



Department for
Business, Energy
& Industrial Strategy

Green Heat Network Fund

Consultation on proposals for scheme design

Closing date: 29 January 2021



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Foreword

In 2019 the UK became the first major economy in the world to pass laws to reduce its greenhouse gas emissions to net zero by 2050, confirming that we are at the forefront of global efforts to combat climate change. Over the past decade, we have reduced carbon emissions by more than any similar developed country.

Decarbonising heat is a key part of the Government's strategy and underpins the Prime Minister's Ten Point Plan for a Green Industrial Revolution. It will also be a focal point of our forthcoming Heat and Buildings Strategy. It is a challenging undertaking that has no single solution and will require a combination of leading-edge technologies and increased customer options to make it happen. However, it is a certainty that heat networks will be vital to making net zero a reality. They are a proven, cost-effective way of providing reliable, low carbon heat at a fair price to consumers, while supporting local regeneration.

The government has demonstrated the value it places on building a sustainable heat networks sector by providing focused project support since 2013 and has committed to investment of nearly half a billion pounds. This has helped the market access private investment, supported the growth of the supply chain and unlocked large scale renewable and waste heat resources. This year we have also introduced proposals to help build a future market framework which will enhance consumer protections, whilst supporting market growth.

As the next step, we now propose to establish a new Green Heat Network Fund. This fund is intended to assist both new and existing heat networks to decarbonise by moving to low carbon technologies, while also ensuring that consumers are treated fairly by the networks that will benefit from its support. Getting the design of the scheme right will be vital to ensuring that it achieves these ambitions.

I am grateful to those who responded to the recent Green Heat Network Fund Call for Evidence and others who have engaged with BEIS in discussions about the scheme since it was announced in the March 2020 Budget. You have demonstrated that there is a wealth of useful knowledge, experience and data that we can draw upon to design the scheme.

This consultation is very much a product of the feedback we have had so far, and I would urge you to participate in it.

Rt Hon Kwasi Kwarteng MP
Minister for Business, Energy and Clean Growth

General information

Why government is consulting

In this consultation BEIS are formally seeking to gather views on how we should design the proposed Green Heat Network Fund (GHNF) scheme. The core goal of the GHNF is to support the continued growth of the heat network sector and to accelerate the adoption of low and zero-carbon (LZC) heating technologies so that heat networks play their part in meeting the UK's 2050 net zero commitment. Where the Heat Networks Investment Project (HNIP), the Department's existing capital support programme for heat networks projects in England and Wales, allowed for efficient fossil based heating technologies to lay the foundation for future decarbonisation, the GHNF is a capital grant funding programme which seeks to fund projects moving to LZC technologies.

BEIS are gathering public views and, where available, evidence in support of or differing from our indicative proposals for the GHNF scheme design. Where we are not sure of how best to proceed, we present open questions to seek your views as to how we might address an area of concern. Where we have a proposed approach, we ask more detailed questions on how we might better develop those specific areas.

Ultimately BEIS wants to ensure that the award of grants to successful projects is done in a fair and transparent way, represents value for money for the taxpayer and that the projects we support will deliver the LZC heating that is needed if the UK is to meet its 2050 net zero commitment. We want projects to be in a position, prior to application, to have a clear understanding of how their project might score, so that they can dedicate their time and resources to applying with the confidence that they are likely to score well and be successful.

Consultation details

Issued: 30 November 2020

Respond by: 29 January 2021

Enquiries to: Green Heat Network Fund Team, Department for Business, Energy and Industrial Strategy.

Please do not send responses by post to the department, as we may not be able to access them during altered working arrangements as a result of the COVID-19 pandemic.

Email: heatnetworkdecarbonisation@beis.gov.uk

Consultation reference: Green Heat Network Fund

Audiences:

We anticipate that this consultation would be of relevance to the following audiences: Local Authorities, investors, Energy Services Companies (ESCos), property and housing developers, Housing Associations, hospitals, universities, prisons and other large consumers of heat, industrial process owners, Local Enterprise Partnerships, Non-Governmental Organisations,

heat and energy technology suppliers, waste incineration companies, sector based associations, consultancies with a heat network sector focus, academics and anyone else with an interest in this area.

Territorial extent:

England and Wales

How to respond

Respondents are encouraged to make use of the online e-consultation platform, Citizen Space, to respond to this consultation wherever possible. This is the department's preferred method of receiving responses. However, responses submitted by email will be accepted. If responding by email, please use the response form found on the GOV.UK consultation page at the link below.

Respond online at: <https://beisgovuk.citizenspace.com/heat/green-heat-network-fund-scheme-design/>

Complete the pipeline questionnaire at: <https://beisgovuk.citizenspace.com/heat/pipeline-questionnaire>

or

Email to: heatnetworkdecarbonisation@beis.gov.uk

Please do not send responses by post to the department, as we may not be able to access them during altered working arrangements as a result of the COVID-19 pandemic.

A response form is available on the GOV.UK consultation page:
<https://www.gov.uk/government/consultations/green-heat-network-fund-proposals-for-the-scheme-design>

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

Your response will be most useful if it is framed in direct response to the questions posed, though further comments and evidence are also welcome. Some of the questions are technical, and respondents are encouraged to respond to those questions that are relevant to them or their organisation and do not necessarily need to answer them all (when not relevant).

Confidentiality and data protection

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

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

We will process your personal data in accordance with all applicable data protection laws. See our [privacy policy](#).

Data and responses may be processed by a third party contracted by BEIS.

We will summarise all responses and publish this summary on [GOV.UK](https://www.gov.uk). The summary will include a list of names or organisations that responded, but not people's personal names, addresses or other contact details.

Quality assurance

This consultation has been carried out in accordance with the government's [consultation principles](#).

If you have any complaints about the way this consultation has been conducted, please email: beis.bru@beis.gov.uk.

Executive Summary

In this consultation, BEIS has set out its scheme design concepts for the proposed £270m Green Heat Network Fund (GHNF) scheme. The GHNF is a capital grant programme that aims to stimulate the growth of low-carbon heat networks that will support the delivery of the UK's 2050 net zero commitment and expand the current heat networks supply chain. The funding, (subject to approval), is expected to open for applications in April 2022 and is anticipated to run for three years, to 2025. Key elements of our policy proposals are set out below.

Scope of the GHNF

Our proposals on the scope of the scheme set out our approach:

- to the technologies and sources of thermal energy intended to be supported;
- to the types of heat networks proposed to be in and out of scope;
- on how emissions will be assessed;
- on the assessment of consumer detriment;
- to the proposed method for the relative scoring of applications.

Monitoring and evaluation:

The proposed approach to the long-term monitoring and evaluation of the GHNF is set out in this document, as well as the extent to which it achieves the GHNF stated aims. Views are sought on what the most appropriate metrics should be for monitoring and evaluating the scheme. A key part of this is setting out the kind of data proposed to be gathered and used to evaluate successful applications over time. As part of this an assessment needs to be made as to the extent to which such requirements will or will not present undue burdens on projects now and into the future, while still allowing the GHNF to measure outcomes.

Benefits realisation:

The GHNF should have a demonstrable impact on reducing emissions and improving local air quality relative to a relevant counterfactual. However, the GHNF aims to deliver enhanced heat network capability, capacity, and industrialisation, leading to new jobs and product development and contributing to the sustainability of the market moving forward. It is anticipated that these wider indirect benefits will provide greater resilience to the wider energy networks, onshore aspects of the supply chain and reduce costs. Measuring such benefits can be challenging, the proposed approach is set out in this document and views are sought on how to build on this to better ensure that a robust and meaningful benefits evaluation approach is adopted.

Finance:

The GHNF will only provide a portion of the funding required to deliver a given project. As such it is imperative that we design the scheme to stimulate a pipeline of applications and help to drive the decarbonisation of heat networks.

Supply Chain:

Another key aim of the GHNF is to help change the UK's heat network capacity for reducing carbon emissions by enabling the supply chain to develop its low-carbon offering. It is hoped that the strong pipeline of projects developed through our existing Heat Networks Investment Project (HNIP), and continued by the GHNF, will provide an incentive for the UK supply chain to expand its existing capacity and for the international heat network supply chain to onshore skills and manufacturing. Through the scheme design, we are seeking to encourage more open procurement, a drive for innovation, regional growth and jobs. Views are sought as to how best to ensure that the overall impact of GHNF helps to move the sector towards a globally competitive heat network supply chain.

Introduction

What is a heat network?

Heat networks supply heat from a central source to consumers, via a network of underground pipes often carrying hot water. Heat networks can cover a large area or even an entire city or be fairly local supplying a small cluster of buildings. This avoids the need for individual heating solutions in every building. Heat networks are sometimes described as “central heating for cities”.

The central heat source is often located in a building, basement or other structure often referred to as ‘the energy centre’. There are many possible technologies that can provide the primary heat supply to a heat network including large scale heat pumps, energy from waste (EfW) facilities, heat recovery from industrial processes, solar thermal arrays and many more.

Heat is typically delivered to each customer through a ‘heat exchanger’, or Heat Interface Unit (HIU) which, for a residential connection, is about the same size as a small gas boiler. All the same heating controls are available, and to the end user the central heating and hot water system work in the same way as a domestic gas-fired central heating system without the need for any combustion to take place inside the building.

Heat networks can be various sizes and serve various combinations of building types. Heat networks can be extended over time, and new heat demands and heat sources can be added to the network. Importantly, as the primary heat source is often centralised in a heat network, this can allow for the rapid decarbonisation of heat with minimal disturbance to customers.

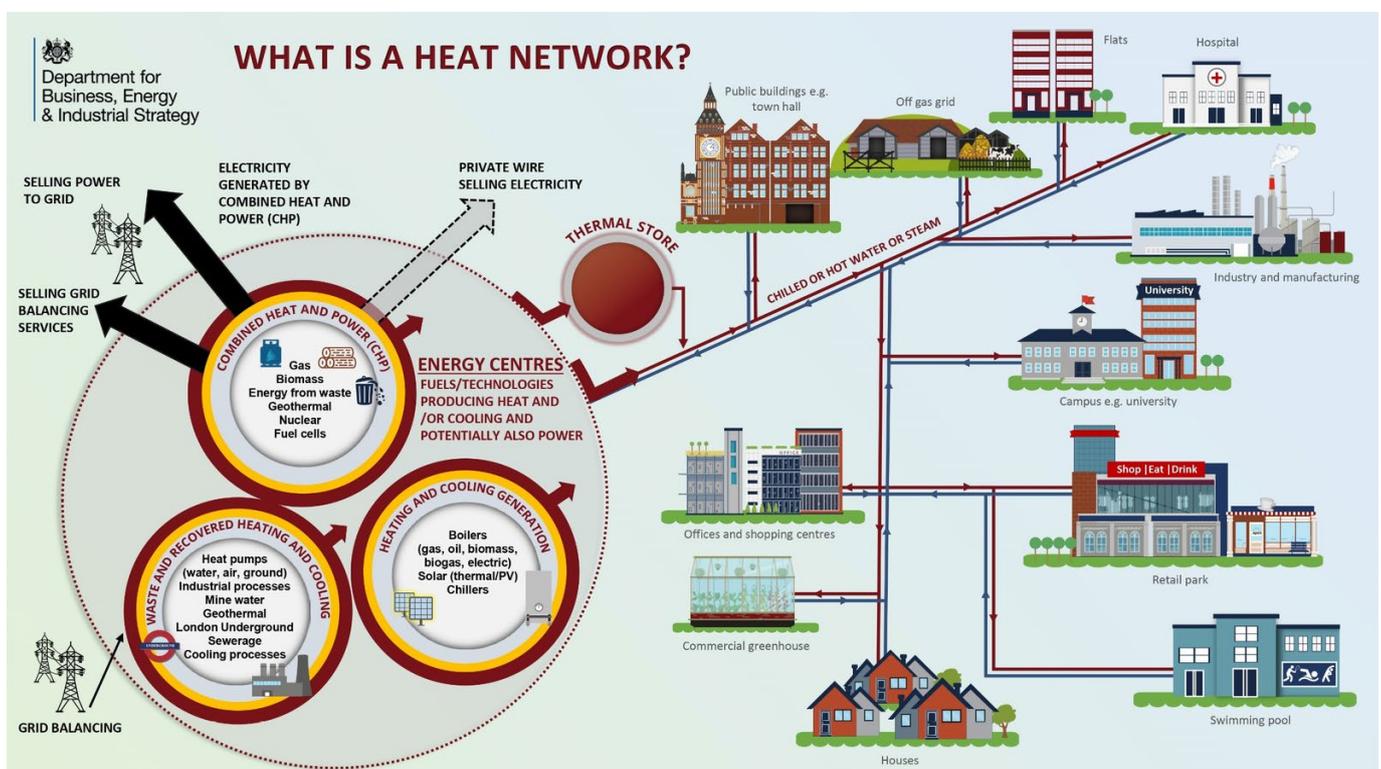


Figure 1: What is a heat network?

The role of heat networks in meeting 'net zero'

Clean Growth is one of the four Grand Challenges of the UK Government's Industrial Strategy and decarbonising heat is a vital part of this ambition. In June 2019, the UK committed in legislation to bring all greenhouse gas emissions to net zero by 2050. Heat in buildings is one of the largest sources of UK carbon emissions and there is demand for low-carbon heating solutions in the marketplace as more local authorities declare climate emergencies and an increasing number of consumers become aware of their carbon impact. The Clean Growth Strategy sets out the need for the heat network market to grow rapidly from a relatively small base if the UK is to meet its carbon targets in a cost-effective way. Well designed and operated heat networks can mean lower bills for consumers, and they are particularly well-suited to denser urban areas, where heat networks are generally more cost effective. The Strategy also sets an ambition to enable business and industry to improve energy efficiency by at least 20% by 2030.

