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HEAT NETWORKS INVESTMENT PROJECT EVALUATION

Pilot Process Evaluation Report

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HEAT NETWORKS INVESTMENT PROJECT EVALUATION: PILOT PROCESS

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

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Executive Summary

Introduction

Heat networks typically convey hot water from a central heat source (or sources) to meet demand for space and water heating distributed across a number of buildings. Some networks also provide cooling. Heat networks, also known as district heating systems, are important because they can offer significant carbon savings. They can deliver heat from a range of sources, such as waste heat recovery, combined heat and power (CHP), and large heat pumps. Compared with property level heating, the economic case for heat networks can be challenging. This is due to the high initial capital costs (compared with individual gas boilers, say), the need for guaranteed demand underpinned by long-term contracts, and relatively low returns over long payback periods.

To address this and other challenges, the Department for Business, Energy and Industrial Strategy (BEIS) implemented the Heat Networks Investment Project (HNIP), which is planned to run from 2016 to 2021. The main objective of the scheme is to contribute to the development of a heat networks market that is self-sustaining and not reliant on Government subsidy. HNIP provides capital support – the pilot offered grants and loans – for the commercialisation and construction of heat networks in England and Wales. As well as new heat networks, the HNIP offers support for the refurbishment, expansion, or interconnection of existing heat networks.

Recognising the complexity of heat network schemes and HNIP, BEIS implemented a HNIP Pilot scheme (that focused on the public sector only). The primary objective of the HNIP Pilot was to provide learning to be used to maximise the smooth running, impact and value-for-money of the planned main scheme. Over the period from October 2016 to May 2017, the pilot proceeded as follows: a pre-qualification stage; a full application stage; an assessment and clarifications stage; a scoring, panel and award stage (funding decisions were announced in March 2017); and a funding agreement stage for successful applicants. The HNIP Pilot follows the introduction in 2013 of the Heat Network Delivery Unit (HNDU). HNDU provides early stage grant funding and guidance support to local authorities in England and Wales to progress the development stages of heat networks projects (from heat mapping through to early commercialisation).

To be eligible for HNIP pilot funding, schemes had to meet two key criteria. First, they had to demonstrate the existence of a ‘funding gap’. This implies that the heat network that is described in the application could not go ahead without HNIP funding, thus attempting to ensure that the Government only supports networks that could not proceed independently; this is the principle of ‘additionality’. Second, to ensure that they are highly likely to be delivered; schemes had to demonstrate that they were at an advanced stage of development. More specifically, they had to be sufficiently mature – implying that all

design, technical, contractual and legal are largely resolved – and be very confident about their costs and revenues. Another way of putting this is that schemes had to be in a position to take a decision to proceed. Applicants were able to apply for funding for 'construction' only, and for 'commercialisation and construction'. Schemes that applied for 'commercialisation and construction' funding did not need to be as advanced as schemes that applied for 'construction' funding only.

BEIS has commissioned a suite of independent process and impact evaluation activities to cover the full HNIP scheme (the pilot scheme and the anticipated main scheme). This report focuses on the HNIP pilot process, and is the first of several that BEIS plans to publish between now and the end of the HNIP scheme. Based upon the pilot evaluation aims, and themes emerging from the research as it proceeded, this report focuses on five key research questions:

1. What were the successes and challenges in the HNIP pilot process (from policy development and implementation, through the pre-qualification, application and assessment stages, to awards and work on the funding agreements)?

2. What are the patterns in the characteristics of the successful and unsuccessful pilot applications?

3. What are stakeholders' (applicants, non-applicants, supply chain members, industry bodies, and third party investors) perspectives on the status of and challenges in the current heat networks market?

4. In particular, what financial barriers and preferred types of finance are identified by stakeholders?

5. What are stakeholders' perspectives on: their early responses to HNIP, the early impacts of HNIP (including in the heat networks development pipeline) and the potential longer term impacts of HNIP (including potential barriers to success)? This question is addressed in Chapter 4.

We synthesised and triangulated evidence and findings from across the following research activities to answer the research questions:

- We conducted fifty eight semi-structured interviews with: the project team in BEIS (13 interviews), the HNIP Pilot delivery body (1), successful pilot applicants (8), unsuccessful pilot applicants (8), non-applicants (organisations that could have applied to the pilot but did not) (5), representatives of the heat network supply chain (18) and potential third party investors (5)

- We undertook documentary analysis of HNIP documents, including: the consultation materials, the pilot applicant guidance, internal project documents and reports, and pilot application, assessment and feedback materials.

- We completed a simple numerical analysis of the characteristics of the successful and unsuccessful applications using SPSS and Excel, based upon information contained in the pilot applications.

Key findings

Design of HNIP Pilot

Policy design and development process

The BEIS policy team stated that the HNIP Pilot policy design and development process took place within compressed timescales and in a context of staff constraints. This meant that policy development and implementation were often happening concurrently, with implications for the application and assessment process (discussed below). The successful development of HNIP in these timescales was heavily dependent on a small number of officials – with substantial technical and commercial knowledge – who led and championed the project.

Administrative design

There were concerns among some applicants that there may be a fundamental tension between two key HNIP eligibility requirements: to demonstrate a funding gap (to ensure additionality) and to be at an advanced stage of preparation. This is because, in practical terms and in some institutional contexts, it is not always possible to be at an advanced stage of preparation – or even to begin to address issues such as contracts and procurement – when there is a funding gap. This raises the prospect that 'additionality' is not being fully achieved within the HNIP Pilot. At the same time, applicants – both successful and unsuccessful – also stressed that the HNIP Pilot was supporting schemes that would not otherwise be financially-viable.

Overall stakeholder response

The objectives of HNIP, the HNIP pilot and the pilot evaluation were widely understood and supported in the heat network market (among pilot applicants, non-applicants, the supply chain and third party investors). Stakeholders also appreciated that considerable planning by BEIS has gone into the pilot project and there is some optimism about the potential of HNIP to support the heat networks market. At the same time, they raised a number of concerns about: the HNIP pilot application process, the challenges that the heat network market faces (for instance, relating to the economic case, knowledge and skills), and the possibility that HNIP and other current heat network market activities may not overcome these. We discuss these in more detail below under immediate impacts.

The pilot application and assessment process

Pilot applicants agreed that the application process followed a logical path, made use of a well-designed web-portal and was typically well-supported by the HNIP teams in BEIS, the Heat Network Delivery Unit and Salix (the HNIP Pilot delivery body). The HNIP teams worked well together and were responsive to challenges that emerged during the pilot application and assessment period.

The pre-qualification stage

The BEIS teams felt that the pre-qualification stage – which took the form of a self-completion form with no oversight from BEIS – largely worked well in eliminating ineligible

applications. In addition, several non-applicants told us that they realised that their scheme was insufficiently mature for the HNIP pilot either at or before the pre-qualification stage. However, several unsuccessful applicants observed that their schemes easily passed through the pre-qualification stage despite having features that made them ineligible for the HNIP Pilot. The BEIS team agreed that this was an issue.

Challenging timescales

BEIS and the HNIP Pilot applicants reported that the pilot application and assessment process took place within highly constrained timescales: just over one month for the pilot applications to be developed and submitted, and only slightly longer for the assessment and clarification process (which also included the Christmas and New Year break). This was very challenging for both applicants and the BEIS assessment teams. The challenge was exacerbated for the applicants by what they saw as the excessive size and complexity of the application task, in terms of the data and evidence required. The HNIP financial model template was particularly challenging for applicants. In addition, applicants were disappointed that the initial applicant guidance document was not published until the day that the application window opened.

Application quality and assessment

BEIS and the HNIP Pilot applicants also agreed that these challenging timescales and related issues adversely affected the quality of the applications, particularly the financial data. For example, some applicants found that their own financial models had structures that did not lend themselves easily to the BEIS template, such as where costs were categorised quite differently. In turn, according to both the BEIS assessor teams and the applicant teams, this magnified the challenges during the assessment and clarification process. These difficulties resulted in a need for more clarifications than had been anticipated, and applicants and BEIS teams alike noted that this was an inefficient process (for instance, the same clarification was requested by more than one assessor). Although, all parties ultimately dealt with the challenge, some applicants raised the possibility that this had adversely affected the quality of the assessments. Both applicants and assessors valued the opportunities that arose for telephone conferences to address queries, particularly relating to the financial input data and model, and agreed that greater use of these and face-to-face meetings would have been of value.

Scoring and awards

Applications that passed the assessment stages were scored. The applicants and BEIS teams reported that the final scoring, awards panel process and signing of funding agreements were also conducted at pace leading to further pressure. In that context, it was particularly helpful that the membership of the awards panel that made the final decisions was unchanged throughout, to ensure consistency of approach.

Pilot awards

The HNIP pilot received 25 full applications, which was within the range that BEIS expected. These applications requested £78.5m in grant funding, supporting a total capital expenditure of £263m. Nine awards – with total funding of £24.2m (£15.7m in grants, and £8.5m in loans) and supporting a total capital expenditure of £75.1m – were made in the pilot. The pilot scheme has therefore provided support of approximately 22% of the total capital expenditure required. Although this is higher than the 10-20% that is expected in the main HNIP scheme, BEIS expected a higher percentage in the pilot due to the lower numbers of expected applicants compared to the main scheme.

Patterns in the awards

Analysis does not show any unexpected or inappropriate patterns in the characteristics of the successful and unsuccessful pilot applicants.

Heat Network Delivery Unit (HNDU)

Applicants in local authorities consistently cited the importance of earlier HNDU support to their progress through HNIP. It is also the case that the three non-local authority pilot applications – which did not have access to HNDU support – were all unsuccessful for a variety of reasons. At the same time, there were two successful HNIP Pilot applicants that had not received earlier HNDU support.

Immediate effects

Snapshot of the current UK heat network market

Interviews with applicants and the supply chain suggest that the heat network market has some of the characteristics of what the academic literature describes as a ‘developing niche technology market’. For instance, it is reported that the market is growing, though relatively slowly, and that companies are investing in skills development, research and development, and marketing. According to the interviewees across the heat networks supply chain and third party investors, three key challenges constrain growth in the heat networks market. Primary among these, and supporting the rationale for HNIP, is the challenging financial environment for heat networks. Potential third party investors perceive risks to be relatively high given the returns available, and think that individual heat networks are too small as investment opportunities. They are particularly concerned about demand risk, the challenge of securing anchor load customers, and construction risk (related to the potential for time and cost over-runs).

Second, stakeholders also emphasised an emerging shortage in the supply of knowledge and skills (within local authorities, technical consultants, financial consultants, design services, procurement, construction and commissioning). This may keep costs high, raise concerns about quality, and affect delivery. Finally, several stakeholders were concerned about the lack of regulation for heat networks, and uncertainty over its future direction.

Immediate effects of the HNIP pilot

According to our interviews with stakeholders, the HNIP pilot is sending a positive signal to the heat networks market in terms of government support, particularly for the large-scale public sector market. This is reflected in: growing interest from consultants and technologists and greater confidence to invest in skills, expertise and marketing. It is also reflected in increased activity in the heat networks development pipeline. Interviewees were clear that HNIP has the potential to boost the UK heat networks market.

Not surprisingly, the immediate effects on successful and unsuccessful applicants were different. In successful applications, further HNIP heat network plans are already in development with support from senior management. Where their applications were unsuccessful, organisations were reassessing individual schemes, and HNIP as a source of funding. We note however, that one applicant whose applications had not succeeded found the feedback useful for future development of their plans, including applying to the main HNIP scheme.

Longer term predicted impacts

It is too early to comment with certainty on the longer term impacts of HNIP, and this will be addressed later in the HNIP evaluation. At this early stage, stakeholders offered mixed views. Some stakeholders suggested that there are grounds for optimism that HNIP will – as is BEIS' objective – help support the establishment of a self-sustaining UK heat networks market. At the same time, others observed that this potential could be compromised if other challenges – such as shortages of skills and knowledge, and regulatory issues – are not also effectively addressed.

Contents

Glossary

Term or acronym	Definition or explanation
Additionality	The extent to which something happens as a result of an intervention that would not have happened in the absence of the intervention.
Anchor load	A long-term, stable and predictable demand source. It provides heat network developers with security that the heat produced will have a buyer and helps to optimise technical efficiency by reducing variability in the level of demand
BEIS	Department for Business, Energy and Industrial Strategy, formerly Department of Energy and Climate Change.
Borrowing limit	The maximum amount that a financial institution will lend to an organisation. This may be based on a whole range of different factors such as assets that can be used as security for borrowing, past and future expected revenues, and other existing liabilities.
CAPEX / OPEX	Capital Expenditure / Operating Expenditure
CHP	Combined heat and power – sometimes called co-generation. Combines electricity and heat, because the waste heat from thermal electricity generation is captured and used.
CHPQA	CHP Quality Assurance – the CHPQA is a government initiative providing a means of assessing CHP schemes in the UK. CHPQA certification demonstrates a level of quality and is necessary for eligibility for a range of benefits.
Counterfactual	A counterfactual is what would have happened without the change or intervention being considered. For example, for a local authority installing a heat network serving several

Term or acronym	Definition or explanation
	blocks of flats, the counterfactual might be individual gas boilers in those flats, or electric storage heating.
DECC	Department of Energy and Climate Change, now Department for Business, Energy and Industrial Strategy (BEIS).
Decentralised energy	Energy (for example electricity, or heat) that is produced close to where it will be used.
Delivery body	In this report the 'delivery body' is the organisation commissioned by BEIS to carry out a range of functions associated with administering the Heat Networks Investment Project pilot, including acting as the key point of contact for applicants and processing applications.
District heating	A scheme that provides heat generated at a central location to nearby buildings.
Funding gap	The gap between the amount of money available to a project from existing sources and the amount needed to fund development of the project so that it can proceed to operation.
Future-proofed	Designed and developed in a manner that considers and takes account of a range of potential future events and changes in relevant drivers (for example commodity prices) to reduce the risk that significant changes will be required in the future to accommodate such changes.
Gearing	Gearing is a financial measure that indicates how much of an organisation's activities are funded by its owner's funds compared with creditor's funds. It is often expressed as a ratio of debt to equity, but can also be expressed as the ratio of earnings to interest payments (also known as interest cover), or of debt to assets. Funders may set limits on the values of such ratios that they will allow, managing credit risk.

Term or acronym	Definition or explanation
Heads of Terms	A Heads of Terms agreement provides the basis for a future agreement between two or more organisations. It sets out the terms of a commercial transaction agreed in principle between parties in the course of negotiations.
Heat interface unit	Heat interface units act as a bridge between the central source of hot water (or sometimes steam) in distribution pipes, and the heating and hot water systems of individual buildings, or individual apartments.
Heat network	A heat network is a distribution system of insulated pipes that takes heat from a central source and delivers it to a variety of customers in separate buildings. These typically include public sector buildings, shops and offices, sports facilities, university buildings, and homes.
HMT	Her Majesty's Treasury, the UK finance ministry
HMT TAP	HMT Treasury Approvals Point – this is the process by which HMT scrutinises and approves project spending above a certain specified limit for each government department.
HNDU	Heat Network Delivery Unit – this BEIS team provides support and guidance to local authorities in England Wales who wish to explore heat network opportunities.
HNIP	Heat Networks Investment Project
HNIP Pilot delivery body	The organisation commissioned by BEIS to carry out a range of functions associated with administering the Heat Networks Investment Project Pilot, including acting as the key point of contact for applicants and processing applications.
Hurdle rate	The minimum value of a rate (such as an internal rate of return) that an investor (internal or external) requires to consider investing.

Term or acronym	Definition or explanation
IRR	Internal rate of return - a measure that is sometimes used in capital budgeting and project appraisal as a measure of profitability. It is calculated as the discount rate that gives a net present value of zero.
kW / MW	Kilo-Watt / Mega-Watt. Most often used in this context as a measure of the heat supply capacity of a system or appliance. Can also be the rate of supply of energy (heat).
kWh	A measure of quantity of heat (equivalent to the quantity of heat supplied at a rate of 1 kW, for an hour)
LA	Local authority
NPV	Net present value – a measure used in project appraisal and capital budgeting to assess the financial return from a project adjusting for time (also see social NPV).
Project sponsor	The entity that initiates the heat network project – they may or may not be the heat network operator.
Rapid evidence assessment	Gathers and reviews evidence in a streamlined systematic manner, aiming to produce results on a short timescale.
Salix	The HNIP Pilot delivery body.
Social NPV	Social net present value – see NPV – this also includes quantification of ‘social’ costs /benefits (e.g. pollution).
Transaction costs	Transaction costs are costs associated with making an economic transaction. For heat networks investments, these will include legal fees for example. Many of these costs – such as the cost of due diligence exercises - will be similar for both small and large investments. Due diligence refers to reviewing a potential investment or other transaction in detail to make sure that the buyer understands the investment and its associated risks.

Chapter 1: Introduction

The Heat Networks Investment Project (HNIP) provides capital support for the latter stages of commercialisation and construction of new heat networks in England or Wales. The scheme also provides funding for the expansion and connection of existing networks. The scheme was piloted ahead of an anticipated wider launch. This report presents the process evaluation of the HNIP pilot scheme and explores very early impacts. This chapter outlines the background to the development of HNIP, and introduces the evaluation aims and methods.

Background

Heat Networks

Heat networks typically convey hot water from a shared heat source (or sources) to meet demand for space and water heating, and space cooling distributed across a number of buildings. Heat networks are important because they can provide an opportunity for greater energy efficiency, lower prices for consumers and carbon savings compared with conventional gas or electric heating. They can deliver heat from a range of sources, such as waste heat recovery, combined heat and power (CHP) plants, and large heat pumps. The economic case for heat networks is challenging compared with other heat sources, such as individual gas boilers, and this deters traditional investors from investing in heat networks[1]. This is because: initial capital costs are high, the need for guaranteed demand underpinned by long-term contracts and relatively low returns over long payback periods.

There are around 5,500 district scale and 11,500 communal scale heat networks in the UK, together providing 10TWh per year (around 2% of UK buildings heat demand)[2]. This remains one of the lowest levels of provision in Europe[3]. Heat networks are most frequently found in locations with a high demand density, such as urban areas, university campuses and hospitals. Recent examination of the system-wide implications of

1 Heat Networks Investment Project Consultation, Capital Funding for Building Heat Networks, June 2016, BEIS. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/532483/HNIP_consultation_vFINAL.pdf; DECC (2013). Research into barriers to deployment of district heating networks, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191542/Barriers_to_deployment_of_district_heating_networks_2204.pdf.

2 Heat Metering and Billing Regulations (2014), Notification Data, https://www.gov.uk/guidance/heat-networks.

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

decarbonisation has highlighted the long lead times for heat network infrastructure and the need for clear plans at a local level for the potential use of heat networks[4].

Policy

The Climate Change Act (2008) requires the UK to reduce its greenhouse gas emissions by 80% on 1990 levels by 2050. The UK's carbon emissions derive mostly from fossil fuel combustion, with heating accounting for 46% of total energy use, and three quarters of this is consumed as heat in buildings, 75% of which are residential[5]. For these reasons, the Committee on Climate Change (CCC) makes low-carbon heat a policy priority and lays out 2032 and 2050 scenarios in which 13% and 18%, respectively, of household demand and half of business demand is met in this way. CCC also identifies heat networks as a 'low regret' measure (i.e. one with relatively low costs and relatively high benefits) to decarbonise heat and recommends their ongoing expansion through the fourth and fifth carbon budget periods (i.e. 2023 to 2032)[6]. The European Commission has emphasised heat networks as a key component of decarbonising heat[7].

The introduction of HNIP follows the introduction in 2013 of the Heat Network Delivery Unit (HNDU). HNDU provides support (grant funding and guidance) to local authorities in England and Wales to progress the development stages of heat networks projects (from heat mapping through to early commercialisation)[8].

Heat Network Investment Project

Aims and objectives

The Heat Network Investment Project is a funding mechanism that responds to the current low levels of heat networks in place and the difficulties described earlier relating to financial investment. Funding for the construction of heat networks was announced in the

4 Imperial College (2015) Energy system crossroads - time for decisions: UK 2030 low carbon scenarios and pathways - key decision points for a decarbonised energy system, https://workspace.imperial.ac.uk/icept/public/energy%20system%20crossroads.pdf; UKERC (2016) Heat Networks and Governance. Report of event held on 11 & 12 April 2016, http://www.ukerc.ac.uk/publications/meeting-report-heat-networks-and-governance.html.

5 DECC (2012) The Future of Heating: A strategic framework for low carbon heat in the UK, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48574/4805-future-heating-strategic-framework.pdf; DECC (2013). The Future of Heating: Meeting the challenge, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/190149/16_04-DECC-The_Future_of_Heating_Accessible-10.pdf.

6 CCC (2015) The Fifth Carbon Budget: The next step towards a low-carbon economy, https://www.theccc.org.uk/wp-content/uploads/2015/11/Committee-on-Climate-Change-Fifth-Carbon-Budget-Report.pdf; CCC (2016). Next steps for UK heat policy, https://www.theccc.org.uk/wp-content/uploads/2016/10/Next-steps-for-UK-heat-policy-Committee-on-Climate-Change-October-2016.pdf.

7 European Commission (2016) An EU strategy on Heating and Cooling, https://ec.europa.eu/energy/sites/ener/files/documents/1_EN_ACT_part1_v14.pdf.

8 https://www.gov.uk/government/publications/heat-networks-funding-stream-application-and-guidance-pack

2015 Autumn Statement by the Chancellor of the Exchequer. In June 2016 the Department of Energy and Climate Change (now the Department for Business, Energy and Industrial Strategy, BEIS) launched a consultation on the scheme design, including application assessment, and monitoring and evaluation. BEIS's response to this consultation was published in October 2016. Above all, the aim of HNIP is, alongside other measures, to contribute to the establishment of a self-sustaining UK heat networks market that does not require Government subsidy.

In more detail, HNIP has the following objectives[9]:

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

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

3. Build capability among local actors (particularly heat network project sponsors) to develop optimised heat networks that will meet local needs.

4. 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:

    a) Will have explored a suitable range of technical options and are efficient heating cooling systems that are technically future-proofed

    b) Are commercially future-proofed

    c) Will operate with no customer detriment in comparison with the likely alternative heat supply.

5. 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.

The HNIP Pilot

Recognising the complexity of heat network schemes and HNIP, BEIS has implemented a HNIP Pilot scheme. The aim of the HNIP Pilot is to provide learning that will be used to maximise the smooth running, impact and value-for-money of the planned main scheme. The HNIP Pilot provides capital support via grants or loans for the latter stages of commercialisation, and construction of, new heat networks in England or Wales, or the

[9] BEIS (2016) HEAT NETWORKS INVESTMENT PROJECT CONSULTATION GOVERNMENT RESPONSE: Capital funding for building heat networks (pp7-8), https://www.gov.uk/government/consultations/consultation-on-the-heat-networks-investment-project-hnip.

expansion of existing heat networks. While the HNIP Pilot was open to public sector organisations only, the main scheme is expected to also be open to the private sector.

Crucially, heat network schemes must meet two key criteria to be eligible for HNIP Pilot funding;

First, they had to demonstrate the existence of a 'funding gap'. This implies that the heat network that is described in the application could not go ahead without HNIP funding, thus attempting to ensure that the Government only supports networks that could not proceed independently; this is the principle of 'additionality'.

Second, to ensure that they are highly likely to be delivered; schemes had to demonstrate that they were at an advanced stage of development. More specifically, they had to be sufficiently mature – implying that all design, technical, contractual and legal are largely resolved – and be very confident about their costs and revenues. Another way of putting this is that schemes had to be in a position to proceed and needed to be in a position to take the decision to proceed.

Applicants were able to apply for funding for 'construction' only, and for 'commercialisation and construction'. Schemes that applied for 'commercialisation and construction' funding did not need to be as advanced as schemes that applied for 'construction' funding only.

The HNIP Pilot was developed, designed, and implemented on the timescale shown in Table 1. Further information about the pilot can be found in Chapter 2 and Annex 1.

About this report

BEIS has commissioned a suite of independent process and impact evaluation activities to cover the full HNIP scheme (the pilot scheme and the anticipated main scheme). Overall, the HNIP evaluation will follow the principles of realist evaluation[10], focusing on contextual questions of "what works, for whom, under what circumstances?" The evaluation will use an evolving Theory of Change that shows how HNIP is expected to lead to the desired impacts and outcomes.

This report is the one of several that BEIS plans to publish between now and 2021. The key aim of this report is to provide a process evaluation of the HNIP pilot scheme, with the objective of offering 'lessons learned' to inform development of the planned main scheme and any future similar schemes. Another aim of the process evaluation was to provide contextual knowledge for the overall realist approach.

[10] Pawson, R., 2013. The science of evaluation: a realist manifesto. Sage.

Table 1: The HNIP pilot timeline

Activity or event	Date or time period
Announcement of funding for heat networks	25 November 2015
Consultation period	29 June 2016 – 3 August 2016
Publication of consultation response	17 October 2016
Pre-qualification application window	18 October – 18 November 2016
Full application window	28 October – 5 December 2016 (extended from 28 November, 2016)
Assessment and clarifications	December 2016 – January 2017
Final scoring and award panels	January – February 2017
Notify applicants of award decision	March 2017
Funding commitment and signing of year 1 funding agreements	30 March 2017
Year 1 funding transferred	April 2017 – March 2018
Funding commitment and signing of year 2 funding agreements and	March 2018
Year 2 funding transferred	April 2018 – March 2019

Research questions

The aims of the evaluation of the HNIP Pilot are to explore six issues:

1. How the application stage has worked and what improvements can be made.
2. The application process and applicant journey.
3. Application assessment and what improvements can be made.
4. How the HNIP Pilot is affecting the Heat Networks in the development pipeline.
5. How the delivery chain is responding to the scheme and early impacts this is having.
6. Demand for capital support – why projects applied for funding, current financial barriers, and preferred types of finance.

