Reheat

HAYDON BRIDGE DISTRICT HEAT NETWORK FEASIBILITY STUDY

EXECUTIVE SUMMARY

JANUARY 2025

Certified B Corporation

Introduction

A feasibility study for a low carbon heat network has been carried out in the village of Haydon Bridge, Northumberland. This report explores and develops a range of low carbon heat network solutions and outlines the recommendations on how a low carbon heating system could be developed and how it would benefit the Haydon Bridge community.

This executive summary provides an overview of the key findings, recommendations, techno-economic analysis and next steps for establishing a heat network in Haydon Bridge. The report examines the potential of a heating network in the village and assesses low carbon heat sources, network options and a provides a counterfactual scenario of individual heat pumps.

Strategic Drivers

Haydon Bridge faces challenges with heat decarbonisation due to its rural, off-gas-grid location. Currently, residents and businesses rely primarily on heating oil, LPG, electric storage heaters, and solid fuels for their heating needs. The community, recognising the urgency of addressing climate change, is committed to transitioning to low carbon heating solutions.

The transition to low-carbon heating in rural areas like Haydon Bridge aligns with national and regional policies aimed at achieving net-zero emissions by 2050.

The feasibility study aimed to use Haydon Bridge as a model for other rural communities across the North East considering the potential for heat networks. Rural heat networks have distinct place-based requirements, and this report seeks to highlight both the opportunities and challenges associated with their implementation. By using Haydon Bridge as an exemplar, the study identifies practical strategies to overcome barriers and demonstrates scalable solutions for decarbonising heating in similar rural settings.

One of the project's key aims is to develop a replicable model for other rural communities. The insights gained from Haydon Bridge will inform strategies for scaling heat networks across areas with similar characteristics. Tailored solutions will ensure that the model remains adaptable to the unique needs of other rural communities.

Energy Demand Assessment

This assessment evaluates the energy demand across the boundary area comprising of 718 residential properties and 17 commercial properties, including schools, shops, community buildings, and churches. A heat density mapping exercise was conducted to identify the spatial distribution of heat demand, highlighting that the highest concentration lies north of the river and south of the railway.

Key energy loads, including the High School, were analysed for potential to serve as anchor loads for a proposed energy network. Residential properties, particularly space heating requirements, represent the predominant source of heat demand within the network.

The total annual heat demand across the network area is estimated at 15,670 MWh/year if all properties and business were to connect, with residential properties accounting for around 90% of the heat and hot water demand and the commercial properties the remaining 10%. The peak demand on the network taking into account diversity has been assessed at just under 7.4MW with all loads connected.

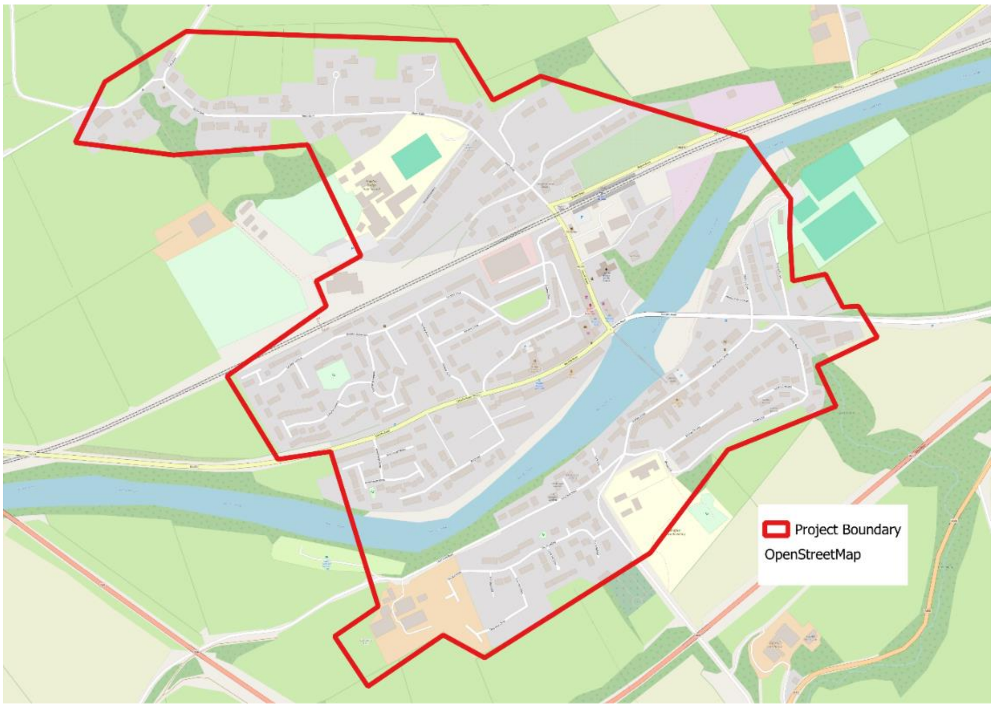


Figure 1 - Initial Project Boundary

A key aspect of the scheme is the selection of a suitable location for the Energy Centre. The site located on the land west of Innerhaugh was identified as the preferred option. Its position on the outskirts of the village offers proximity to areas of high heat demand and high housing density, including social housing. However, the site is subject to a flood risk, and discussions with the Environment Agency are ongoing to address this concern.