Heat networks are well placed to play a key part in decarbonising heat and achieving net zero commitments. Heat networks can benefit from economies of scale and are able to decarbonise a large number of consumers and therefore a large amount of overall heat demand. The carbon saving potential of a heat network is further increased when technologies which enable the use of low-carbon sources such as heat from energy from waste, heat recovered from industry or environmental sources such as ground and river source heat are used. In a 2013 report for the Mayor of London, it was estimated that 38% of London's heat demand at the time could be met from waste-heat recovery.¹

There are currently over 14,000 heat networks (12,000 communal and 2,000 district) in the UK, providing heating and hot water to approximately 480,000 consumers². Heat networks can deliver space heating, hot water, and/or cooling from a central source or sources to a wide range of buildings including domestic dwellings, public buildings, businesses, factories, sports facilities, hospitals and universities. Heat networks currently provide approximately 2% of UK heat demand and the Committee on Climate Change (CCC) estimated in 2015 that with Government support, they could provide 18% of heat demand by 2050 in a least-cost pathway to meeting carbon targets³.

Since 2013, government support for heat networks has been focused on the development of the UK's growing heat network sector and creating the conditions necessary to build a sustainable heat network market. Initiatives in this respect have included the Heat Networks Delivery Unit (HNDU) and the Heat Networks Investment Project (HNIP)⁴ which have provided financial support and guidance to the developers of networks. We also launched the 'Heat Networks: Building a Market Framework'⁵ consultation in February 2020, which set out options for regulating the market in order to drive decarbonisation and enhance consumer protection, whilst supporting market growth. Work is currently underway to engage further with stakeholders and refine the policy ahead of implementing the regulatory framework.

¹ BuroHappold (2013), Secondary Heat Study- London's Zero Carbon Energy Resource: <https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/secondary-heat-study-londons-zero-carbon-energy>

² <https://www.gov.uk/government/publications/energy-trends-march-2018-special-feature-article-experimental-statistics-on-heat-networks>

³ <https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/>

⁴ <https://www.gov.uk/guidance/heat-networks-overview>

⁵ <https://www.gov.uk/government/consultations/heat-networks-building-a-market-framework>

The heat network sector will therefore be crucial for the overall decarbonisation of heat, offering a low regrets option, across all CCC pathways. This requires the sector to shift towards low-carbon heat sources, whilst continuing to grow in order to supply more of the overall heat demand. Our aim is therefore to maximise the amount of carbon savings within the heat network industry in the mid 2020s, but also to encourage projects that have the prospect of expanding, so that the sector is well prepared to meet future carbon budgets in the 2030s and onwards.

Our vision for the GHNF scheme is to incentivise the transition of the heat network market to low-carbon heat sources via targeted financial support, that will help stimulate the increased deployment of low-carbon technologies at scale.

The GHNF objectives are as follows:

- Achieve carbon savings and decreases in carbon intensity of heat supplied;
- Increase the total amount of low-carbon heat utilisation in heat networks (both retrofitted and new heat networks);
- Help prepare the market for future 'low-carbon' regulation and ensure compliance with existing regulations (such as the Heat Network (Metering and Billing) Regulations, Heat Network Market Framework and the Future Homes Standard).

Government support for Heat Networks

The GHNF will follow on from a strong track record and history of support for the sector. The HNDU⁶ was established in 2013 with the aim of supporting local authorities in England and Wales in the development phase of heat network projects. The HNDU expanded its scope in response to the views and needs from industry to help support the development and delivery of a wider range of projects in both private and public sectors.

Prominent examples of projects include, hospitals, universities, housing developments and the utilisation of energy from waste heat. Over the lifetime of the HNDU (9 rounds of funding), HNDU has invested more than £25m in grant funding, to over 200 projects across 180 local authorities. This ongoing support has helped to grow the heat network market substantially. Figure 2 provides an illustrative example of the coverage of HNDU support.

HNDU has facilitated and supported the sharing of knowledge and best practice across the heat networks industry by supporting the development of technical standards, the creation of detailed project guidance documents⁷ and facilitating project development. We have also continued to raise the profile of the heat network sector and promote heat network investment opportunities to investors via high profile events such as the Triple Point Heat Networks Meet the Projects events. This includes publication of a list of interested investors; and publication of a quarterly pipeline of projects.⁸

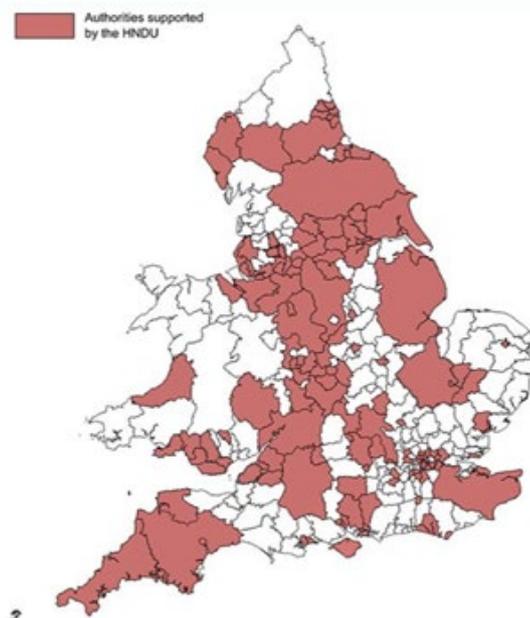


Figure 2: Local authorities supported by HNDU

In parallel to the work of HNDU, we are also investing up to £320m via the Heat Networks Investment Project⁹ to support the commercialisation and construction of heat network projects

⁶ <https://www.gov.uk/guidance/heat-networks-delivery-unit>

⁷ <https://www.gov.uk/government/collections/heat-networks-uk-guidance-for-developers-and-the-supply-chain>

⁸ BEIS (2019), HNDU pipeline: <https://www.gov.uk/government/publications/hndu-pipeline>

⁹ BEIS (2018), <https://www.gov.uk/government/collections/heat-networks-investment-project-hnip-overview-and-how-to-apply>

in England and Wales. HNIP has accelerated market growth, including a number of innovative projects, through the provision of capital grants and loans, as well as provided a standardised suite of project contracts¹⁰. It is expected that HNIP will leverage in approximately £1 billion of private and other investment. To date, HNIP has awarded over £125 million of funding in six rounds of the scheme.

HNIP has begun the process in delivering a step-change in the heat networks market, improving skills and capability and demonstrating to banks and investors that heat networks are a viable investment proposition. It has also demonstrated that the heat network sector is a growing market and should therefore help to drive greater competition between developers. An expanded market should also encourage a greater harmonisation of sector standards. By the end of the HNIP scheme, we expect to see improved investor confidence as a result of increased levels of performance data and a better understanding of the operational risks. The net result should lead to a lowering of finance and investment costs and facilitate greater economies of scale from larger heat networks.

The work done by HNDU and the impact of HNIP has laid the strong foundations necessary for a growing and thriving heat network market. We aim for this to continue by supporting heat network growth and further strengthening the sector through the Heat Network Market Framework¹¹, which is being developed to regulate heat networks to protect consumers, ensure fair pricing, while also increasing investment and the development of low-carbon networks.

In addition as part of the Heat Network Market Framework we intend to consult on heat network zoning in spring next year. This consultation will look to explore how a legislative framework could be built to compel new and some existing buildings to connect in designated heat network zones. It will also explore how to best design those zones and the roles of local authorities and local communities in developing them. We believe that this structure as part of the market framework will deliver long-term growth in heat networks.

To be able to deliver and maintain this planned market growth, and as such we will work with the sector to support the establishment of a strong supply chain base, as well as building on the skills development work started in the BEIS heat network skills review¹².

How we deliver the GHNF is key to enabling the delivery of the Government's net zero commitments for heat in buildings and the heat network sector will be critical in achieving this, which is why we are developing the GHNF and have launched this consultation.

¹⁰ <https://tp-heatnetworks.org/heat-contract-templates/>

¹¹ BEIS (2020): <https://www.gov.uk/government/consultations/heat-networks-building-a-market-framework>

¹² BEIS 2020 <https://www.gov.uk/government/publications/heat-network-skills-review>

Context

Heat networks are already one of the most cost-effective ways to supply heat to end users because of the economies of scale that they provide. Deploying low-carbon technologies at a network level can offer significant value when compared to a building level alternative low-carbon solution:

- Accessing heat sources such as mine water, marine, aquifer, river, lake, industrial waste heat etc. that would otherwise be largely inaccessible to building level heating solutions;
- Benefiting from demand diversity, particularly for domestic hot water, allowing for a lower overall heating system capacity to be installed saving costs and resources;
- Utilising large thermal storage allowing for wider energy system balancing at a cost far lower than many chemical or alternative batteries;
- Enabling relatively fast technology switch out as lower carbon heating solutions come forward with minimal consumer disruption;
- Where heat pumps are used, large scale professionally managed systems can use refrigerants with very low or even zero global warming potential, reducing the social cost of end of life disposal.

Historically, many heat networks have adopted gas CHP as their preferred technology. This is largely due to the low cost and availability of gas. Gas CHP can offer better financial incentives than other forms of generation, as additional revenues can be attained via electricity sales and grid/system ancillary services. Without intervention, there may be little incentive for investors to move away from this technology despite a broad range of low-carbon technology options for networks being available (see *Generation* section below). Low-carbon options often have high upfront capital costs and may currently have higher net operating costs compared to heat networks that are heated using gas CHP technology.

We therefore recognise that more needs to be done to help the heat network industry accelerate the transition to low-carbon heat sources and address the variety of barriers and market failures that exist. While the most prominent of these may be financial, which will be directly addressed by the grant funding provided by the GHNF, we have actively engaged stakeholders to ascertain some of the generation specific barriers so that they can be incorporated into the scheme itself or supporting actions from the GHNF.

Rationale for intervention

The intention of the GHNF scheme is aimed at capitalising on the progress and development made by the Heat Networks Investment Project (HNIP) with a focus on low-carbon technologies. Without additional support heat network projects taken forward are unlikely to opt for low-carbon heating solutions when gas CHP is available. It is crucial that the GHNF facilitates a seamless transition in support from HNIP and delivers LZC heating solutions at scale, helping to bring their cost down and underpin an expanding pipeline of projects that are economically viable.

By increasing the deployment of low-carbon technologies at scale, the GHNF will tackle some of the most prominent barriers to decarbonisation of heat networks. Large scale deployment will help bring down the upfront capital costs of low-carbon technology due to increased standardisation. Increased utilisation of low-carbon technology will help bring down operating costs in the long-term as well upscale the skills and knowledge required to operate low-carbon heat networks. The upscaling of the supply chain, skills, procurement and increasing the overall competition that will take place as a result of the GHNF are all crucial if the market is to become both self-sustaining and low-carbon. The GHNF is therefore critical in order to lay the groundwork for a healthy thriving low-carbon heat network industry that is well prepared for the future carbon budgets in the late 2020s and ready to grow even further in order to meet the carbon budgets in the 2030s.

Call for Evidence

A Call for Evidence was published on 30 September 2020. The views of stakeholders were sought to help inform the design of the Green Heat Network Fund, and to shape the questions in this consultation. Evidence was asked for on topics such as:

- the state of the heat network market and the supply chain;
- the financial, technological and consumer drivers for heat network decarbonisation;
- the potential project pipeline for the fund;
- examples of best practice in scheme design.

Following the closure of the Call for Evidence, 47 responses were received and the responses were analysed, and have been used to inform the questions asked in this consultation.

Scope of the consultation

This consultation covers the major components of the scheme including the application criteria, the sources of thermal energy supported, the types of heat networks in scope and the eligibility criteria including the minimum heat load requirements. This consultation also includes heat network market related aspects including sections focussing on finance, and the supply chain. It also considers delivery mechanisms as well as processes to monitor benefits and long term impacts of the scheme.

Devolution

Climate change policy is devolved to the Welsh government and we are working with them to understand the potential for alignment on the GHNf. It has not yet been determined whether the scheme proposed within this consultation will apply to both England and Wales or if the Welsh Government will develop a separate scheme.

Next steps

We will review stakeholder responses to this consultation and will use them to inform the design of the scheme. This will be outlined in the response to this consultation in 2021. We also aim to hold stakeholder workshops between the close of the consultation and the Government Response, to further discuss some of the key scheme design areas and the key responses received from the consultation. The GHNf scheme is expected to launch in April 2022.

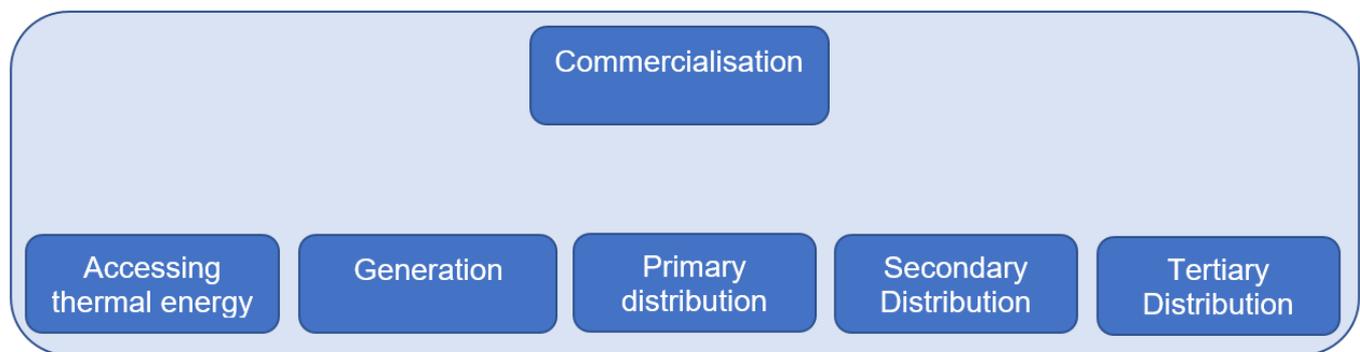
Scope

What will the GHN Fund fund?

Breaking down areas for capital support into constituent parts

Heat networks, in a UK context, may often involve investment into a whole system. This can range from accessing a heat source, converting energy to distributable heat, distributing the heat across a wide geography, and managing end consumer heating systems. It is key that the GHN Fund is absolutely clear to applicants about which aspects are/are not permissible to be included within an application for funding.

Below is visual breakdown of the sections covered in more detail and consulted on:



Commercialisation

We anticipate that the majority of applications will be for projects that have undertaken a techno-economic feasibility study and conducted off-taker engagement, potentially with heads of terms in place. An internally approved business case setting out how the project is expected to be procured and financed would also be expected at this stage. Clearly much work would still be ahead of the project before a final investment decision could be made. Activities such as the following would be expected (but not limited to):

- Final contract negotiation for Energy Supply Agreements;
- Procurement of the heat network delivery, or procurement of the concession that will deliver the network depending on approach;
- Legal, technical, commercial and financial support throughout the procurement process;
- Planning requirements;
- Agreeing utility connections;
- Environmental Impact Assessment and other assessments as necessary for planning and/or licencing;
- Etc.

