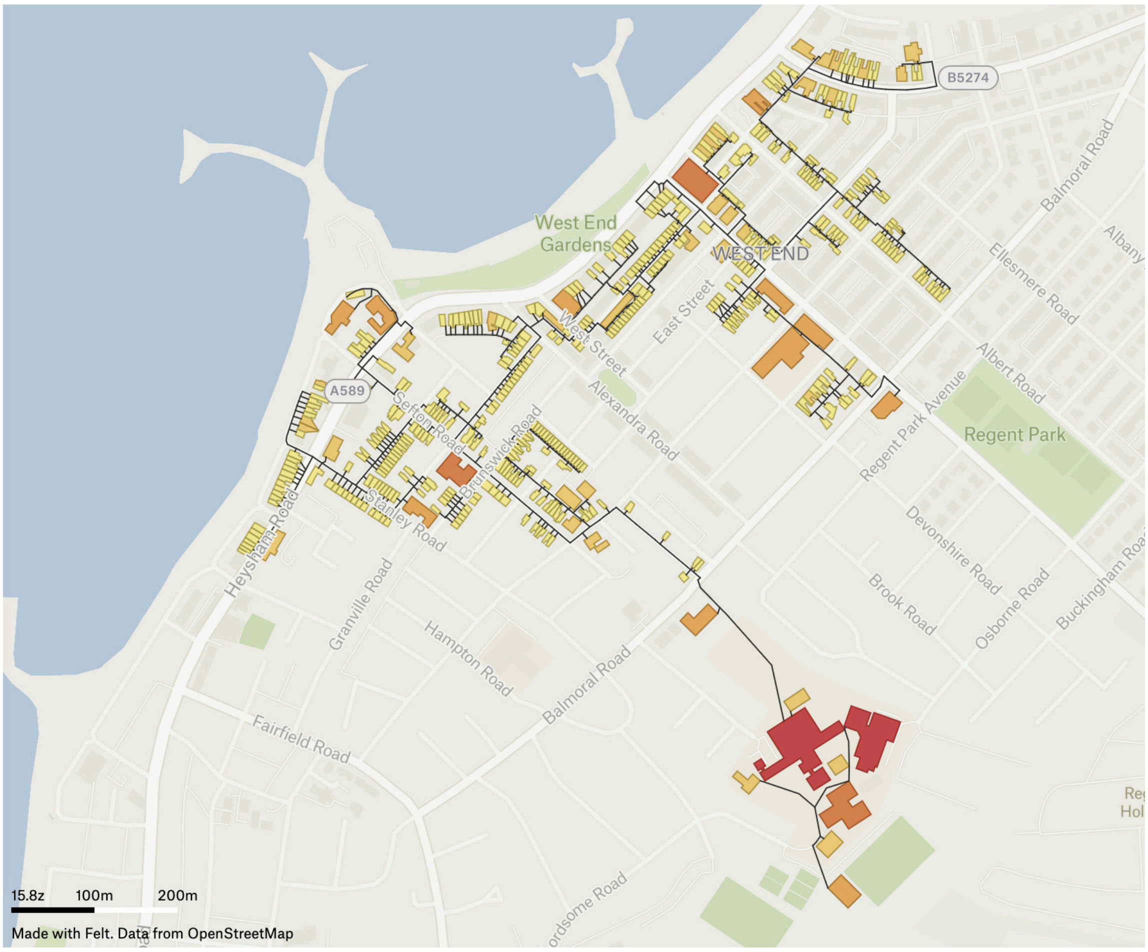
Community Heat Development Unit

Morecambe Heat Network Case Study



A Report on behalf of

Morecambe Bay Community Renewables Limited

Funded by the Energy Redress Scheme

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Contents

Power and Energy Units

Term	Description
kW	Unit of power.
kWh	Unit of energy. For example a 3kW kettle running continuously for 1 hour consumes 3kWh of electrical energy.
MWh	1,000 kWh
GWh	1,000,000 kWh

1. Executive Summary

1.1. Introduction

The Community Heat Development Unit (CHDU) is an ambitious research and innovation project led by Sharenergy and funded by the Energy Redress Scheme that aims to jumpstart a wave of community owned low carbon heat networks in the UK. The focus of the CHDU[1] project is on centralised district heat networks inspired by the Bishop's Castle Heat and Wind project led by Lightfoot Enterprises[2] and Shropshire and Telford Community Energy[3].