Based upon these aims, and further themes that emerged during the research, we have organised our research around five key questions:

1. **What were the successes and challenges in the HNIP pilot process (from policy development and implementation, through the pre-qualification, application and assessment stages, to awards and signing of funding agreements)? (Aims 1, 2, 3, and 4)**
   This question is addressed in Chapter 2, from the perspective of the BEIS teams and the applicant teams.
2. **What are the patterns in the characteristics of the successful and unsuccessful pilot applications? (Aims 1 and 3)**
   This question is addressed in Chapter 3.
3. **What are stakeholders' (applicants, non-applicants, supply chain members, industry bodies, and third party investors) perspectives on the status of and challenges in the current heat networks market? (Aim 4 and 5)**
   This question is addressed in Chapter 4.
4. **In particular, what financial barriers and preferred types of finance are identified by stakeholders? (Aims 1 and 6)**
   This question is addressed in Chapter 4.
5. **What are stakeholders' perspectives on: their early responses to HNIP, the early impacts of HNIP (including in the heat networks development pipeline) and the potential longer term impacts of HNIP (including potential barriers to success)? (Aims 4 and 5)**
   This question is addressed in Chapter 4.

Research design

Annex 2 provides detailed information on the research methods used. Here we summarise the research design, research methods and data used in the analysis. Our analysis relies upon semi-structured interviews, documentary review and analysis of the applications (we describe these in more detail below). Across research questions 1, 3, 4 and 5, we used semi-structured interviews to understand the breadth and depth of perspectives and experiences; in addition, we drew upon analysis of documents and applications in these chapters. Research question 2 relies upon analysis of the applications, along with analysis of the interviews and documents as appropriate.

We used methodological triangulation[11] to synthesise and cross-reference the data in order to produce a comprehensive and in-depth narrative for reporting (see Annex 2). Within the context of constrained timescales, we triangulated the data by constructing an evolving analytical frame based around the five research questions and systematically populating this with themes, insights, evidence and data from the three research methods. We also developed new themes based upon the data. As the analysis progressed, we developed the analytical frame into a full report structure.

In general, we did not observe conflicts between datasets. However, occasionally, interview data about a particular document conflicted with the document itself. In these instances, we have highlighted the difference between the actual document content and the interviewee's experience or understanding of the document.

Semi-structured interviews

We selected interviewees in six categories based upon specific purposive sampling strategies, and we recruited them using a rigorous protocol (see Annex 2). We conducted 58 semi-structured interviews with:

a) The project team in BEIS (13 interviews) and Salix (the HNIP Pilot delivery body) (1). High coverage of relevant individuals, based on information supplied by BEIS.

b) Successful pilot applicants (8 out of 9). High coverage, based on information provided by BEIS (with permission from applicants).

c) Unsuccessful pilot applicants (8 out of 17). Lower coverage, based on information provided by BEIS (with permission from applicants).

d) Non-applicants (organisations that could have applied to the pilot but did not) (5). Lower coverage, based on lists provided by BEIS.

[11] Denzin, N. (2006).*Sociological Methods: A Sourcebook*, Transaction Publishers; Jack, E. and Raturi, A. (2006),"Lessons learned from methodological triangulation in management research", *Management Research News*, 29(6): 345 - 357.

e) Representatives of the commercial heat network supply chain (multiple function companies[12], component manufacturers, property developers, consultants and industry bodies (18). Lower coverage, based upon lists provided by BEIS and snowballing[13].

f) Potential third party investors (banks, investment banks, and other potential investors) (5). Lower coverage, based on lists provided by BEIS.

Although there was lower coverage in categories c-f than in categories a-b, it is important to note that the interview team reported reaching 'saturation' – the point at which we were not coming across new insights – across all categories of interviewees (see Annex 2). We gave interviewees comprehensive information about the project and about the arrangements for confidentiality and consent (see Annex 3). We recorded consent in all cases. We prepared a detailed topic guide for each category of interviewee (see Annex 3).

The interviews were undertaken by a team of six experienced interviewers, and voice recordings were professionally transcribed. We used thematic approaches, in which themes are derived from the research questions and also from the data, to analyse the interview transcripts[14] (see Annex 2). A single researcher conducted this analysis, and emerging themes were discussed and clarified between the analyst and the rest of the interview team throughout the analysis.

Documentary review

We reviewed documents relating to:

a) The development of HNIP policy, including the HNIP consultation and BEIS' response

b) The HNIP Pilot application process, including the applicant guidance documents, and reports from the BEIS internal 'lessons learned' workshops relating to the application stage and the assessment process

c) Applications to the pilot scheme, assessment of the applications and the communication of decisions

d) The web-based application portal itself.

Documentary review took two key forms. In some cases, we analysed documents according to the principles of thematic analysis (see above and Annex 2). In others, we reviewed documents to establish specific facts about the pilot application process or a particular application.

[12] We use this term to describe large companies that perform a range of functions in the heat networks market, such as: funding, designing, constructing, owning, operating and maintaining heat networks.

[13] Snowballing describes an approach within which interviewees are asked to recommend further interviewees with particular characteristics.

[14] Boyatzis RE (1998) *Transforming Qualitative Information*. Sage: Cleveland.

Analysis of applications

BEIS carried out analysis of applications – both successful and unsuccessful, and we have included key results from the analysis in Chapter 3. The analysis provides a concise picture of the key characteristics of the applications as a whole, and the successful and unsuccessful applications as subsets.

Limitations

A full review of the limitations of the research is available in Annex 2. In summary, as in most evaluative research of this nature, particularly work that is executed at speed, it is possible that there is sampling bias, non-response bias and inadequate coverage in some elements of the semi-structured interview programme. That said, our concerns about the effects of this are largely mitigated by the facts that the narratives that we heard both within and between interview groups were broadly consistent, and that we reached 'saturation' within each of the interview groups. Within this context, we regard the findings and conclusion that derive from the semi-structured interviews to be robust. BEIS analysis of applications does not attempt to draw conclusions beyond the sample it reports on.

Chapter 2: The HNIP Pilot application and assessment process

This chapter reports findings on the development and implementation of the pilot application and assessment process (Research question 1).

Chapter Summary

- The objectives of HNIP, the HNIP Pilot and the pilot evaluation were widely understood and supported in the heat network market and supply chain. Further, the pilot application process was viewed as logical, well-constructed, clear to the applicants and well-supported by BEIS and Salix.
- The HNIP Pilot was primarily designed to be a learning opportunity to maximise the smooth running, impact and value-for-money of the planned main scheme. The evaluation of the pilot application process has highlighted three key areas that could be improved.
    - Timescales: The entire HNIP Pilot application and assessment process was implemented within very tight timescales. This was very challenging for the BEIS policy team, the assessors and the applicant teams. This affected the quality of the applications and, a small number of applicants suggested, potentially, the quality of the assessment process.
    - The volume and complexity of the application requirements: This was seen as considerable, in particular for the financial model (which was unfamiliar to many applicants), and was exacerbated by the short timescales. Applicants felt that this could have been mitigated to some extent, but not entirely, by release of the applicant guidance material much earlier
    - Pre-qualification: Although a number of applications had characteristics that made them inappropriate for HNIP funding, these passed the pre-qualification stage without these characteristics being identified, increasing the workload for assessors and applicant teams.

The pilot applicant journey

In this chapter, we use the term 'pilot application process' to refer to the whole of the process from the early awareness of the pilot scheme, through submitting an application to the post-award stage. Within the context of the overall process, we refer to a number of separate stages within the process. This section provides a brief description of the stages within the pilot application process, drawn from applicants' experiences (see Figure 1).

Early fact-finding stage

As indicated in Figure 1, this early stage consisted of: hearing about HNIP and finding out more about HNIP (perhaps through communications or attending events), deciding to submit an expression of interest, and deciding to enter the HNIP Pilot pre-qualification stage.

Pre-qualification stage

The pre-qualification stage took the form of a simple, online self-completion form designed to determine whether a project was eligible and sufficiently prepared for the HNIP Pilot. There were no independent checks of this information. Applications that failed at this stage were not permitted to submit full applications and were provided with feedback. Successful applicants at pre-qualification could continue to the full application stage.

Full application stage

The full application stage required applicants to complete online self-declaration forms and spreadsheets, and to upload other documentation. The full application consisted of the following items (these are described more fully in Table 2 in Annex 1):

- a business case or equivalent
- technical heat network design documentation
- a cash flow or financial model (compliant with HM Treasury's Green Book[15])
- heads of terms agreements with anchor load customers [16]
- funding gap evidence
- an HNIP input template
- a CHPQA certificate (where appropriate)
- Other supporting documentation.

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

[16] A Heads of Terms agreement provides the basis for a future agreement between two or more organisations.

Full applications could be submitted between 28 October, 2016 and 5 December, 2016 (extended from 28 November, 2016). The application guidance was released shortly after 28 October, 2016.

Assessment and clarification stage

The assessment process involved analysis by three BEIS assessment teams: techno-economic, (these were often external to BEIS), cost-benchmarking and commercial (see Figure 2 in Annex 1). As these assessments were undertaken, BEIS sent clarification questions to applicants (via Salix) as necessary, asking for responses typically within three working days. Following rounds of clarifications, each of the three assessment teams classified applications as Pass or Fail. This process took place in December 2016 and continued into January 2017, thus spanning the Christmas break. To enter the scoring phase, applications had to pass all three of the assessments.

Scoring and decision stage

The applications that passed all three assessments in the assessment stage entered the scoring stage. These applications were scored by members of the assessment teams against five categories, aligned with the long-term aims of the project:

1. Carbon savings value for money - short-term (quantitative metric)
2. Carbon savings potential - long-term (qualitative metric)
3. Consumer heat price comparison (quantitative metric)
4. Customer impact - Quality of service (qualitative metric)
5. Social net present value (NPV)[17] (quantitative metric)

We discuss and comment on the scoring frame in more detail in Chapter 3. After scoring, applications were considered by an awards panel. The applications and assessor recommendations were considered across five separate award panels meetings. The process culminated in a final award panel meeting that made decisions on funding.

Post-award stage

Following the final awards panel, BEIS sent decision letters to applicants. Successful applicants proceeded to discussions of any outstanding evidence gaps, the provision of further information, and the preparation of Memoranda of Understanding. Those who had submitted unsuccessful applications were sent feedback and had access to a decision review process.

[17] Social Net Present Value (social NPV) is a calculation of the value of a project to society as a whole.

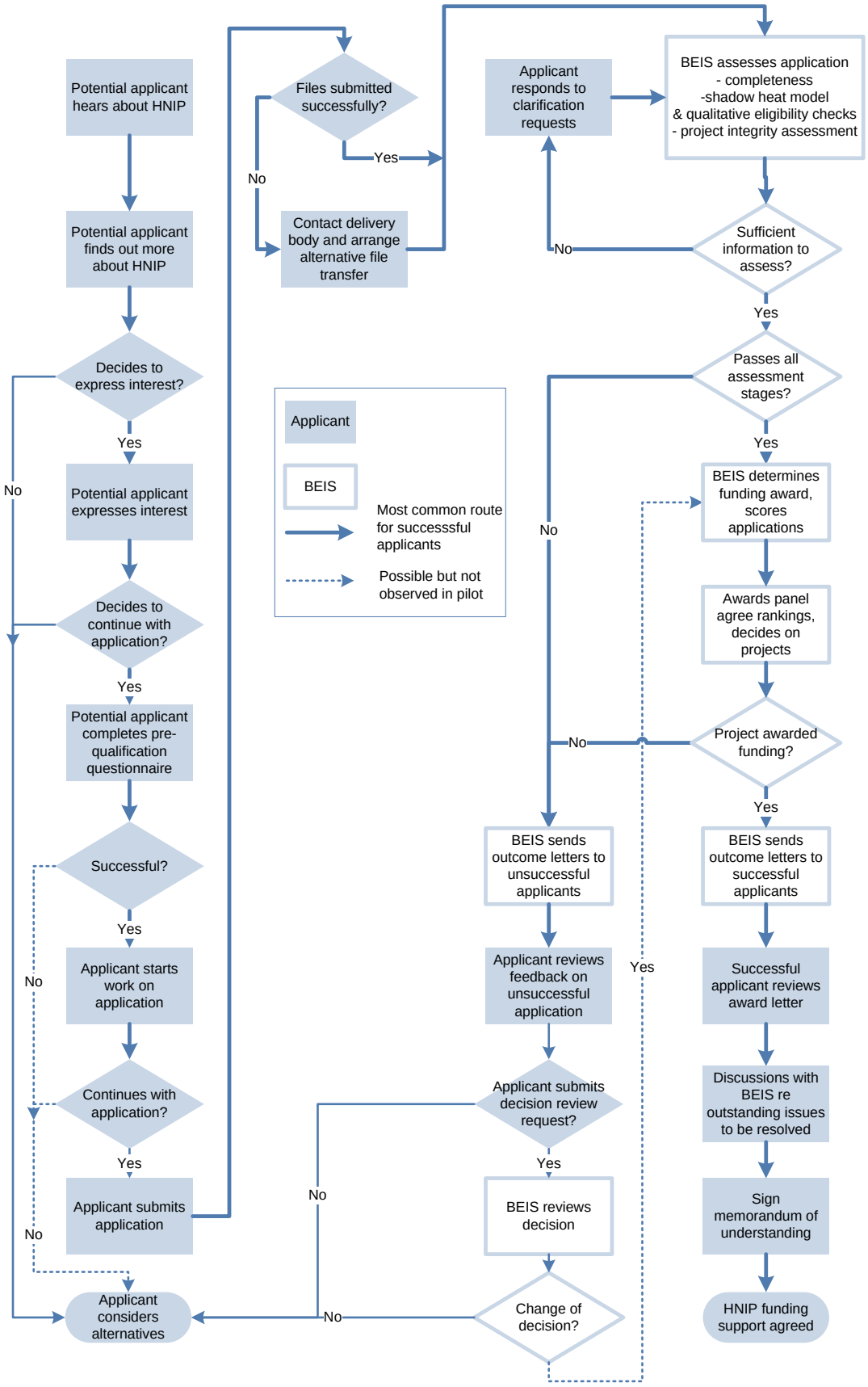

Figure 1: HNIP pilot applicant journey

Overall response to HNIP and the HNIP Pilot

Stakeholder interviewees (applicants, non-applicants, members of the supply chain and investors) almost universally supported HNIP, and the emphasis on running a pilot and a pilot evaluation. They also appreciated the considerable planning that BEIS had put into the pilot project. Applicants generally found the pilot application process to be clear and logical, and stated that they found it straightforward to track their application and to know where it was in the process. Many interviewees expressed optimism at the potential of HNIP. We were told that some private sector representatives had been disappointed that they were ineligible to apply directly for pilot funding.

At the same time, interviewees among the applicants and their teams raised a range of concerns about: aspects of both the HNIP Pilot application process and the design of the project, as reflected in the pilot; the challenges that the heat network market faces; and the potential that HNIP and other current heat network market developments might not overcome these. Further, a few interviewees – sometimes with reference to past experience – emphasised the importance of BEIS actively engaging with these concerns.

> **HNIP Applicant:**
> *"I welcome it because it's really stimulating the market but we'd like to see improvements in the process. So I hope we're not deemed as being negative, we provide constructive criticism. After all it is a pilot and that's what pilots are about."*

> **HNIP Applicant:**
> *"I'm curious as to what the next step is, is BEIS going to carry on the process of dialogue with these successful applicants to get the best feedback and shape the process? I think from a local authority's perspective, you see somebody [BEIS] who sucks lots of information in but never particularly engages back."*

Highly restricted timescales

A key finding in this evaluation – supported by the BEIS team, and the pilot applicants and their partners[18] is that the development of HNIP, the set-up of the HNIP Pilot and the 'pilot application process' took place within very tight timescales (see Table 1). This was for two reasons. First, there were delays in policy development related to the EU referendum and the subsequent merger of DECC and BIS into BEIS. Second, there was a need to commit funding before the financial year end. These constraints meant that policy development

[18] Many heat network sponsors, particularly in local authorities, do not have all the necessary skills to develop heat networks plans and rely on input from both internal teams (for example, legal) and external partners (for example, experts in heat network design, and financial modelling).

and implementation happened concurrently. A key outcome of this – according to the BEIS team and the applicants – is that the quality of the applications was affected. In addition, a small number of applicants raised the possibility that this also affected the quality of the assessment process. We discuss these issues further below.

Policy development

The constrained timescales led to an ongoing process of policy development while simultaneously dealing with issues and problems that arose, described by a member of the BEIS team as constant 'firefighting'. Interviews with the BEIS team suggest that it was also widely felt that the HNIP team was under-resourced, compounding the impact of the short timescales. Many of the BEIS staff we interviewed thought that the successful development of the HNIP Pilot had been driven forward by a small number of highly knowledgeable individuals. It was repeatedly noted that if any of the key staff had left the project, this would have caused significant disruption to HNIP.

Implementation of the application and assessment processes

Because of the constrained timetable detailed application guidance was not available to prospective applicants until after the launch of the main application phase, and the application, assessment and post-award periods were all very short. This was exacerbated as the assessment period straddled the Christmas break.

> **HNIP Applicant:**
> *"'I think that the detail of what would be required in order to submit a successful application should have been known six months earlier so that organisations could have been working on it before."*

Confusion between BEIS and some applicants around the calculation of social NPV – a key HNIP Pilot scoring criterion – is one example of a specific problem resulting from concurrent development and implementation. Just before the application period opened, BEIS decided that it would calculate the social NPV for each application rather than requiring applicants to do so. However, this requirement was not changed in the web-portal, so applicants tried to calculate it, with inadequate support.

The time constraints led to the following:

- The BEIS team, and the applicants and their partners thought that the time constraints negatively affected the quality of the proposals submitted; for instance, there was often too little information and mandatory fields were left blank

> **A BEIS Team Member:**
> *"The quality of the applications and the material that was provided was extremely variable, ranging from really high quality applications that met all the criteria through to applications that were really very poor."*

> **HNIP Applicant:**
> *"We didn't do it to the quality that we wanted to because the deadline was so short."*

- A commonly held view among applicants and their partners was that the pilot timetable gave the impression that BEIS did not understand either the ways in which large public sector organisations work or the complexity of heat network development

> **HNIP Applicant:**
> *"That was one of the problems with HNIP, not having enough time – it's as though they don't realise that local authority decision-making is quite slow."*

- The lower than expected quality of some applications meant that BEIS had to ask 600 clarification questions – far more than they had expected – during the assessment process
- A small number of applicants suggested that the short timescales appeared to have affected the quality of the assessment process, hinting that this may even raise questions about the integrity of the assessment decisions

> **HNIP Applicant:**
> *"I can imagine they [BEIS] were under pressure themselves getting that information round. That would lead to rash decisions, poor decision making."*

- A majority of applicant teams felt ambivalent or negative about their HNIP Pilot experiences, and relationships with BEIS may have been strained somewhat. Examples of this are provided throughout this chapter.
- BEIS team members and assessors reported that the scoring, panel and award decision processes were also time-limited and challenging.

Prior to the launch of the HNIP Pilot

In this section, we comment on: how stakeholders first heard about HNIP, the HNDU pipeline, the consultation and the HNIP workshops.

A large number of stakeholders recalled that they first heard about a future funding scheme for heat networks in the 2015 autumn budget statement. Frequently mentioned ongoing sources of information were the HNDU communications channel, Huddle, and the

Association for Decentralised Energy (ADE). One successful applicant said that they did not hear about HNIP until as late as October 2016.

Although only limited information about HNIP was available at the time, the HNIP consultation drew 110 responses. Interviewees had little to say about the consultation; while one pointed towards an inevitable concern that a consultation is not sincere if one's suggestions are not taken on board. Another applicant argued that the consultation was valuable because it showed that BEIS were listening.

> **HNIP Applicant:**
> *"Being cynical, we spent a lot of time producing a lot of work and information; do I believe that there was a significant difference in what BEIS issued as the final document? Not really, I think they'd already made up their mind as to what they were going to issue and there wasn't much of a change."*

Almost all of the pilot applicants and potential applicants that we spoke to had received HNDU funding, for example for heat mapping projects or feasibility studies, as well as ongoing advice. Although it is not the role of HNDU to provide guidance on HNIP applications, HNDU is highly valued and respected within the heat networks market and appears to have succeeded in developing a pipeline of projects, both prior to and now in the context of HNIP Pilot funding. In addition to funding for the early stages of heat network development, many interviewees noted HNDU's earlier role in providing advice and articulating BEIS's understanding of heat networks. In London, the Decentralised Energy Project Delivery Unit (DEPDU) and the Decentralised Energy Enabling Project (DEEP) were discussed in similarly positive ways[19].

Importantly, many applicants that we spoke to suggested that earlier HNDU support had helped them to develop their projects to a level of maturity or development that was sufficient for the HNIP Pilot, and thought that some applicants to the main HNIP scheme might struggle without prior HNDU support. The importance of the advisory role of HNDU in sharing knowledge should also be considered within the context of widespread concerns of a knowledge and skills gaps within the heat networks market (we discuss this more fully in Chapter 4).

> **Non-Applicant Heat Network Developer:**
> *"The HNDU heat network specialist we've got is very supportive and generally accessible. We did have a changeover of HNDU specialist at Round 4 and it's not detrimentally affected the projects so I would say that the quality of support from HNDU has been very good."*

[19] https://www.london.gov.uk/what-we-do/environment/energy/energy-supply.

> **HNIP Applicant:**
> *"It will depend on the level of expertise and knowledge in those organisations but it's definitely beneficial to us knowing what HNDU look for, what their priorities, drivers and motivations are. It certainly puts us in a better position than if we had not had that HNDU funding."*

> **Non-Applicant Heat Network Developer:**
> *"Presumably [organisations who do not have HNDU support] wouldn't develop as good quality plans. We have had quite a lot of support."*

> **Independent Assessor:**
> *"If they haven't been indoctrinated in the HNDU process, they most probably won't be aware of the kind of things that they need to have and put in place and the processes and procedures that BEIS will want."*

Potential applicants valued the HNIP Pilot stakeholder workshops and training events hosted by BEIS, and we were told that this was positive evidence of forward planning by BEIS. Attendees very often highlighted the opportunity to learn from other potential applicants and industry stakeholders (including those from overseas) (called peer-to-peer learning) as much as or more than what could be learned from BEIS at these events. A theme that runs through this evaluation is an appetite for ongoing face-to-face interaction between BEIS, potential HNIP applicants and wider stakeholders.

The HNIP Pilot pre-qualification stage

The pre-qualification stage was intended to filter out potential applications that were ineligible or inadequately prepared for the HNIP Pilot scheme. A total of 39 organisations expressed interest in the HNIP Pilot, 29 applicants entered the pre-qualification stage and, of these, 25 submitted full applications.

We interviewed a number of local authorities who were broadly eligible for the HNIP Pilot but had not applied. We refer to these organisations as non-applicants. The key reason reported by non-applicants as to why they did not apply to the HNIP Pilot was the realisation, based on the eligibility criteria and pre-qualification stage questions, that the HNIP Pilot was designed for schemes at a higher level of maturity.

> **Non-Applicant Heat Network Developer:**
> *"We felt that the project wasn't at maturity yet to apply for HNIP funding."*

> **Non-Applicant Heat Network Developer:**
> *"We were told by the BEIS team that what we were seeking was very much an HNIP type project, but we realised that the pilot was targeted at spending in 2017/18 and we were just not ready."*

However, interviews with pilot applicants and the BEIS team (as well as the BEIS 'lessons learned' workshops) suggest that the pre-qualification stage did not always filter out inappropriate schemes. A number of schemes that BEIS felt were not ready, inadequately prepared or inappropriate (for example had a negative internal rate of return (IRR)) passed this stage. This resulted in fruitless effort on the part of applicants and an additional burden on the assessment teams.

> **HNIP Applicant:**
> *"I think the general view from the industry was there was an unbelievably basic and simplistic pre-qualification tick box process that took about five seconds to do and then a stupidly complex application process, that should really have taken about five months to do."*

> **HNIP Applicant:**
> *"The pre-qualification stage was a bit of nonsense really because you just ticked a load of boxes, and then you got through to the next stage! And what was really amusing is that some of those questions that you said "yes, yes, yes, we'll do this, we'll do that", actually never even got followed through into the full application."*

Individual applicants told us they thought the following characteristics of HNIP were also problematic:

- Live procurement processes that limit information sharing due to commercial confidentiality meant that one bid was ineligible
- Within some public sector procedures, the existence of a 'funding gap' made it difficult in practice to meet some other HNIP Pilot criteria (e.g. ideally, Heads of Terms for anchor loads should be in place). This means that schemes cannot at the same time be at the advanced level of preparedness required by the HNIP Pilot. This might be particularly the case in the context of schemes that applied only for construction funding.