As the GHN Fund is a capital fund, applicants would need to apply at the point where they have a high enough degree of confidence that the project will go ahead and therefore that the Finance Director of the applicant's organisation is comfortable that expenses incurred relating to the project can be capitalised within the applicant's financial accounts.

Commercialisation: Consultation Questions

- 1. Should costs associated with commercialisation activities be included within the GHNF scope? If not, which costs should be excluded?**
- 2. Should commercialisation costs include wider costs such as counterparty costs to better enable connection, e.g. legal costs of an energy off-taker? Please provide your reasoning.**
- 3. Should commercialisation stage awards be awarded:**
 - a) as part of a single application for commercialisation and construction funding; or**
 - b) in a single application for commercialisation funding only?**

Please explain your answer.

- 4. What period of time should be allowed for the commercialisation stage for a LZO heat network project? Please provide examples and/or your reasoning as appropriate.**
- 5. What, if any, additional work would be required to support a project that was moving from HNIP to GHNF? What are the anticipated costs of doing so?**

Accessing thermal energy

A number of technologies require investment in infrastructure to access a heat source. Examples might include:

- building access chambers to a sewer;
- drilling boreholes to access an aquifer;
- laying abstraction and discharge pipework on the seabed;
- accessing a mineshaft;
- installing a plate heat exchanger in an EfW;
- etc.

There will be too great a variety of examples to ever be able to exhaustively list how heat sources might be accessed. We want the GHNf to be supportive of accessing LzC heat sources where it is technically feasible to do so and represents value for money when compared to an alternative LzC heat source in a given geography.

As such, we are minded to support the costs required to access heat sources that will enable the use of large scale heat pumps, LzC combustion or where the heat accessed is of a sufficient temperature to supply to consumers. Examples might include but not be limited to:

- Costs associated to safely abstract and discharge to a body of water such as river, canal, aquifer, lake, sea, sewer etc. prior to use with a heat pump;
- Costs associated with accessing heat from industrial processes or other heat from human activities, including ongoing compensation to the process owner to the extent that taking heat from the process impacts said process;
- Cost of gas pipework from a green hydrogen manufacturing facility to energy centre;
- Etc.

The cost of plant, equipment or wider infrastructure that generates heat as a bi-product of a different process is not eligible for the scheme. Examples might include investment in an EfW facility, data centre, anaerobic digester etc. which would not be eligible for capital support.

Accessing heat: Consultation Questions

- 6. Should the cost of accessing heat sources be included within the GHNf scope?**
- 7. If so, do you agree or disagree with the scope of support for accessing heat sources proposed? If not, what would you propose and why?**

Generation

Generating thermal energy requires not only plant capable of converting one energy form to useful thermal energy but will also require a substantial balance of plant to enable a safe and stable supply of thermal energy to end customers. When referring to the cost of generation, the GHNF means not only the cost of the primary plant, but all costs associated with enabling the supply of thermal energy. This will include but not be exhaustive of:

- Primary generating plant;
- Secondary generating plant (to the extent used);
- Peaking plant;
- Centralised thermal storage;
- Mechanical and electrical costs (e.g. pumping, ventilation etc.);
- Sub-Metering, SCADA etc.;
- Utility connections;
- Design, supplier margins, preliminaries etc.

It is proposed that all such costs associated are included within the GHNF.

The aim of the GHNF is to decarbonise heat networks through the utilisation of low-carbon technologies, decreasing the carbon intensity of thermal energy supplied and achieving carbon savings.

Our proposed approach to eligible technology selection is to set out as a framework the means of generating thermal energy and providing the principles against each that would govern whether it would or would not be eligible for GHNF support. This will allow us to set the core technology boundaries for the GHNF, create a clear framework for potential applicants to calculate emissions and will allow the market the freedom to be innovative and adopt the most effective generation method for a given project.



Primary Combustion

<i>Fuel type</i>	<i>Examples</i>	<i>Evaluating CO₂e</i>
<i>Hydrogen</i>	<ul style="list-style-type: none"> • Hydrogen CHP • Hydrogen boilers 	<p>BEIS will be consulting on CO₂e emissions calculations for H₂ in 2021. In advance of that consultation we would welcome thoughts on the methodology set out below for the GHNF:</p> <ul style="list-style-type: none"> • Steam methane reformation: carbon is the kWh of gas * kgCO₂e/kWh gas for each kWh of H₂ • Electrolysis where electricity source is grid connected: carbon is kWh of electricity * kgCO₂e/kWh electricity for each kWh of H₂ • Electrolysis where there is a private wire direct to the H₂ manufacture

<i>Fuel type</i>	<i>Examples</i>	<i>Evaluating CO₂e</i>
		process and the electricity generation is either solar/wind/tidal – zero carbon
<i>Fossil based</i>	<ul style="list-style-type: none"> Natural gas boilers acting as peaking plant 	<ul style="list-style-type: none"> kgCO₂e/kWh * kWh of fuel combusted
<i>Biomass</i>	<ul style="list-style-type: none"> Biomass boilers Biomass CHP 	<ul style="list-style-type: none"> See <i>Appraising CO₂e</i> section below
<i>Biogas</i>	<ul style="list-style-type: none"> Not eligible under the scheme when used as primary heat source but acceptable for peaking plant 	<ul style="list-style-type: none"> kgCO₂e/kWh * kWh of fuel combusted
<i>Syngas and other gasses</i>	<ul style="list-style-type: none"> Not eligible under the scheme when used as primary heat source but acceptable for peaking plant 	<ul style="list-style-type: none"> kgCO₂e/kWh * kWh of fuel combusted

Refrigeration cycle / phase change

<i>Technology type</i>	<i>Examples</i>	<i>Evaluating CO₂e</i>
<i>Centralised heat pump/electric chiller/absorption heat pump</i>	<ul style="list-style-type: none"> Water source heat pumps Air source heat pumps Ground source heat pumps Sewer source heat pumps River source heat pumps Lake source heat pumps Marine source heat pumps Electric chillers Absorption heat pump / chiller 	<ul style="list-style-type: none"> kWhe to deliver end customer heat and cooling * electricity emissions factor in a given period (kgCO₂e/kWh) For absorption heat pumps / chillers the emissions associated with the heat supplied to the absorption process need to be evaluated as would be the case for end customer heat supply Emissions associated with the refrigerant used (kgCO₂e)
<i>Ambient loop</i>	<ul style="list-style-type: none"> Building level WSHP with inbuilding heated risers/laterals; Unit level WSHP 	<ul style="list-style-type: none"> kWhe to deliver end customer heat and cooling * electricity emissions factor in a given period (kgCO₂e/kWh) Emissions associated with the refrigerant used (kgCO₂e)

Heat recovery without heat pump

<i>Technology type</i>	<i>Examples</i>	<i>Evaluating CO₂e</i>
<i>Existing EFW - steam cycle</i>	<ul style="list-style-type: none"> Energy from waste from existing plant without a heat pump 	<ul style="list-style-type: none"> kWh foregone electricity (in line with estimated Z-Factor) * electricity emissions factor in a given period (kgCO₂e/kWh)
<i>New EFW – steam cycle</i>	<ul style="list-style-type: none"> Energy from waste from new plant without a heat pump 	<ul style="list-style-type: none"> If heat production is a requirement of planning approval, or was submitted for approval as part of application, then the heat cannot be treated as waste

<i>Technology type</i>	<i>Examples</i>	<i>Evaluating CO_{2e}</i>
		<p>and the total emissions of the EFW need to be allocated to the heat network in proportion to the total energy exported</p> <ul style="list-style-type: none"> • If it is not a requirement then adopt the Existing EFW steam cycle method
<i>Industrial processes or other heat from human activities</i>	<ul style="list-style-type: none"> • Heat recovered from crematorium • Heat recovered from steel manufacture • Etc. 	<ul style="list-style-type: none"> • The applicant would need to evaluate the impact of recovering heat from a given process to supply a heat network; • Please refer to the principles based approach to evaluating emissions from more complex processes;
<i>Deep geothermal</i>	<ul style="list-style-type: none"> • Deep boreholes (e.g. 1km+) • Accessing deep mineworks 	<ul style="list-style-type: none"> • Zero carbon (to the extent no heat pump is required)

Resistive heating

<i>Technology type</i>	<i>Examples</i>	<i>Evaluating CO_{2e}</i>
<i>Electric boilers</i>	<ul style="list-style-type: none"> • Immersion • Water jet 	<ul style="list-style-type: none"> • kWh_e required to supply end customer heat * electricity emissions factor in a given period (kgCO_{2e}/kWh)

Chemical heating

<i>Technology type</i>	<i>Examples</i>	<i>Evaluating CO_{2e}</i>
<i>Fuel cells</i>	<ul style="list-style-type: none"> • Hydrogen fuel cells 	<ul style="list-style-type: none"> • Follow combustion method for relative fuel type (e.g. H₂ or CH₄)

Solar heating

<i>Technology type</i>	<i>Examples</i>	<i>Evaluating CO_{2e}</i>
<i>Solar thermal</i>	<ul style="list-style-type: none"> • Flat plate • Evacuated tubes 	<ul style="list-style-type: none"> • Zero carbon

For all technologies, when calculating the CO_{2e} it will be necessary to include the CO_{2e} associated with pumping, system monitoring and general system electricity requirements not included in primary/secondary/peaking generation calculations.

We have given careful consideration to the inclusion of biofuels and other waste fuels into the scope of the GHNF, particularly, given wider analysis about the sustainability of such fuels.

Biogas

For the purposes of the GHNF, our current thinking is that biogas should not be in scope as the primary heat source as it is adequately supported by the Green Gas Levy announced in the March 2020 Budget. Proposals for this scheme were set out in the April 2020 consultation Future support for low-carbon heat¹³. However, if biogas is manufactured on site then it is proposed it could be used for peaking plant but not primary generation, given many projects will still seek to use conventional gas fired boilers for winter peak demand.

Syngas

For the purposes of the GHNF, we do not think that syngas should be in scope when proposed as the primary heat source. However, if syngas is manufactured on site then it could be used for peaking plant but not primary generation, given many projects will still seek to use conventional gas fired boilers for winter peak demand.

Biomass

Our position on biomass is that it should be in scope for the GHNF, provided the biomass is from a sustainably managed source, adheres to existing regulations (including air quality standards), is not made up of virgin construction grade logs or timber, and is sourced within a radius of no more than 50 miles of the point of combustion in line with existing Ofgem rules for non-domestic biomass¹⁴. We will also take into consideration the outcome of the Non-Domestic RHI closure regulations and any other requirements that may be appropriate.

Generation: Consultation Questions

- 8. Do you agree with the proposed scope of generation costs? Should there be any other costs included or excluded?**
- 9. Are there any other LZC sources of thermal energy that have not been covered in our framework approach to technology section (combustion, heat recovery, etc.)?**
- 10. Do you agree or disagree with the proposed methods for calculating emissions against the specific technologies listed (see also section *Appraising CO₂e*)? If you disagree please provide an alternative method for calculating emissions to support your response.**
- 11. Should biogas and/or syngas be out of scope of the GHNF as the primary heat source for a heat network? Please provide your reasoning.**
- 12. Should biomass be in the scope of the GHNF, with the stipulations set out above? Please provide your reasoning.**
- 13. Should authorisation of a biomass fuel on the Biomass Sustainability List (BSL) or Sustainable Fuel Register (SFR) play a role in the GHNF assessment of a biomass fuel's sustainability?**

¹³ <https://www.gov.uk/government/consultations/future-support-for-low-carbon-heat>

¹⁴ https://www.ofgem.gov.uk/system/files/docs/2018/10/volume_2_for_publication_1.10.18_pdf_0.pdf

14. Should the maturity of technology types be a consideration for the GHNF in terms of eligibility? For example, permitting only technologies where at least one other operating example exists at a similar scale.

Primary distribution

The primary distribution network refers to the pipework used to deliver thermal energy, often from a centralised point (with the exception of ambient heat networks), to thermal substations in or adjacent to buildings. Costs associated with this may include but are not limited to:

- pipework to distribute thermal energy;
- the civil engineering costs to excavate roads, walkways etc. so pipework can be buried;
- leak detection;
- traffic management;
- substation costs;
- distributed thermal storage;
- design, supplier margins, preliminaries etc.
- etc.

The GHNF was established with the express purpose of supporting a transition to LZC heating technologies and is therefore a scheme that focuses on supporting these activities (see *Accessing thermal energy and Generation* above).

However, it is self-evident that investment in primary distribution infrastructure will be an essential component of any successful project; the LZC thermal energy generated needs to be distributed to customers via a heat network when a decision to invest in large scale thermal generation has been made. Whether investment is made directly by the applicant into the distribution infrastructure or by another party, the investor in that infrastructure will need to achieve a return reflective of their exposure to project risk.

Where costs relate to the distribution of energy that has been generated at a key point on the heat network (e.g. Energy Centre) but is **not** thermal energy (e.g. electricity generation), it is proposed that the GHNF will only support the cost of connecting to existing distribution or transmission infrastructure (e.g. DNO / National Grid for electricity). The rationale for this is that the basis for private wire is under greater scrutiny following Ofgem's Targeted Charging Review (TCR)¹⁵. As gas CHP is not expected to be supported by GHNF as a primary heat source this position is not anticipated to present a material impact for most applications; however, for schemes exploring hydrogen CHP, hydrogen fuel cells and biomass CHP, this might have implications on project economics to the extent private wire is being considered.

Primary Distribution: Consultation Questions

- 15. Do you anticipate projects that come forward will seek to separate generation from distribution as distinct legal entities? If so, to what extent do you expect this to happen?**
- 16. Do you agree or disagree with the scope of costs that are attributable to primary distribution? Should further costs be included or excluded?**
- 17. Do you agree or disagree that projects that are CHP based, but which come forward with sufficiently low-carbon intensity should be supported by GHNF in their investment in grid connection costs, but not private wire and associated costs?**

¹⁵ <https://www.ofgem.gov.uk/electricity/transmission-networks/charging/targeted-charging-review-significant-code-review>

Secondary distribution

Pipework that supplies thermal energy from a thermal substation to a point of supply that can be metered and an invoice raised to a customer is classed as a secondary distribution network. This might typically (but not necessarily) be expected to be a hydraulically separated system from customer connections and represent riser and lateral pipes located within a building up to a customer Heat Interface Unit (HIU).