Following a process of techno-economic modelling and a nationwide site search to identify locations which are best suited to district heating, the West End area of Morecambe was identified as a location to investigate further. This area is of particular interest since much of the housing stock are large, solid walled Victorian terraced houses, ranging between 2 and 4 storeys, with minimal outdoor space. The hard to insulate nature of these properties and lack of space to install individual air source heat pumps (ASHPs) means that connecting to a centralised heat network may be a more viable option for heating decarbonisation. There are also a range of potential non-domestic anchor loads in the area including multiple schools and a swimming pool.

This case study reports on the potential for a community owned heat network in Morecambe, focusing on a model where most of the heat is supplied by large ASHPs with much of their electric demand met by a nearby wind turbine. A CHDU project summary report and case studies at Bishop's Castle, Forres and Letchworth are published on the CHDU project website: https://communityheat.org.uk.

1.2. Proposed Low Carbon Heat Network

The proposed low carbon heat network aims to provide around 80% of the annual heat demand of connected buildings using a large 2.25MWh^{th} ASHP with 20% of the heat being supplied by centralised gas back-up boilers. The heat sources would be installed alongside a 600m^3 hot water tank to store heat when it can be produced cheaply for use later.

[1] https://communityheat.org.uk
[2] https://lightfootenterprises.org/heat-network/
[3] https://stcenergy.org.uk

It is necessary to reduce the cost of electricity consumed by the ASHP as much as possible to ensure financial viability of the network. Wind generation correlates well with heat demand as it tends to be windier during the colder months when heat demand is higher. The proposed scheme includes the development of a 4.26MW onshore wind turbine to supply around 90% of the electricity consumed by the ASHP. This wind turbine would supply electricity to the ASHP and potentially generate additional income via sales of excess electricity to the Bay Leadership Academy and export to the electricity network. The wind turbine could potentially be located towards the south east of the network site, a region which already has a number of multi-megawatt wind turbines in operation. The wind turbine would be owned and operated as part of the heat network scheme. Allowances have been made for the costs associated with connecting the wind turbine to the grid however a grid connection application needs to be submitted to Electricity North West to fully understand the costs and timescales involved.

Customers joining the scheme during the initial phase of construction would be offered a connection with no upfront costs. The scheme would charge customers for their heat usage in a similar manner to how gas and electricity is supplied. Customers would be charged an annual standing charge, roughly equivalent to the annualised costs of maintaining and replacing an individual gas boiler, and a unit price for heat consumed which would be metered on a per property basis. The overall price of heat would be comparable to the cost of heating a home using a boiler running on mains gas.

The main benefits to customers joining the scheme are insulation against the spikes in the global gas markets experienced in recent years and an investment free opportunity to decarbonise their heating. Centralised district heat networks also offer a low-hassle means of decarbonising domestic heating since they require little interference to the heating system within a home: all that is required is for the existing gas boiler to be switched for a heat interface unit and connected to the pipework main in the street. The scheme takes care of the maintenance of the network and heat interface units. There is an additional benefit that, by removing their gas heating system, customers can disconnect from the gas network and hence save on paying the daily gas standing charge, provided they have no other appliances which require gas.

1.3. Financial Performance

The scheme revenues are generated from heat sales and standing charges paid by heat network customers, the sale of wind generated electricity to the Bay Leadership Academy and the export of excess wind generation, not consumed by the heat network heat pumps or academy, to the electricity network. Assuming 555 domestic customers and 59 non-domestic customers, located in Morecambe's West End and Sandylands areas, join the scheme the initial payback period is estimated to be 24 years, with a 25 year project IRR of 6.6% on a capital investment of £23.7m. The projected 25 year project balance is ca. £2.1m and the 50 year project balance is estimated as being ca. £39.4m following replacement of the wind turbine and heat generating after the first 25 years of operation. The overall project lifetime is modelled as 50 years, which aligns with the expected lifetime of the heat network pipework.