> **HNIP Applicant:**
> *"I'm not going to take a report to [my executive-level decision-making body] saying, 'We want approval of a project, to commence procurement and investment' and saying also in that same report, 'there's a funding gap'."*

BEIS staff have suggested that the challenges might be best dealt with by making the pre-qualification stage more challenging in terms of the questions that it asks and the evidence that it demands. Some BEIS staff have suggested that one option would be to move away from a process based purely on self-assessment.

The full application window

Introduction

We note above that the length of the full application window (five weeks or 25 working days) was inadequate for many applicants and their partners. This was particularly the case, applicants reported, given the size and complexity of the task and because the applicant guidance was not available until the application window had opened. BEIS has also noted that the full application window would ideally be longer, but policymakers generally thought that the complexity of the full application task was appropriate (applicants requested an average of £10.6m).

Applicant teams and institutional structures

Most applications were led by one or two individuals within the applicant organisation. These individuals worked in a wide variety of departments, such as: energy, waste, sustainability, regeneration and planning. Levels of experience of heat networks and complex infrastructure projects in general varied enormously.

Typically, on a complex infrastructure project, the project lead worked with a range of internal and external centres of expertise, such as financial, technical, legal and commercial departments, or consultancies, as well as a complex set of external project stakeholders, customers and other suppliers. It should also be noted that at least two proposals were prepared by freelance consultants on behalf of local authorities, and that most applicants also incurred costs for financial, technical and legal consultancy in preparing their bids.

The opportunity time costs – both internally and externally – of these bids was felt by applicants to be considerable. In addition, applicants made it clear that marshalling all of these actors within limited timescales of the HNIP Pilot was a significant challenge.

Processes reported by applicants for senior sign-off in local authorities varied between relatively streamlined processes and processes tied to specific events, such as senior management meetings or local authority cabinet meetings. Neither model was dominant. The latter typically run to fixed timetables set well in advance, offering little flexibility for adjustment. This issue presented challenges for many applicants. Applicants agreed that support among both very senior local authority officers, and elected members are advantageous to the development of heat networks; this suggests that these groups would be key targets for communications and engagement.

> **HNIP Applicant:**
> *"I report to the Head of [department], he's absolutely integral, the internal champion for this and is regularly dialoguing directly with the council leader. Whenever we meet with people from other offices within the borough they know that this is one of the leader's top projects that he wants delivered."*

These issues led the interviewees associated with a small number of bids to propose that the HNIP main scheme should remain open for applications throughout its operating period, so that applicants can submit when they are ready. It was also suggested that this would ease the intensity of the burden on assessors – which we discuss in the next chapter – by spreading out the applications over time.

Applicants estimates of the number of person days that the proposals took to prepare (including responding to post-submission clarification requests) ranged from 30 to 50 person days.

> **HNIP Applicant:**
> *"I most probably spent, in the entire process, from start to finish, 40 days I'd expect."*

Many applicants were keen to share their impression that the demands made by BEIS in the HNIP Pilot reflected a lack of understanding of the processes by which local authorities and other large public sector organisations deal with complex infrastructure projects such as heat networks. Although the BEIS team claimed a knowledge of local authority processes (several members of HNDU are ex-local authority officials), it is important to note that this was the impression created in many instances.

A sizeable and complex full application process

As noted earlier, submitting a full application required the following (described more fully in Table 2, Annex 1): a business case or equivalent, technical heat network design documentation, a cash flow or financial model, Heads of Terms, funding gap evidence, an HNIP input template, a CHPQA certificate (where appropriate) and other supporting documentation.

Most applicants felt that the size and complexity of completing the full application was considerable or excessive (especially within the limited time available, the context of the financial value of their bid, the relative simplicity of their scheme or the size of their scheme). Although they recognised that public money must be carefully spent, many felt that the full application was burdensome. Several interviewees compared the complexity of HNIP pilot bids unfavourably with other funding programmes, including European

Community (EC) programmes. [20] This was particularly the case with respect to the financial model, and we discuss this below.

Interviewees from the BEIS HNIP team generally thought the complexity of materials requested was appropriate (applicants requested an average of £10.6m), but reflected on the burden that developing these under such tight timeframes placed upon applicants:

> **BEIS Team Member:**
> *"It's easy to understand the burden that we were putting on applicants because we had to solve each problem separately, [such as] this is what you need to provide us for State Aid, this is what you need to provide us with for the funding gap, this is what you need to provide us for short and long-term carbon, for customer detriment, for social NPV. That is too burdensome for them."*

Suggestions by applicants for improving the process included:

- Rationalising the number of locations where the same information had to be entered.
- Introducing differentiated application routes depending on factors such as the financial value of the bid, the complexity of the scheme or the size of the scheme.

> **Independent Assessor:**
> *"Some of the projects are just three or four buildings, job done, move on. And then you get the really complex ones which are multi stakeholders, the heat sources you don't own, those kind of things, and they're just really complicated, bigger projects, I think they should split it into different application streams."*

A complex and unfamiliar financial model

The interviews with applicants suggest that local authority finance teams are typically not familiar with HMT Green Book[15] principles on which the financial model was based, and that this caused significant problems. The leaders of bids worked with both internal and external financial specialists. Most interviewees told us that these financial specialists were unfamiliar with and confused by the type of financial model that was required in the HNIP pilot, and this was the element of the application about which Salix received the most queries. Due to an error in the initial applicant guidance applicants attempted to calculate social NPV when they were not expected to. Applicants told us that the social NPV calculations were particularly unfamiliar and burdensome.

[20] BEIS reported setting evidence requirements for HNIP below third-party investor standards, in line with HNIP's objective to transition the market to self-sustaining growth.

BEIS compared applicants' financial models with an internal BEIS model, known as the shadow financial model. The purpose of this was to ensure the quality and legitimacy of the applicants' own models, and to reduce the risk of 'gaming'. One interviewee spoke of '*shadow boxing*' with the shadow financial model, by which he meant that he was asked to explain why his financial model did not agree with a financial model that he had no access to. Another applicant pointed out that it was not possible to spot errors or inconsistencies between their model and the BEIS model until the end of the process; while it is helpful that it was possible to spot inconsistencies, this interviewee suggested that regular review stages would have made this process less burdensome.

One interviewee and BEIS staff proposed that a fully populated and annotated sample financial model would be extremely helpful for applicants. A member of the BEIS team also mentioned the availability of a financial model template for public sector organisations on the Carbon Trust website [21], which might be helpful. Clearly, greater support for applicants is required to overcome this lack of familiarity.

> **HNIP Applicant:**
> *"I think the application forms had quite a lot of duplication of information and they weren't very intuitive, it wasn't evident that you got it wrong until the clarification came to us. What would have been much nicer perhaps is to have something where you could enter data and actually see it and present it in a cash flow model so you could see there's something wrong that doesn't match our cash flow projections."*

> **HNIP Applicant:**
> *"Social NPV – for both public and private sector – was something quite new and a lot of the challenges with that were trying to calculate your various elements of social NPV but also work out how they impact on other areas of the bid."*

> **HNIP Applicant:**
> *"They should just have one model, we just have something we populate and we can all see what the answer is."*

We were also told by a few applicants that the BEIS financial model was not suitable for particular financial elements of their scheme. Examples of this were schemes that charge householders a flat rate for heat, regardless of consumption (for example, to align with local social or fuel poverty objectives) and schemes that do not subsidise the cost of heat to householders. Schemes with no paying customers (e.g. universities and hospitals)

[21] https://www.carbontrust.com/resources/tools/heat-network-cashflow-template/

found it difficult to complete applications as many sections seemed to be designed for schemes with external customers; this issue prompted one interviewee to observe that – despite claims to the contrary – the HNIP Pilot appeared to have been designed for local authorities only.

The BEIS team has confirmed that these schemes are indeed not appropriate for HNIP Pilot funding because they do not meet the requirements or fulfil the objectives of the scheme. Again, this highlights the short-comings of the pre-qualification process and the application guidance in the HNIP Pilot.

Other elements of the HNIP Pilot full application

Business case: After the financial model, this is the element of the application that may require additional guidance from BEIS, perhaps in the form of a sample business case. Our review of the applications highlights wide inconsistencies. More than one applicant said that the clarification questions suggested that BEIS had something very specific, but inadequately explained and illustrated, in mind.

> **Private sector partner on a proposal:**
> *"It didn't specifically ask for a business plan to be presented in this format to follow this structure with these context sections completed. If it had we would have obviously submitted it in that format. We felt a little bit sore about that."*

Another applicant suggested that BEIS wanted HM Treasury Green Book business case, but thought that this was inappropriate due to the size and characteristics of heat networks as infrastructure projects. There appears to be a lack of clarity within BEIS on this point; while the need for Green Book compliant businesses cases was not made explicit in the applicant guidance, assessors told us that they were assessing businesses cases against this standard.

> **HNIP Applicant:**
> *"It was horrible! I think it used the Green Book business case and tried to make it relevant for district heating. It is supposed to be applicable to all levels of investments but really it's more tailored to a big road building scheme or something like that, so there were bits in there which I needed the guy to recognise that this had never been done before for heat networks, but he said "but please do it anyway"! So it was pretty horrible."*

Technical heat network design: This element of the full application appeared to work as intended and was completed without significant problems by applicants.

Heads of terms: Applicants found this area difficult where they were in situations in which Heads of Terms or 'letters of intent' are not possible (for instance, in a new build where the customers are not yet known) or not appropriate (when the 'customers' are internal).

'Funding gap' evidence: The principle of a 'funding gap' (to ensure 'additionality') is central to HNIP. Our analysis of the applications and the assessments shows that the documents submitted in this section varied both in form and level of detail (e.g. financial models, summary narratives and letters from financial directors), and that this issue was the subject of many clarification questions.

While BEIS interviewees thought that 'gaming' of the scheme was unlikely, this was one area where a small number of applicants suggested that it might be relatively easy to adjust an existing scheme – for example, by adding to it – such that a funding gap becomes apparent. The BEIS team thought that applicants would have insufficient information on the detailed scoring methods to make gaming likely. As previously discussed, it is also notable that some applicants observed that in some institutional contexts it is not practicable to have a funding gap and be at an advanced stage of preparedness.

Missing information: To ensure 'additionality', HNIP is intended to fund only features of projects that go beyond what is necessary to meet planning requirements. However, while information about this was required in the HNIP Pilot full application, the precise nature and content of this information was not specified. This meant that assessors had to seek further information and evidence during the assessment period. Also, BEIS officials felt the application process did not collect the most useful data from applicants on heat price reduction to facilitate scoring, taking account of effects on, for example, different customer groups, effects over time, and comparison with counterfactuals.

To support applicants better, one member of the BEIS team suggested that it would be useful to include examples of application materials, and more detail on *why* particular items of information were important.

Strong support for applicants, and the web-portal

In this section, we examine the various forms of support that were available to pilot applicants, as well as the performance of the web-portal.

Application guidance: The application guidance document was 94 pages long and was available on the HNIP web-portal. As the application window progressed, updates were provided in a separate Q&A document as applicants asked questions and anomalies became apparent. Applicants generally responded well to the application guidance document and the ways in which it was updated as new queries were processed, although a small number noted there were a few errors and omissions, or conversely criticised it as too long.

The most significant comment – from both applicants and the BEIS team – is that applicants would have preferred and significantly benefitted from having this guidance (or a summary) well in advance of the opening of the application window. It was widely felt that this would have alleviated, though not eliminated, the twin concerns about the short length of the application window and the size of the evidence submission.

In addition, our own examination of the application guidance indicated that the detail of how the five scoring criteria were to be applied and weighted was not explained in the applicant guidance. BEIS officials indicated that they did not wish to overly determine the type of schemes that applied to the HNIP Pilot. However, it is important to note that stating this more clearly and linking it with the aims of the HNIP Pilot in the applicant guidance might have focussed the minds of applicants more sharply on the objectives of the HNIP Pilot and meant that BEIS received more applications that were suitable for the pilot scheme.

Telephone, email and web-form: Applicants used all three of these approaches extensively to communicate with Salix for advice during the application process (as well as during the clarification process, which we discuss below). Applicants and BEIS team members reported that these approaches worked well, with Salix proving responsive and flexible, and providing timely and helpful responses.

Web-portal: The application web-portal appears to have operated smoothly and applicants reported largely positive experiences. Some applicants had to email very large files to Salix when they exceeded the upload limit, and reported that Salix was very helpful when this was the case.

The HNIP Pilot assessment and scoring process

Introduction

We comment on how the scoring system might have affected outcomes in Chapter 3. Here, we focus on the process. Figure 10 (see Annex 1) describes the application and assessment process. The assessment process involved analysis by three teams: techno-economic assessors (these were often external to BEIS), cost-benchmarking assessment by one of the lead engineers, and commercial assessment by the commercial team. As these assessments were undertaken, BEIS sent clarification questions to applicants as necessary, with typical required response times of three days.

Following rounds of clarifications, assessors were required to either pass or fail the applications. This process took place in December 2016 and continued into January 2017, thus spanning the Christmas break. To enter the scoring phase, applications had to pass all three of the assessments. Based on the information to which we have access, it appears that nine or more bids were unsuccessful in the assessment process and did not enter the scoring phase. Applicants seemed to struggle with the techno-economic assessment most often (at least 6 applications were unsuccessful on this assessment

criteria), and a smaller number were unsuccessful at the assessment of financial or commercial documentation.

The applications that entered the scoring process were then scored by members of the assessment teams against five categories, aligned with the long-term aims of the project:

1. Carbon savings value for money - short-term (quantitative metric)
2. Carbon savings potential - long-term (qualitative metric)
3. Consumer heat price comparison (quantitative metric)
4. Customer impact - Quality of service (qualitative metric)
5. Social net present value (NPV)[22] (quantitative metric)

After scoring, applications were considered by an awards panel. The awards panel considered the suite of applications over the course of five separate meetings, and the process culminated in a final award panel meeting where funding decisions were made. These panel meetings took place over a relatively short time period and with constant membership to ensure consistency.

Experiences of the BEIS team and the applicants

Assessment and clarification

BEIS staff reported that the assessment and clarification stage was made more burdensome by the lower than expected quality of the applications (e.g. too little information, empty mandatory fields and technical/financial information in a range of formats). In addition, the BEIS team noted there was an internal lack of, and turnover of, human resources during the process, and that assessment forms and assessor guidance arrived in a piecemeal way and changed as the process unfolded. Finally, the BEIS team agreed that communication and co-ordination between the assessment teams was lacking, resulting in confusion and delay.

During the assessment process, 600 clarification questions – far more than had been expected – were communicated to the 25 applicants. Almost half of them related to the financial model. One applicant received 85 queries. Recognising that technical financial issues are not easy to deal with by email, BEIS offered many applicants a teleconference with a BEIS financial modeller to discuss clarification queries; this approach was valued by those applicants that used it and by the BEIS team.

The successful resolution of the 600 clarification questions represents a significant achievement for BEIS, the delivery body, and the applicant teams. Nonetheless, although applicants and BEIS staff acknowledged the importance of this process, the limited

[22] Social Net Present Value (social NPV) is a calculation of the value of a project to society as a whole.

timescales and timing caused a significant burden both for applicants and their partners, and BEIS and its team of assessors. On both sides, we heard reports of late night working, weekend working and working during the Christmas break. Although this was challenging for many applicants, none dropped out or considered dropping out at this stage.

> **Independent Assessor:**
> *"It was all very last minute stuff, we just had to get in and start assessing them as best we could and you know, there wasn't lots of peer collaboration, getting things consistent but I think to be fair to BEIS, that was just because it was the pilot stage and everything was being done so quickly."*

Applicants reported that several factors made this a difficult process:

- This phase came immediately after the demanding application submission process
- Clarification questions were sent sporadically over the clarification period, by more than one person, and in a range of formats (for instance, as text in an email, within emailed documents and on the telephone) and were often duplicated within or across these formats;

> **HNIP Applicant:**
> *"Well, I don't think we found it that positive. We had trouble with the assessors, they asked for clarifications, they wanted to do phone calls then, we would organise that and then they wouldn't be available or one would be available and the other wouldn't be on the line from the HNIP side. I don't know that they were that familiar with heat networks from the types of questions that we got asked."*

- Lead applicants were typically working with one or more internal and external partners; this meant that answering queries was often a time-consuming two-stage process; in some cases, Salix acted as an intermediary for clarification questions, which also made this a two-stage process on the BEIS side.
- Applicants often found the clarification questions complicated and unclear.
- In one instance, clarification questions relating to one application was sent to the wrong applicant, although this did not include any sensitive information.

Interviews with the applicants also highlighted a set of further challenges related to ensuring consistency across the assessors:

> **HNIP Applicant:**
> *"Different questions were coming back on our two applications and the applications in my mind were quite similar and sometimes, things were being picked up by one assessor but not by the other assessor, so there was a massive inconsistency in the assessors' questions."*

> **HNIP Applicant:**
> *"At some stages, somebody would say, 'This isn't a very helpful model' and yet at other stages the modellers would be saying, 'This is a brilliant model, we find it really easy to understand.'*

The interviews with the BEIS team indicate that it appreciates these challenges.

These issues led to a general impression among the applicants of a rushed process. A small number of interviewees expressed concern about the integrity of the decisions that were taken in such circumstances. On this topic, one interviewee with considerable experience across the domestic heat networks market commented that they '*could not believe*' that two *'very strong*' schemes – which they were not involved in – were not funded. This led the interviewee to hold some scepticism about the assessment process and the design of the HNIP Pilot.

We note, however, that an apparently high quality and eligible scheme might not meet all of the objectives of the HNIP Pilot to the same extent as some other schemes, and would therefore not scored as highly as these schemes. This might explain why otherwise excellent schemes did not receive funding. This is, perhaps, another example of how not being explicit about the scoring system and its links with the HNIP Pilot objectives led to misapprehensions in the heat network market.

Awards panel processes

Members of the BEIS team have reported that, since the panel meetings took place in quick succession, assessors were often faced with multiple tasks on the same day (such as panel meetings, panel report deadlines and assessment deadlines). This meant that deadlines were missed and a back-log of delayed tasks quickly built up. Team members have also noted that it was often unclear to them which applications were going to which panel, meaning that it was very difficult to prioritise their workload.

Importantly, the BEIS team clearly appreciates the challenges that were encountered during the assessment, clarification, scoring and panel processes, and their experience is informing the development of the main scheme. Suggestions made at interview and in lessons learned reports for improvements include:

- Providing a longer period for the assessment, clarification, scoring and panel processes
- Making greater use of external consultancy-style or delivery body support during these processes, (though the challenges of this in terms of learning curves, quality control and cost were also noted)
- Allocating a single point of contact within BEIS or the delivery body, either for each scheme, or for all the schemes, would help ensure that clarification questions are

asked once only, and that assessments are more consistent (the term 'data manager' was used in this regard)

- Offering opportunities to discuss the scheme and the clarification questions face-to-face; applicants asked were always keen to do this, and stressed that it is very helpful if this can be done regionally.

Decision letters, decision review and funding agreements

Successful applicants

Decision letters: Successful applicants were sent decision letters that detailed the award that had been made and identified a set of 'conditions of support', which often took the form of further clarification questions. A small number of successful applicants commented that their award letter featured an amount that was different to the sum they had applied for, but noted that no explanation was offered for this.

Funding agreements stage: As with other stages in the application process, the 'conditions for support' had to be dealt with within very tight timescales; two of our evaluation interviews had to be postponed so that applicants could focus on these issues, and several applicants told us that they would not be able to meet the originally stated deadlines for this process. One successful applicant told us that it required considerable '*brinkmanship'* to convince BEIS of the veracity of their own financial model in the application, after which BEIS agreed to fund the scheme to the extent that had been requested. This applicant was pleased by the flexibility BEIS demonstrated during this final stage.

> **HNIP Applicant:**
> *"I think people really went the extra mile from BEIS' side."*

Another applicant reported that questions from the clarification stage were repeated at this stage. The BEIS team reported that some questions were repeated at this stage to secure further information on a particular issue beyond that which had been provided in response to a clarification question.

Unsuccessful applications

Communication of the award decision

Unsuccessful applicants were sent a one-page letter featuring the decision itself and details of the decision review process, along with a one-page annex containing detailed feedback and recommendations for development (including recommending applying for HNDU development funding where appropriate).

Unsuccessful applicants commonly expressed dissatisfaction with the decision letters. For instance, applicants used terms such as '*confusing'* or '*bog standard'*, and one said that the letter did not explain why the project had been rejected. One unsuccessful applicant

was waiting for a response from BEIS relating to clarifications, and then unexpectedly received a rejection letter. An exception to this from one unsuccessful applicant noted that the rejection letter would be useful in the preparation of an application to the main scheme. Our own examination of these letters suggests that they were detailed, helpful and bespoke, offering specific reasons for rejection and specific ideas for future development.

One applicant suggested that the HNIP team could learn from the BEIS Regional Growth Fund team on how to provide helpful feedback. While it is certainly possible that the dissatisfaction on the part of unsuccessful applicants is shaped by the disappointment of rejection, this may be a useful suggestion.

The decision review process

The decision review process was described in the application guidance and in the outcome letters to unsuccessful applicants. Applicants had to respond to the decision letter within ten working days. Each decision review was considered by a 'senior civil servant' working in BEIS but external to the Heat Networks team. Three organisations who had submitted unsuccessful applications requested decision reviews; in each case the decision was upheld. However, one of the unsuccessful applicants described the decision review process as unhelpful, noting that the team had provided considerable further explanation and justification of its scheme, again on a very tight timescale, and that all of its points were '*ignored'* or *'dismissed*' in the BEIS response.

> **HNIP Applicant:**
> *"I think it's fair to say that we haven't had a satisfactory response to our appeal. It's been dismissive and ignored the points we made."*

Our own analysis of this review and the BEIS response leads us to conclude that the BEIS response, while somewhat brief in its explanation of why the review was not upheld, was not dismissive. Significantly, the BEIS response acknowledged that the assessment process could have been better conducted with respect to this scheme, reinforcing earlier findings in this report about the assessment process.

Chapter 3: The applications, funding decisions and the scoring system

This chapter describes the key characteristics of HNIP applications, and compares the characteristics of successful and unsuccessful characteristics. It also presents a brief review of the scoring system used by BEIS. The chapter draws on analysis of all applications carried out by BEIS, on interviews with the BEIS team and with applicants, and on review of BEIS materials relating to applicant guidance, and assessment and scoring of the applications.

Applications

Overview of applications

There were 29 pre-applications followed by 25 full pilot applications[23]. Of these:

- 19 were from local authorities while four were from other public sector organisations and two were from universities
- 19 applications were for new heat networks, while five sought to expand existing networks and one related to interconnecting (and expanding) existing heat networks
- 16 were gas CHP projects, four were energy from waste, two included biomass boilers, one a geothermal CHP, one proposed only a gas boiler, and one proposed a water source heat pump.

The 25 projects requested a total of £78.5m funding. Planned capital expenditure for individual projects proposed ranged from £0.5m to £30m, with total planned capital expenditure across all 25 amounting to £263m.

Of the 25 applications 16 proposed serving new and existing buildings, while five proposed serving existing buildings only and four proposed serving new buildings only. Thirteen planned to provide heating and to generate electricity, two panned to provide heat and cooling, and to generate electricity, while nine planned to provide heat only, and one planned to provide heating and cooling (with no electricity generation).

[23] All information here supplied by BEIS, available at https://hnip.salixfinance.co.uk/sites/default/files/uploaded_files/HNIP%20Pilot%20results%20presentation.pdf

Overview of successful applications

BEIS awarded funding to nine projects. Of these:

- All nine were submitted by local authorities
- Seven proposed new heat networks, one sought to expand an existing heat network while one sought to interconnect existing heat networks
- Seven were gas CHP projects, one included energy from waste, and one included a water source heat pump.

BEIS awarded total funding of £24.2m to the nine projects - £15.7m in grants, and £8.5m in loans. Planned capital expenditure for the individual successful projects ranged from £1.8m to £13.6m, with total planned capital expenditure across the nine amounting to £75.1m.

Comparison of successful and unsuccessful applications

As **Error! Reference source not found.** shows, successful and unsuccessful applications how a similar mix of new heat networks and expansion of existing heat networks. **Error! Reference source not found.** shows successful and unsuccessful applications by utilities provided; it suggests that those proposing heating with electricity generation were more likely to be successful than those providing only heat.

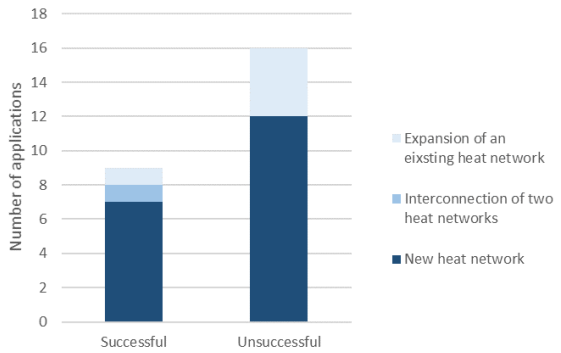

Figure 2: Successful and unsuccessful applications: new or existing heat network

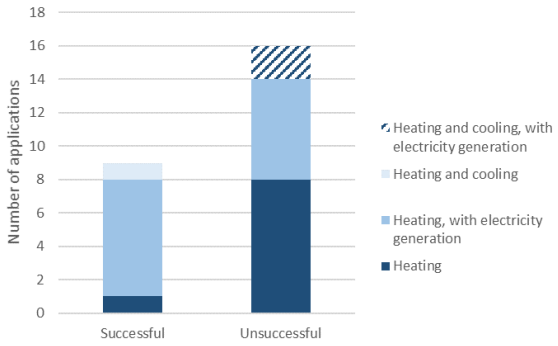

Figure 3: Successful and unsuccessful applications: by utilities provided

Source: BEIS analysis of applications to pilot scheme[23]

This apparent increased likelihood is coherent with **Error! Reference source not found.**, hich suggests that successful applications were more likely to have gas CHP as their primary heat source, although other technologies were also observed in successful applications.