Capital costs associated with the secondary distribution network may include but are not limited to:

- Pipework from the thermal substation to the point of connection with a building;
- The cost of interfacing with an existing building (plant removal, installation of a building level plate heat exchanger etc.)
- Installing riser and lateral pipework;
- Lagging existing pipework to minimise heat losses;
- Building level water quality treatment system;
- Metering and installation of customer HIUs;
- Installation of building level heat pump where ambient loop systems are adopted (however, for the purposes of GHNF this would be classed as Generation);
- Installation of building level thermal storage.

A key challenge that secondary distribution costs represent is whether some of these costs would or would not have been incurred in the absence of a viable heat network. It should not be the case that the GHNF indirectly (see section *Generation vs downstream capital costs*) funds capex that would have otherwise been incurred.

Secondary Distribution: Consultation Questions

18. In your view should secondary distribution costs be included within the scope of the GHNF? What works would be involved and would they have an impact on the network's ability to operate as intended? Please provide any details to support this.

19. Do you agree or disagree with the scope of costs that are attributable to secondary distribution? Should other costs be added or subtracted? What would the costs of those works be and who would ordinarily bear those costs?

Tertiary distribution

Tertiary distribution relates to the customer pipework that sits behind their point of connection to the secondary distribution network (typically defined by an HIU but potentially just a heat meter when customers are not hydraulically separated). This system includes the customer's hot water heat emitters (radiators / UFH) and chilled beams & vents when cooling is supplied. For the supply of heating, in the context of centralised LZC technologies, it may be necessary to enable customers to accept heat supplied at a lower flow temperature to improve the overall system efficiency. As such it may be necessary to increase the capacity of heat emitters in buildings being connected.

A further design consideration could be to install distributed heat storage in the form of hot water cylinders and/or buffer tanks within customer dwellings. By doing so the network might be able to design a more baseload derived centralised plant and smaller diameter primary distribution pipework as the customer thermal storage could be used to manage points of peak demand. A further benefit could be to reduce losses associated with keeping the secondary network "hot" in anticipation of customers demanding hot water from taps/showers etc. Such activities could well be to the benefit of the system and it could be counterproductive to exclude such interventions if shown to be of value to the project and overall emissions.

Another consideration could be investment in the overall building's thermal efficiency. While improving the level of insulation, air tightness and building ventilation would potentially provide an even better system performance level, it is proposed that the GHNF would not fund this activity. However, see section on *Innovation and energy efficiency* which explores possible scoring uplifts to projects that do seek to do this but recover the cost of doing so through monetising energy efficiency measures or are supported by other means.

A key challenge that tertiary distribution costs represent (as with secondary distribution costs) is whether some of these costs would or would not have been incurred in the absence of a viable heat network. It should not be the case that the GHNF indirectly (see section *Generation vs downstream capital costs*) funds capex that would have otherwise been incurred.

Tertiary Distribution: Consultation Questions

- 20. In your view should tertiary distribution costs be included within the scope of the GHNF? If so, should there be a distinction made between new and existing behind the meter systems when considering eligible tertiary distribution network costs?**
- 21. Do you agree or disagree with the scope of costs that are attributable to tertiary distribution? Should further costs be included/excluded? What would the costs of those works be and who would ordinarily bear those costs?**
- 22. Are there customer level interventions that could be encouraged and supported but which have not been included?**

Approach to new and existing heat networks

The scope of the Green Heat Network Fund will include decarbonising existing heat networks, and support the development of new low-carbon networks.

We are aware of concerns raised by stakeholders that the scheme could inadvertently favour existing networks if applications are assessed on a value for money basis, as existing heat networks will have less capital costs associated with their decarbonisation and so the cost and risk would be relatively less compared to a new venture.

One request from stakeholders has been to formally partition funding with a designated amount allocated annually from the scheme budget to new and existing networks separately. A clear challenge such an approach would present would be the risk that funds allocated to one budget may be undersubscribed and allocations to the other oversubscribed. Were the funds managed in a single budget, assessors could appraise the relative merits of supporting new and existing projects and have designed the scoring to better ensure that investment in new networks is not appraised as achieving a worse value for money when compared to an exercise of replacing the thermal generating plant (re-planting) on an existing network from high carbon to LZC technology. As such we are minded not to make a formal budget split but instead use softer methods to show that the GHNf supports both new networks and existing networks.

Several approaches have been considered:

- Make no distinction between new and existing networks but apply a weighting system within the assessment process that seeks to treat existing and new networks on a level playing field. For example, £1.5 of GHNf spent on an existing network is treated as equivalent to £1 of GHNf spent on a new network (values are for example purposes only and detailed analysis would be required should this approach be taken forward);
- Require existing network applications to include an application for the expansion of the network representing at or over 2GWh/year of end customer demand¹⁶, in line with section *Gateway metric 3: minimum annual thermal demand*, in addition to decarbonising thermal generation;
- Require existing network applications to include, in addition to their application, works to improve the overall operating efficiency of the network in addition to decarbonising thermal generation.

We are minded to opt for the expansion requirement for existing networks but seek stakeholder views on the implications of doing so. Supporting connection to new heat loads while decarbonising existing heat network customers should better enable those existing networks to plan for existing and future regulation.

¹⁶ 2GWh/year of end customer heating demand would be approximately equivalent to 150 domestic dwellings

New versus existing networks: Consultation Questions

- 23. Please provide your thoughts on the proposed approaches. What issues and challenges do you see with each and what approach do you prefer? Please provide details.**
- 24. Are there other approaches that have not been considered that could reduce the risk of existing networks taking too great a share of the GHNF budget? Please explain your answer.**

The types of heat networks in scope

The entry criteria for all different types of networks within scope is proposed to be a thermal energy demand of 2GWh/year. This floor for thermal energy demand is a continuation of HNIP policy and represents thermal demand at the point of consumption (i.e. excluding thermal losses). Alternative approaches to this have been proposed by stakeholders, such as setting a minimum capex figure or maximum £/Tonne CO₂e abated, to be used as a methodology for identifying the best projects to fund. Our current view is that focusing on energy demand is the correct approach for accomplishing the objectives of the scheme, as it is directly linked with the core objective of the GHNF – decarbonisation of heat – and requires no presumption of what might have occurred otherwise.

Shared ground loop versus ambient heat network

The significance of the proposal of a 2GWh/year minimum thermal energy demand, is that it would exclude shared ground loop systems (SGL) but would include ambient heat networks, sometimes referred to as 5th generation heat networks. An Ambient Heat Network and an SGL for the purpose of the GHNF are identical in what they do: circulating a liquid around a buried loop benefitting from heat transfer from the ground or a watercourse, as well as the insulating properties the ground during winter months. A SGL will provide a smaller amount of heat and might typically draw heat from either boreholes or a ground lattice / slinky coil. In both systems a water source heat pump will be located in individual buildings and will take latent heat from the liquid and elevate this to a useful temperature. An ambient network may serve a large number of buildings and could even be designed to serve simultaneous heat and cooling to different customers.

As such, for the purposes of GHNF, the difference between a SGL and ambient heat network is of scale only. Ambient systems providing heat to a small number of buildings / dwellings are not explicitly excluded but it is anticipated that they are unlikely to meet the 2GWh/year criteria and therefore would be categorised as SGLs and would not be eligible. The Low Carbon Heat Support Scheme, announced in the March 2020 budget and consulted on in the Future Support for Low-Carbon Heat consultation¹⁷ as the Clean Heat Grant will be the means of accessing Government support for smaller scale in-building heat decarbonisation at the point the GHNF is launched.

Communal heat networks

A communal heat network is where heating plant is located in a room within a multi-tenanted building and supplies heat to individual units. As with the observation of SGL, it is possible that only a few individual communal heating systems would supply 2GWh of heat to customers in a single building each year. It is therefore probable that communal heat networks would also be out of scope of the GHNF in most cases due to the 2GWh/year criteria and would either require buildings with communal systems to pool together and apply for a centralised system to meet GHNF eligibility criteria, or else look to have received support from existing schemes such as the Public Sector Decarbonisation Scheme¹⁸ or the Social Housing Decarbonisation Fund Demonstrator¹⁹.

¹⁷ BEIS (2020): <https://www.gov.uk/government/consultations/future-support-for-low-carbon-heat>

¹⁸ <https://www.gov.uk/government/publications/public-sector-decarbonisation-scheme-psds>

¹⁹ <https://www.gov.uk/government/publications/social-housing-decarbonisation-fund-demonstrator>

Networks in scope: Consultation Questions

- 25. Do you agree or disagree that the differences between SGL and Ambient Heat Networks is one of scale? If not, how should they be distinguished?**
- 26. Do you agree or disagree that Ambient Heat Networks should be within scope of the GHNF and SGLs should be out of scope? Can you provide any evidence demonstrating the value of including/excluding SGL or Ambient Heat Networks from the GHNF?**
- 27. Should Communal Heat Networks be within scope of the GHNF? Can you provide any evidence demonstrating the value of including/ excluding Communal Heat Networks from the GHNF?**
- 28. Do you agree or disagree with our minimum thermal energy criteria of 2GWh/year? Is the GWh approach the right approach to set the floor on smaller projects? If you disagree what alternative approach would you suggest?**

Benefits Realisation

The benefit realisation plan outlines the key systems and indicators that will be used to monitor the delivery of GHNF main scheme benefits, both at project and portfolio level. The outlined indicators and associated metrics will be used to create robust monitoring and reporting to enable effective progress tracking.

The GHNF is expected to build on progress that HNIP has made in tackling the barriers to growth in the heat network market. The primary aim of the GHNF and the wider government support on heat is to deliver more low or zero carbon heat networks in the UK, through the following measurable objectives:

- An increase in carbon savings and therefore contribute towards the UK's Net Zero ambition;
- An increase in LZC heat provisions via the deployment of heat networks at scale; and,
- An increase in market readiness of the heat network sector ahead of this sector's low-carbon regulation, achieved by wider clean market growth, supply chain capacity expansion and cost reductions.

To advance these objectives, we propose to capture the following list of measurable benefits we expect GHNF to deliver:

- An increased proportion of thermal energy supplied through low-carbon sources;
- A decrease in carbon intensity of thermal energy delivered by GHNF supported heat networks;
- Carbon savings and air quality improvements relative to the alternative thermal energy source;
- Increased use of thermal energy recovery in heat networks funded via GHNF;
- Increased investment in the UK heat network market leveraged by GHNF funding;
- Increased supply chain capacity and capability in the UK;
- Reduction in costs of low-carbon generation in heat networks;
- Greater innovation and energy efficiency in heat networks.

The above benefits are designed to reflect GHNF objectives, whilst also being measurable in a robust manner. They are set out at both the project and portfolio level, and where relevant, market-wide. Also, these benefits need to be attributable to the GHNF: the CBA assumes 85% additionality²⁰ and can demonstrate alignment to BEIS's Industrial Strategy.

The monitoring of GHNF benefits will provide an overall contextual understanding of the low-carbon heat network environment and where opportunities for future low-carbon heat networks lie. In order to ensure the benefits can be effectively captured and measured in a robust manner, we are proposing a list of relevant indicators (see Figure 3 below) to ensure that progress towards the benefits realisation is monitored and that GHNF is on track to deliver them.

The data for these benefits indicators will be obtained from various data sources ranging from project level data to wider market sources. Project level data should be provided by the project sponsors to the GHNF as part of their monitoring and reporting requirements. This data will be

²⁰ Additionality is the extent to which benefits are achieved as a result of GHNF support.

transferred to BEIS securely for future analysis and reporting (to the extent that BEIS and the GHNFB are separate entities).

Benefit Indicators

In order to monitor progress towards the benefits and ensure the GHNFB is on track to deliver them, a set of indicators are proposed below:

Benefit ID	Benefit	General Indicator	Baseline/Counterfactual	Relevant GHNFB Objective
GHNFB1	An increased proportion of thermal energy supplied through low-carbon sources	Volume of thermal energy supplied from low-carbon sources via GHNFB projects TWh/yr	0	Increase Carbon Savings from heat networks
GHNFB2	Decreased carbon intensity of heat delivered by GHNFB supported heat networks	Average carbon intensity of heat networks kgCO ₂ e/kWh	Average Carbon Intensity of Heat Networks at time of scheme launch	Increase Carbon Savings from heat networks
GHNFB3	Carbon Savings relative to the alternative heat source	Carbon Savings MTCO ₂ e	Alternative thermal energy source	Increase Carbon Savings from heat networks
GHNFB4	Increased use of waste thermal energy recovery in heat networks funded via GHNFB	TWh of thermal energy from waste heat GHNFB projects	0	Increase the proportion of thermal energy delivered by heat networks
GHNFB5	Increased investment in the UK heat network market	No. of reported first time investors in GHNFB	0	Increase the proportion of thermal energy delivered by heat networks

GHNFB6	Increased supply chain capacity in the UK – market wide	<ul style="list-style-type: none"> - Enhanced investment in local economies (£) - Increased no. of skills and training offers in sector 	0	Market Readiness
GHNFB7	Reduction in costs of low-carbon generation in heat networks	HNDU and market data on Capex	Current Capex Value	Market Readiness
GHNFB8	Innovation and energy efficiency	<ul style="list-style-type: none"> - Reduction in kWth of installed capacity - No. of DSR - No. of energy conservation measures - No. of networks recovering cooling 	0	Market Readiness

Figure 3: sets out a general indicator for each benefit

Benefits: Consultation Questions

- 29. Are the outlined benefits the most important and most appropriate to measure? If applicable, please indicate your views on benefits that should be monitored instead/as well.**
- 30. Are the general indicators the most appropriate for each benefit? If not, please suggest measures you believe to be more suitable. Suggestions on supply chain capacity and capability indicators are welcomed.**

Consumer protection and pricing

Policy Context

The Heat Trust²¹ was set up in 2015 and has been developed with industry, consumer groups, and local and national Government. It is a UK-wide, independent consumer protection scheme designed specifically for heat network consumers. It puts in place a common standard for the quality and level of customer service that is provided to domestic and micro-business consumers by their heat energy supplier. It also provides an independent dispute resolution service through an agreement with the Energy Ombudsman, the independent body for resolving consumer complaints. As a voluntary scheme, the Heat Trust does not cover pricing and is limited in the sanctions it can impose.