These figures assume that a capital grant of 21% of the total heat network and wind turbine capital costs can be awarded by Green Heat Network Fund, based on a rate of 4.5p/kWh of heat delivered over the first 15 years. This is equivalent to 35% of the capital costs of the heat network components (excluding the wind turbine). It is currently unlikely that the scheme could receive this level of grant funding since the competitive application process favours schemes focussed on non-domestic properties which have had alternative pots of grant funding available to fund large connection fees e.g. the Public Sector Decarbonisation Scheme[4]. This is despite the proposed scheme achieving carbon emissions which are 60% less than the GHNF threshold, pushing up to 7.3 GWh of gas generated electricity off the grid due to exported wind generation and delivering significant social value through community ownership.

The proposed heat network scheme's main financial challenge is matching or reducing the annual energy cost of customers compared to mains gas heating systems. Currently gas prices are low (7.4p/kWh[5]) compared to electricity, at these prices the scheme is only just financially viable assuming heat is sold by the network at an equivalent price.

The viability of the scheme is dependent on achieving an average cost for connecting each property to the network of around £6,500, excluding the cost

[4] https://www.gov.uk/government/collections/public-sector-decarbonisation-scheme
[5] Assuming an oil boiler efficiency of 84%.

of installing pipework from the network main to the property. Estimates by Buro Happold[6] suggest that the cost of connecting a domestic house could be ~£9,000 in 2025 prices. Scheme finances could be improved by charging the public sector and larger non-domestic anchor loads a connection fee but set at a price which is less than the cost of these buildings decarbonising their heating on an individual basis. An extension of the UK Government's Boiler Upgrade Scheme[7] to fund heat network connections would greatly benefit the finances of the proposed heat network in Morecambe to the extent that only 18% of the total capital costs would need to be funded by the GHNF scheme (equivalent to a competitive GHNF rate of 2.5p/kWh). Some low income households may also be able to have their connections funded by the Warm Homes: Local Grant[8] if plans to extend the fund to include heat network connections are implemented.

Approximately 33% of the Scheme's income is from the sale of grid electricity. There is a risk that the export of excess wind generation will be limited due to constraints on the upstream transmission network; a G99 grid connection application will need to be submitted to SSEN before the extent of this is understood.

1.4. Governance

If the scheme progresses a new Community Benefit Society (CBS) would need to be set up to own the wind turbine and manage the Scheme. A CBS would enable a share offer to be launched ensuring community ownership of the Scheme, including the wind turbine. It is anticipated that this CBS would contract out much of the development, operation and maintenance activities to skilled contractors, while ensuring local ownership and governance.

If a local CBS were to develop a heat network in Morecambe, they will need a high degree of support. We envisage a federated system where multiple individual societies are supported by a specialised centralised development, advice and administration service with the addition of well supported peer to peer learning between the societies. Unfortunately, we do not think the time is right for setting up this centralised service at this point as options for viable heat

[6] https://www.usdn.org/uploads/cms/documents/161214_-_connecting_existing_buildings_to_dhns_-_technical_report_00.pdf
[7] https://www.gov.uk/apply-boiler-upgrade-scheme
[8] https://www.gov.uk/apply-warm-homes-local-grant

networks are so limited. However, the ideas for such a service developed as part of this project should be further developed for the future.

1.5. Supply of Local Electricity

The CBS could also act as a license exempt Class A Small Supplier[9] to benefit from the recent BSC P442 Modification[10] which can enable some cost savings (expected to be up to 5p/kWh) when wind generation exported to the grid is matched to consumption on a half hourly basis. Benefit is limited to Class A Small Suppliers who supply up to a maximum of 5MW of electricity (or 2.5MW if supplied to domestic customers).

Additionally, if the P441[11] modification to the local energy trading rules is approved, the CBS, acting as a Small Supplier, could also potentially supply a significant proportion of Morecambe's West End with low-cost electricity alongside the heat network. This is because most of Morecambe's West End is supplied by the same primary substation and is expected to be considered "local" to the proposed wind turbine following implementation of P441. This would strengthen the scheme's revenue stream and, by reducing the cost of purchasing locally generated electricity, potentially enable customers who are not located on the heat network route to decarbonise their heating using individual heat pumps.