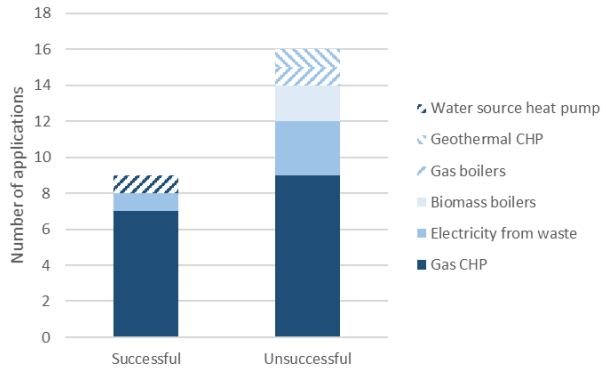

Figure 4: Successful and unsuccessful applications: by primary heat source

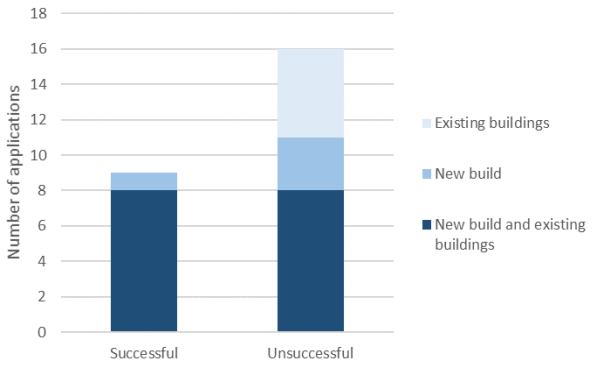

Figure 5: Successful and unsuccessful applications: by new build or existing buildings

Source: BEIS analysis of applications to pilot scheme[23]

Looking at **Error! Reference source not found.**, applications involving new build and xisting buildings appear to have been more likely to be successful. None of the applications involving only existing buildings were successful. BEIS' analysis indicated that these applications were unsuccessful for one of three reasons; two were not sufficiently mature proposals, two provided insufficient evidence in their applications, and one failed on economic grounds[23].

Error! Reference source not found. shows the type of end users of heat networks in uccessful and unsuccessful applications. Those schemes with a mix of domestic and non-domestic customers appear to have been more likely to be successful. Neither of the applications involving only domestic end users was successful.

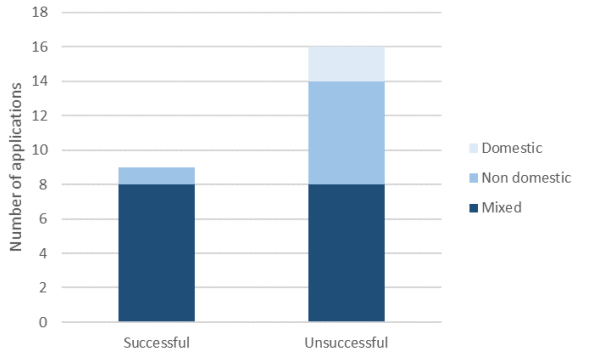

Figure 6: Successful and unsuccessful applications: by end users

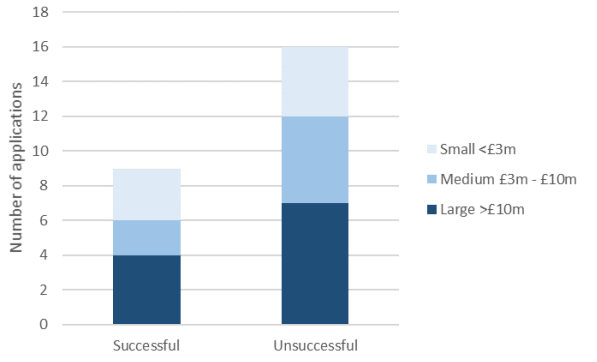

Figure 7: Successful and unsuccessful applications: by total capex

Source: BEIS analysis of applications to pilot scheme[23]

Thermal characteristics of successful projects

In terms of planned annual delivery of heat, BEIS characterised six of the applications as small, two as medium and one as large, as shown in Figure 8. Figure 9 shows that in terms of installed capacity, BEIS has characterised four as small, four as medium and one large.

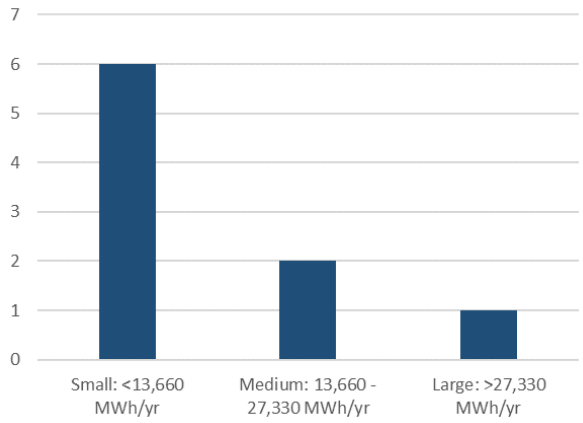

Figure 8: Successful projects – planned heat delivery

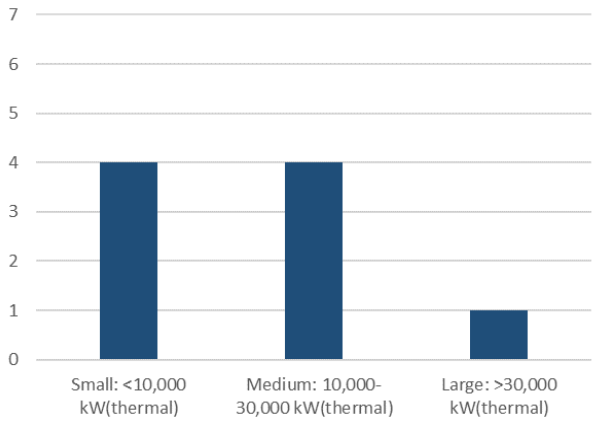

Figure 9: Successful projects – installed capacity

Source: BEIS analysis of applications to pilot scheme[23]

The scoring system

The applications that passed assessment then entered the scoring process, and members of the assessment teams scored them against five categories, aligned with some of the long-term aims of the project. As Table 2 shows, the scoring framework used both quantitative and qualitative metrics. Applicants were made aware of the five key criteria but BEIS withheld details of the relative weightings in the scoring framework. BEIS told us this was because they sought to make investment decisions on projects "as is" – they did not want to influence local decisions relating to heat network scheme design through the scoring framework. There is clearly a potential conflict between seeking to avoid affecting local decision-making, and ensuring that the profile of applications reflects those factors of most importance to BEIS.

Broadly, interviewees from BEIS were satisfied with the scoring criteria, noting that they allowed BEIS to distinguish between 'good' and 'bad' applications. The scoring also secured a spread of results, with some applications scoring highly and others clearly scoring poorly. Complementing quantitative measures with qualitative description allowed BEIS staff to get a better idea of each application. However, applicants expressed uncertainty about the scoring methodology and relative importance of the criteria; this is not surprising as they had no access to the details. Discussions with BEIS and our own review of the scoring scheme identified some areas where BEIS might wish to consider whether to amend scoring for the main scheme. We discuss these below.

Table 2: HNIP pilot scoring framework

Criteria	Method
Short term carbon savings	Carbon savings calculated and scores allocated based on carbon savings in comparison with project specific counterfactuals, per £1,000 of HNIP funding (quantitative)
Potential for long-term carbon savings	Assessment of future low carbon heat source options, certainty and expansion opportunities (qualitative)
Heat price comparison	Scores based on heat price compared with the project specific counterfactual for each domestic and non-domestic end-use customer group as relevant (quantitative)
Customer impacts	Customer impacts in relation to Heat Trust[24] equivalent standards (qualitative)
Social NPV[25]	Social NPV calculated and scores allocated based on the social NPV of the heat network compared with a project specific counterfactual, per £1,000 of HNIP funding(quantitative)

Source: BEIS, private communication

Social NPV

The metric used to assess social NPV was social NPV of the heat network compared with a project specific counterfactual, per £1,000 of HNIP funding to be awarded. This metric allowed comparisons to be made between small schemes and large, on the basis of maximising value from public money.

We note the following:

- Where a scheme is extending an existing heat network, capital costs are likely to be lower than for a completely new heat network; there may, for example, be no need for additional installed heat generation capacity. This may result in higher social NPVs for schemes extending existing heat networks
- Capital costs for new heat networks serving new buildings are likely to be lower (and so social NPV may be higher) than for new heat networks serving existing buildings, where access may be difficult, and retrofitting costs may be high. (Note,

[24] Heat Trust sets out a common standard in the quality and level of customer service that heat suppliers should provide their customers.

[25] Social Net Present Value (social NPV) is a calculation of the value of a project to society as a whole, taking costs and benefits into account.

however, that retrofitting costs were only eligible for funding from the pilot scheme in limited circumstances[26]).

- Of course, in some cases the benefits of heat networks may be higher for some existing buildings, as they may be replacing relatively inefficient electric heating, while for new buildings, they would be an alternative to modern and relatively efficient property-level heating solutions.

The numbers of applications to the pilot scheme were such that no evidence is available regarding whether the approach chosen favoured any type of scheme over others.

Carbon savings: short term and long term

We note that short term carbon savings were scored quantitatively, while the potential for long term carbon savings was addressed qualitatively, and then allocated to one of a limited number of scoring categories, thus allowing only limited differentiation between applications. Depending on the specifics of their own scheme, some applicants thought that immediate significant carbon-savings (for instance, from waste CHP rather than gas-CHP) needed to be strongly emphasised in the scoring because these were more certain. At the same time, others with different project specifics (e.g. waste CHP coming on stream at a later date) felt that future carbon-savings should be given more prominence than short-term carbon savings in the scoring. Key to these discussions is the fact that applicants were not aware of the detail of the scoring framework.

> **HNIP Applicant:**
> *"I think there was a lot of confusion going around about how carbon savings were scored, initial carbon savings, future carbon savings, what was calculated in the lifecycle of those carbon savings."*

Heat price comparison

Interviews with applicants raised three issues relating to this criterion. In one instance, in support of social fuel poverty objectives, a local authority intended to charge a flat rate for heat. In another, in pursuit of what they referred to as 'a truly self-sustaining market', a local authority decided not to subsidise heat for its customers, thus reducing the price reductions that were feasible. Finally, an interview with an applicant from a non-local authority applicant revealed the challenges in preparing application materials for HNIP for schemes that have no paying customers for whom price reductions can be secured (such as where the network operator is also the consumer of heat). The applicants in these cases all felt that the scoring system did not take account of their circumstances, or that it unfairly disadvantaged them.

26 https://www.salixfinance.co.uk/system/public_files/hnip_pilot_pre-qualification_applicant_guidance.pdf

Customer impacts

Interviewees in BEIS felt that the range of potential scores was too small to fully differentiate between different applications. This criterion might also need examination in the context of public sector single owner-operator-consumer schemes in which there are no paying customers.

Factors not included explicitly in the scoring system

Discussions with BEIS officials highlighted a range of factors which, although of less immediate importance and relevance to HNIP, align with BEIS' wider strategic objectives, and were not included in the formal HNIP project aims. These were therefore not explicitly accounted for in the assessment and scoring process. These include (across the portfolio of schemes): level of innovation, the mix of heat sources used, geographic spread of heat networks, and additional funding sources. On these issues, we note that, although not explicitly accounted for in scoring, the process produced a portfolio with a mix of primary heat sources and a mix of geographical locations. Some BEIS interviewees also mentioned capacity building among local actors, which is included in HNIP's aims, but not in the assessment or scoring process. This seems sensible, as objective metrics would be difficult to establish.

Chapter 4: The current UK heat network market and the early effects of HNIP

This chapter moves away from the specifics of the HNIP Pilot to address research questions 3, 4 and 5. The chapter draws on and synthesises the interviews with applicants, representatives of the heat network supply chain and potential third party investors to provide a snap shot of the current UK heat network market and supply chain. The chapter also describes the early impact of HNIP and reports interviewees' predictions of the longer-term impacts of HNIP. The chapter draws on 'innovation' literature to provide a theoretical framework within which the insights of the interviewees can be better understood.

According to our interviewees, the UK heat networks market has a number of characteristics of a growing market, but also faces challenges with respect to: financial viability and funding, planning and other regulatory support, and the supply of knowledge and skills. The chapter then examines the early and predicted longer term effects and impacts of HNIP. In the near term we look at the effects on successful and unsuccessful applicants, as well as the heat networks market. Regarding longer term impacts, we focus on evidence relating to whether HNIP can promote a self-sustaining market, and the extent to which attention to broader market drivers – such as supply-side support, regulation and financial instruments – might be necessary.

It is a conspicuous finding of this analysis that broad-based perspectives on the heat network market and the potential of HNIP did not vary significantly across the groups and categories within the interview set. For this reason, in this chapter in particular, we only highlight specific distinctions where they are prominent.

Overview of the current UK heat network market

This section draws upon the interviews with applicants, non-applicants, the supply chain and third party investors. The aim of this section is to provide a broad-based snap shot of the heat networks market in early 2017. Interviewees reported that the UK heat networks market is growing steadily, albeit relatively slowly. A figure of around 2% per annum was mentioned on a number of occasions[27]. Interviewees variously reported that this growth

[27] Up-to-date information about growth in the UK heat networks market is not available. BRSIA (2013: 16) cites overall (public and private) market growth of 4.2% from 2010-2011 and 9.5% from 2011-2012. BRSIA (2013) UK District Energy 2013: a multi-client study by Henry Lawson, https://www.bsria.co.uk/download/product/?file=0FHNCbEcNV4%3D.

was reflected in new entrants into the market, and investment in people and skills in organisations already within the supply chain. The market for design and construction is based on a mix of new schemes, and refurbishments of and extensions to existing schemes. In addition, there is a market for maintenance and operation.

Interviewees from the heat network supply chain told us that the market is currently driven by technological improvements – in both heat centre technologies and components such as heat interface units[28], meters and valves – that can deliver more efficient and reliable networks. In addition, largely in the context of carbon targets, heat network sponsor interviewees referred to the importance of BEIS's provision of support in the form of guidance and funding for scheme development. Earlier work of the Decentralised Energy Programme Delivery Unit and more recent work of HNDU was also mentioned as important) as now was funding for commercialisation and construction (in HNIP). Some planning support is also present, particularly in London[29].

Interviewees noted that, although large scale heat networks have long been a feature of the UK market (schemes in the 1980s were often mentioned), recent activity has focused more on smaller schemes with private property developers and single site public schemes. Although the UK market is developing, it remains relatively small and less well-developed than some continental markets; Denmark, Sweden, Germany, France, Poland and the Czech Republic were all mentioned to us. We discuss the reasons for this below.

> **Component Manufacturer (Supply Chain):**
> *"We've definitely invested in training and we've had to develop our own knowledge as we go along."*

> **Component Manufacturer (Supply Chain):**
> *"There would have been capital investment in the R&D development and there were changes made to the production lines."*

The current heat networks supply chain

Multiple function companies

Our analysis of the interviews suggests that the heat networks supply chain is diverse and complex. A key finding is that the market is largely arranged around a growing group of large organisations that we have referred to as multiple function companies (MFCs).

[28] Heat interface units act as a bridge between the central source of hot water (or sometimes steam) and the heating and hot water systems of individual buildings, or individual apartments.

[29] The London Plan requires developers to prioritise connection to existing or planned heat networks where feasible.

These companies are similar in that they perform a range of functions, such as: commissioning, funding, designing and specifying, constructing, owning, operating and maintaining heat networks (as well as other energy infrastructure assets in many cases).

Thus, these are good examples of organisations that are 'vertically integrated' across the supply chain. The specifics of what each company does varies, and they do different things on different projects, sometimes competing for an element of a project and sometimes working as partners on different elements of projects. Some of these companies are from the big six energy companies (such as SSE, E.ON and Npower), some are large infrastructure companies (such as Arup and BuroHappold) and others are more specialised (such as Brookfield Utilities and Vital Energi). Interviewees within MFCs reported that heat networks tend to contribute a very small percentage to the turnover of such companies, though our interviewees typically predicted growth, especially in the large-scale public sector (partly due to HNIP).

> **Multiple-Function Company (Supply Chain):**
> *"We would be kicking ourselves if we didn't gear up to being a big player in the growing towns and cities market."*

> **Multiple-Function Company (Supply Chain):**
> *"We design, build, operate and maintain district energy networks, and other energy infrastructure. We also provide metering, billing and energy efficiency services. We don't manufacture, and apply the most appropriate technology to meet the future needs of the project or our client."*

Multiple function companies may act as project sponsors or be appointed by property developers and public sector organisations (one interviewee mentioned that public sector organisations were considered to be slow as clients). MFCs are attractive to project sponsors because they consolidate risk and are cost effective.

The broader supply chain

Other members of the supply chain include more specialised companies, for instance: design or financial consultants, component manufacturers (for example, of pipes, valves, boilers and meters), construction companies, operating and maintenance companies etc.

An international market

Across this landscape, while some of these companies are UK-based, -owned and -focused in terms of clients and suppliers, others are international (bringing opportunities for learning from other markets). Interviewees within the supply chain typically noted an increased interest in UK heat network markets among international companies. Views in the supply chain on the preferred geographical source of components varied: for some, overseas components signify high quality, with the associated long term warranties that are appreciated by the public sector, while for others UK components are more

appropriate due to perceived reliability of supply. Neither view dominated. One interviewee noted that their organisation had used overseas components when they first entered the market, but had since invested in their own domestic manufacturing capacity.

Current challenges to further growth

Interviewees across the interview groups were typically keen to discuss the challenges that might constrain growth in the heat networks market. Within the context of HNIP, these were valuable discussions because they reveal the widespread view – that we heard from across the interview groups – that an emphasis on short term finance and funding alone is not sufficient to create a self-sustaining UK heat networks market. This view is also held within BEIS and reflected in the objectives of HNIP.

One interviewee from an MFC expressed frustration that many of the large scale projects currently in development or construction, which would be suitable for heat networks, had selected other options for heating or cooling (we discuss the reasons for this challenge below). Interviewees in some potential investors spoke of the UK heat networks market as both mature (in the sense that it has a 30-40 year history) and immature (in the sense that it still struggles to compete with both alternative heat sources and alternative investment opportunities); hence, one investor spoke of 'market failure' and another pointed out that there is still no secondary investment market for heat networks (which might attract more investors).

> **Multiple-Function Company (Supply Chain):**
> *"I'm aware of a large project that's about to start work where they're putting in [property level heating]. That's because the consultants have looked at the building regulations and said to the developer, 'You don't need to worry about district heating, we can put in [property level heating] and you'll achieve what you need to achieve'."*

'Innovation' scholars[30] have highlighted a number of factors that support the development of niche technology markets, such as heat networks. We have used some of these to encapsulate the challenges faced by the UK heat networks market:

- Resource mobilisation - which responds to challenges in the economic case
- Legitimation - which responds to the challenge of a lack of familiarity

[30] With origins in the 1960s, innovation studies is now a well-established area of scholarship. In broad terms, the objective of the field is to understand and describe how innovation happens and niche markets are developed. Crucially, innovation is understood to be a collective socio-technical achievement that requires entrepreneurial actions by numerous actors in the public, private and third sectors (for instance, see: Fagerburg, F. (2003) Innovation: a guide to the literature, http://in3.dem.ist.utl.pt/mscdesign/03ed/files/lec_1_01.pdf.

- Knowledge diffusion and human capital - which respond to a lack of knowledge and skills[31].

Since HNIP is a financial instrument offering grant and loan funding for heat networks, we can note that HNIP is primarily designed to address the issue of 'resource mobilisation', but does not directly address 'legitimation', 'knowledge diffusion' or 'human capital'. We now discuss the ways in which some of these factors were present in the discussions of the interviewees.

Financial viability, risk and the investment landscape

The challenge of finance and investment is referred to as 'resource mobilisation' in the innovation literature. The difficulties in securing and providing funding for some heat networks – particularly large district schemes – was the key element of interviewees' discussions across applicants and the supply chain, and among third party investors. This underlines the potential value of HNIP.

Several interviewees from local authorities and third party investors confirmed that loan-based funding for public sector (but not private sector) heat networks – some of it very 'cheap' – is readily available from a range of sources. However, these interviewees also said that, typically, due to the high capital costs and long payback periods, large public schemes are often not financially viable – in terms of investment hurdle rates – even in the context of these loans. The challenge of investing in projects with relatively low returns on investment over long periods of time was reported as especially acute within the context of local authority investment, which is often (although not always) subject to internal competition on the basis of return on investment. This led interviewees within local authorities to emphasise their strong preference for grant funding.

For their part, third party investors – both large investors, such as banks, and smaller more specialised investors – highlighted a number of investment challenges in the heat networks market. The scale of the challenge to greater institutional investment is reflected in the difficulties that the research team had in securing interviews with large investors such as banks, who did not see the relevance to them of either heat networks or HNIP. Third party investors also cited the difficulties in making heat networks schemes financially viable within the context of loans.

These investors reported that they would accept long repayment terms and relatively low returns in principal, but that such investments would need to be low risk. Heat networks

[31] Bergek et al (2008) Analyzing the functional dynamics of technological innovation systems: A scheme of analysis, Research Policy 37: 407–429; Markard and Truffer (2008) Technological innovation systems and the multi-level perspective: Towards an integrated framework, Research Policy 37: 596–615.

were typically described by investors as having a number of high risk characteristics – particularly relating to demand risk (related to securing anchor load contracts) and construction risk (relating to time and cost over-runs during the construction phase).This aligns with recent comments from the IPPR on the perceived risk of heat networks.

> **IPPR Report (2017)** [32]**:**
> *"The (HNIP) funding is a welcome development in that it recognises a market failure affecting heat networks whereby the lack of an existing UK industry, compared to Scandinavian countries for example, has meant that the market overestimates the risk of the projects and many do not get beyond the feasibility stage."*

Several investors also noted that heat networks compete with an existing gas infrastructure, which can render gas installation much more financially viable. In addition, most investors highlighted a preference for investments of above £20-25m, many times larger than typical individual heat networks investment opportunities. In this context, transaction costs[33] (such as legal fees) – which are typically fixed, rather than scaling with the size of the investment – were cited by investors as challenging within the context of these smaller investments. The practice and possibility of bundling heat networks investments was raised several times.

> **Investor:**
> *"Long-term, low risk, they're all subtly different but it is low risk, longer-term."*

The key risk, raised by all of the investors with whom we spoke, was demand risk. This results from the challenges of ensuring a reliable income stream through guaranteed demand, for example via reliable 'anchor load' end-users (such as a hospital or a university) or a 'captive' residential market[34]. In the context of 'anchor loads', the particular difficulty of securing long term contracts in the private sector was raised by interviewees across the groups. In the case of 'captive' residential markets, interviewees mentioned potential reputational risk to heat network developers and operators should gas and electricity prices fall dramatically, and heat network customers find themselves paying conspicuously more for their heat than they would with a conventional energy source.

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32 Emden, J., Aldridge, J., and Orme, B., (2017), *Piping Hot,* IPPR, p.22-23, http://www.ippr.org/read/piping-hot#.

33 Transaction costs are costs associated with making an economic transaction. For heat networks investments, these will include legal fees for example. Many of these costs will be similar for both small and large investments, for example, the cost of due diligence exercises. (Due diligence refers to reviewing an investment or other transaction in detail to make sure that the buyer understands the investment and its associated risks.)

34 The word 'captive' is used here to describe a situation in which domestic consumers cannot switch to an alternative heat provider.

Investors also suggested that the construction risks (typically increased construction costs and timescales) associated with heat networks are a hindrance to investment. Finally, several investors also reported that – within the context of a relatively unregulated market – there is a risk that future regulation may be applied retrospectively with impacts on the revenue stream.

The investors whom we spoke to highlighted the potential for a variety of investment products to serve the heat networks market, but also typically identified a preference for loan arrangements (as opposed to equity investments or combinations). Given the perception of relatively high risk (and what they saw as modest returns), one investor noted that if the 'first loss' lies elsewhere, this could support third party investment. Given the perception of high construction risks, one investor noted that specific arrangements for this phase or a focus on later phases would be of value.

Other challenges in the heat networks market

Although a range of financial and investment issues were discussed by the interviewees, other non-financial challenges were also discussed. This is an important point because it indicates that – according to stakeholders – there are a range of market challenges that may need to be tackled in ways that go beyond the HNIP funding.

Planning, regulation and taxation

Interviewees in MFCs and investors were keen to note the extent to which those planning heat provision in the private and public sectors are typically minded to stick with familiar solutions such as gas-fired boilers, which they regard as low-risk, uncomplicated and manageable compared with relatively unfamiliar heat networks. The lack of public demand for heat networks was also mentioned. In the 'innovation' literature, these challenges come under the heading of 'legitimation', and causes what is often referred to as 'customer inertia'[35].