A future overarching regulatory model was outlined by BEIS in *Heat networks: building a market framework – consultation*²² which set out the scope of consumer protections expected to be included in the future regulatory framework. Our expectation is that all heat network domestic customers should have a good quality of service, fair and transparently priced heating and a redress option should things go wrong.

Our approach to consumer protection

It is proposed that for existing and new heat networks applying to the GHNF, their operators be registered participants of the Heat Trust or equivalent. An equivalent consumer protection regime should at a minimum provide the same degree of consumer protection as the Heat Trust to domestic and micro-business consumers by the time any funding is drawn down.

During our discussions with stakeholders they were supportive of the Heat Trust standards. There was some concern from stakeholders about the term “equivalent standards”, and that we should consider that any equivalent standards regime should be of a similar high quality.

We are not aware of any equivalent standards schemes, but if an alternative scheme is developed, stakeholders could choose to sign up to that new scheme. The GHNF must however be able to recognise when an alternative scheme or consumer protection regime carried out under a statutory duty (such as those of a Local Authority) is equivalent (or better) in consumer protection outcome to those of the Heat Trust. If a stakeholder makes an application in these circumstances they will be required to demonstrate to us that their consumer protection offering provides an equivalent level of governance and requirements, with fully developed rules and bye-laws or duties that cover:

- Support for heat consumers in vulnerable circumstances;
- Heat supplier obligations;
- Heat consumer service and a mechanism for reporting a fault or emergency levels;

²¹ <https://heattrust.org/>

²² <https://www.gov.uk/government/consultations/heat-networks-building-a-market-framework>

- Processes for consumers joining and leaving;
- Heat meter requirements;
- Heat Interface Units (HIUs) requirements;
- Heat bill and heat charge calculations;
- Heat bill payment arrangements and the management of arrears and/or debt;
- Suspension and resumption of service processes;
- Complaint handling and independent complaint handling services;
- Privacy policy and data protection requirements.

An applicant would also need to demonstrate that they are offering features equivalent to the Heat Trust's Non-Compliance Panels, Appeals Panels, Independent Complaints Handling service and Alternative Dispute Resolution through Ombudsmen Services. It would also need to demonstrate that it can deliver consumer protection outcomes at least equivalent to those provided by the Heat Trust so that the standard of consumer protection it offers can be assured.

On this basis, it is proposed that applicants to the GHNF are registered participants of the Heat Trust in good standing (or become so in advance of first customer connection), are registered participants in good standing of an equivalent scheme and have not been disbarred by the Heat Trust or an alternative equivalent scheme, or provide equivalent levels of consumer protection to customers under a statutory duty.

Our approach to consumer pricing

Heat Trust is an industry led scheme. Its focus is the assessment of whether contract terms are being met, and consequently pricing is outside of the Heat Trust's remit. The Heat Trust requires participants to set out how the heat price (standing and variable where relevant) is calculated, how it might change in the future and provides a price comparator against the alternative gas boiler or electric heating options.

To mitigate consumer detriment, our proposed approach is to assess consumer pricing by category. Some indicative consumer types and buildings have been distinguished to better recognise the cost of an appropriate counterfactual heat supply. A core reason for designing this approach is to ensure that consumers, particularly vulnerable consumer groups, are protected from unaffordable pricing.

The table below provides a summary of the various consumer categories and our proposed position for each category.

Public body offtaker	Commercial / Industrial offtaker	New build residential consumer	Retrofit residential consumer	Micro-businesses
<p>Definition:</p> <p>Key public buildings such as:</p> <ul style="list-style-type: none"> • LA offices • Hospitals • Universities • Prisons • Law courts • Libraries • Etc. 	<p>Definition:</p> <p>Key privately owned buildings such as:</p> <ul style="list-style-type: none"> • Leisure centres • Office buildings • Industrial processes • Retail buildings • Theatres • Etc. 	<p>Definition:</p> <p>Residential dwellings that are to be developed.</p>	<p>Definition:</p> <p>Residential dwellings that are to be connected to a heat network including communal systems, having previously been heated using alternative heating arrangements.</p>	<p>Definition:</p> <p>Micro-businesses (e.g. small retail shops).</p>
<p><i>Owners of such buildings would be expected to be sufficiently resourced to negotiate mutually agreeable offtake terms.</i></p>	<p><i>Owners of such buildings would be expected to be sufficiently resourced to negotiate mutually agreeable offtake terms.</i></p>	<p><i>Residential consumers would not be expected to negotiate heat offtake agreements and typically will adopt energy supply agreements as a requirement of purchase.</i></p>	<p><i>Residential consumers would not be expected to negotiate heat offtake agreements and typically will adopt energy supply agreements as a requirement of purchase.</i></p>	<p><i>For micro-business owners connected to a heat network, it is expected that they would be treated in the same way as residential consumers making a distinction between new and retrofit.</i></p>
<p>It is therefore not necessary for the GHNf to evaluate consumer detriment for this consumer class.</p>	<p>It is therefore not necessary for the GHNf to evaluate consumer detriment for this consumer class</p>	<p>It is proposed to evaluate consumer detriment against the cost of heat under the Future Homes Standard.</p>	<p>It is proposed to evaluate consumer detriment against a gas counterfactual or where an alternative fuel is used, the applicant can specify that fuel.</p>	<p>It is proposed to treat microbusinesses in the same way as residential consumers, making a distinction between new developments and retrofit of existing buildings.</p>

Figure 4: customer types

For the GHNf, we propose that a distinction is made between networks connecting to new builds and those being retrofitted for residential consumers. A gas counterfactual will apply when evaluating retrofits, and the Future Homes Standard (FHS) will apply for new build

properties. This is because for new build properties the FHS is due to take effect in 2025 for new build developments in England. With the GHNf open to applications in the second quarter of 2022 it is expected that the majority of residential new build connections will fall close to or after the point that this important standard is implemented. With no gas connections permitted an air source heat pump counterfactual becomes one of several possible options for decarbonising heating and it is proposed that this is used when assessing consumer detriment. It is proposed that the cost estimates established to support the consultation on the *Future Home Standard: changes to Part L and Part F of the Building Regulations for new dwellings*²³ is used as the basis for establishing that counterfactual heating solution.

It is also proposed that the treatment of micro-businesses (e.g. small businesses and retail shops) is the same method as for domestic consumers.

It is our current view that public bodies, commercial and industrial sectors are sufficiently resourced to be able to negotiate their own mutually agreeable offtake terms and are better able to value the holistic benefit of the supply. Therefore, it is proposed not to evaluate consumer detriment for this class of consumer.

During our earlier engagement with stakeholders, their feedback centred on how the GHNf will consider consumers who are not using gas. In light of stakeholder comments, it is proposed that where an applicant's existing consumer base is using a non-gas counterfactual, the applicant states their alternative counterfactual to gas, the GHNf will then factor into its assessment the different costs for this alternative counterfactual.

It is important to note that when evaluating the counterfactual cost of heat, under any scenario, consideration will be given to the following areas:

- The cost of installing the counterfactual plant (assumed to occur at the point connection to the heat network is made for new build);
- The cost of maintaining the counterfactual plant;
- The cost of fuel associated with operating the plant;
- Any irrecoverable VAT on the above costs – most relevant to domestic consumers.

Consumer Pricing and Consumer Protection: Consultation questions

31. Do you agree or disagree with our proposal that heat networks supported by the GHNf should be a member of the Heat Trust or commit to offering equivalent standards to domestic and micro-business consumers by the time any GHNf funding is drawn down? If you disagree, what consumer protection standard would be more appropriate?

²³ MHCLG (2019): <https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings>

- 32. Is the counterfactual heat price structure clear? Do you agree or disagree with the general principle of using different counterfactual pricing for different consumers and different types of building?**
- 33. Would it be appropriate to use a self-declared counterfactual where an applicant is not connected to the gas network? If not, what counterfactual would be appropriate?**
- 34. Do you agree or disagree that public bodies, commercial and industrial sectors are sufficiently resourced to negotiate their own mutually agreeable offtake terms i.e. if it is not good value, they will not connect?**
- 35. Do you agree or disagree with our current view that a distinction should be made between new build residential and retrofit, with a gas counterfactual for retrofit and the Future Home Standard for new build?**
- 36. Do you agree or disagree with our proposed view that micro-business should be treated in the same way as domestic consumers, making a distinction between new build and retrofit?**
- 37. Are there any types of consumer or necessary considerations that have not been adequately reflected in Figure 4, when considering a counterfactual cost of heat for the assessment of consumer detriment?**

Scheme delivery mechanism

Overview of delivery

The commercial arrangements for the delivery of GHNF will be developed in line with Government best practice.

In terms of the GHNF scheme format, at present, our intention is to broadly follow the processes developed under the HNIP scheme. The key area where change is expected is in the application process and assessment. It is our intention to design metrics that can be assessed by projects in advance of application such that a probable score can be self-appraised and a decision made whether to apply.

The likely process for application is therefore to have a competitive application process consisting of quarterly funding rounds in which applicants can apply for grants. During each round, applicants would have a window to submit pre-applications to confirm that they have met the gateway metrics (see *STAGE 1: Gated metrics* section). These would be checked by the GHNF team for basic eligibility and the project's readiness to proceed to full application. Applicants who pass this stage would then submit their full applications, which would undergo techno-economic, financial and commercial assessment and be scored against defined criteria (see *STAGE 2: Deliverability* and *STAGE 3: Adjustment metrics* sections). Applications that fail the Stage 2 deliverability gateway would be reviewed on a case-by-case basis by a senior member of the GHNF allowing for rejection with explanations to be provided to the applicant in a timely manner, increasing their chances of having sufficient time to address material concerns in advance of the next funding round.

Applications that pass the Stage 2 deliverability gateway would then be evaluated²⁴ in line with the Stage 3 adjustment metrics to derive an adjusted annual kWh thermal energy delivered per £ of GHNF grant proposed. This plus a summary paper on each application would be considered by a panel which would determine the successful applicants and agree the funding awards to be offered. Potential applicants would be assigned a designated business development manager by the GHNF, who would help them through this process.

Successful applicants would be required as a condition of funding to provide regular monitoring and reporting information during construction and, when their project is complete, and periodic operational data (see Monitoring and Reporting requirements below).

Unsuccessful applicants would be given feedback and may be invited to reapply to a subsequent round, depending on the status of their projects. Unsuccessful applicants would also have a right to ask for a review of the decision.

Launch

The GHNF is expected to be launched with application guidance in January 2022 and will open for applications in April 2022. The timeline for launch reflects stakeholder feedback, and

²⁴ In reality Stage 2 and Stage 3 will be simultaneous. If deliverability is found to fail (see *STAGE 2: Deliverability*) then the assessment would stop and rejection made.

experience gained from HNIP that potential applicants will want as much notice and advanced information about the scheme as possible.

Application process

As has been the case with HNIP, prospective applicants would be assigned a business development manager (BDM) by the GHNF. The BDM would be their day-to-day contact and would help them through the application process. BDMs would assist projects to interpret more complicated areas of eligibility or where grey areas are found provide supplementary guidance for the benefit of future applicants. They would escalate issues to relevant team members within the GHNF when they are unable to directly address an issue, to help potential applicants make an application with the confidence that key issues have been considered and, ideally, resolved.

Each round of the GHNF would consist of two “windows” with separate deadlines for submission. The first “window” would be a pre-application stage, in which applicants will be able to submit a form with basic details of their project sufficient to address the *STAGE 1: Gated metrics*. Applicants who pass this stage will then be able to submit a more detailed full application in the second “window”.

As part of their full application, applicants would be required to submit information on the technical, legal, commercial and financial details of their project. This would likely consist of an application form and a set of supporting documents. These would be set out in the applicant guidance but are likely to include a short cover note, detailed business case, technical specifications, supply chain plans, correspondence with utilities/planners etc., heads of terms for offtake agreements and project plans as well as evidence of the costs to consumers.

Application assessment

All eligible applications will be scored and ranked based on a set of pre-determined criteria (see *Application assessment* section). These assessments will be undertaken by individuals with appropriate qualifications and experience. The final assessment criteria will be published in the Application Guidance document.

The assessors will prepare reports with their assessment and scoring of each application, along with their recommendations for which projects should be funded. These reports will be submitted to a funding panel, which will make the final judgment as to which projects will receive GHNF funding, how much funding they should receive (which may differ from the amount applied for), and other terms and conditions attached to the funding, such as conditions precedent.

Unsuccessful applicants will be notified of the panel’s decision and receive feedback on their applications. They may be advised to apply again at a later funding round if, for example, the assessment determines that their project is not yet mature enough to get underway.

There will be a decision review process whereby unsuccessful applicants can request a review of the assessment and the decision-making process with respect to their application.

Funding awards

It is proposed that funding awards will be in the form of grants only.

All grant awards to local authorities will be made under Section 31 of the Local Government Act 2003.

Funding agreements

Successful applicants will receive a Funding Award Letter and be asked to sign a Funding Agreement. The agreement will include the detailed terms and conditions attached to the funding, including eligible expenditure, monitoring and reporting requirements, an agreed description of the project and conditions precedent to be met before funding can be drawn down.

See *Financing Projects* section for consideration of the possibility of provisional awards.

Monitoring and reporting requirements for successful projects

Successful applicants will be required to submit regular reports to the GHNF. This information may be subject to financial and techno-economic assessment depending on its nature. Applicants will need to demonstrate that their project has met certain conditions, including compliance with the Funding Agreement, achievement of project milestones, and that it remains on track to deliver the intended benefits.

Following the procurement of infrastructure for which funding was awarded, it is anticipated that projects will need to complete an updated supply-chain statement that sets out how they have addressed the supply chain commitments made as part of their original submission (see *STAGE 2: Deliverability and supply chain commitment gate*). This is likely a one-off requirement; however, for multi-phase projects it may be part of a delivery plan which provides regular progress updates to the GHNF at different project stages.