1.6. Conclusions and Next Steps

A centralised heat network is proposed which aims to deliver an affordable solution to decarbonising the heating of both domestic and non-domestic properties. The scheme would supply heat through a centralised energy centre connected to a local distribution network, and either sell surplus electricity to the Bay Leadership Academy or export it to the national grid. This provides a dual revenue scheme: stable income from long-term heat supply agreements and additional income from sales of wind generated electricity which is not consumed by the network heat pumps. The proposed Morecambe heat network

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[9] UK Government, (2001). The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001

[10] Ofgem, (2024). https://www.ofgem.gov.uk/decision/approval-bsc-modification-p442

[11] Ofgem, (2024). https://www.ofgem.gov.uk/decision/dcp441-proposal-increase-number-allowed-change-report-alternative-variations-two-three-authority-decision

is projected to reduce carbon emissions from heating for those joining the scheme by 77%.

The scheme offers customers a low-carbon alternative to fossil-fuel heating without requiring them to fund the upfront cost of installing individual heat pumps as domestic customers will be able to join the initial phase of the scheme at no upfront cost. Ongoing heat tariffs are structured to match the cost of heating properties with gas central heating and provide customers with cost certainty and protection against future volatility in global energy markets. Long-term operation and maintenance of the network, including lifecycle replacement of plant, are factored into the scheme's business model, ensuring reliable heat delivery across its 50-year life.

The success of the scheme depends on achieving sufficient customer density within the network area at the point of construction. Heat network economics typically favour early connection of as many properties as possible, as retrofitting connections at a later stage is more costly. This creates a strong incentive for local stakeholders to coordinate demand aggregation in the early phases of deployment. The scheme also relies on a suitable regulatory environment and access to power purchase agreements to maximise the value of exported wind generated electricity.

The main priorities should be:

- Establishing local support.
- Engaging with the leadership at Morecambe Bay Academy.
- Developing a better understanding of the costs of connecting the building archetypes in Morecambe to the network using local tradespeople.
- Progressing the development of the community owned wind turbine.

It is essential that local community support is demonstrated for a community owned heat network scheme to progress. It is anticipated that attendance of scheme advocates at local events will be essential in establishing local support. Local advocates for such a scheme should get in touch via chdu@sharenergy.coop to register their interest and continue discussions about how the scheme could be progressed.

Should local support be demonstrated, a more detailed feasibility study is recommended to develop the heat network proposal to the stage where an application to the Green Heat Network Fund can be submitted alongside a planning application for the community owned wind turbine.

2. Community Heat Development Unit Project

2.1. Overview

The Community Heat Development Unit (CHDU) is an ambitious research and innovation project led by Sharenergy and funded by the Energy Redress Scheme that aims to jumpstart a wave of community owned heat networks in the UK.

The experience of community heat network projects in the UK is that many are suggested, but few are successful. The CHDU project brings a data-led approach to identifying where the best chances for successful community heat networks are – drawing on work that has already been done but adding the crucial element of community ownership that is Sharenergy's specialism.

The focus of the CHDU project has been on identifying possible locations where a domestic focussed low-carbon heat network could operate and developing a business model that can operate in these 'sweet spots', as well as considering a Community Heat Delivery Unit to support the development of locally-owned networks. More information about the CHDU project is available online at https://communityheat.org.uk.

2.2. Site Identification

A site search across mainland GB has been conducted to identify the most feasible locations where a centralised heat network incorporating large air source heat pumps and on-site renewable electricity generation could be developed. Specifically, these are areas the CHDU techno economic model has identified as being able to generate enough income through sales of heat and electricity to pay off the loans required to finance the projects.

The sites identified during this process were correlated with locations of existing community energy organisations who were interested in collaborating on a heat network project.