Central Plant

Low carbon sources were assessed for their potential to supply the heat network. The shortlisted technologies included centralised air source heat pumps, ground source heat pumps, and biomass. Other technologies, such as water source heat pumps from the South Tyne, mine water, and industrial waste heat, were considered but ruled out due to technical challenges or lack of suitable sources.

Heat Network Assessment

Two network scenarios were evaluated as part of the study:

1. **A non-phased approach**. This approach involves the simultaneous development of all four phases, creating a network that serves the majority of the village. This includes the main residential areas both north and south of the river, the high school, commercial users in the village centre, the primary school, and additional commercial users on the south side of the river.

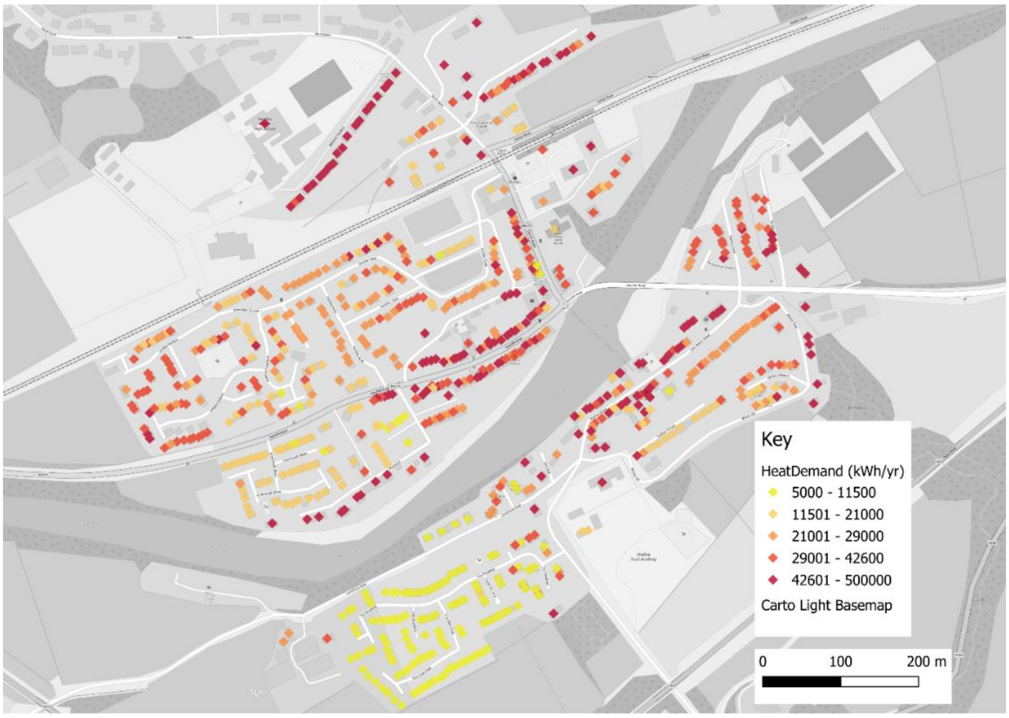
2. **A phased approach**. Initially implementing Phase 1 with the energy centre and primary distribution branches designed to accommodate future expansion of the scheme to encompass all four phases. However, the initial costs and energy demand calculations are focused exclusively on Phase 1 of the network.

The report recommends a phased development for the Haydon Bridge District Heating Scheme, structured across four distinct phases. This approach provides several advantages, including reduced initial capital investment, lower associated risks, flexibility for adaptation, gradual community engagement, incremental revenue generation, and enhanced stakeholder confidence. Additionally, it allows for easier integration with existing infrastructure. The network route and phasing strategy have been shaped by key physical constraints, such as the railway and river crossing along the B6319, as well as the distribution of heat demand across the village.

The report explores multiple scenarios for network connection rates. Connection rates of 60% and 40% were used to inform plant and thermal storage sizing, with a scenario of 100% connection rate considered for future system expansion. The total number of residential properties included in the network based on an initial 60% connection rate is 430 (224 in Phase 1 only), with this reducing to 286 for a 40% connection rate (156 in Phase 1 only).

Under both scenarios, the energy and network have been future proofed with both sized to allow for a 100% connection rate. The annual heat demand for the whole network with 60% and 40% connection rates is estimated at 9,882 MWh and 6,988 MWh respectively. The diversified peak loads are 4.9MW and 3.7MW.