Projects will submit brief monthly monitoring reports during their development, which will summarise progress and any issues encountered, with planned mitigations. These will also set out any changes to the project including the scope, budget and the timescale for completion. Where significant changes to the project become likely, or circumstances arise which will affect the deliverability of the project, the expectation is that the project team would inform the GHNF as soon as possible.

When a project is built and the network becomes operational, the operators will be required to submit quarterly operational reports and potentially live monitoring data. These will provide data on the performance of the network and the achievement of the benefits for which funding was provided. This data will also help to provide long-run analytical evidence on the performance and benefits realisation of heat networks more generally.

Drawdown of funds

Projects will be able to draw down their funds from the GHNF when they have satisfied the conditions precedent in their funding agreements. With respect to local authorities who have been awarded Section 31 grants, it is likely that they will be paid their grant in a single payment once fully approved. For non-Section 31 grants, payments may be disbursed in tranches according to pre-agreed milestones linked to completed work.

Scheme Delivery Mechanism: Consultation Questions

- 38. What information do you think that the GHNF monitoring and reporting system should capture?**
- 39. Are there aspects of HNIP delivery that you would like to see changed for the GHNF and if so, which ones?**
- 40. Should applicants be held to their supply chain commitments as part of a monitoring cycle? At what project stage would you see supply chain commitments adding the most value?**
- 41. What steps could be taken to monitor the performance of the networks? Should there be consequences for poor performance? If so what?**

Application Assessment

Proposals on application evaluation

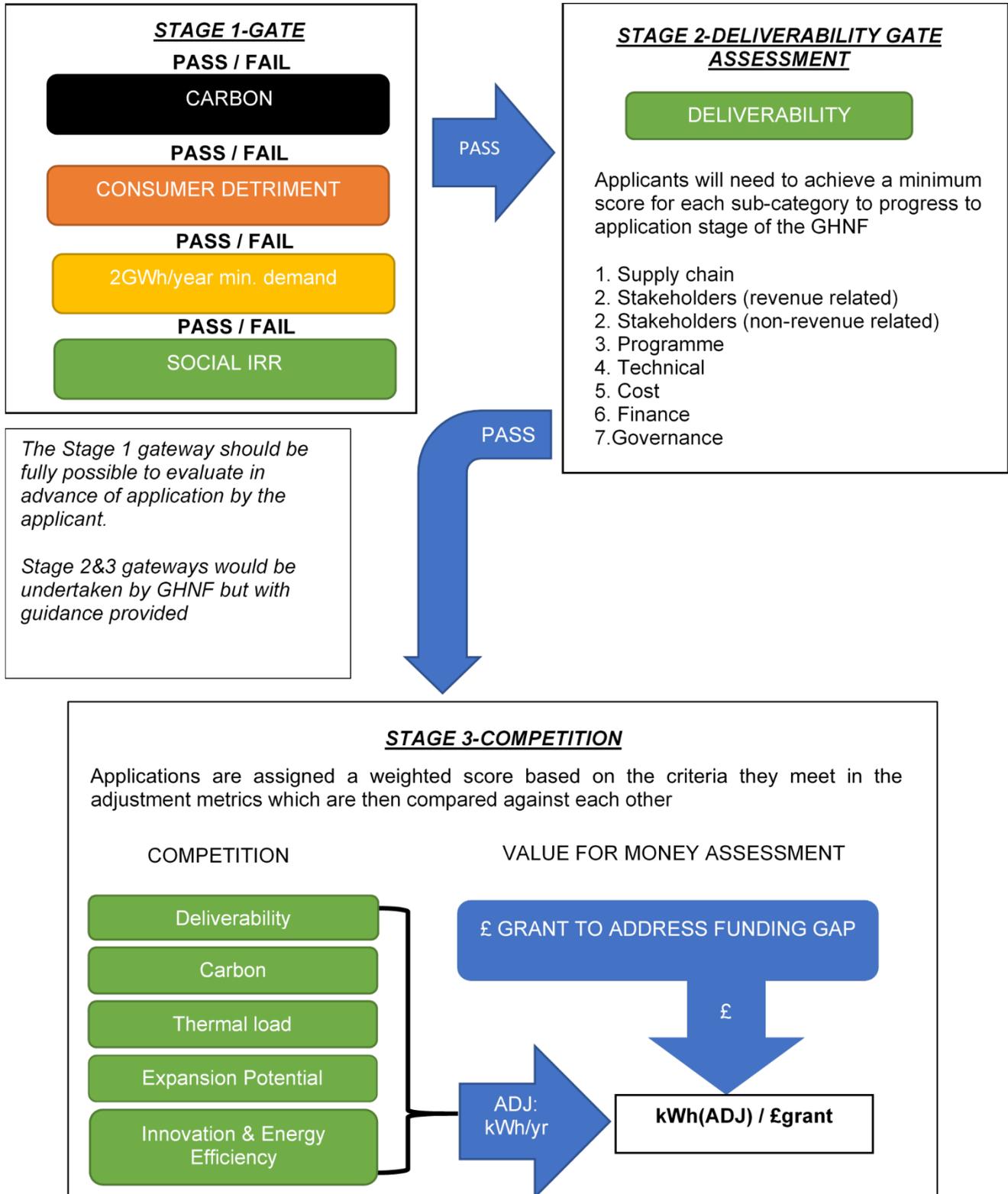


Figure 5: proposals on application evaluation

STAGE 1: Gated metrics

It is proposed to use four gated metrics (carbon, consumer detriment, minimum annual demand and social IRR) with clearly stated counterfactuals to allow potential applicants to self-appraise their eligibility for the GHNF (see *Figure 5: proposals on application evaluation*).

All four metrics are pass/fail, and each of the Stage 1 gates need to be passed in order to progress to Stage 2. They are intended to be designed in such a way that an applicant will be able to self-assess each gated metric in advance of application. In this way applicants can allocate the time and resources necessary to complete a full application with the confidence that doing so will not be a wasted effort.

Gated metric 1: Carbon Intensity

The purpose of this gate is to be able to demonstrate that a low-carbon heat network is capable of outperforming (in terms of carbon abatement) a conventional air source heat pump. Importantly, the calculations for evaluating carbon intensity need to account for thermal losses and emissions associated with electricity consumption to operate the system (e.g. electricity for pumping, monitoring and general system electrical parasitics). As such the GHNF carbon intensity ceiling reflects the kgCO_{2e} per kWh of heat delivered to end customers.

A provisional Seasonal Coefficient of Performance (SCOP) of 2.5 has been proposed to be benchmarked against. Were this adopted, below is the indicative GHNF maximum permissible carbon intensity of thermal energy delivered to end customers:

	2022/23	2023/24	2024/25	...	2061/62
Long Run Marginal Emissions Factor (kgCO _{2e} /kWh e)	0.245905	0.23287	0.219097	...	0.0252
SCOP	2.5				
GHNF carbon intensity ceiling of end customer thermal energy demand (kgCO _{2e} /kWh th)	0.098362	0.093148	0.0876388	...	0.01008

Figure 6: Absolute carbon gateway metric

Appraising CO_{2e}

For a number of technologies appraising the carbon intensity of heat delivered can be established following the tables provided in HMT's *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*²⁵. For biofuels, the

²⁵ <https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal>

emissions tables provided by DEFRA & BEIS should be used: *Greenhouse gas reporting: conversion factors 2020*²⁶. Below is a basic worked example, in a given year, for a heat pump based project with gas peaking plant:

	GWh	Carbon Intensity (kgCO ₂ e/kWh)	Tonnes CO ₂ e	Network carbon intensity 2024/25 (kgCO ₂ /kWh)
Electricity imported in 2024/25:	15	0.219097	3,286	
Gas imported in 2024/25:	1	0.18396	184	
End customer heat demand 2024/25:	45		3,470	0.07711
Permissible intensity				0.0876388
Pass/Fail				PASS

Figure 7: Carbon emissions worked example

Clearly with projects that use a temporary plant as an early stage technology before a sufficient number of customers are connected to enable the deployment of larger scale LZC thermal generation, the GHNF will need to be designed to allow for an overall pass even should one period fail. A method to address this could be to permit a maximum number of early period FAIL events over a 40 year appraisal period.

The approach to carbon intensity gets more complicated when considering heat recovered from wider processes. Rather than specifying a specific methodology for every conceivable manner of recovering heat from wider processes, instead a principles based approach to estimating the carbon intensity of the heat imported to a heat network is proposed as follows:

- Assess if the heat intended to be recovered by the heat network would or would not be available irrespective of whether the heat network does or does not go ahead;
- If the answer is that the main process would not go ahead without the heat network then the emissions associated with the primary process are clearly attributable in part to the heat network and should be accounted for as such. In such instances the applicant would need to consider an appropriate method for allocating a portion of the overall CO₂e emissions of the process to the supply of heat to the network;
- If the answer is that the wider process would go ahead / continue irrespective of the heat network’s development, then the emissions associated with heat recovery are assessed to the extent that the recovery of heat impacts the primary energy consumption or energy output of the wider process depending on what the process is. For example, if heat taken from a blast furnace were to result in a requirement to increase input energy to ensure that the smelting process was completed, then

²⁶ <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020>

emissions associated with the increased energy input would need to be attributed to the heat network.

Where projects generate electricity that is exported, and not for own use, the long run marginal electricity emissions associated with generation attributed to the kWh of electricity generated should be subtracted from the emissions calculated as per sections above.

Gated metric 2: Consumer detriment

This would be for new build and existing residential/micro-business consumers only – see section *Consumer protection and pricing*. The whole life tariff the consumer could pay under the applicant's heat network would be compared to the counterfactual whole life heat price. This would be appraised on both a p/kWh basis and an average £/year basis and would be inclusive of irrecoverable VAT (e.g. for residential customers). Only if on both accounts detriment was established, would detriment be determined to have occurred and a FAIL assessed.

Gated metric 3: minimum annual thermal demand

It is proposed that all projects applying for GHNF have a minimum new customer thermal demand of 2GWh/year or more. The rationale for this position is set out, with questions, in section: *The types of heat networks in scope*.

Gated metric 4: positive social IRR and quality of operating cash flows

Whilst the existing HNIP scheme requires a positive IRR of the applicant's forecast project cash flows, it is proposed for the GHNF that it may be appropriate to accept projects that have negative (or possibly incalculable) IRR of cash flows but do have positive Social IRR. Social IRR would be proposed to be calculated as cash flows attributable to the project but additionally monetising the value of carbon abatement against a gas counterfactual and the relative impact of air quality against a gas counterfactual. The methodology for monetising emissions and air quality impact is set out in HMT's *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*²⁷.

The IRR of these combined cashflows would need to reflect a social return of 3.5% when appraised over a 40 year period. Supporting guidance would be provided to assist applicants in carrying out these calculations independently of GHNF.

As part of the Social IRR assessment the quality of the post-construction cash flows would be assessed. Post-construction cash flows would need to be sufficiently robust to give a greater degree of confidence that GHNF is genuinely being awarded to meet high capex costs as opposed to subsidising the cost of heat where applicants have a negative or incalculable project IRR. Sufficiency would likely be assessed by evaluating the project's debt service cover ratio on the assumption of capital having been provided by a low interest loan.

Gated Metrics: Consultation Questions

42. To what extent will an applicant be able to self-assess against the initial gates outlined above? Do you agree or disagree that having initial gates that are pass/fail are a helpful mechanism?

²⁷ <https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal>

- 43. What are your views on the appropriate minimum SCOP a project should be benchmarked against?**
- 44. Do you envisage any challenges with the CO₂e appraisal method proposed for the GHNF? Is there a risk it will exclude technologies or solutions that would still be of social benefit, and if so, which ones and why?**
- 45. Do you agree or disagree with the Social IRR gateway?**

STAGE 2: Deliverability and supply chain commitment gate

Deliverability initial assessment

An assessment of a project's likelihood of being delivered successfully will always involve a degree of judgement and cannot be satisfied through an exhaustive list of questions. However, it is imperative that public funds are not simply awarded to highly ambitious yet potentially undeliverable projects. It is proposed that an intermediate step is introduced to the application assessment that considers an application's deliverability. Each of the following categories would be considered:

- Stakeholders (revenue related) – e.g. heat customers and income – does the project generate sufficient operating margins post construction? Are customers likely to connect? What is their credit worthiness? etc.
- Stakeholders (non-revenue related) – e.g. status of utility connections, planners, highways, etc.
- Programme – how realistic is the timeline presented, and are there any key milestones that have to be met in order for the network to be successful?
- Technical – is the solution proposed compliant with the Heat Network Code of Practice or other appropriate industry standards?
- Cost – are the costs presented within an acceptable tolerance of benchmarked costs for the network proposed? Are the costs presented comprehensive or are key items missed or not sufficiently granular to evaluate?
- Finance – while it is not intended that the GHNF will be funder of last resort (see section *Financing Projects*) it will be important to understand to what extent funding the balance of investment requirement has been considered; and
- Governance – how is the project being managed, what are the internal approvals processes, what is the experience of the project team etc.

These key areas would be evaluated and for each area a minimum score would be set. If an applicant scores below the minimum score for any single area assessed for deliverability, then the application would be failed and feedback provided in a timely manner.

Supply chain commitment

In order to be successful, the GHNF needs to help grow the UK's heat network supply chain across skills, system design, manufacturing, installation of infrastructure and ongoing O&M. In order to meet the CCC's estimate of 18% by 2050 significant investment will be required. We estimate that annual new and expanded network investment will reach £1 billion per annum before 2030. This is a rapid growth curve that will require significant investment in the capability and capacity of the UK heat network offer.

In light of the commitment to achieving net zero emissions by 2050 the government is also considering how it can encourage the growth of sustainable, efficient and low-carbon supply chains through consideration of their carbon footprint. The GHNF is considering introducing clear supply chain commitments for successful projects, in line with the Industrial Strategy's 5 Foundations, that will deliver against these expectations. These foundations support the vision

for a transformed economy – a transformation that is already taking place and will continue to accelerate over the coming decades:

- Ideas: the world’s most innovative economy
- People: good jobs and greater earning power for all
- Infrastructure: a major upgrade to the UK’s infrastructure
- Business Environment: the best place to start and grow a business
- Places: prosperous communities across the UK

To deliver against these supply chain commitments, projects will need to demonstrate that they will adopt open and fair procurement, creating opportunities for better jobs and diversity within the sector, to grow the next generation of heat network specialists. They will support local businesses and new supply chain entrants where appropriate to do so, consider ongoing innovation and ensure good working practices are adopted. Applicants would provide a statement setting out how they intend on meeting these commitments as part of their application.