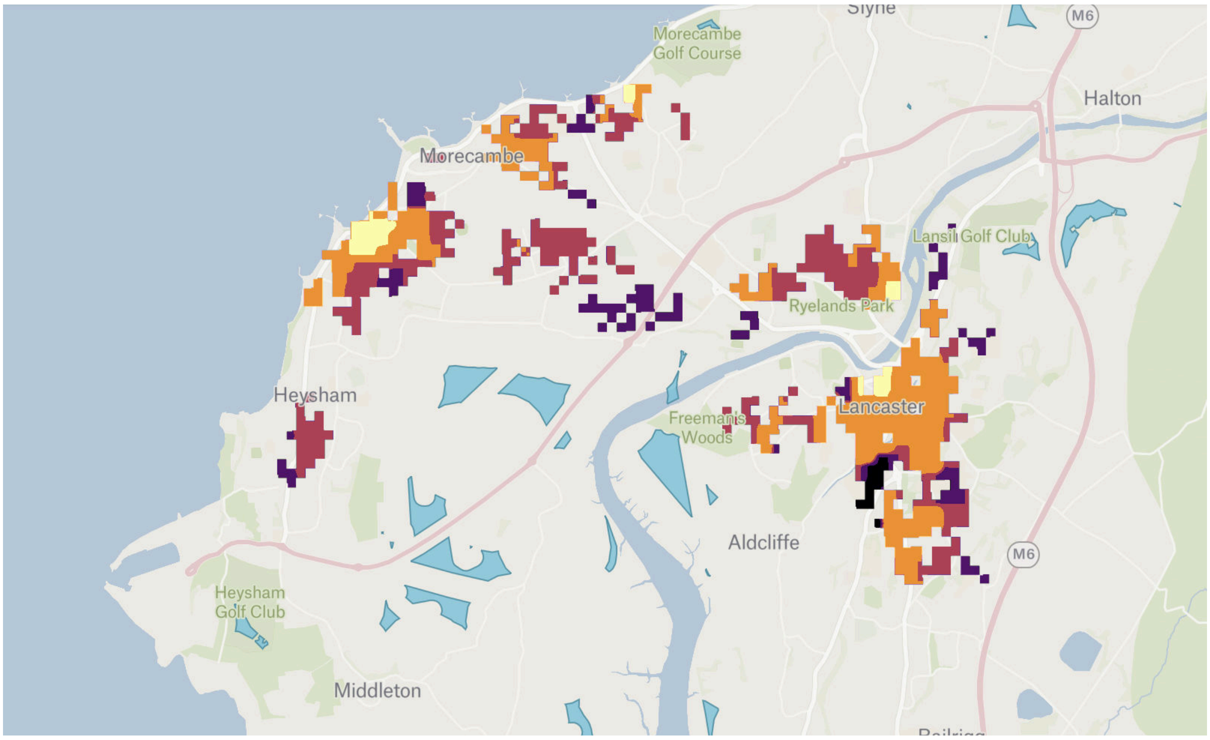

Figure 1: Potential network locations (yellow-purple) and wind sites (blue)

A site centered around the Bay Leadership Academy was selected due to the possibility of linking non-domestic anchor loads with high density, solid wall terraces in Morecambe's West End and the potential for wind generation. While other potential sites in the area could offer better payback periods, these sites tended to have worse wind prospects or include non-domestic buildings only, which goes against the principals of the CHDU project which is aiming to support communities to decarbonise their homes.

3. Network Focus Area

This case study investigates the heat network potential of the West End region of Morecambe. The area under investigation is fairly well defined by the Middle Layer Super Output Area (MSOA) named "Morecambe West End", which is highlighted in the figure below.

Figure 2: Morecambe West End MSOA is well aligned with the heat network focus area

3.1. Morecambe's residents

Morecambe is a seaside town close to the city of Lancaster in North West England. Following the decline of tourism in the town in the later part of the last century, Morecambe has a population of around 35,000 with the average age being higher than that of both nearby Lancaster and the national average. Some areas in Morecambe, particularly Morecambe West End MSOA, along the seafront and to the west of the town, are among the 10%[12] most deprived in the UK; in Morecambe West End, 33%[13] of children are living in poverty compared to 20% across the UK[14].

Compared to the rest of England, Morecambe has a lower proportion of ethnic minority groups, and a higher average of people classified as disabled. It has a

[12] Morecambe Town Council, (2020). Morecambe baseline assessment draft report
[13] WEM Big Local study, (2024). https://www.nhsconfed.org/case-studies/west-end-morecambe-big-local
[14] Joseph Rowntree Foundation, UK Poverty 2023, https://www.jrf.org.uk/uk-poverty-2023-the-essential-guide-to-understanding-poverty-in-the-uk

unique social and housing profile with a higher proportion of social renters, low-income households, and homes lacking modern heating systems. Engaging with this community is essential to ensure that any energy transition is inclusive and responsive to local needs.

