft Ltd
Amber Infrastructure	Cheshire West and Chester Council	ENER-G
Angus Biofuels	CIBSE – Chartered Institution of Building Services Engineers	Energy Advisory Associates
Avantigas	Citizens advice	Energy Effective Ltd
Bath & North East Somerset Council	City of Bradford Metropolitan District Council	Energydirection Limited
Bioregional	City of London Corporation	ENGIE
Bridgend County Borough Council	Colchester Borough Council	Exeter and East Devon Low Carbon Taskforce
Brighton & Hove City Council	Community Energy England	Exeter City Council
Bristol City Council	Community Works CIC	Forestry Commission - South East England
British gas	Crawley Borough Council	Frank Mills Consulting Ltd
British Geological Survey	Danish Embassy Trade Council	Fuel Poverty Action
Bromsgrove District Council	Doosan Babcock	GDC Group Ltd
Brookfield Utilities UK	Drax Power Limited	Grant Thornton
Buckinghamshire County Council	E.on	Greater London Authority
Camden Council	East Hampshire District Council	Greater Manchester Combined Authority
Canal & River Trust	EAUC – Environmental Association for Universities and Colleges	Green Fox Community Energy Co-operative
Carbon Alternatives Ltd	Eden District Council	Greenfield
CBxchange	North East Lincolnshire Council	Ground Source Heat Pump Association
Herefordshire Council	Nottingham City Council	Stoke-on-Trent City Council
ICAX Ltd	Orchard Partners London Ltd	Swindon Borough Council
Ingenious Energy	PassivSystems Ltd	Tarmac
Ionica Energy	Plymouth City Council	Tees Valley Combined Authority
Islington Council	Procure Plus	Teignbridge District Council
Kirklees Council	Redditch Borough Council	The Association for Decentralised Energy
Leeds city council	Regen	The Carbon Trust
Leicester city council		
Lewisham Council		
Liverpool City Region LEP		

London Borough of Lambeth Council	Regen Energy	Transport for London
London Councils	Renewable Energy Association	UK District Energy Association
London Legacy Development Corporation	Royal Devon and Exeter NHS Foundation Trust	UK Energy Research Centre
London South Bank University	RWE npower	UK Green Investment Bank plc
Low Carbon	Sheffield City Council	University of Edinburgh
Luton and Dunstable University Hospital	Solar Trade association	University of Exeter
Max Fordham LLP	South Gloucestershire Council	University of Oxford
Minerals Products Association	Spark Assessment Services limited	Veolia
Mouchel	Springbok Sustainable Wood Heat Co-operative	Waste Heat Engagement Group
National Trust	SSE Enterprise Heat	Welsh Government
Newcastle City Council	Stockton Borough Council	Westminster City Council
		Wiltshire council
		Woking Borough Council
		Worcestershire County Council

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