Deliverability and supply chain commitment gate: Consultation Questions

46. Is the deliverability of the project an important consideration? If so, are the broad categories outlined appropriate to determine this?

If a supply chain commitment were to be made as a requirement of award:

47. What are the key areas that should be included in the supply chain commitment? Please provide your reasoning.

48. Should a distinction be made between larger and smaller projects with regards to supply chain commitment? If so, what would you propose?

49. What is the appropriate level of reporting to ensure supply chain commitments are being delivered? Please provide appropriate examples.

50. Are there any gaps in standardising contracts to support projects that are not covered by the existing heat network contract templates “Sales, Operations and Maintenance Set (SOMS)”²⁸?

51. Should additional activities be carried out over the next year, in advance of the GHN Fund to support up-skilling across the sector? If yes, what activities should these be?

²⁸ <https://tp-heatnetworks.org/heat-contract-templates/>

STAGE 3: Adjustment metrics

Projects that have successfully passed through the first two gates should be aligned with the principles of the GHNf: delivering low-carbon heat at scale without customer detriment. The purpose of this final stage of evaluation is to introduce a competitive element to the process. Budgets will be limited, and it will be important to be able to demonstrate that for each pound spent the GHNf is decarbonising heat as cost effectively as possible.

The core metric for evaluation would be an adjusted kWh/£ GHNf grant proposed.

The pound value of the grant would be provided by the applicant on application, and assessed in a shadow project model developed for the GHNf. The shadow model, much as with the equivalent model in HNIP, would goalseek the £ grant required to achieve the applicant's stated hurdle rate. Evidently the higher the grant required, all things being equal, the less heat would be delivered per pound spent and so the applicant may score worse than other applications made in a given funding round.

The kWh heat delivered would be the average annual thermal energy forecast to be delivered during the first life cycle of primary plant, but no longer than 20 years. The kWh of average annual thermal energy would be adjusted up/down based on scoring against the following metrics with the approximate weighting set out below:

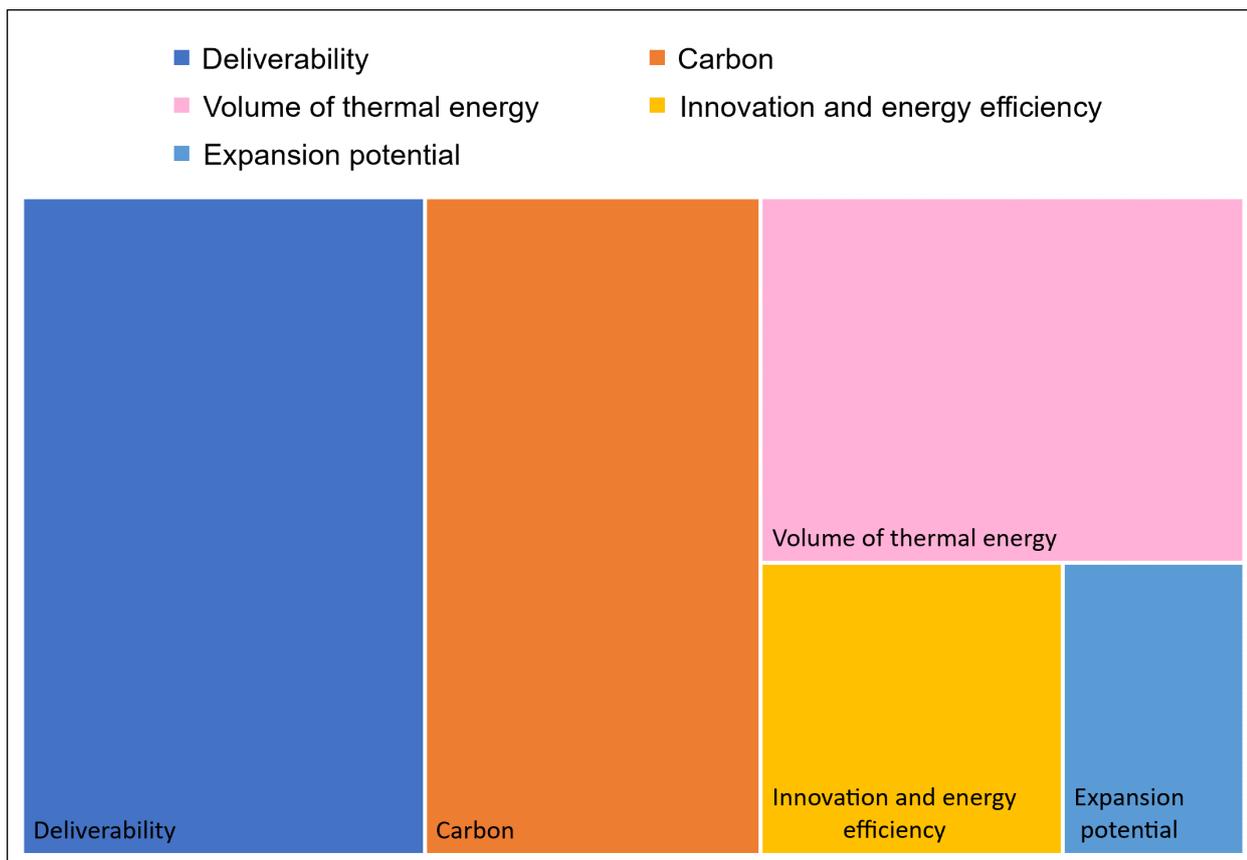


Figure 8: indicative assessment weighting

An example of how this method might work is as follows:

#	Unadjusted GWh/year	Deliverability (0.2-1)	Carbon (1-5)	Thermal energy (1-4)	Innovation & energy efficiency (1-3)	Expansion (1-1.5)	Weighted score	Adjusted GWh/year
1	10	0.7	3	3	2	1.5	18.9	189
2	10	1	1	1	1	1	1	10

Figure 9: indicative adjusted kWh example (expressed in GWh)

If a grant of £1m had been requested for both applicants 1 and 2 then the kWh/£ score would be 189kWh thermal energy delivered per year per £ spent for project 1 and 10kWh/£ spent for project 2. On this basis project 1 would score better than project 2. When reporting on the successful projects the **unadjusted** GWh/year would be the reported heat delivered to end customers.

It should be noted that the weightings shown above are purely indicative and analysis will be undertaken against data sets available both from HNIP and the Call for Evidence²⁹ to consider what the most appropriate weighting should be.

Deliverability

While it may appear that Deliverability is being double counted (having been the main component of the Stage 2 gate), the purpose of this stage is to consider not simply whether the project is assessed to meet a minimum deliverability threshold but to score how well key delivery risks have been mitigated, managed or left unaddressed relative to other projects applying for funding.

It is proposed that the delivery metric from the HNIP application guidance³⁰ is adopted. Deliverability is an assessment of the likelihood of the application being able to use the agreed GHN funding within project timescales, and its ability to deliver the benefits outlined in the application. A deliverable, realistic project is one that is more likely to complete on time, within budget, to quality and has secure future revenue. Deliverability is not based solely on numerical data but is also a judgement on the evidence provided on how developed the project is.

The seven subcategories³¹ under the HNIP delivery metric are proposed to be used for GHN applications, to capture the spectrum of factors the GHN should consider when evaluating applications. These are set out in Stage 2 above.

²⁹ BEIS (2020): <https://www.gov.uk/government/consultations/designing-the-green-heat-network-fund-call-for-evidence>

³⁰ BEIS and Triple Point Heat Networks Investment Management, 2019. HNIP Application Guidance. Available at: <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/832223/heat-networks-investment-project-application-guidance.pdf>

³¹ Ibid.

Carbon

This is a relative assessment of the 'actual' carbon counterfactual i.e. the CO₂e that is actually proposed to be displaced as opposed to benchmarking the project's carbon intensity against an ASHP (see section *Gated metric 1: Carbon Intensity*).

Volume of thermal energy

The GWh of thermal energy (heating and/or cooling) supplied per year baselined against the 2GWh/year minimum (see section *Gated metric 3: minimum annual thermal demand*). The greater the thermal energy delivered the higher the score with a maximum score possibly for schemes delivering at or over 100GWh/year.

Expansion potential

This is an assessment of the potential of the project to expand and increase its impact through achieving greater carbon savings, beyond the carbon savings stated in the application. This metric is proposed to account for the growth potential of heat networks, and the associated carbon savings this growth could bring. Below is a non-exhaustive list of the criteria expected to be evaluated:

- Proximity of applications to areas of existing thermal loads or planned growth (e.g. 2000 homes being built nearby);
- Local Plans and other local authority produced planning and energy documents to detail thinking on how networks could expand.

The purpose of this weighting is not to promote and encourage applications with unrealistic expansion targets; rather it is to acknowledge that heat networks located in areas that have a clear expansion potential will more likely offer future decarbonisation opportunities in the 2030s and beyond than those that do not. It will be important for the GHNF to acknowledge and give merit to this, but commensurate to the likelihood of that outcome.

Innovation and energy efficiency

Heat networks have the potential to deliver wider energy benefits and innovations. Areas being considered with regards to providing a score uplift for projects that can demonstrate the following type of behaviours are as follows:

- **Unlocking diversified peak demand**

A heat network with multiple customers should be able to install a lower overall thermal capacity to meet peak demand from customers as not all customers will demand heat simultaneously. This is particularly true with the supply of domestic hot water. Reducing the overall capacity installed should reduce the strain on wider energy infrastructure, particularly when an individual heat pump counterfactual is considered.

- **Demand side response**

Where projects intend to use heat pump technology combined with large scale thermal storage, batteries and PV, the project could operate the heat pump to avoid periods of peak electricity demand to the benefit of the wider electricity grid. Potentially this could be monetised through a Demand Side Response (DSR) contract with National Grid.

- **Ancillary Services**

Where projects are able to meet the carbon gateway and have installed CHP technology (potentially sized to meet electricity requirements of a larger heat pump) it may be possible for the project to enter into ancillary services contracts with National Grid such as frequency response.

- **Energy Conservation**

Some projects may look to combine energy efficiency services, batteries and PV with the delivery of a heat network. The GHNF has not been established to fund these activities and as such the capital cost of such activities and any future revenue streams associated with them should be excluded from the cash flows evaluated for GHNF capital support. However, such activities are clearly to the benefit of society and the GHNF could award merit to projects that have committed to these works.

- **Recovered cooling**

Projects that are able to significantly enhance the SCOP of a heat pump by being able to sell both the heat and the cooling generated would conserve energy as well as provide stronger returns (all things being equal).

Adjustment Metrics: Consultation Questions

52. Do you agree or disagree with the core metric an adjusted kWh/£ GHNF budget spent for evaluating projects against one another?

53. Are there any metrics you feel should be included or removed, which ones and why?

54. What, in your view, should the relative weighting of the metrics proposed be?

55. Do you agree or disagree with the Innovation and Energy efficiency sub-categories proposed? Are there any additional areas that should be included?

56. Should a minimum score be set for any project to be funded or are the use of the gated metrics sufficient?

Assessing the grant awarded

Overview

A grant that is likely to be accepted by an applicant will need to provide them with a suitable return evaluated over an appropriate appraisal period. The grant calculated by the GHNF would be the lower of:

- the grant evaluated by GHNF to be sufficient to achieve the applicant's stated hurdle rate;
- the grant applied for by the applicant; or
- 50% of total eligible project capex

The greater the difference between the pre-grant project IRR and the desired investor return on project cash flows, the higher the grant needed. Given the key metric for competition is the adjusted kWh of thermal energy supplied per £ of grant awarded: the higher the grant asked for, the worse the applicant's score will be relative to other applications.

When considering the assessment of the grant proposed the following is assumed:

- Project cash flows appraised would be real (i.e. excluding CPI/RPI inflation) and before tax;
- Project cash flows would therefore be: revenue less capex less opex (including fuel) plus any other income / grants awarded or applied for;
- Cash flows would be appraised on an annual basis;
- Cash flows would be discounted at the applicant's stated hurdle rate and the grant intervention evaluated by the GHNF would be the evaluated Net Present Cost.

An upper limit of 50% of total eligible project capex has been put forward at this stage as a continuation from HNIP.

Generation vs downstream capital costs

The GHNF has been established with a strong focus on decarbonising heat networks. Attention has therefore been directed towards technology selection. However, centralised thermal sources/generation clearly need to be distributed to customers via pipework, customers need to be connected to gain access, systems may need to be upgraded to enable connection to LZC generation, etc.

While funding is targeted at generation, a method that will unlock the whole system needs to be developed; one that does not rely on an assumption that investment in downstream distribution infrastructure is capable of being fully self-financed without support.

It is therefore proposed that, irrespective of the applicant's investment structure, the applicant evaluates the annual amount that the investor in the distribution network would need to charge the generator such that their hurdle rate is achieved when appraised over a 40 year period – the Annual Distribution Charge. While full disclosure of the distribution costs forecast would be provided to GHNF, the applicant's economic model would include only the capital cost of

accessing and generating thermal energy. The Annual Distribution Charge would also be included in the economic model as a 40 year operating cost to the generator.