According to the 'innovation' literature[31], the challenge of 'legitimation' (as well as 'resource mobilisation') can be addressed through a combination of regulation, incentives and demonstration. Interviewees suggested a number of potential interventions. For instance, a commonly expressed view from interviewees in MFCs was that, with support from national government, local authorities could drive heat networks through firm planning (a 'regulatory response'). London has strict planning requirements in favour of heat networks, and was cited as an example of how planning support can lead to an increase in the development of heat networks[36]. One interviewee in an MFC also pointed out that end-

[35] Wu, LW (2011) Satisfaction, inertia, and customer loyalty in the varying levels of the zone of tolerance and alternative attractiveness, Journal of Services Marketing, 25 (5): 310-322.

[36] The Mayor of London (2016: 188-9) Policy 5.5 Decentralised Energy Networks, in The London Plan, https://www.london.gov.uk/sites/default/files/the_london_plan_2016_jan_2017_fix.pdf.

users, both businesses and domestic consumers, still typically have a choice as to whether or not to use a heat network that has been constructed. It was mentioned that the Scottish Government is consulting on both of these issues. Regulation was also widely discussed by interviewees within the context of a need for industry standards (such as for scheme specification, components and construction) designed to bring down costs.

> **Component Manufacturer (Supply Chain):**
> *"How do we get the cost reductions and economies of scale in heat networks and one of the big things is getting better standardisation."*

One interviewee highlighted the extent to which the very low price of gas makes heat networks less competitive and suggested – with little expectation that this would happen – that the government should tax gas more highly. The same interviewee also questioned the equity of much higher business rates for heat networks than other energy businesses. Several third party investors also suggested that the negative perceptions of heat networks as an investment opportunity might be addressed by demonstrating the viability of heat networks, for example through project case studies and a well-publicised pipeline of projects (HNIP aims to do this). This might also help to address perceived risks associated with heat networks projects.

The supply of knowledge, skills and materials

The innovation literature refers to the associated challenges of 'knowledge diffusion' and 'human capital'[31], which can be understood here as shortages of skills and knowledge. These themes were prominent in discussions with applicants, the supply chain and investors. Most of the interviewees among the applicants and representatives of the supply chain identified a lack of knowledge and skills capacity as a significant emerging challenge in the heat network market – one interviewee referred to a 'skills gap' – and noted that HNIP could exacerbate this by increasing demand such that it outstrips supply.

Specialised knowledge-based skills and services – such as those provided by: technical consultants, financial consultants, mechanical engineers, design services, legal services, procurement expertise and construction skills, such as welding – were all cited as subject to supply shortages (design and legal services were cited less often). One interviewee in a local authority expressed disappointment that public engagement skills were not considered relevant in heat networks projects, especially when householders' lives are disrupted by construction and retrofit works. Interviewees argued that this issue needs particular attention from BEIS in addition to HNIP, for instance through HNDU or other skills and knowledge based initiatives.

The potential of components shortages were raised by some supply chain organisations although there was no evidence of current shortages. It was noted that HNIP-supported construction is still to come on stream and supply chain interviewees reported a concern that the cost of overseas components may increase once the UK leaves the European Union.

Investor:
"The reason why a lot of projects don't happen, there's a lack of knowledge within local authorities and the market: procurement, structuring, skill set, knowledge, a whole list of stuff."

HNIP Applicant:
"No [there is not enough capacity], far from it. You get people pulling out of tender processes, because their boards have had a change of heart and they don't think heat networks are worth exploring or they've got too much work because the sector's too small and there's another more lucrative project from a private sector developer, that's going to get delivered quicker, it's a messy little world out there, trying to let one of these contracts."

HNIP Applicant:
"The supply chain is under pressure. There's a limited number of consultants who have the right level of expertise and you've got the delivery partners out there who again are currently under quite a bit of pressure."

Component Manufacturer (Supply Chain):
"I think there's skills gaps throughout the supply chain, the designers themselves, the installers, in terms of they're just not used to installing a heat network, the things you should be doing and how you should be approaching it, and there's a huge gap with the commissioning side of things."

HNIP Applicant:
"I think there's a massive piece of work that BEIS needs to do about engaging with the supply chain. Funding schemes isn't the issue, it's about having a supply chain that is capable of delivering."

Several potential implications of supply-side constraints for the heat networks market were raised by interviewees across the interview categories:

- Projects could be held up by shortages of knowledge and skills
- Supply-side constraints on knowledge and skills can lead to higher costs (due to suppliers increasing their prices and an increase in transaction costs due to inexperienced commissioners), which can further diminish the financial case
- Insufficient supply can lead to quality issues (especially within the context of a lack of industry standards), which one interview expressed in terms of '*cowboys*'.

It was commonly suggested across the interview groups that quality issues could be alleviated and costs could be brought down through the greater provision by government of some knowledge-based services. For instance, a central procurement service or a system of accreditation for suppliers (here, we note that BEIS is funding a pilot project, the District Energy Procurement Agency, based upon VÄRMEK, a similar organisation in Sweden)[37]. One interviewee explained how a central procurement service has the potential to: avoid each organisation reinventing the wheel and upskilling at great cost; get better deals from the supply chain; and to deal more efficiently and effectively with the international supply chain. HNIP does not aim to address these issues.

Other suggestions included the provision of more formal knowledge-based or consultancy services through HNDU and development of robust industry standards. Interviewees in local authorities and MFCs also highlighted the value of the work by CIBSE and ADE in training consultants, and developing the supply chain Code of Practice[38], and the work of the Heat Trust on consumer protection[39]. The consensus among interviewee was that more work was needed in this area, as HNIP is likely to increase demand and the market does not yet appear to be scaling up to meet that demand, possibly involving greater intervention by BEIS.

> **HNIP Applicant:**
> *"It's really regrettable that BEIS are not setting a procurement framework for local authorities to get all this consultancy work straight from the framework, because 200 [sic] local authorities have been procuring this consultancy work, when really if there would have been a framework in place, it would have been probably money better spent."*

Uncertainty about future UK energy policy

Several interviewees from across the interview groups told us that they thought uncertainty about future UK energy policy might undermine confidence and growth in the heat networks market. One interviewee highlighted previous government policies – such as Green Deal and the Feed-in-Tariff, in which organisations made significant investment on the basis of a policy intervention that was subsequently terminated or made less attractive. Interviewees expressed the concern that future climate policy could change, for example, to favour alternative carbon-reduction technologies, and that a potentially uncertain investment landscape while the UK negotiates its future trading relationship with the European Union could result in increased difficulties in securing investment.

37 DEPA: https://www.greatermanchester-ca.gov.uk/info/20115/depa_district_energy_procurement_agency; VÄRMEK: https://sinfra.se/.

38 http://www.cibse.org/knowledge/knowledge-items/detail?id=a0q200000090MYHAA2.

39 http://www.heattrust.org/.

> **Non-Applicant:**
> *"People haven't forgotten about Feed-in Tariffs and Green Deal. People heavily invested in the market to build a supply chain and the government pulled the rug out from under them with potentially no notice. Businesses went to the wall. People lost their jobs. So BEIS has to be cognisant of that. People are once bitten twice shy."*

Opinions of the implications of the UK leaving the European Union in the supply chain varied. While some felt that it would not affect the market, others noted that the costs of overseas components might increase (as a result of movements in currency exchange rates). A component manufacturer reported that their exploration of greater involvement in the heat networks market had been curtailed.

> **Component Manufacturer (Supply Chain):**
> *"We had this section which was looking at operating heat networks but we've pulled back from that at the moment. I'm afraid Brexit has kind of put paid to that."*

The early effects of the HNIP Pilot

At this early stage, few observable impacts of the HNIP Pilot were expected. That said, our interviewees were able to reflect on some very early changes and signs of potential impacts.

In heat network schemes

Several applicants and non-applicants told us that the HNIP Pilot had encouraged them to embark on a heat network plan that had been dormant or to speed up development of existing plans. There is also evidence that potential applicants are thinking more ambitiously about the heat networks that they might be able to implement with HNIP support, for example, with respect to implementing larger schemes, using emerging technologies or heat sources, and creating linkages between networks.

> **HNIP Applicant:**
> *"[Without HNIP] it would have just stuck around in the doldrums while we tried to figure out a cut-down, reduced, pared down version that we could deliver with the returns that we needed."*

In successful bids

Unsurprisingly, successful applicants told us that success in the HNIP Pilot would enable a previously financially unviable scheme to go ahead, or more specifically to move into commercialisation and construction phases. Perhaps more interestingly, we were also told that success in the HNIP pilot had already started to positively affect the attitudes of senior management towards heat networks, with the implication that future schemes were more likely.

> **HNIP Applicant (Successful):**
> *"We had the idea of the project but it wasn't going to happen because the economics didn't stack up without the HNIP funding. HNIP made a project viable that otherwise wasn't going to be viable."*

In unsuccessful bids

The flip side of this is that at least one unsuccessful applicant to the HNIP Pilot reported that the lack of success had negatively affected the perception of heat networks at senior levels within their organisation. Reflecting on this point, one interviewee told us that this was particularly so when the scheme appeared to '*tick all the boxes*' and failed for reasons that '*were not adequately explained*'. Our (non-expert) view is that the rejection letters were explanatory, but it is salutary to note the negative effects that an unsuccessful outcome can have. A more positive, though less frequently expressed, view was that the feedback was useful in terms of developing ideas for other funding sources and the main HNIP scheme.

> **HNIP Applicant (Unsuccessful):**
> *"It's currently on hold. I have had conversations with the [anchor load] but they're only interested if it's financially viable, and that project will not be financially viable without a capital grant from HNIP."*

In the heat networks market

In a complex industry landscape, interviewees across the interview categories were understandably hesitant to attribute change directly or wholly to the HNIP Pilot. Nonetheless all firmly acknowledged a role for the pilot, alongside other factors, in encouraging: greater creativity in heat network design, a growing interest from consultants and technologists, greater confidence to invest in skills, expertise and marketing, reductions in costs and the boost to the large-scale public sector market. Several interviewees noted the importance of HNIP in signalling government commitment to heat networks. We were also told that the private sector had been disappointed by its exclusion from the HNIP pilot, but was preparing for its entry into HNIP in the main scheme.

> **Investor:**
> *"HNIP signals that this was one sector that government is going to continue to support."*

> **Component Manufacturer (Supply Chain):**
> *"I think [HNIP's] helped with the feeling that there is help to make sure that the market does develop and that gives us confidence, that the market will develop to a point that's really a useful market for us to go at."*

Investor:
"I think it takes projects from being uncommercial to commercial, if it's put in correctly and then hopefully as the market develops, the cost of capital comes down."

Non-Applicant:
"Well I've got [HNIP] factored in as an option for funding support. Our business case will be subject to consideration of HNIP funding if our project financials aren't strong enough."

Non-Applicant:
"[HNIP] has made us more open to exploring, for example, alternative energy sources like the water source heat pump and I think that the project would not have reached the level it's at now if HNIP funding was not on the horizon."

Potential longer term impacts of HNIP

Views varied – and many interviewees were ambivalent – about whether HNIP would lead to significant longer term growth in both public and private sector markets. Recognising the funding challenges that face the heat networks market, some applicants and investors were very positive about the potential for HNIP to have a significant impact on the market. However, some interviewees from MFCs and third party investors were more sceptical about the extent to which HNIP would lead to any additional market growth on top of what would happen anyway, and about how sustainable that growth would be beyond HNIP.

The arguments used to support this view referred back to some of the challenges identified in the previous chapter. Sceptical interviewees argued that these issues – especially those relating to skills and knowledge in the supply chain – were at least as pressing as the financial viability issue. In addition, one interviewee in an MFC argued that £320m was an insignificant sum – '*a drop in the ocean*' – in terms of initiating a self-sustaining heat networks' market. Another interviewee in an MFC expressed dismay at the lack of awareness of HNIP in local authorities. Finally, one of these individuals suggested that – on the basis of the outcomes of the pilot – HNIP might struggle to leverage the £2bn of other funding that is envisaged.

Investor:
"I think obviously the HNIP fund is going to be the catalyst for getting things moving and I think the challenge is to use it in a way makes sure that there's an ecosystem that comes out of it, to support the ongoing growth and increasing competitiveness of the heat market."

Investor:
"It's impossible to say, but the evidence in any other market like this is that as you start to scale it, the costs come down. You can't say categorically but I think the evidence is that it should go a long way to helping create a sustainable market and ultimately, if you're not going to create a sustainable market, you'll have [a lot of] good heat networks which are going to reduce carbon along the way."

Supply Chain Company:
"To be honest, three hundred and twenty million quid is a drop in the ocean so it isn't going to make a jot of difference in the market. However it is a very useful tool in discussions with prospective clients to talk knowledgeably about HNIP, establishing your credentials."

Supply Chain Company:
"Large London boroughs who have large existing heat networks and big carbon problems and if they don't know about HNIP and aren't excited about getting on and sorting this out, well frankly my excitement levels reduce and I can't see this happening as quickly as the government thinks it might."

Multiple Function Company (Supply Chain):
"I think HNIP is a useful carrot to incentivise the investment in schemes but there is also some stick needed…for local authorities to enforce planning."

Chapter 5: Conclusions

This section draws conclusions based on evidence presented earlier in this report. Based upon the pilot evaluation aims (see Annex 2), and developments during the implementation of the pilot evaluation, this report focuses on five key research questions.

These research questions are:

1. What were the successes and challenges in the HNIP pilot process (from policy development and implementation, through the pre-qualification, application and assessment stages, to awards and signing of funding agreements)? This question was addressed in Chapter 2, from the perspective of the BEIS teams and the applicant teams.

2. What are the patterns in the characteristics of the successful and unsuccessful pilot applications? This question was addressed in Chapter 3, based upon an analysis of the applications.

3. What are stakeholders' (applicants, non-applicants, supply chain members, industry bodies, and third party investors) perspectives on the status of and challenges in the current heat networks market? This question was addressed in Chapter 4, on the basis of interviews with these stakeholder groups.

4. In particular, what financial barriers and preferred types of finance are identified by stakeholders? This question was addressed in Chapter 4, also on the basis of interviews with stakeholders.

5. What are stakeholders' perspectives on: their early responses to HNIP, the early impacts of HNIP (including in the heat networks development pipeline) and the potential longer term impacts of HNIP (including potential barriers to success)? This question was addressed in Chapter 4, again, on the basis of interviews with stakeholders.

In summary, the process evaluation of the HNIP Pilot suggests that the application process as a whole was delivered on time, but the timescales were extremely tight. The full application stage required a large volume of materials, often in a format that was unfamiliar to many applicants. These factors were reported to have affected the quality of the applications and caused considerable challenges in both the BEIS teams and the applicant teams.

Applicants reported that HNIP Pilot funding would enable projects to proceed which would otherwise not have done. However, applicants and wider industry stakeholders reported a tension in some institutional contexts between the key HNIP Pilot requirements to be both at an advanced stage of preparedness and to have a project funding gap. This suggests that some HNIP Pilot spend may not have been entirely 'additional'.

The challenges in funding heat networks was well-appreciated among stakeholders and – within this context – the funding that will be provided in the HNIP Pilot and main scheme was welcomed by stakeholders. There are very early signs that organisations are responding to HNIP through their own investment. At the same time, stakeholders also highlighted the extent to which other market challenges – such as skills and knowledge, and the certainty that is provided by regulation – would also need to be addressed in order to create a self-sustaining heat networks market.

Application and assessment processes (RQ1)

In this section we highlight learning from the evaluation concerning the application and assessment processes based on the findings presented in Chapter 2. In this section, as in Chapter 2, we use the term 'the application process' to describe the entire process, and we refer to specific stages within that overall process (such as the full application stage and the assessment stage).

Scheme development

1. **Limited BEIS resources and time:** The BEIS team had limited resources and time to plan, design and implement the HNIP pilot. This led to parallel processes of policy development and implementation, described as constant 'firefighting'. This meant that all stages in the application process took place later and in more compressed timeframes than had been originally planned.

2. **A small number of BEIS 'champions' was critical:** A small number of individuals possessing the necessary technical and commercial knowledge were credited with being the driving force behind the pilot scheme.

3. **Market support for HNIP:** In broad terms, the rationale of HNIP – to provide initial grant and loan funding in support of a longer term self-sustaining market – was widely understood and supported by stakeholders within the heat networks market. Challenges not directly addressed by HNIP were also identified – with respect to skills and knowledge, and regulation – and we discuss these further below.

4. **Possibility of tension between having a 'funding gap' and being at an advanced stage of preparedness:** Eligibility for HNIP funding relies on two key principles: the existence of a 'funding gap' to ensure 'additionality' and being at an advanced stage of preparedness to provide greater certainty that schemes will be delivered. There is evidence that these principles can be in tension in some cases. This can be for a variety of reasons. For instance, advanced schemes need to have been in planning for many years, and the impact of the HNIP Pilot may have been to accelerate the development of these 'already existing' projects. In addition, in some cases, schemes cannot be signed-off for procurement and legal work, which is necessary in practice in some institutions to get to the necessary advanced stage of preparedness for the HNIP Pilot, if they have a 'funding gap'. This tension may have constrained the 'additionality' that was achieved in the HNIP Pilot. At the same time, applicants – both successful and unsuccessful –

also stressed that the HNIP Pilot was supporting schemes that would not otherwise be financially-viable.

Prior to scheme launch

5. **Limited advanced notice of guidance negatively affected the quality of applications:** It is recognised within BEIS that given the amount of detail and complexity of the data submission requirements, applicants would have preferred guidance at a much earlier stage to allow them to begin drafting application materials – even if only some general indication of the types of information that would be needed. Applicants also expressed this view; more notice of BEIS' requirements would have allowed applicants time to assemble the right information, and to customise their project documents (financial models, technical specifications etc.) to meet BEIS' needs.

6. **Potential applicants, supply chain organisations and potential investors found BEIS engagement events valuable**: This was often because they offered the opportunity to network with other interested parties (peer-to-peer learning), not simply because they provided more information about the HNIP pilot.

7. **Respondents differed in their opinions the success of the pre-pilot engagement with stakeholders**: Within BEIS, views varied on the effectiveness of outreach to stakeholders. Some participants emphasised the number of events held, the meetings with stakeholders and potential applicants, and the emails sent out to stakeholder lists. Other BEIS policymakers noted that dissemination of detailed information happened only shortly before the launch of the scheme, and some stated that dissemination events tended to be focused around London, while potential applicants were distributed throughout England and Wales

8. **The pre-HNIP support of HNDU:** Local authorities (LAs) that had received earlier support from HNDU universally commented on the value of this. In addition, the small number of non-LA public sector organisations – which had not been eligible for prior HNDU support – that applied to the pilot were not successful. At the same time, some LAs that had not received prior HNDU support were successful in the HNIP Pilot.

The Application process

9. **Applicants reported that the HNIP Pilot application process was logical and well-supported (both technically and administratively), and the web-portal worked well.**

10. **The short application and assessment windows led to increased pressure on both applicants and assessment teams**. This contributed to a lower quality of applications than was expected by BEIS. In turn, this led to significant challenges as BEIS staff sought clarifications to allow them to carry out assessments effectively, and applicants struggled to turn around responses on the required timescales.

11. **Applicants did not always find developing the application materials straightforward:** Some applicants struggled to provide data in the format required at the application stage; most applicants told us that the application tasks were sizeable and complex, compared with other bids they had been involved in. The

shadow heat model was particularly challenging for some applicants. A small number of policymakers and applicants highlighted that the information central government requires (measurements of social NPV, for example, which BEIS calculated based on inputs supplied by the applicants) are not measures that local policymakers routinely work with.

12. **In the full application stage, some documentation that was required was not specifically requested:** One example relates to the condition that the HNIP Pilot should only fund features of projects that are additional to planning requirements (thus further demonstrating 'additionality'). Although information on this was requested as part of the full application, the precise documentation required was not specified. This meant that assessors had to request detailed information as part of the assessment process.

13. **The pre-qualification stage was partially successful:** Although the pre-qualification stage filtered out many 'immature' projects, it also allowed a number of projects that were inappropriate for the HNIP Pilot to enter the full application stage.

The assessment process

14. **The most significant hurdle to applicants was the techno-economic assessment:** The majority of projects that were unsuccessful at the assessment stage failed at the techno-economic assessment stage because the documentation was not sufficiently mature – for example, failing to demonstrate adequate design, or describing a design that did not deliver the required efficiency.

15. **A large number of requests for clarification were issued by the assessors – this process was not always managed well for applicants:** For those applications for which we have information on clarifications, BEIS sent approximately 600 requests for clarifications to applicants. All applications received clarification requests. Deadlines for response were often challenging for the applicant teams. In some instances, Salix asked BEIS to prioritise clarification questions as they thought the volume of requests being sent to applicants was unrealistic. Clarifications from different assessors were not well co-ordinated.

Key characteristics of applications, and the scoring system (RQ2)

The conclusions here are drawn from BEIS' analysis of applications, described in Chapter 3, along with comments on the scoring system, and some of the analysis presented in Chapter 2. Note that the analysis was based on small numbers; 25 full applications were submitted (9 of which were successful).

16. **The number of applications was in line with the expectations of BEIS staff:** In total 39 organisations expressed interest in the scheme, 29 completed pre-qualification applications, and twenty-five submitted full applications.

17. **Nineteen of the applicants and all of the successful applicants were local authorities**. Four applications were from other public sector organisations and two

were from Universities. However, these small numbers make it hard to draw wider conclusions.

18. **BEIS staff thought that scoring criteria were effective at separating out the promising projects from those needing further development**: Broadly, interviewees (from BEIS) seemed satisfied with the scoring criteria, noting that they were allowing BEIS to distinguish between 'good' and 'bad' schemes. The scoring also secured a spread of results, with some schemes scoring highly and others clearly scoring poorly. Combining quantitative measures with qualitative description allowed BEIS staff to get a better idea of each application.

19. **Some aspects of wider interest to BEIS were not in HNIP's aims, and so were not explicit in the scoring system for pilot applications. Nevertheless, the scoring system produced a good mix of successful projects**. A good mix of heat source technologies was observed in the successful applications, together with a range of geographical locations, and a range of customer types.

20. **The scoring of long-term carbon savings potential allows only limited differentiation between applications:** scoring of the potential for long term carbon savings in the pilot scheme was based on qualitative assessment and allowed the allocation of one of a limited number of scores.

21. **The scoring of customer impacts allows only limited differentiation between applications:** interviewees in BEIS felt that the range of potential scores was too small to fully differentiate between different applications. This criterion might also need examination in the context of schemes in which there are no paying end-use customers.

Financial and other challenges in the UK heat networks market (RQ3 & RQ4)

Conclusions regarding the heat networks' market draw on the findings from the applicant, supply chain and third party investor interviews that are presented in Chapter 4.

22. **The UK heat networks market was described by interviewees as small, and growing slowly:** new companies are entering the market and existing organisations in the supply chain are investing in people and skills. It is not however as well developed as some continental markets, such as Denmark, Sweden, Germany, France, Poland and the Czech Republic.

23. **Interviewees in multiple-function companies said that, although large scale heat networks have been a feature of the UK market for more than thirty years, recent activity has focused more on smaller schemes with private property developers and single sites in the public sector.**

24. **Financial challenges:** Interviewees from the applicant, supply chain and investor interview groups stated that slow market growth is related to the often challenging economics of heat networks, especially when compared with conventional property level heating such as individual gas boilers and alternative investment

opportunities. High initial capital costs and long payback periods were often mentioned in this regard.

25. **Potential investors perceive risks associated with heat networks to be too high given the returns available:** Investors were particularly concerned about the demand risks relating to securing a long term 'anchor load', and were reluctant to take construction risk. They also noted concerns about the potential impact of changes in energy prices and in the regulatory environment. Institutional investors also noted that heat network investment opportunities are typically much smaller than they would prefer and expressed reluctance to take equity stakes in heat network schemes.

26. **Given that local authorities already have access to relatively inexpensive funding, interviewees in local authorities not surprisingly expressed a strong preference for grant funding through HNIP.**

27. **Other challenges:** Interviewees from applicants and the supply chain also consistently highlighted potential future shortages of skills and knowledge, and regulatory uncertainty as further key challenges. HNIP will only address these issues indirectly.

Early Impacts of HNIP (RQ5)

28. **Stakeholders, including potential investors, saw HNIP as a signal that government takes the development of heat networks seriously,** which provided them with increased confidence in the heat networks market**.**

29. **There is some evidence that HNIP has encouraged organisations to speed up the development of existing plans, and to think creatively and ambitiously about their heat networks**. Some respondents told us that projects that would not have gone ahead in its absence would now be built.

30. **In some local authorities, HNIP success has generated senior management support, while some unsuccessful applicants reported the opposite effect**. Feedback from an unsuccessful applicant was viewed positively, as useful in terms of developing ideas for other funding sources and the main HNIP scheme.

31. **There is some evidence that HNIP has prompted interest from consultants and technologists, and boosted confidence to invest in skills, expertise and marketing**.

32. **Supply chain stakeholders expressed a range of views about the long term potential of HNIP to achieve its objectives:** There was widespread optimism that HNIP will provide a much-needed boost to the heat networks market. However – since HNIP does not address the challenges relating to skills and knowledge, and regulation – some stakeholders questioned whether it will achieve its long term objective of creating a self-sustaining heat networks market. Another more sceptical view was that, although HNIP will support the development of heat networks, these might not be in addition to those that would have gone ahead anyway.