3.2. Housing Profile & Suitability

An understanding of local housing types is essential in assessing the suitability and design of a heat network. The table below compares the distribution of housing types in Morecambe West End and the national average for England & Wales.

Housing Type	**Morecambe West End MSOA**	**England & Wales**[15]
Detached house	3.6%	23.2%
Semi-detached house	11.4%	31.5%
Terraced house	33.8%	23.2%
Purpose-built block of flats	26.8%	16.7%
Flats in converted or commercial buildings	24.1%	5%
A caravan or temporary structure	0.2%	0.4%

Table 1: Housing Types in Morecambe West End vs. England & Wales

The housing density per hectare within the Morecambe West End area is illustrated below, with the MSOA highlighted.

[15] 2021 Census, Office for National Statistics, https://www.ons.gov.uk/census

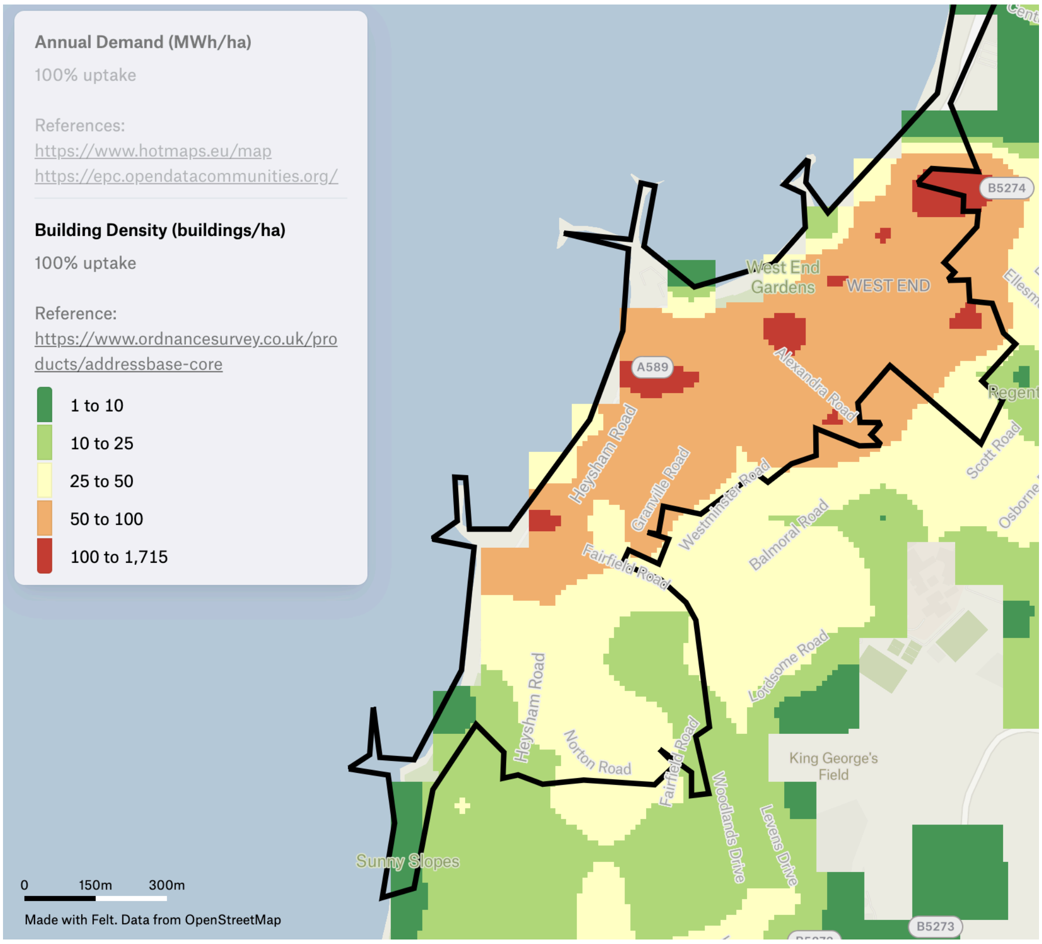

Figure 3: Building density within Morecambe West End MSOA

3.2.1. Key observations

Lower proportion of detached housing

Detached homes account for just 3.6% of the housing stock in Morecambe West End, significantly below the national average (23.2%). This suggests fewer high-footprint properties, and more limited scope for technologies that require external space, such as individual ground or air-source heat pumps.