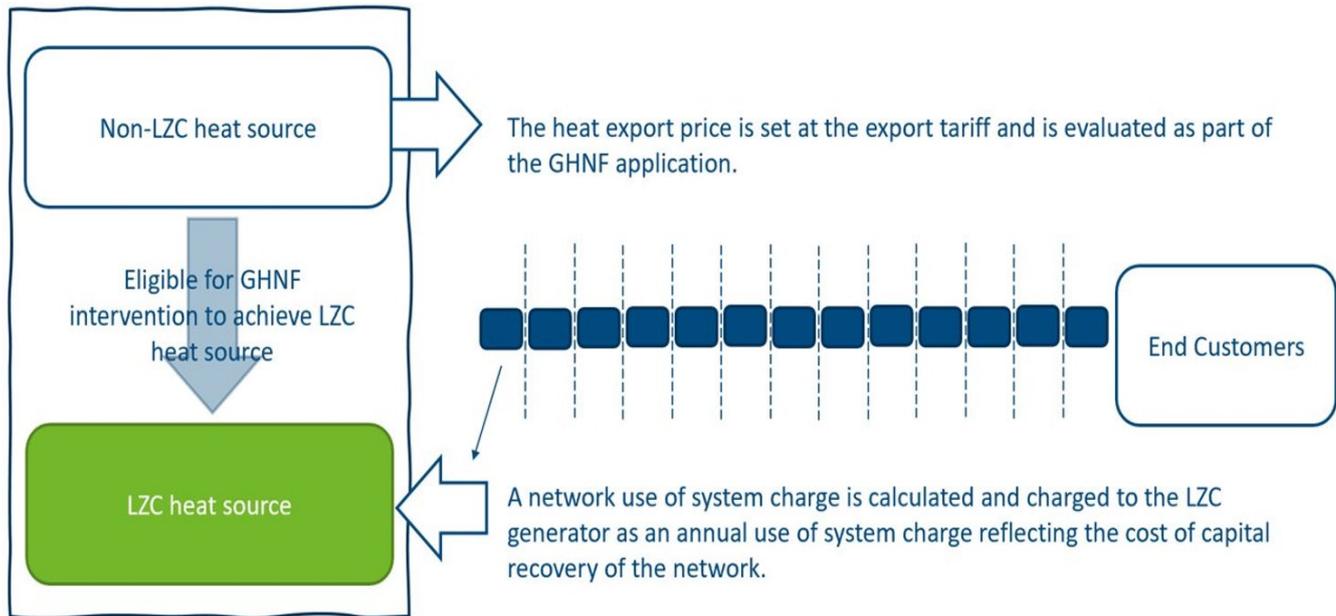


Figure 10: managing distribution costs

The GHNF would not be mandating that an investor in distribution infrastructure would have to be different to the applicant; however, in the event that they were, clearly the GHNF would be awarding a grant to the investor in the generation not to the investor in the distribution infrastructure. While the grant would be sized to meet the requirements of both investors it would be necessary for the investor in the generation to on-grant to the investor in the distribution infrastructure.

For projects where the investor in distribution infrastructure is other than the investor in generation capex this could present challenges:

- The generator would be responsible for on-granting to the investor in distribution infrastructure with the potential for dispute should actual costs differ materially from forecast costs;
- A transfer of funds from one organisation to another may have tax / accounting / legal implications;
- There may be further issues still;

Assessing the Grant: Consultation Questions

57. Will the general approach to grant calculation be sufficient to meet the financial needs of applicants seeking support? Please explain your response?

58. Are the cashflows proposed to be evaluated sufficient? For example, should nominal post-tax cash flows be considered? Should the proposed finance structure be included and blended investor returns (shareholder loans + equity) be appraised?

59. Should there be a ceiling/cap on permissible returns and if so, what should it be?

Generation vs. distribution costs:

- 60. Does evaluating generator only cash flows but accounting for the cost of distribution through a notional (or actual if appropriate) 40 year use of system charge present any challenges for an applicant? If yes, please explain under what circumstances these challenges would arise.**

- 61. If a project intends to have a formal distinction between investment in generation and distribution (e.g. GenCo/DisCo), does a GHN award to the generator, sufficient for both generation and distribution returns, present any issues?**

Financing Projects

The point at which a project makes an application to GHNF is unlikely to be the point at which a project is ready to break ground and start construction (see *Commercialisation* section). As such a project applying to GHNF will not be expected to have a fully worked up and agreed funding stack. The sorts of activities expected to have been completed with regards to finance at the point of application are (but not limited to):

- Engagement with the finance community, potentially through an introduction by a GHNF Business Development Manager;
- Full financial model that sets out the proposed funding stack including the GHNF grant applied for;
- Assessment of relevant taxes, inflation risk, accounting, legal separation (where appropriate) etc.
- Commercial risk evaluation and implications for investor returns;
- Etc.

Rather than requiring that all funding should be in place it is anticipated that it would be more helpful to projects to have the option to be able to formally engage with the investor community with a provisional offer from GHNF in hand. However, as our budgets are annual it would be necessary for provisional offers to be time limited.

Financing Projects: Consultation Questions

62. Should GHNF allow projects to apply that have not secured finance? Please provide your reasoning.

63. If provisional awards were offered what would the minimum expiry duration have to be for it to be of value to the applicant/investor community?

Levels of Government support

From 1 January 2021, the UK will follow World Trade Organisation rules and other international commitments on subsidies. Any support that we provide will be compliant with these commitments.

Economic Assessment

Appraisal and evaluation are essential activities to support evidence-based decision making in HMG. In support of the GHNF business case that feeds into the HMG's public spending decisions, an economic assessment to understand the value for money of the GHNF scheme is carried out following the cost and benefit analysis (CBA) guidance set out in the HM Treasury's Green Book³².

The relevant costs and benefits valued or monetised are those for society overall, and take into consideration the social, economic, environmental and financial impacts which are to be assessed against a Business As Usual (BAU) counterfactual (i.e. what would have taken place in the absence of intervention).

The result from a CBA is a social net present value (SNPV). In the case of GHNF, the SNPV is determined by appraising the social costs and benefits of the heat networks that are assumed to be deployed under the scheme over a specified appraisal period, which are then compared to those that would be incurred by meeting the same heat demand profile with gas-fired technologies (the BAU counterfactual).

An Impact Assessment (IA) has been developed alongside this consultation, adopting this CBA approach, to provide an indication of the nature and scale of the costs and benefits associated with the GHNF. Wider impacts of the scheme, where relevant, have also been considered in the IA. Given the scheme design is not fully developed, the CBA in this IA is predicated on a series of assumptions which have been made regarding the nature of the projects that will be funded via the GHNF. A list of these assumptions can be found in Annex A of the accompanied IA.

Once the scheme design is further developed with more details and informed by the responses to this consultation, the CBA and the subsequent IA will get updated accordingly to reflect the final design.

Economic Assessment: Consultation Questions

64. Do you think the assumptions listed in Annex A of the accompanied Impact Assessment are reasonable for the purpose of an economic appraisal? If not, please provide suggestions on how they can be improved.

³²https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

Scheme evaluation

It is important that a scheme of the size and scope of the GHNF is properly evaluated. This will help to determine whether it has had its intended effect on the heat network market but will also capture any lessons that can be learned from it which can inform other schemes planned by central government or the Devolved Administrations. As was the case with HNIP³³, we propose to commission an independent evaluation of the GHNF which will get under way when the scheme is operational. This evaluation will follow the principles of realist evaluation³⁴, focusing on contextual questions of “what works, for whom, under what circumstances?” and will use an evolving Theory of Change to examine the way in which the GHNF will achieve its intended outcomes.

As part of the evaluation process, it is envisaged that applicants for GHNF funding will be asked to take part in interviews with researchers to obtain their feedback on the scheme. It is also likely that applications will be shared with the appointed evaluators on a confidential basis, under a data sharing agreement with BEIS. Successful applicants to the GHNF will be required to take part in the evaluation of the GHNF as a condition of their funding. However, the GHNF will seek to minimise the burden on them, e.g. through the sharing of project management information and monitoring reports with the evaluators. In the case of unsuccessful applicants, or those who, for whatever reason, decide to withdraw an application, their participation will be requested on a voluntary basis. Feedback from participants in the research will be anonymised and all data collection and sharing will be compliant with the General Data Protection Regulation.

The precise terms of the evaluation will be finalised, and an evaluator appointed, as the scheme is further advanced. However, the evaluations will consider various aspects of the GHNF such as the “applicant experience” and the impact that the scheme is having, both on the projects awarded funding and on the market as a whole. Outcomes are likely to include a series of reports which will be published online on gov.uk.

Scheme Evaluation: Consultation Questions

65. Are there any particular areas which you think an independent evaluation of the scheme should explore?

³³ <https://www.gov.uk/government/publications/evaluation-of-the-heat-networks-investment-project-hnip-pilot-scheme>

³⁴ Pawson, R., 2013. The science of evaluation: a realist manifesto. Sage.

List of Acronyms

ADE	The Association of Decentralised Energy
BEIS	Department for Business, Energy and Industrial Strategy
Capex	Capital Expenditure
CBA	Cost Benefit Analysis
CCC	Committee on Climate Change
CHP	Combined Heat and Power
DEEP	Decentralised Energy Enabling Project
DEFRA	Department for Environment, Food and Rural Affairs
EFW	Energy from Waste
EU	European Union
FF	Future Funding
FHS	Future Homes Standard
GHNF	Green Heat Network Fund
GW	Gigawatt
GWh	Gigawatt Hours
HBS	Heat and Buildings Strategy
HIU	Heat Interface Unit
HMG	Her Majesty's Government
HMT	Her Majesty's Treasury
HNDU	Heat Networks Delivery Unit
HNIP	Heat Networks Investment Project
IA	Impact Assessment
IRR	Internal Rate of Return
KW	Kilowatt

KWh	Kilowatt Hour
LRVC	Long-Run Variable Cost
LZC	Low or Zero Carbon
MF	Heat Network Market Framework
MHCLG	Ministry of Housing, Communities and Local Government
Opex	Operational Expenditure
Repex	Replacement Expenditure
RHI	Renewable Heat Incentive
SCOP	Seasonal Coefficient of Performance
TCR	Targeted Charging Review (Ofgem)
TWh	Terawatt Hours
UFH	Under Floor Heating
WTO	World Trade Organization

Definitions

Ambient Heat Network	An ambient heat network pumps water at low/ambient temperatures to buildings. Importantly, the ambient temperature might be with reference to the ground, a body of water or some other form of low-grade heat but which is able to maintain a relatively constant temperature year-round. Heat pumps located within buildings are able to extract the latent heat within the water supplied to provide space heating and domestic hot water. The benefit of such an approach is that the efficiency of the heat pump should be fairly constant year-round, whereas a more conventional air source heat pump's efficiency will be influenced by the variability of ambient air temperatures. Additionally there are reduced thermal losses in comparison to higher temperature networks, and prosuming of heat and coolth between network customers is possible.
Biogas	A renewable fuel produced by the breakdown of organic matter such as food scraps and animal waste, by microorganisms in the absence of oxygen, via anaerobic digestion.

Communal Heat Network	A communal heat network is where the heating plant is located in a room within a multi-tenanted building and supplies heat to individual units via riser and lateral pipes within the building.
Distribution Network	The buried (or potentially above ground) pipework that is used to distribute thermal energy to end customers. Primary distribution is considered to be delivery to a thermal substation where hydraulic separation is made and from which smaller diameter pipework is taken to individual customer connections (secondary distribution). Pipework behind the customer connection is referred to as tertiary distribution.
District Heat Network	A network of buried (or above ground) pipework that supplies thermal energy to two or more buildings.
Energy Centre	The building/structure/room within which core generating plant, pumping equipment, water treatment etc. for a heat network is located.
Energy from Waste (EFW)	The industrial process, permitted by the Environment Agency, for the incineration of waste. Thermal energy, in the form of steam, is used to drive a turbine to generate electricity. Other forms of EFW are possible such as anaerobic digestion but for the purposes of this consultation EFW refers to energy recovered from the incineration of waste.
Existing networks	A heat network that already has customers connected to a centralised thermal energy source (be that ambient, elevated temperature or cooling).
Generation	The conversion of one energy type to thermal energy.
Heat Recovery	<p>Where thermal energy is recovered from a process whose primary purpose is other than heat generation. For example, the biproduct of waste incineration is heat but its primary purpose is to manage waste. To the extent that a project is able to recover heat that otherwise would have been vented to air or transferred to water, this is referred to as heat recovery.</p> <p>Some heat recovery will be at no cost to the primary process; however, in some cases the act of heat recovery will have the effect of reducing the efficiency of the primary process. For example, diverting steam away from the steam turbine in an EFW facility will have the effect of reducing the electricity generated by the plant.</p>
Low-carbon	For the purpose of the GHNF, low-carbon is defined as the carbon intensity of heat delivered to end customers, accounting for emissions associated with wider system requirements (e.g. pumping), that is assessed to be lower than the emissions

	associated with an in-building heat pump with a SCOP of 2.50 – see <i>Gateway metric 1: Carbon Intensity</i> .
New Networks	A heat network that requires investment in both generation and distribution infrastructure.
Primary Combustion	The process of generating thermal energy through the combustion of a fuel such as biomass, hydrogen, fossil gas etc.
Refrigeration Cycle / Phase Change	<p>The refrigeration cycle is the basis of heat pump technology.</p> <p>A heat pump is designed to take heat from the air, ground, water or waste heat sources and then emit that heat into a building or process. Refrigerants with low boiling points are used: when the liquid refrigerant turns into a gas it undergoes a phase change which absorbs heat. To release the absorbed heat into the customers heating system, the refrigerant is turned back into a liquid by raising the pressure with a compressor, which is typically powered by electricity.</p> <p>The process can be reversed to provide cooling to the customer.</p>
Resistive heating	Resistive heating passes an electric current through a medium such as Nichrome that has a high resistance to electric current. Heat is generated as a result.
Shared ground loop	For the purposes of the GHNF, a shared ground loop is assessed to be an ambient heat network where the annual thermal energy delivered to end customers is less than 2GWh – see section <i>Gateway metric 3: minimum annual thermal demand</i> .
Solar heating	Radiation from the sun is used to heat water. There are two basic forms of solar heating used in heat networks: flat plate and evacuated tubes. Evacuated tube technology can often reach temperatures well in excess of 100°C.
Syngas	Combustible gases that are synthetically manufactured through gasification processes are referred to as Syngas.
Thermal energy	Thermal energy comes in many forms. In the context of heat networks this refers to the energy value attributed to hot water and/or cooling. In the UK this is most commonly expressed in kilowatt hours (kWh) but equally can be expressed in Joules which is the unit of energy in the International System of Units.
Thermal substation	A point on a heat network where hydraulic separation is made between a primary network and a secondary network via a plate heat exchanger.

This consultation is available from: www.gov.uk/government/consultations/green-heat-network-fund-proposals-for-the-scheme-design

If you need a version of this document in a more accessible format, please email enquiries@beis.gov.uk. Please tell us what format you need. It will help us if you say what assistive technology you use.