Annex 1: Further information about HNIP

The HNIP pilot process

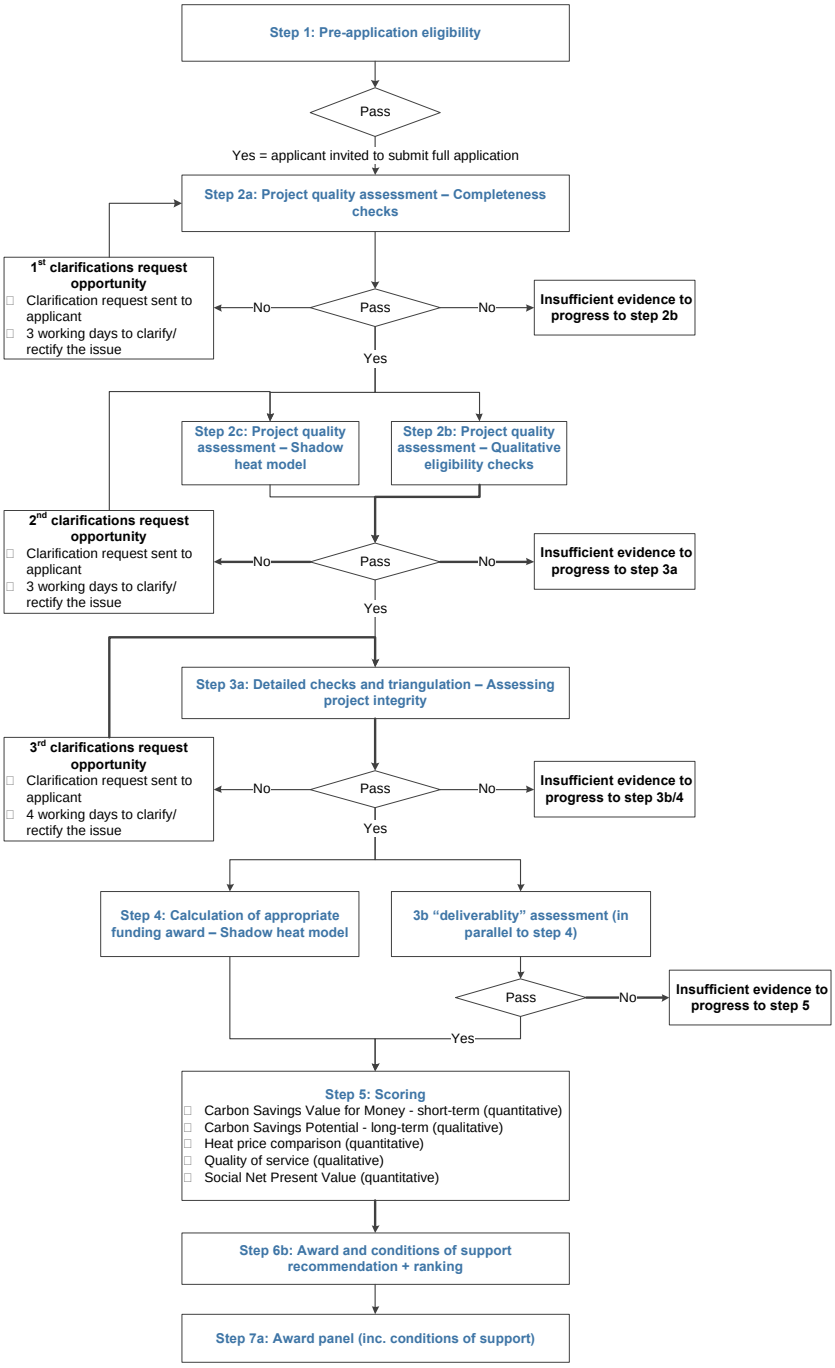

Figure 10: The application and assessment process

Source: HNIP website, information page (https://hnip.salixfinance.co.uk)

Materials required for the full HNIP pilot application

Table 2: Materials required for an HNIP application

Document	Description
Outline business case or equivalent	Strategic rationale, procurement strategy for a delivery partner, anticipated sources of funding and evidence of senior approval and long term commitment.
Technical heat network design documentation	Feasibility studies, technical designs, techno-economic energy modelling and carbon savings
A cash flow or financial model	Scenarios with and without HNIP funding, to demonstrate the funding gap and so the need for HNIP funding.
Heads of terms	High level contracts or initial agreements with anchor load heat customers.
Funding gap evidence	Evidence to demonstrate inability to secure the funding sought from HNIP from other sources, due to: inadequate investor hurdle, external borrowing limits, gearing or funder requirements).
HNIP input template	An Excel document created by the BEIS team.
CHPQA certificate	Applications including an existing network incorporating combined heat and power (CHP) required a CHPQA certificate.
Other supporting documentation	e.g. letters of support, wider development plans

Key characteristics of the successful pilot applications

Table 3: Key characteristics of the successful pilot applications

Recipient	Project Name	Funding Awarded		Project Information	
		Grant	Loan	Project Type	Technology
Sheffield City Council	Sheffield District Energy Network Development	£2.23m	£3.50m	Expansion & Inter-connection	Energy from Waste
Camden Council	Somers Town Energy (Phase 2)	£1.05m		Expansion	Gas CHP
Manchester City Council	Manchester Civic Quarter Heat Network	£2.87m		New Network	Gas CHP
Colchester Borough Council	Colchester Northern Gateway	£3.51m		New Network	Heat Pump
London Borough of Waltham Forest	Wood Street South	£1.00m		New Network	Gas CHP
London Borough of Barking & Dagenham	Becontree	£1.08m		New Network	Gas Boiler
Westminster City Council	Church Street District Heating Scheme	£2.56m		New Network	Gas CHP
Crawley Borough Council	Crawley Town Centre Heat Network	£1.40m		New Network	Biomass & Gas CHP
Manchester City Council	St Johns Heat Network		£5.00m	New Network	Gas CHP
Total		Total Grant £15.7m Total Loan £ 8.5m		Total Project's CAPEX £75.14m Total HNIP Funding £24.21m	

Source: https://www.gov.uk/government/publications/heat-networks-investment-project-hnip

Annex 2: research methods

The HNIP evaluation

BEIS has commissioned a five-year suite of independent, process and impact evaluation activities relating to the entire HNIP scheme. Overall, the HNIP evaluation will follow the principles of realist evaluation[40], focusing on contextual questions of "what works, for whom, under what circumstances?" and will use an evolving Theory of Change showing the theory for how HNIP will achieve its intended outcomes. The key aim of this report is to provide a process evaluation of the HNIP pilot scheme, with the objective of offering 'lessons learned' to inform development of the planned main scheme and any future similar schemes. Another aim of the process evaluation was to provide contextual knowledge for the overall realist approach.

Evaluation aims and research question

The original aims for this report were expressed as follows:

1. How the application stage is working and what improvements can be made
2. Application process and customer journey
3. Application assessment and what improvements can be made
4. How HNIP is affecting the Heat Networks in the development pipeline
5. How the delivery chain is responding to the scheme and early impacts this is having
6. Demand for capital support – why projects applied for funding, current financial barriers, and preferred types of finance.

Over the course of the research, the expression of these original evaluation aims has been developed and refined, and converted to research questions. These research questions cover all of the issues that were identified in the original evaluation aims, and other points that emerged as our research proceeded. This report focuses on five key research questions:

1. What were the successes and challenges in the HNIP pilot process (from policy development and implementation, through the pre-qualification, application and assessment stages, to awards and work on the funding agreements)? This

[40] Pawson, R., 2013. The science of evaluation: a realist manifesto. Sage.

question is addressed in Chapter 2, from the perspective of the BEIS teams and the applicant teams.

2. What are the patterns in the characteristics of the successful and unsuccessful pilot applications? This question is addressed in Chapter 3.

3. What are stakeholders' (applicants, non-applicants, supply chain members, industry bodies, and third party investors) perspectives on the status of and challenges in the current heat networks market? This question is addressed in Chapter 4.

4. In particular, what financial barriers and preferred types of finance are identified by stakeholders? This question is addressed in Chapter 4.

5. What are stakeholders' perspectives on: their early responses to HNIP, the early impacts of HNIP (including in the heat networks development pipeline) and the potential longer term impacts of HNIP (including potential barriers to success)? This question is addressed in Chapter 4.

Research design and data synthesis

The research was characterised by: a wide range of research topics, a wide range of research 'audiences', relatively small numbers in each research 'audience', and relatively short timescales. On this basis, a range of well-established research methods was used: semi-structured interviews, documentary review, numerical analysis and 'methodological triangulation' (we describe these in more detail below). After we describe these methods in detail, this Annex closes with an examination of the limitations of what we did.

Across the five research questions and using these three research methods, as appropriate, we used 'methodological triangulation'[41] to synthesise the data and produce a comprehensive and in-depth narrative for reporting. We used 'methodological triangulation' because this responds to the observations that a single method can never adequately shed light on a social phenomenon and that using more than one method can help to address this. In 'methodological triangulation', researchers generally use more than one research method – often, but not necessarily, combining qualitative and quantitative approaches – to ensure that understanding, and accounts of that understanding, are rich, deep, robust, comprehensive and well-developed.

The principles of 'methodological triangulation' suggest that it is most successful when: the methods focus on the same phenomena (e.g. heat networks and HNIP) within the same context (e.g. in the UK in 2017); the methods used have complementary (i.e. different)

[41] Denzin, N. (2006).*Sociological Methods: A Sourcebook*, Transaction Publishers; Jack, E. and Raturi, A. (2006),"Lessons learned from methodological triangulation in management research", *Management Research News*, 29(6): 345 - 357.

strengths (e.g. qualitative and quantitative methods); each data set and analysis is internally robust and rigorous; one or more of the methods elucidates different perspectives on the same phenomena (e.g. the views of HNIP applicants and BEIS staff); and, that the impacts of 'methodological triangulation' on generalisability are considered (e.g. although it is not relevant in this case, triangulating a large scale survey with in-depth interviews would limit the generalisability of the survey). In specific contexts, triangulation was also used to cross-reference observations and claims. For instance, claims about the application process that were made in interview were triangulated with other documentary material to understand the context within which they were made and to comment on their legitimacy. That said, we note that, even if a claim is not well supported in the documentary evidence, the fact that the claim was made tells us something about the context.

Within the context of constrained timescales, the data was triangulated by constructing an evolving analytical or thematic frame based around the five research questions and systematically populating this with themes, insights, evidence and data from the three research methods. We developed new themes based upon the data. As the analysis progressed, we developed the analytical frame into a full report structure. In general, we observed no conflicts between triangulated datasets.

However, occasionally, interview data about a particular document conflicted with the document itself. In these instances, we have highlighted the difference between the actual document content and the interviewee's experience or understanding of the document. Throughout the research, analysis, triangulation and writing processes, we used high levels of interaction and review between the research team, quality-assurance review from outside of the research team, and valuable review and comment from the BEIS team to ensure high quality reporting.

We conducted the research for this report in two stages. In January and February 2017 we focused on the perspectives of BEIS and the HNIP Pilot delivery body (Salix) project team members, and reviewed pilot applications and other documents. From late February to early May 2017, we carried out wider research, as well as returning to the documentary analysis and reviewing application outcomes. We analysed the data and began drafting in late May 2017.

Semi-structured interviews

We used semi-structured interviews because they are a well-established qualitative research method for the elucidation of in-depth understanding of a particular social context or phenomena[42]. Although both semi-structured interviews and large-scale surveys each

[42] Bryman, A (2012) Social Research Methods (4th edition), OUP Oxford.

have their relative advantages and disadvantages in terms of understanding attitudes and experiences, semi-structured interviews were particularly appropriate in this case because the research populations were too small to conduct large-scale surveys. Semi-structured interviews were also appropriate because they allow the researchers to investigate pre-determined themes while also allowing the interviewee to introduce themes that may not have been in the researcher's mind in advance. The interviews were undertaken by a total six different researchers from the evaluation team. This is useful because – through discussion of the interviews and the data – it contributes to maximising quality and minimising subjectivities in the interviews and the analysis.

Sampling

Sampling strategies

Given the timescales within which the research was conducted, we used a combination of sampling strategies to maximise coverage within each category in the most effective and efficient way. We used a combination of – as appropriate – census, convenience, purposive and snowballing approaches to sampling:

- Census approach: A census approach to sampling implies attempting to interview all of the individuals within a particular group or population. We employed a census approach in the context of the relatively small numbers of successful applicants to the HNIP Pilot and due to their particular importance.

- Purposive sampling involves selecting specific potential interviewees with specific objectives or characteristics, in this instance to cover as many domains of interest to BEIS among the stakeholders as we can. Within the context of working with lists provided by BEIS, purposive sampling can be differentiated from representative sampling which tries to derive a representative sample of the population.

- Convenience samples are appropriate when the population is relatively unknown (such as prospective investors and the wider heat network supply chain) or timescales are constrained. In this instance, much of our sampling was based upon lists of potential interviewees that have been provided by BEIS. We also preferred potential interviewees for whom named individuals and contact details were provided; this is important because it is often very difficult and time-consuming to identify the appropriate person in an organisation.

- Snowballing describes an approach within which interviewees are asked to recommend further interviewees with particular characteristics. In this instance, we asked applicants to recommend key partners who we might interview, and asked those key partners to recommend interviewees within sections of the market that had not been well-served by the convenience approach (e.g. component manufacturers). As well as being an effective sampling strategy, this approach also mitigates against any biases that might have arisen arising from the convenience approach, and allowed us to get multiple perspectives on particular projects.

‘Saturation’ and flexibility in sampling

The timescales for the pilot evaluation meant that we had to concurrently analyse interview transcripts while we were also still recruiting and interviewing interviewees. This ‘responsive interviewing’ approach had the advantage of allowing us to be flexible in our recruitment strategy based on the extent to which we were achieving ‘saturation’ with particular categories. A commonly-used principle in qualitative research, ‘saturation’ is the name given to the stage in the analysis at which no new information is being obtained from the data by the researcher. Since our research began with the applicants, this was the first category of interviews in which we reached ‘saturation’. This allowed us to flexibly shift our attention to the other categories. By the end of the analysis, we were confident that we had reached ‘saturation’ across all categories of interviewees based on our experience of the lack of new themes from the in the data.

Applicants

BEIS provided contact details for the HNIP Pilot applicants who agreed that their details could be shared; we used this list as a convenience sampling frame. We aimed to interview up to 20 applicants, including all nine that were successful (a census approach) and up to 11 unsuccessful applicants. Among the unsuccessful applicants, we purposively attempted to interview at least one of the three non-local authority applicants, and we purposively avoided contacted applicants who had appealed until after the appeal was resolved. As a result of these activities, we interviewed 16 applicants. This comprised the 8 successful applicants whose details were shared with us (one successful applicant did not give permission for details to be shared), and 8 who had submitted unsuccessful applications).

Non-applicants

We used the term non-applicants to describe organisations who were likely to have been eligible to apply to the HNIP Pilot, but who did not. We derived the sample frame for non-applicants from the list of organisations who submitted HNIP Pilot Expressions of Interest and the list of organisations in the HDNU pipeline forward look for commercialisation in 2017-8. To exclude applicants and avoid duplication, the lists were cross-referenced with the list of applicants and each other. This produced a sampling frame with 50 organisations. It is notable that this approach produced a sampling frame that was dominated by local authorities. This means that the views of other types of public sector organisations – such as health trusts and universities – might be under represented in the data. We purposively selected twelve of these, in the first instance, with the objective of securing up to ten interviews (actual 5). In purposively selecting the twelve, we considered the following:

- Approximately six from each of the two sources (EOIs and HNDU)
- A mix of types of location (e.g. city, large town, small town)
- A geographical spread

- Others that looked interesting or unusual (for example, in terms of heat source technology).

Stakeholders (supply chain, investors and industry bodies)

Our objective was to conduct up to 20 interviews with wider stakeholders in the heat networks or district heat market. We have divided the stakeholders into three broad categories – the supply chain, investors and industry bodies – and different topic guides were used for each. We suggested that the up to 20 interviews should be allocated as follows:

- Supply chain: up to 13 (actual 18)
- Investors: up to 5 (actual 5)
- Industry bodies: 2 (actual 1)

The supply chain

Our growing understanding of the heat networks supply chain revealed this as very complex with lots of different ways of categorising organisations, as well as lots of blurred distinctions and complexity within the categories. This makes it difficult to categorise organisations, especially without speaking to them first. We have tried to capture the supply chain within four broad categories:

- Multiple function organisations. We observed that there are many large organisations which perform multiple functions (or, at least, more than one function) on any given project (consult, design, build, operate, manage, maintain), and perform different combinations of these functions on different projects. The large utility companies, large 'construction' companies, and more specialised companies might fit into this category. This category was relatively straightforward to populate based upon our convenience approach;
- Component manufacturers, who supply these multiple function organisations with manufactured products (such as pipes, boilers and meters). We used a mixture of convenience and snowballing approaches to populate this category.
- Property developers, who can also play a role as constructors of heat networks. We used a mixture of convenience and snowballing approaches to populate this category.
- Consultants, or knowledge providers, who provide expert input into, variously, design commercial issues, finance and investment, and technology. We used a mixture of convenience and snowballing approaches to populate this category.

Investors

We were able to populate the investor category well from our convenience approaches. This category includes banks, investment banks and other potential investors, some of whom are specialists in energy or heat networks and others who are more general investors.

Industry bodies

There are two major heat networks industry bodies: the Association for Decentralised Energy and the District Energy Association. These were considered particularly useful as they had an overview of the supply chain and market.

Recruitment

We balanced the need to progress work to meet the required timescales against the risk of over-burdening interviewees. Our standard recruitment protocol was designed to minimise this burden:

1. An email was sent to the prospective interviewee, inviting them to interview (see below). This email was accompanied by a letter signed by BEIS (on a BEIS letterhead), the participant information sheet and consent form (see Annex 3).

2. When we received a positive response, we established a convenient date and time for the interview. If we received no response after one week (or sometimes sooner, due to the urgency of the task), we sent a reminder email.

3. In the event of no further response after one week (or sometimes less, due to the urgency of the task), a second reminder email was sent, or telephone calls were made.

4. If we received no response after this process, the individual was removed from the list of potential participants.

Topic guides

We constructed bespoke topic guides for each of the research audiences or categories (applicants, non-applicants, the supply chain, third party investors and industry bodies) (see Annex 3). The topic guides were informed by: the overall aims of the evaluation, the research questions and parallel work on the development of high level themes for the evaluation. Topic guides were reviewed within the evaluation team and by BEIS, and revised accordingly. Due to the very short time-scales within which the research was conducted, topic guides were also revised on the basis of ongoing experiences within the interviews themselves.

Analysis of interviews

We analysed interview transcripts drawing on the key principles of 'thematic analysis'[43]. We used 'thematic analysis' because it is the most commonly used approach to the analysis of semi-structured interview data, especially relating to experiences, perspectives and attitudes. 'Thematic analysis' follows a well-established set of steps, and is appropriately flexible within this structure. We also employed approaches associated with thematic analysis because they allow researchers to investigate both pre-determined

[43] Boyatzis RE (1998) *Transforming Qualitative Information*. Sage: Cleveland; Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology, Qualitative Research in Psychology, 3:2: 77-101

themes and new themes that might emerge from the data. We did not use grounded theory due its emphasis on the latter.

Within thematic analysis and qualitative research in general, the analytical objective is not to quantify, count or measure. Instead, the aim is to reflect range and diversity, and – as far as possible – to explore and explain these, while also taking some consideration of the prevalence of particular perspectives. Indeed, while outliers might be omitted from quantitative analyses, in qualitative approaches these 'extreme' cases often provide considerable insight and elucidate key themes within the data[44]. Our approach to 'thematic analysis' was shaped by the need to be highly rigorous within the context of the relatively limited time that was available for the research, analysis and report writing. Themes for the analysis were derived in two ways. First, as described earlier, we used the five research questions to derive a thematic structure for the analysis (and for the report itself). The analysis then relied upon close reading and re-reading of the interview transcripts.

The second way in which we developed themes was by deriving new themes from the close reading of the data. This is an important element of qualitative analysis because it allows the voice of the interviewees to be heard independently of the preconceived ideas of the researchers about what is important. These themes were validated through discussion with the interview team. From the perspective of grounded theory, this approach ensures that the analysis is 'grounded' in the data[45]. A key theme that emerged in this analysis was the extent to which interviewees (HNIP pilot applicants and non-applicants, and representatives of the supply chain) wanted to talk about aspects of the heat network market and supply chain development that were not directly related to HNIP (e.g. regulation, tax, standardisation, skills and knowledge and so on).

The interview data was manually coded by populating the triangulated thematic structure with the data as it was read and analysed; coded data was tagged with the interview/transcript code and page number. This approach is a standard approach, for example see the recent Evaluation of the Transitional Arrangements: Phase 1 Main report[46]. As this process was undertaken, great care was taken to differentiate between contexts, such as applicants, representatives of the supply chain and third party investors, and – where feasible and appropriate – sub sections within these categories.

To ensure consistency across the analysis, coding was undertaken by one researcher. The researcher regularly formally and informally discussed and interrogated the emerging

[44] Ritchie, J. et al (2014) Qualitative Research Practice - A Guide for Social Science Students & Researchers, 2nd Edition, NatCen (National Centre for Social Research)/SAGE; Morse, J. (1995) The significance of saturation, *Qualitative Health Research*, 5(2): 147-149..

[45] Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N.K. Denzin & Y.S. Lincoln (Eds.), Handbook of qualitative research (2nd ed., pp. 509–535). Thousand Oaks, CA: Sage.

[46] BEIS (2017) *Evaluation of the Transitional Arrangements: Phase 1 Main report*, February 2017, https://www.gov.uk/government/publications/evaluation-of-the-transitional-arrangements-phase-1.

themes –derived from both the research questions and the data – with the interview team (individually and as a group) and with the broader evaluation team. In this way, themes were further developed, refined and (re)structured as conclusions in the report. Drafts of the report were the subject of internal review by senior members of the project team.

Documentary analysis

We reviewed documents relating to:

- The development of HNIP policy, including the HNIP consultation and BEIS' response
- The application process, including the HNIP applicant guidance documents, and reports from the BEIS internal 'lessons learned' workshops relating to the application stage and the assessment process
- Applications to the pilot scheme, assessment of the applications and the communication of decisions
- The web-based application portal itself.
- Similarly to the in-depth interview transcripts, the documents were analysed according to the principles of 'thematic analysis'[47] (please see the earlier description).

Numerical analysis

We have not carried out numerical analysis of the applications. Instead, we have drawn on BEIS' descriptive analysis of the successful and unsuccessful applications[23]. As there were a limited number of applications, the analysis does not seek to draw conclusions beyond the applications on which it is based.

Limitations

As in most evaluative research of this nature, particularly work executed at speed, there is some potential for sampling bias, non-response bias and inadequate coverage in some elements of the semi-structured interview programme. These are discussed separately below. However, concerns about the likelihood and potential impact of these are largely mitigated by the facts that the narratives that we heard both within and between interview groups were broadly consistent, the overall populations for interview are small, and we reached 'saturation' within each of the interview groups. Within this context, we regard the

[47] Boyatzis RE (1998) Transforming Qualitative Information. Sage: Cleveland.

findings and conclusions derived from semi-structured interviews to be sufficiently robust to be relied upon by industry stakeholders, and fit for use and consideration during the policy design of the HNIP main scheme.

Sampling bias

Sampling bias occurs when an interviewee cohort is selected in such a way that some members of the intended population are less likely to be included than others. Obviously, within the context of purposive sampling, this can sometimes be a specific objective. We do not feel that sampling bias was an issue among the HNIP Pilot applicants.

However, as the sampling strategies for the non-applicants, the supply chain and the third party investors were largely based upon lists provided by BEIS, it is clear that organisations that were not on these lists were less likely to be selected for interview than those that were. Given the currently small number of market actors engaged in the domestic heat networks market, we can be reasonably confident in the comprehensiveness of BEIS' interview lists for the supply chain and third party investors. Our use of snowballing techniques would further offset the impact of this. However there remains the possibility of some sampling bias. For example, it is possible that potential applicants to the HNIP Pilot who were not on any BEIS lists might have different perspectives to those that were. In this case, this is because we can assume that they will know less about heat networks and the HNIP Pilot. At the same time, it is important to note that these organisations would probably not have not been informative interviewees due to this lack of familiarity.

Non-response bias

Non-response bias occurs when individuals who are selected for interview are unwilling or unable to participate. This can be a problem because we might conjecture that the non-response is related to a lack of engagement with the topic or perhaps a negative view of the topic, such that of the views of respondents may differ in meaningful ways from those of non-respondents. We do not consider that non-response bias occurred in the context of the successful applicants, the local authorities among the unsuccessful applicants, the non-applicants and the supply chain interview groups due to our achieved coverage of these groups.

We experienced non-response in the case of the unsuccessful applicants who were not in local authorities; these applicants were in hospitals and universities. Of the three such cases, only one agreed to be interviewed. We also experienced non-response within the context of the large, institutional third party investors (such as investment banks and pensions companies). Tellingly, systematic non-response occurred in this group because these organisations did not regard heat networks as relevant to them because the investment opportunities are too small. We also experienced non-response in the context of property developers; no interviews could be secured within this sub-category of the heat networks supply chain. We cannot therefore not rely upon our research to *fully* reflect the

diversity of opinion with these interview cohorts due to the likelihood of some element of non-response bias.