There is a high degree of uncertainty and limited data relating to connection rates to district heating schemes in the UK, so it is recommended that these are revisited at the next stage of project development if data becomes available indicating alternatives that are more realistic for Haydon Bridge.



Economics

A techno-economic analysis included a financial assessment of each technology and network scenario with key parameters including:

- Diversified and non-diversified peak heat demands
- CAPEX costs
- OPEX costs

- Heat sales tariffs
- Carbon savings and emissions modelling
- Potential funding

The summary below presents the financial assessment of the 40-year outlook for the two network scenarios with 40% and 60% connection rates for the shortlisted low carbon technologies. Option A - Full Network 60% Connection Rate Biomass is the most economically viable scenario.

	Option A	**Option B**	**Option C**	**Option D**
	Full Network 60% Connection Rate Biomass	**Full Network 60% Connection Rate GSHP**	**Full Network 60% Connection Rate ASHP**	**Full Network 60% Connection Rate Combination**
Financial Outputs 40 Years				
NPV (£)	278,903	(4,245,406)	(3,821,163)	(2,833,385)
IRR (%)	3.73%	0.73%	-0.61%	1.03%
Payback (Years)	21.02	32.38	44.86	30.37
Carbon Savings 40 Years				
kg CO2e/kWh	64,659,346	49,882,726	46,250,021	72,738,496
	Option E	**Option F**	**Option G**	**Option H**
	Phase 1 Network 60% Connection Rate Biomass	**Phase 1 Network 60% Connection Rate GSHP**	**Phase 1 Network 60% Connection Rate ASHP**	**Phase 1 Network 60% Connection Rate Combination**
Financial Outputs 40 Years				
NPV (£)	106,818	(7,049,592)	(1,972,332)	(2,443,759)
IRR (%)	3.66%	-3.05%	(0)	(0)
Payback (Years)	21.23	70.18	48.87	51.57
Carbon Savings 40 Years				
Kg CO2e/kWh	31,879,189	23,482,830	21,756,611	22,683,262

	Option I	**Option J**	**Option K**	**Option L**
	Full Network 40% Connection Rate Biomass	**Full Network 40% Connection Rate GSHP**	**Full Network 40% Connection Rate ASHP**	**Full Network 40% Connection Rate Combination**
Financial Outputs 40 Years				
NPV (£)	(783,045)	(3,989,133)	(3,695,891)	(2,827,561)
IRR (%)	2.75%	0.28%	-1.50%	0.44%
Payback (Years)	23.92	36.45	53.71	34.96
Carbon Savings 40 Years				
kg CO2e/kWh	45,686,963	34,673,442	32,009,426	51,434,544
	Option M	**Option N**	**Option O**	**Option P**
	Phase 1 Network 40% Connection Rate Biomass	**Phase 1 Network 40% Connection Rate GSHP**	**Phase 1 Network 40% Connection Rate ASHP**	**Phase 1 Network 40% Connection Rate Combination**
Financial Outputs 40 Years				
NPV (£)	(710,903)	(5,524,715)	(1,833,794)	(2,154,370)
IRR (%)	2.25%	-3.05%	(0)	(0)

Payback (Years)	25.59	-	52.21	56.25
Carbon Savings 40 Years				
kgCO2e/kWh)	22,474,387	16,310,974	15,043,829	15,724,045

Conclusions and recommendations

The main conclusions from the feasibility study are:

- The implementation of a heat network in Haydon Bridge presents a technically feasible solution that could lead to substantial reductions in carbon emissions.
- A heat network could offer a competitive cost compared to energy sources currently used within the village including oil, LPG, and electric heating.
- The heat sale tariff (p/kWh) is the primary source of income for the network. A balance between maximum economic return and offering a competitive price for potential customers must be found to ensure the network is an attractive option for customers.
- A biomass system is likely the most effective option for generating heat, bringing with it wider socio-economic benefits.
- While the initial investment for a heat network is higher than continuing with current energy practices, access to funding sources such as the Green Heat Network Fund or Borderlands would significantly improve the financial feasibility of the project.

The next steps for the project would be to:

- Actively pursue significant funding from public sources, such as the North East Carbon Marketplace and the Energy Investment Programme, to support the project's timeline and scale, ensuring alignment with community decarbonisation goals and County Council carbon neutrality targets.
- Refine the project design through value engineering to optimize CAPEX and OPEX, while exploring additional revenue opportunities and securing funding sources to improve the project's financial viability.
- Collaborate with local, regional, and national public bodies, social housing providers, and other stakeholders to address the unique needs of rural communities, advocating for tailored funding and development solutions for rural heat networks.
- Organise a workshop with key stakeholders, including Northumberland County Council and the North East Combined Authority, to explore and develop new approaches to rural heat decarbonisation, using Haydon Bridge as a model for innovation.
- Submit an expression of interest for maximum funding (e.g., 80% of total project cost), positioning the project as an exemplar initiative that will drive regional supply chains and demonstrate community-scale heat decarbonisation in rural areas.