Coverage

Coverage describes the extent to which the material collected covers the target audiences for the research. Clearly, a lack of coverage can be the result of both sampling bias and non-response bias, as well as of larger populations. With this in mind, with respect to relevant BEIS staff, Salix staff, successful applicants and unsuccessful applicants from the sample members, coverage was high. However, coverage of non-applicants, the supply chain and investors was not as high, in particular in the areas described above.

Annex 3: Research materials

Email invitation

Invitation to contribute to the HNIP pilot evaluation

Dear xxxx

I am writing to request your participation in a telephone interview to discuss the Heat Networks Investment Project (HNIP) pilot. This is to inform the independent evaluation of the scheme and to help drive future policy development. HNIP is a Government scheme, ran by the Department for Business, Energy and Industrial Strategy (BEIS), to provide capital support to develop Heat Networks. A Heat Network connects multiple buildings to one or more shared heat source. We would like to talk to you about your experiences or perceptions of HNIP.

We have identified you as an important stakeholder for this research because [DELETE AS APPROPRIATE: you applied to the scheme and so have a clear interest in the development of heat networks/ have valuable experience of heat networks / you have a key role in the development of heat networks / you have an interest in infrastructure or energy investments].

Your interview will contribute to the independent evaluation of the HNIP pilot which BEIS has commissioned to help it consider any changes it needs to make for the main scheme. It is an opportunity for you to make your views heard, and to build the evidence base upon which policy will be made for this important industry going forward. The interview will be conducted by an experienced evaluation researcher from the Policy Studies Institute (University of Westminster) or the Tavistock Institute for Human Relations (TIHR).

I am attaching three documents:

1. A letter from Patrick Abbey, the lead Research Officer for HNIP at BEIS.
2. A participant information sheet.
3. A consent form.

Please read the participant information sheet, which includes information on how we will protect any information you provide and either: complete and return the attached interview consent form. Alternative you can confirm consent in an email. We would also be grateful if you could propose two or three dates and times in the coming week or so that would suit you best for us to interview you. Many thanks for your support.

Email reminder

Dear xxxx

Following on from my email last week, I hope you don't mind me writing to you again regarding the possibility of conducting an HNIP interview with you. This would be incredibly valuable to the evaluation of HNIP.

If you have any concerns, please do raise them with me directly.

If this is possible, we would be grateful if you could propose two or three dates and times – in the coming weeks – that would suit you best for us to interview you.

Thank you for your support.

Participant information sheet

PARTICIPANT INFORMATION SHEET: HNIP EVALUATION

Aim of interview

The aim of the interview is to inform an independent evaluation of the Heat Networks Investment Project (HNIP), and its pilot. The evaluation is funded by the Department for Business, Energy and Industrial Strategy (BEIS), and is being conducted by an independent consortium led by Risk Solutions. This interview will be conducted by a member of the evaluation team from either the Policy Studies Institute, Risk Solutions or the Tavistock Institute for Human Relations.

Aim of the evaluation

The aim of this element of our research is to evaluate the processes used during the HNIP pilot, and to explore how the scheme is expected to deliver outcomes. More specifically, we aim to understand what is working and what is not working so well in the HNIP pilot, and to identify potential improvements that could be made. This will feed into the design of the main HNIP scheme.

About the interview

The interview will be conducted by telephone or face-to-face, at a time that is convenient for you, and will last up to one hour. The interview will take the form of an informal conversation. Importantly, there are no right or wrong answers, we are interested in your impressions, knowledge and experiences. With your consent (see details below), we will record the interview to facilitate our analysis.

Queries and concerns

If you have any queries about the interview, please contact Kevin Burchell at Policy Studies Institute (email address and telephone number redacted) in the first instance. If you have any concerns about the way in which the interview process is conducted, you may contact the Risk Solutions HNIP Evaluation Director, Helen Wilkinson (email address and telephone number redacted) or the Director of Policy Studies Institute, Ben Shaw [email address and telephone number redacted]. Alternatively, you may contact the BEIS evaluation manager, Patrick Abbey,

Principal Research Officer in Heat & Business Energy Team [email address and telephone number redacted].

Confidentiality and consent

We would be very grateful if you could confirm by completing and returning the consent form – that you have read, understood and give your consent to the following:

- Your participation in the evaluation is voluntary and – even after granting consent – you may withdraw from the interview at any time. Subsequent to the interview, you may withdraw from the evaluation at any time and request that the evaluators delete your data, up until the point at which we complete analysis for the report in early April.
- The interviewer will record the interview You may choose to not answer questions or to ask the interviewer to turn off the recorder when you answer certain questions;
- The voice-recording will be professionally transcribed for analysis;
- This transcript will not be shared beyond the independent evaluation team and their transcribers.
- Any direct quotations used or published will be anonymised and we will not identify you unless you request otherwise. No personal or commercial data (e.g. names or contact information) will be shared or made public.
- Recordings, transcripts and notes from the interview will be kept securely and stored on the University of Westminster's encrypted and password-protected system. We will keep these until the end of the 5-year evaluation project (ending in 2021), and then we will delete them.

Use of data collected, benefits and risks of taking part

The benefit of taking part in this study is that your insight will help to inform our evaluation of HNIP, and thus shape and improve its future operation and implementation.

The research team will use the transcript as part of the analysis of the HNIP pilot. This analysis will be reported in a report to BEIS (to be published after May 2017). In addition, with permission from BEIS, the analysis may be reported in other outputs such as academic papers.

Your input will be kept confidential and secure as described above. There are no significant risks or disadvantages to taking part.

If you have any questions about the interview, please contact Kevin Burchell at the Policy Studies Institute [email address and telephone number redacted].

Letter from BEIS

<OFFICIAL>

Department for Business, Energy & Industrial Strategy

1 Victoria Street
London SW1H 0ET

T +44 (0) 20 7215 5000
E www.beis.gov.uk/contact

www.beis.gov.uk

Our ref HNIP/EVAL/PILOT/1
Your ref

1 March 2017

Dear HNIP stakeholder

On behalf of the Department for Business, Energy and Industrial Strategy, I am writing to ask for your participation and support towards the research and evaluation of the Heat Networks Investment Project (HNIP) Pilot.

As you may be aware, the HNIP represents up to £320m capital investment by BEIS over five years, designed to increase the volume of heat networks being built, to help create a self-sustaining heat network market and to deliver carbon savings.

You have been identified as an important stakeholder across at least one element of the heat networks system – perhaps as an applicant, potential investor, or supplier – and so your thoughts and experiences are crucial to ensuring we know what is, and is not working about HNIP so far.

HNIP is a significant investment and it is important that we get it right. This is why we implemented a pilot programme in 2016/17 and why we have commissioned a comprehensive independent evaluation.

The researchers that have been in contact with you are part of this independent evaluation, which is being led by Risk Solutions (in collaboration with the Policy Studies Institute at the University of Westminster, the Tavistock Institute for Human Relations and London Economics). Please rest assured that any information you provide will only ever be reported anonymously unless you explicitly consent to attribution, and all researchers are subject to a comprehensive confidentiality agreement.

If you would like to know more about the evaluation, please contact Kevin Burchell at PSI in the first instance [redacted]. If you have any concerns in your interactions with these researchers, you are also very welcome to contact me in confidence to discuss.

Yours faithfully

[redacted]

Patrick Abbey
Principal Research Officer

D [redacted]
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<OFFICIAL>

Consent form

HNIP EVALUATION
INTERVIEW CONSENT FORM

I agree to participate in an approx. 40 - 60 minute interview as part of the evaluation for the Heat Networks Investment Project (HNIP). This interview is being led by the Policy Studies Institute at the University of Westminster under the direction of Risk Solutions (Risksol Consulting Ltd) and on behalf of the Department for Business, Energy and Industrial Strategy (BEIS)

I have read the participant information sheet provided, and understand the aim of the study, and how my input will be recorded and used.

☐ **I give permission for the interview to be recorded and transcribed**

(please check the box)

Details below can be filled in electronically and returned via email

Name	
Signature	
Date	
Email	
Phone	

Topic guides

Applicant topic guide

Prior to each applicant interview, we will use the materials provided by BEIS to establish these details (the interviewer will have this information to hand when setting-up and during the interview)

The characteristics of the bid, including within the context of the others

Whether the bid was successful or not, and the reasons for this outcome

Any contributions to the consultation

Details of any stakeholder workshops or training attended

Interviewer introductions

Introduce self, and check that it is convenient to do the interview.

Introduce the evaluation; we are independent researchers who have been contracted by BEIS to evaluate the Heat Networks Investment Project (HNIP) as it is rolled out. In this interview, we are keen to understand what has gone well **in the pilot**, and what could be improved for the main scheme later in 2017.

Comment that – although we will try to cover only issues that are appropriate to the interviewee – we may raise issues that the interviewee does not feel qualified to comment on. This is fine, just confirm when this is the case.

Double check the interviewee has received participant information sheet, and is happy to reconfirm verbal consent to proceed, record the interview and transcribe. Ask for written consent form to be returned after the interview (if it hasn't already been sent to us).

Begin recording

State date, interviewer name and interviewee name, thanks for participation, any questions before we begin?

1. About your application team

This information will be used to focus the ensuing discussion, by exploring their background in working with heat networks (generally) and HNIP (specifically).

- Confirmation of organisation. What is your job title, and which team are you part of? How long have you worked in this team? Broader background?
- What was your role in the in the HNIP application? Did you lead the application? If not, who led?
- What other departments in your organisation were involved in the HNIP application? What specific roles did they perform?
- What other external organisations were involved in your HNIP application? What roles did they perform?

2. The objectives of the HNIP

- What are your organisation's objectives for your heat network? *Try to get unprompted answers. If any of the points below are mentioned, prompt for more detail)*

  Carbon savings

  Cheaper heat for householders

  Income for my organisation

  Complying with planning regulations

- What do you understand to be BEIS' objectives for the HNIP (the project as a whole, as opposed to the pilot)? *Try to get unprompted answers. If any of the points below are mentioned, prompt for more detail.*

For each answer, also prompt: to what extent to you think that the HNIP will achieve these objectives?

Carbon savings

Volume of heat networks built

Encouraging technological innovation / technological future proofing

Customer experience

Building a sustainable (or self-sustaining) market

Building a UK supply chain / industrial base

Bringing in private finance

Types of applicant – what kind of applicant is the project seeking to attract?

3. The origins of your application

- Do you recall when a heat network was first mooted in your organisation, and who raised it? Is HN the only option you considered?
- Did your organisation's heat network plans precede the HNIP or were they prompted by it (*the assumption is that they would have preceded it*)?
- Why did you apply for HNIP? What would you have done without it?
- How was your HN plan developed over time? What were the major internal stages of development and approval within your organisation?
- What was the role of senior management and high level priorities in the decision wrt heat networks and the bid to HNIP?
- **Local authorities only**: what was the role of councillors in the decision and the bid to HNIP?

5. The HNIP consultation and events (stakeholder workshops and training), HNIP promotion

- How did you first hear about the HNIP? Do you recall when this was?
- Did you see any promotional material regarding the HNIP? If so, what did you see? How did you respond to it?
- Can you recall any other ways in which you heard about the HNIP?

Based on interviewer briefing notes (or ask: Did you participate in the HNIP consultation in 2016?, in any stakeholder workshops? in any HNIP training?)

EITHER:

- You participated in *the HNIP consultation in 2016 /workshops/training,* how did you hear about *this/these*; what were the benefits of involvement; did involvement support your application; would you participate again?

AND/OR

- You didn't participate in *the HNIP consultation in 2016 /workshops/training*: had you heard about them; how did you hear about them; why didn't you participate; what would help you to participate in the future?

4. HNIP and your application

- What difference did the HNIP make to your existing plans? *Depending on other earlier answers, prompt on:*

  Initiated a new project. What difference did HNIP make?

  Accelerated an existing project. Why? In what way?

  Changed the way in which you planned to fund an existing project. In what way? What other sources of funding had you been considering? What was the advantage of HNIP funding?

  Drew in new partners to an existing project

  Changed the technical design of an existing project. How? (including making it bigger)

  Changed T&Cs for consumer, eg relating to 'no consumer detriment'. How?

  Enabled you to incorporate other features, e.g. technical or commercial future proofing – if so what?

- Do you think that your organisation would have considered a heat networks project at this time in the absence of the HNIP?

- **For successful applicants only:** Since notification that your HNIP bid was successful, what difference has this made to your funding environment. *Prompt on:*

  allows access to other sources of funding. Which?

  allows access to other funding on better terms. Detail?

  has allowed other funding to be re-allocated. How?

- **For successful applicants only:** Can you identify any ways in which the structure (as opposed to the process) of the HNIP could be improved: *Prompt on:*

  Funding issues. Type? Amount? Payment terms?

  Eligibility criteria

  Are there other barriers

- **For unsuccessful applicants:** What difference has not receiving HNIP funding made to your scheme? How have your plans changed?

6. The application process

From interviewer briefing check if the participant was excluded or withdraw at any stage

In this section, we would like to discuss your recollections of various stages of the application process. *For each item as appropriate, prompt about:*

size/difficulty of the task
timescales available for the tasks

- Your initial enquiry
- The pre-application eligibility stage. Do you have any views on the eligibility criteria? Were they easy to understand?
- The main application stage *prompt on*
  - Support. Are you aware of the following sources of support? If so, did you use any of them? If so, what were your experiences: what kinds of queries did you have, how easy was it to use the support, how helpful were the responses, were the responses timely?

    on-line support material, in particular the Application Guidance PDF

    on-line support query form

    support email addresses

    support telephone line

  - The elements of the application. Do you recall working on these sections? How big/difficult was the task? Were any of them particularly challenging? In what ways were they challenging? How could they have been made more straightforward?

    The business case

    The technical design documentation

    The financial model

    Heads of terms

    Funding gap evidence

    HNIP input template

  - Other supporting documentation (letters of support, wider development plans)
  - The clarification stages. Was the timeframe for the clarifications adequate? Did you think the clarifications were reasonable? Were there misunderstandings? Did you take part in a conference call with the programme's financial modeller? What happened in this discussion? Was this a helpful discussion?
    - One suggestion that has been made is to hold a face-to-face meeting or conference call at the clarification stage. If this meeting were to be at BEIS, do you think this would be feasible? If the meeting were to be at your offices, do you think this would be feasible?
  - Feedback regarding scoring, assessment and decision
  - Post-award support
- What was your experience of tracking your application?

- What is your opinion of the communications that you received during the application process? Was it clear and useful?
  - Were you aware of what would be required and when?
  - About the web-site:
    - Can you comment on the overall look of the application website (prompt on: *URL, branding, design*)
    - How easy was it to use? *Prompt for specifics*
    - Did you have any technical problems with the portal? *Prompt for specifics*
- Finally overall:
  - Do you have an idea of how many person/days were spent on the application?
  - Did you consider withdrawing at any stage? Why?
  - What do you think worked well about the application process?
  - What do you think did not work so well?

7. The main scheme

- Thinking back to what you have just told me, and thinking forward to the main scheme, what do you think are the key lessons that BEIS could learn from the pilot? We are keen to hear about both positive and negative issues. *Prompt according to key themes in the interview (and possibly on eligibility, the type of funding, the process, contractual issues)*
- Are there any aspects of the process that you would suggest are changed between the pilot and the main scheme? Why is this? *Prompt according to key themes in the interview and as above.*
- Did your proposal go through the HNDU pipeline?

  If yes: Many applicants to the main scheme will not have access to HNDU support, was HNDU support material to your decision to pursue a heat network, what benefits did you gain from this support, could you have obtained similar support from elsewhere, where do you think applicants to the main scheme may particularly struggle in the absence of HNDU support?

8. Impacts in the broader supply chain

Finally, we would like to ask you a couple of questions about the broader heat networks market or supply chain.

- How do feel that the heat networks supply chain has been developing over the past few years? For instance, are you aware of more suppliers of consultancy services, materials, construction services etc?
- In particular, have you noticed any changes in the market and supply chain specifically since the HNIP was announced?
- From what you can tell, is there sufficient capacity in the heat networks supply chain at present?

7. Concluding the interview

- Are there any other issues relating to the things we have discussed that you'd like to mention?
- I am wondering if there are any external members of the core proposal team that it might be useful for us to talk to. We are particularly keen to speak to commercial participants in the heat networks market. *If yes, prompt: ask if they could email the individual and include your email address within the email (or cc if appropriate)*
- Thank you for taking part in the evaluation.
- If we need to come back and ask for anything else, could I phone you, or send you an email?

Non-applicant topic guide

This topic guide is intended for use in interviews only with target organisations – mainly local authorities, but some others (such as universities or hospitals) – who might have been expected to apply for the HNIP, but did not. These include organisations who are in the HNDU pipeline and others who are not, and also draws on organisations who did not apply after submitting an Expression of Interest in HNIP. In both cases, due to the sampling approach, we can assume that the organisation has been actively developing a heat network scheme.

Interviewer introductions

Introduce self, and check that it is convenient to do the interview.

Introduce HNIP - As you may be aware, the Heat Networks Investment Project (HNIP) is a government capital funding initiative to help accelerate HN market growth towards a larger self-sustaining market.

Introduce the evaluation. We are independent researchers who have been contracted by BEIS to evaluate the Heat Networks Investment Project (HNIP) as it is rolled out. In this interview, we are keen to understand the perspectives on heat networks and the HNIP pilot of organisations – local authorities and other large public sector bodies, such as hospitals and universities – who did not apply. The objective of the interview is to understand what could be improved for the main scheme later in 2017.

Comment that – although we will try to cover only issues that are appropriate to the interviewee – we may raise issues that the interviewee does not feel qualified to comment on. This is fine, just confirm when this is the case.

Double check the interviewee has received participant information sheet, and is happy to reconfirm verbal consent to proceed, record the interview and transcribe. Ask for written consent form or email consent to be returned after the interview (if it hasn't already been sent to us).

Begin recording

State date, interviewer name and interviewee name, thanks for participation, any questions before we begin?

1. About your heat network team

This information will be used to focus the ensuing discussion, by exploring their background in working with heat networks (generally) and HNIP (specifically).

Confirmation of organisation. What is your job title, and which team are you part of? How long have you worked in this team?

- Is [your organisation] currently planning or developing a heat network or has it recently?
- What is your role with respect to your organisations' heat network plans?
- Who else is involved in the development of the scheme? Internally and externally?
- Are there any Directors or Councillors involved in the plans?
- Do you recall when a heat network scheme was first mooted in your organisation, and who raised it?
- At what stage of technical and commercial development is your scheme?
- What technology will the network use for generating the heat?
- Are there any particularly challenging aspects of the development process that you would highlight? *Prompt on:*
  - *Technical challenges*
    - *Funding challenges: any specific barriers? What kinds of funding are most helpful? Any particular contractual terms helpful or unhelpful?*
    - *Lack of senior internal* support
  - *Planning challenges*
    - *Lack of time*
    - *Lack of knowledge or expertise? (if so, what – technical? Financial modelling?)*
    - *Lack of reliable external support and advice*
    - *Difficulties finding customers*
    - *Working with multiple stakeholders*

Contractual issues

Commercial considerations

The results of a cost-benefit analysis

- What are your organisation's objectives for your heat network? *Try to get unprompted answers. If any of the points below are mentioned, prompt for more detail)*

  Carbon savings

  Cheaper heat for customers

  Income for my organisation

  Complying with planning regulations

- Are you already operating a local heat network or district heating scheme? *If yes, prompt:* can you tell us about the scheme (size, customers, technology, how long has it been operating, budget, how is it funded?)

2. HNIP

- Are you familiar with the Heat Network Investment Project?
- What do you understand to be BEIS' objectives for the HNIP (the project as a whole, as opposed to the pilot)? *Try to get unprompted answers. If any of the points below are mentioned, prompt for more detail.*

  For each answer, also prompt: to what extent do you think that the HNIP will achieve these objectives?

  Carbon savings

  Volume of heat networks built

  Encouraging technological innovation / technological future proofing

  Customer experience

  Building a sustainable (or self-sustaining) market

  Building a UK supply chain / industrial base

  Bringing in private finance

  Types of applicant – what kind of applicant is the project seeking to attract?
- How did you first hear about the HNIP? Do you recall when this was?
- Did you see any promotional material regarding the HNIP? If so, what did you see? How did you respond to it?
- Can you recall any other ways in which you heard about the HNIP?
- *Based on interviewer briefing notes (or ask:* Did you participate in the HNIP consultation in 2016? In any stakeholder workshops? in any HNIP training?*)*

  EITHER:

  - You participated in *the HNIP consultation in 2016 /workshops/training,* how did you hear about *this/these*; what were the benefits of involvement; did involvement support your application; would you participate again?

  AND/OR

  - You didn't participate in *the HNIP consultation in 2016 /workshops/training*: had you heard about them; how did you hear about them; why didn't you participate; what would help you to participate in the future?
- What difference if any is the HNIP making to your existing plans? . *Depending on other earlier answers, prompt on:*

  Initiated a new project or projects. What difference did HNIP make?

  Accelerated or delayed an existing project. Why? In what way?

  Changed the way in which you planned to fund an existing project. In what way? What other sources of funding have you been considering? What was the advantage of HNIP funding?

  Drew in new partners to an existing project

  Changed the technical design of an existing project. How? (including making it bigger)

  Changed the commercial design or structure of the project

  Changed T&Cs for consumer, eg relating to 'no consumer detriment'. How?

  Enabled you to incorporate other features, e.g. technical or commercial future proofing – if so what?

  Invested more time and resources in heat networks

  Costs of services and components have increased due to demand
- *Based on interviewer briefing notes* (or ask: Has you scheme been supported by the HNDU (the Heat Networks Delivery Unit)

If yes:

- What can you tell us about the kinds of and quality of support that you have received from HDNU?
- Many applicants to the main scheme will not have access to HNDU support. What do you think the impact of this will be? Where do you think applicants to the main scheme may particularly struggle in the absence of HNDU support?

If no:

- Can you say anything about why not?

3. The HNIP pilot application process

- Did you start an application to the HNIP pilot?

If no:

- Why not? Prompt if necessary on eligibility criteria, scoring criteria (eg appropriate, fair?)
- Is the project going ahead, outside HNIP? *Probe on how they are being funded*.

If yes:

- Do you recall what stage your application reached? *As appropriate, prompt for any comments on stages that were completed (ease of completion, size of tasks etc):*
  - *Pre-application eligibility stage*
  - *Do you think the pre-eligibility criteria were appropriate and fair?*
  - *Main application stage*
  - *Clarification stage*
- Can you tell us what stopped you completing the application? *Prompt on*
  - *Size/difficulty of the tasks*
  - *Timescales available for the tasks*
  - *Insufficient support from BEIS/HNDU*
  - *Insufficient support internally*
  - *We realised that our plans were under-developed. Technically? Financially?*
  - *Lack of skills within the project team, relating to, for example: technical skills; procurement skills; supply chain management; identification of potential investment.*

- Thinking back to what you have just told me, and thinking forward to the main HNIP scheme, what do you think are the key lessons that BEIS could learn from the pilot? We are keen to hear about both positive and negative issues. *Prompt according to key themes in the interview (and possibly on eligibility, the type of funding, the process, contractual issues)*

4. Future plans

- Can you tell me about your future plans regarding heat networks? (*Prompts:, with respect to: expansion, integration and de-carbonisation.)*
- Have your plans changed as a result of the introduction of HNIP. In what ways?
- Have your plans changed due to anything you have learned about the HNIP application process? If yes, how?
- Do you think your heat networks plans could achieve the level of investment needed for the expansion sought without the HNIP?
- Do you plan to apply to the HNIP main scheme? If yes, why? If no: why not? *If not, prompt on how the scheme will be funded and what are the conditions that allow this.*

5. Impacts in the broader supply chain

- Finally, we would like to ask you a few questions about the broader heat networks market or supply chain.
- How do feel that the heat networks supply chain has been developing over the past few years? For instance, are you aware of more suppliers of consultancy services, materials, construction services etc, or changes in quality or technology?
- In particular, have you noticed any changes in the market and supply chain specifically since the HNIP was announced?

Prompt on technical developments; quality of support, prices?

- From what you can tell, is there sufficient capacity in the heat networks supply chain at present, and in the future?

6. Concluding the interview

- Are there any other issues relating to the things we have discussed that you'd like to mention?
- I am wondering if there are any external members of the core proposal team that it might be useful for us to talk to. We are particularly keen to speak to commercial participants in the heat networks market. *If yes, prompt: ask if they could email the individual and include your email address within the email (or cc if appropriate)*
- Thank you for taking part in the evaluation.
- If we need to come back and ask for anything else, could I phone you, or send you an email?

Supply chain topic guide

This topic guide is intended for use in interviews only with commercial organisations that are part of the heat network supply chain. These *include* consultants of various kinds, product manufacturers and construction companies.

Interviewer introductions

Introduce self, and check that it is convenient to do the interview.

As you will be aware, the Heat Networks Investment Project (HNIP) is a government capital funding initaitive to help accelerate HN market growth towards a larger self-sustaining market.

Introduce the evaluation. We are independent researchers who have been contracted by BEIS to evaluate the Heat Networks Investment Project (HNIP) as it is rolled out. In this interview, we are keen to understand ways in which the HNIP pilot is starting to impact on the heat networks supply chain – consultants, product manufacturers, construction companies etc – as well as what has gone well in the pilot, and what could be improved for the main scheme later in 2017.

Comment that – although we will try to cover only issues that are appropriate to the interviewee – we may raise issues that the interviewee does not feel qualified to comment on. This is fine, just confirm when this is the case.

Double check the interviewee has received participant information sheet, and is happy to reconfirm verbal consent to proceed, record the interview and transcribe. Ask for written consent form to be returned after the interview (if it hasn't already been sent to us).

Begin recording

State date, interviewer name and interviewee name, thanks for participation, any questions before we begin?

1. About your organisation

The objective in this section is to gather some general information about the organisation, which will also be useful in contextualising the discussion of other topics later on. Note that there is a specific set of questions about HNIP and the organisation later on.

- Confirmation of name of the organisation. What is your job title, and which team are you part of?
- Very briefly, can you tell us about the range of activities and customers (public/private; UK/international) of your organisation, and – in broad terms – anything about how the range of activities has developed over the past five to ten years? *Prompt in particular on heat networks and the specific product/service that they provide.*
- Can you tell us something about your place in the heat networks supply chain? For example, do you deal directly with network commissioners, operators or main contractors, or are you a little further along the chain?

2. About HNIP

The objective in this section is to understand more about interviewees' knowledge and experience of HNIP. NB: Since the email invitation and information sheet make it clear that the interview is about HNIP, we are assuming that all interviewees will know something about the project.

When did you first hear about the Heat Networks Investment Project, or HNIP for short?

- Has your organisation been involved with the HNIP development and pilot phases at all?

Prompt on different modes of involvement:

Responded to the consultation in early 2016

Attended stakeholder workshop

Attended HNIP training

Acted as a technical, financial or feasibility consultant, partner or service provider in the development of a pilot application

Responded to an invitation to tender or a request for a quote for the provision of materials or services relating to heat networks.

If the interviewee was involved in any of these ways, probe for more details.

- What do you understand to be BEIS' objectives for HNIP (the project as a whole, as opposed to the pilot)? *Try to get unprompted answers. If any of the points below are mentioned, prompt for more detail.*

  Carbon savings

  Volume of heat networks built

  Encouraging technological innovation / technological future proofing

  Customer experience

  Building a sustainable (or self-sustaining) heat networks market

  Building a UK supply chain / industrial base

  Bringing in private finance

- Types of applicant – what kind of applicant is the project seeking to attract?

3. The heat network market and impacts of the HNIP pilot

The objective in this section is to learn about the ways in which the organisation engaged in the HN market before HNIP, and the ways in which HNIP has impacted on the organisation.

- When did your organisation start working in the heat networks market? What prompted your organisation's entry into the market?
- Who are your main competitors in your segment of the heat networks market? Are these competitors typically UK or overseas companies? Is the market getting more or less competitive?
- First thinking about the situation prior to HNIP
  - How many heat network projects has your organisation been part of? Ask for details: customers (public/private sector), which, where, when, partners, role, profitability.
  - Is it possible to estimate the current value of your heat networks business as a proportion of total turnover?
  - Of the heat network products and services you sell, do you know approximately what proportion of the value is imported?
  - How has the importance of the heat networks market to your organisation changed over time?
  - *If heat networks have increased in importance over time, ask*: in what ways have your organisation responded to this? Again, here, we are particularly interested in things you were doing before the launch of HNIP. *As appropriate, prompt and ask for detail on*:

    Developed a heat networks business strategy, however informal or formal

    Invested in training

    Invested in a dedicated sales force

    Initiated fact finding or research projects

    Implemented marketing campaigns targeting the heat networks market

    Implemented product development programmes

    Made capital investments, for instance in manufacturing or construction plant

    Joined any heat networks industry bodies

    Employed heat networks specialists

    Attended *industry* events, such as conferences or exhibitions

    Invested in branding, positioning, advertising and marketing aimed at the heat networks market.
- Now thinking about HNIP
  - Can you tell me how the HNIP has impacted on your organisation's attitude to the heat networks market? *If needed, prompt on the extent to which HNIP has increased the importance of the market.*
  - Thinking back to the activities that we discussed a moment ago, in what ways has the HNIP impacted on your organisation's investment of time and funds into the heat networks market?
  - Thinking forward over the five years of the HNIP, do you anticipate increasing investment and/or business activity in heat networks as a result of HNIP? Where do you see the most potential for growth in the market? Do you expect demand for your services to rise? Why/why not?
  - *If yes*: how easy do you think this will be, for instance, is there sufficient expansion potential in terms of skilled labour, training, raw materials etc.
  - Who is likely to be your main customer or type of customer? Public vs. private sector. Could this change over time?
  - What would you anticipate the impact on the supply chain will be? For example, would any rise in demand

be met by UK companies or foreign firms entering the UK market? Who would be your main competitors? Would you rely more on imports for the heat network product/service you sell

- What other factors could affect the heat networks market over the next few years
- How could Brexit affect the structure of the market and HNIP outcomes? Prompts: For example, more expensive imports, greater risk for providers of finance, changes in climate legislation/regulations etc.
- What other risks does the heat networks market face over the next few years?
- What opportunities might there be? *Prompt on changes in regulations.*

Interviewer will need to gauge how useful conversation here is and move on quickly if need be

If 'yes' to international customers above, prompt on: which countries? Do the services it provides differ in each? Why do you operate in some countries and not others? What do you find to be the most important 'ingredients' for successful heat networks activity in any given country? How does the UK compare with other countries in terms of ease of conducting heat networks business and what are the major obstacles in comparison with other countries?.

4. About the HNIP pilot application process

It is important to note that most participants in the heat networks supply chain will not have had much experience of the HNIP pilot application process. However, consultants may have played a major role, and manufacturers and constructors may have heard about the process from one or more applicant. Therefore, this section should be used quite flexibly depending on the answers to the earlier question about involvement in HNIP applications. If interviewees were involved in one or more HNIP application, ask:

- In this section, we would like to discuss your experiences of, or what you heard about, the application process.
- Were you involved in the application process?
- *IF NO* - have you heard of others' experiences? if YES ask for brief details then:
  - Are there particular things you understand worked well in the application process?.
  - Are there some things you understand did not work so well?
- *IF YES* - How were you involved?
  - *If ONLY LIGHTLY*
    - What was your role? Do you have an idea of how many person/days your organisation spent on the application?
    - Are there particular things that worked well in the application process?.
    - Are there some things that did not work so well?
  - IF MORE SUBSTANTIALLY
    - How would you describe your experience of the application process? What worked well, what worked less well *As appropriate, prompt about the size/difficulty of the task, the timescales available and support provided for the tasks at each stage:*

      enquiry

      the eligibility criteria

      the main elements of the application.

      The business case

      The technical design documentation

      The financial model

      Heads of terms

      Funding gap evidence

      the clarification stages once the application has been submitted

      the feedback stage

      communications throughout

      any issues with the portal.

Finally

- Would you consider being part of a submission if approached by a potential partner? Why or why not? What would be the obstacles to applying/collaborating for your organisation?

5. Concluding the interview

- Are there any other issues relating to the things we have discussed that you'd like to mention?
- Is there anything else relating to HNIP that you'd like to mention?
- Thank you for taking part in the evaluation.
- Just in case. If we need to come back and ask for anything else, could I phone you, or send you an email?
- Final reminder to send consent form if not already received.

Industry body topic guide

This topic guide is intended for use in interviews only with industry bodies relevant to heat networks. These organisations are expected to have an overview of the whole of the supply chain.

Interviewer introductions

Introduce self, and check that it is convenient to do the interview.

Introduce the evaluation. We are independent researchers who have been contracted by BEIS to evaluate the Heat Networks Investment Project (HNIP) as it is rolled out. In this interview, we are keen to understand ways in which the HNIP pilot is starting to impact on the heat networks supply chain – consultants, product manufacturers, construction companies etc – as well as what has gone well in the pilot, and what could be improved for the main scheme later in 2017.

Comment that – although we will try to cover only issues that are appropriate to the interviewee – we may raise issues that the interviewee does not feel qualified to comment on. This is fine, just confirm when this is the case.

Double check the interviewee has received participant information sheet, and is happy to reconfirm verbal consent to proceed, record the interview and transcribe. Ask for written consent form to be returned after the interview (if it hasn't already been sent to us).

Begin recording

State date, interviewer name and interviewee name, thanks for participation, any questions before we begin?

1. About your organisation

The objective in this section is to gather some general information about the organisation, which will also be useful in contextualising the discussion of other topics later on. Note that there is a specific set of questions about HNIP and the organisation later on.

- Confirmation of name of the organisation. What is your job title, and which team are you part of?
- Very briefly, can you tell us about what your organisation does, and – in broad terms – anything about how the range of activities has developed over the past five to ten years? *Prompt in particular on heat networks and any increase in member numbers.*
- Can you tell us something about the organisations you represent/ engage with? Public/ private sector, nature of their activities – commissioners, design, construction, component suppliers (eg meters etc), operators? ***NOTE: if they mention component suppliers, ask at end if they could suggest anyone we could speak to*

2. About HNIP

The objective in this section is to understand more about interviewees' knowledge and experience of HNIP. NB: Since the email invitation and information sheet make it clear that the interview is about HNIP, we are assuming that all interviewees will know something about the project.

- When did you first hear about the Heat Networks Investment Project, or HNIP for short?
- Has your organisation been involved with the HNIP development and pilot phases at all?
  Prompt on different modes of involvement:

  Responded to the consultation in early 2016
  Attended stakeholder workshop
  Attended HNIP training
  Provided publicity or information about HNIP to members
  Advice to organisations involved?
  Hosted meetings, seminars or conferences about HNIP? Or including HNIP?

  If the interviewee was involved in any of these ways, probe for more details.
- What do you understand to be BEIS' objectives for HNIP (the project as a whole, as opposed to the pilot)? *Try to get unprompted answers. If any of the points below are mentioned, prompt for more detail.*

Carbon savings

Volume of heat networks built

Encouraging technological innovation / technological future proofing

Customer experience

Building a sustainable (or self-sustaining) heat networks market

Building a UK supply chain / industrial base

Bringing in private finance

- Types of applicant – what kind of applicant is the project seeking to attract?

3. The heat network market and impacts of the HNIP pilot

The objective in this section is to learn about the ways in which the organisation engaged in the HN market before HNIP, and the ways in which HNIP has impacted on the organisation.

- When did your organisation get involved in the heat networks? What prompted your organisation's interest?
- Have you observed growth in the importance of heat networks over time? To your members, or more generally?
- *If heat networks have increased in importance over time, ask*: in what ways have your organisation responded to this? Again, here, we are particularly interested in things you were doing before the launch of HNIP. *As appropriate, prompt and ask for detail on*:

  Developed a heat networks business strategy, however informal or formal

  Started to develop, or encouraged the development of standards related to heat networks

  Initiated fact finding or research projects

  Written news articles or blog posts to inform members

  Implemented marketing campaigns targeting the heat networks market

  Increased numbers/ types or scope of industry events, such as conferences or exhibitions

  Lobbied Government on issues related to heat networks? (if yes – ask for further details – can you tell me more about that?)
- Now thinking about HNIP
  - Do you think HNIP has affected attitudes to the heat networks market? If needed, prompt on the extent to which HNIP has increased the importance of the market, or how
  - Thinking forward over the five years of the HNIP, do you think your members will increase investment and/or business activity in heat networks as a result of HNIP? Where do you see the most potential for growth in the market?
  - What would you anticipate the impact on the supply chain will be?
  - For example, would any rise in demand be met by UK companies or foreign firms entering the UK market?
  - Do you think there might be price increases, or falls in quality?
  - Do you think that any increase in demand will come from the public sector? Or the private sector? *(both? Which more important?)* Do you think there are sufficient skills and knowledge to meet increased demand? Is there scope for supply to increase?
- What other factors do you think could affect the heat networks market over the next few years
- How could Brexit affect the structure of the market and HNIP outcomes? *Prompts: For example, more expensive imports, greater risk for providers of finance etc.*
- What other risks does the heat networks market face over the next few years?
- What opportunities might there be?

4. About the HNIP pilot application process

Industry bodies are unlikely to have direct experience of the HNIP pilot application process, unless as a member of a different organisation. However, they may have heard about the process from one or more applicant, and may have been involved in consultations and information events.

- Do you think you were adequately consulted about HNIP before its introduction?
- DO you have any views on the policy design? Was it sensible? Was the funding gap approach sensible, in your view?
- Have you heard of your members' experiences in relation to applications to HNIP? if YES ask for brief details then:

- Are there particular things you understand worked well in the application process?.*(What? Why?)*
- Are there some things you understand did not work so well? (*What? Why?*)
- *IF they seem to have had significant feedback from members, or direct involvement, use this:*
  How would you describe the experience of the application process? What worked well, what worked less well?
  As appropriate, prompt about the size/difficulty of the task, the timescales available and support provided for the tasks at each stage:
    - *Enquiry*
    - *The eligibility criteria*
    - *The main elements of the application.*
    - *The business case*
    - *The technical design documentation*
    - *The financial model*
    - *Heads of terms*
    - *Funding gap evidence*
    - *The clarification stages once the application has been submitted*
    - *The feedback stage*
    - *Communications throughout*
    - *Any issues with the portal.*
- From what you know, do you think that 'good' heat networks projects were deterred from applying to the pilot scheme? What deterred them?
- Do you know of any heat networks projects that you think were good schemes that applied and were not successful? Do you have any views on that, e.g. on scoring criteria?
- Do you think that any of the schemes that were successful in the pilot round would have gone ahead without HNIP funding? Why do you think that?
- Thinking about the main scheme: Have any of your members expressed any views on the main scheme? E.g. do they have plans to submit an application under the main scheme? Have any members mentioned obstacles to applying, or any reasons that have encouraged them to apply?
- Does your organisation have a position on the HNIP scheme, either formal or informal?
- Do you think it is likely to create the conditions for a self-sustaining heat networks market? (If yes, why? If no, why not? What are the barriers? What more could be done?)
- Would you change anything about the policy to make it more effective?

5. Concluding the interview

Finally

- Are there any other issues relating to the things we have discussed that you'd like to mention?
- Is there anything else relating to HNIP that you'd like to mention?
- Thank you for taking part in the evaluation.
- Just in case. If we need to come back and ask for anything else, could I phone you, or send you an email?
- Final reminder to send consent form if not already received.

Third party investor topic guide

Interviewer introductions

Introduce self, and check that it is convenient to do the interview.

Introduce the evaluation; we are independent researchers who have been contracted by BEIS to evaluate the Heat Networks Investment Project (HNIP) as it is rolled out. In this interview, we are keen to understand the heat networks investment landscape and your views about how the HNIP will or could impact on this. We are also interested in what has gone well in the pilot, and what could be improved for the main scheme later in 2017.

Comment that – although we will try to cover only issues that are appropriate to the interviewee – we may raise issues that the interviewee does not feel qualified to comment on. This is fine, just confirm when this is the case.

Double check the interviewee has received participant information sheet, and is happy to reconfirm verbal consent to proceed, record the interview and transcribe. Ask for written consent form to be returned after the interview (if it hasn't already been sent to us).

Begin recording

State date, interviewer name and interviewee name, thanks for participation, any questions before we begin?

1. About you and your organisation

This information will be used to focus the ensuing discussion, by exploring their background in working with heat networks (generally) and HNIP (specifically).

- *Confirmation of organisation.* What is your job title, and which team are you part of? How long have you worked in this team? Broader background?
- Do you manage your own funds or on behalf of others?
- What is the investment mandate / focus of the funds you currently manage?
- How would you characterise your investments? *Prompts: risk/ return E.g. High and fast returns or patient capital looking for low but long term steady returns "Impact investing" with a focus on social and environmental impacts? (**Note for interviewers: 'high and fast' example would be bank loans, while patient capital is e.g. pension fund, especially defined benefits (becoming less important though) which has long term predictable liabilities)*
- To what extent does your organisation currently invest in
  - different aspects of heat networks
  - low carbon heat/decentralised energy generation/ distribution/energy efficiency/infrastructure?
  - networks, or national infrastructure projects
- How do you invest in these kinds of projects? Debt, equity or a combination?

2. Views on HNs from investor perspective

- I'd like to spend just a few minutes talking about what a heat network is, and how the revenue model works. [*Stop if interviewee makes it clear they already know all about heat networks*]

  Heat networks distribute heat produced at a central location to a number of separate buildings via a system of insulated pipes. A heat network avoids the need for individual boilers or electric heaters in every building. They can be both cheaper and more efficient than traditional building-level heating solutions and are particularly attractive in high-density built-up areas such as city centres. They also work well for new build developments and campuses. There are already over 2,000 heat networks in the UK; some of which have been operating for over 50 years. The heat for such networks can come from a variety of different sources."

  [*mention if asked gas boilers, combined heat and power plants (which also provide electricity), recovered waste heat from factories or infrastructure, energy from waste plants, large water-sourced heat pumps, and in the case of Southampton (existing heat network), a geothermal heat source*. *District heating is a type of heat network scheme – heat networks are much more common in some other parts of the world than in the UK, eg in Scandinavia)]*

  [*potential additional information if relevant: Not only can heat networks enable carbon savings in the short term, they also allow us to increase these carbon reductions over time because the pipe infrastructure can utilise new lower carbon heat sources in the future,]*

From an investment perspective, other key features are that revenue streams are reliable and predictable over a relatively long period of time because of anchor load contracts. Some schemes use CHP so sell electricity as well as heat. Typically, heat networks are designed for a minimum 50-year pipework life – the heat source can change over those 50 years, so that lower carbon sources can be used if they become more attractive.

- How attractive are heat networks currently as investment opportunity?
- What aspects make them attractive / unattractive? (prompt on: de-carbonisation, multi-party contracts? Transaction costs?)
- What would make them more attractive? (prompt if necessary: better known, better understood risk/ return profile? Better understanding of revenue model?
- (*If not mentioned*) does the current lack of regulation in the heat networks market affect your views? Would the market be more attractive if it was regulated, say in a similar way to the gas and electricity markets? Why?
- How attractive are HNs for investment compared with
- Other wider infrastructure projects (eg transport? Waste management? Water supply and effluent treatment?) Why?
- Other energy infrastructure projects (eg power generation? energy from waste schemes?) Why?
- What scale of HN are you most likely to consider investing in: e.g. investing in a single network; several networks; secondary market investment in bundles of networks; investment in heat production?
- Are particular elements of heat networks more attractive to you than others?: *heat generation? / distribution? / customer supply…? or whole networks?*

  Why is that?

- Would you be more interested in investing in development (design, commercialisation and construction) or operating assets? Or are both equally attractive?

  Why?

- What type of investment would be attractive to you? (Prompts if necessary (try not to prompt): for example, equity? Debt – loans? Bonds? Convertibles? Any particular tiers of debt or equity more attractive? (***Note to interviewer: tiers reflect order in which people lose their money or share in profits – so reflect risk*)
- Thinking about the market – are there key movers who you think others might follow, if they began to invest more heavily in heat network assets? (Who? Why – ie why would people follow them? (*eg large, respected, big in infrastructure…?)*)

3. Involvement in heat networks

- What is your perception of the current Heat Networks market in the UK? (if necessary – market generally, and market for investment in heat networks prompts: is there a market?)
- What is your perception of the future of the Heat Network market in the UK? How might it evolve from here? Why do you think that?
- In what ways and to what extent have you been involved in heat networks and to what extent do you plan to be in future? *If they have been, please explore since when, in what ways, where and to what extent they have been involved:*
- Providing advice on business cases, and financing?
- Supporting application(s) for funding, including the HNIP?
- Providing finance (in what form?)
- Do you hold any HN investments? *If yes* did you acquire these assets during the development/ construction phase, or as an operating asset What size holding do you have, compared with other holdings?
- Do you have Heat Network investment experience outside the UK? *If yes* how does it differ?
- If involved: what have your experiences shown you about the benefits and/or challenges of investing in HNs?

  Prompts, if necessary:

  Invested in development phases? Or operating assets?

  Nascent industry

  Demand risk

  Lack of consistent quality of project documentation

  Visibility/ volume of pipeline of projects in development

  Lack of regulation / prospect of future regulation / price regulation

  Technical standards (or lack of)

- If not involved: Why not? (*see prompts above*)
- If not involved or if would like to be more involved: From what you know, what do you currently see as the benefits and/or challenges of investing in HNs?

4. Awareness and understanding of the HNIP

- Are you aware of the existence of the Heat Networks Investment Project?

  If not – brief description:
  In November 2015, the Government announced that it was making available £320m of capital funding to support investment in heat networks1 over the next five years. This is expected to draw in up to £2 billion of additional investment and lead to the construction of hundreds of heat networks in England and Wales. The investment support aims to increase the volume of heat networks being built to deliver cost effective carbon savings, whilst benefiting consumers and helping to create the conditions necessary for a self-sustaining heat networks market to develop. The pilot scheme has recently announced support to a number of schemes, comprising a mixture of grants and loans.

  I'd like to take a couple of minutes to talk about the HNIP's funding requirements, then ask a few questions about how HNIP capital support might affect the attractiveness of heat networks as an investment.
  Applicants have to demonstrate that their project would not be able to go ahead without HNIP funding – they have to demonstrate that they have a funding gap. .For example, for the pilot scheme, a project to construct and operate a new heat network would have to demonstrate that while financial metrics for their project (for example, IRR) were positive they were not attractive enough to secure funding; the funding gap in such a case would be the amount of capital needed to take the IRR up to the hurdle rate of the equity investors.

  How would the support offered by HNIP affect the investment case for heat networks? (*from the third party investor's perspective)e.g. for the pilot scheme, only public sector projects (some investors like this, others prefer private)*
  grant vs loan terms (e.g. impact of long term [38yr] low interest loans, deferred repayment of principal under operation, low interest [-1% below public sector loan board])

  Would the type of capital support offered affect this? What types of capital support would make heat networks more attractive as an investment? *(e.g. loans/ grants/ equity) thinking here about risk allocation, who gets first call on revenues, and assets)*

  Does the 'funding gap' approach affect how you would view heat networks as an investment opportunity?

5. Factors affecting investment decisions

NOTE FOR INTERVIEWER: You may already have discussed many of these so may not need to ask them all. However, if still running short of time, skip to bold questions.

- What are the main considerations affecting your organisation's decision to invest/further invest or not in HNs?
  Prompts if necessary:

  Expected return of investment above a particular hurdle rate

  Expected payback period/ timescale of return on investment

  Lack of an established regulatory environment

  Expected future growth of HN market / Unknown or uncertain / invisible pipeline of projects / ability to access these opportunities

  New heat networks/ expansions, refurbishments / interconnections

  Secondary market: refinancing and acquisition opportunities

  The price cap implied for individual projects by the 'no detriment' to consumers [only applicable for HNIP projects]

  Type & characteristics of HN sponsors or owners (i.e. public or private)

  Projects with access to HNIP funding

  Your investment threshold / Size / scale of HN projects (heat networks currently average c. £10m capex and project sponsors might not be seeking all this from one investor) and size of investment heat network project sponsors are seeking from third parties

- Do you think that transaction costs for heat networks investments are a significant barrier for investors? Are they prohibitively high? *(**Note for interviewers – transaction costs often relate to negotations on risk allocations, risk transfer, including costs for commercial lawyers to address contractual issues associated with these, eg for debt,*

so may be high for smaller projects)

- Does HNIP funding help with this? How? How might it? (*Note: if HNDU funding is mentioned, similarly,* how does it help?
- Does the standardisation of documentation due to HNIP help with transaction costs?
- What are the risks of investing in HNs from your perspective currently?
  Prompts, if necessary:
  - *Negative impact of Brexit on HN market*
  - *Changes in government policy/regulation relating to carbon*
  - *Technological developments*
  - *Regulatory risks*
  - *Withdrawal of subsidies*
  - *Demand risk*
  - *Difficult to exit the investment because there is no secondary market or it is very thin*
  - *Lack of (technical) expertise in-house to judge quality of investment case*
- Has the existence of HNIP affected your investment decisions – directly or indirectly?

Is it likely to make you more / less likely to invest in HNs?

- What would your attitude to HN investment be if the HNIP did not exist?
- Do you think HNIP (capital support through grants and loans, to address funding gaps) is the right way to support a nascent market to help it reach a self-sustaining state (i.e. continue to grow with no more Government capital needed) (Why? Why not?)
- What is the likely effect of Government funding on sub-commercial terms, compared with pari passu terms?*(**Note for interviewer – equal footing, same terms…)*
- Do you think Government is the right actor to provide the heat network investment project?
- What does a sustainable / self-sustaining market look like?
- What else might be needed to encourage you to invest for the first time or to invest more and to achieve a self-sustaining market?
- From what you know about HNIP, do you think it will succeed? Why? Why not? and what will happen after HNIP?

6. Concluding the interview

- Are there any other issues relating to the things we have discussed that you'd like to mention?
- Thank you for taking part in the evaluation.
- If we need to come back and ask for anything else, could I phone you, or send you an email?

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Contact us if you have any enquiries about this publication, including requests for alternative formats, at:

Department for Business, Energy and Industrial Strategy
1 Victoria Street
London SW1H 0ET
Tel: 020 7215 5000

Email: enquiries@beis.gov.uk