Low prevalence of semi-detached homes

Semi-detached properties represent 11.4% of all homes in Morecambe, notably lower than the national average (31.5%). These homes often lend themselves well to energy retrofit measures and are likely to be suitable for individual ASHP installation. It is still technically feasible to connect these homes to a centralised network however their lower density may mean they require more network pipework to connect compared to higher density terraced housing.

Higher share of terraced homes

This area is characterised by large Victorian, terraced houses adjacent to the sea front making up 33.8% of the housing stock, significantly higher than the national figure (23.2%). Built as single homes, many of these buildings have been subdivided into flats. The buildings are 2, 3 or 4 storeys, and are of solid brick wall construction under slate roofs. There are also many upper rooms with sloping ceilings and room-in-roof (RiR) rooms. These factors limit the scope for fabric-first improvements without the options to install cavity or external wall insulation.

The area is built to a high density with very small rear yards and back lanes making installation of individual ASHPs challenging, although ground source heat pumps may be more feasible. This density is to the benefit of a heat network, requiring less network pipework per property.

Figure 4: Four storey terraces in Morecambe West End

Figure 5: Example of rear of terraces in Morecambe West End

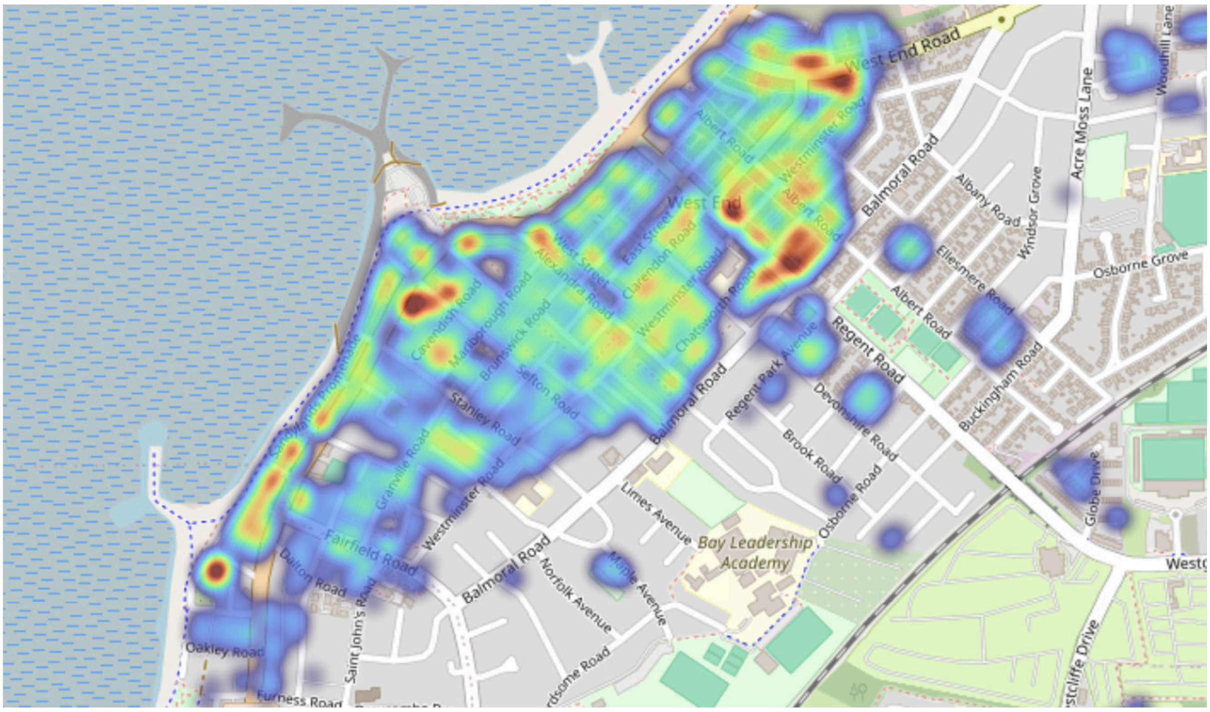

Figure 6: Density of terraced housing in Morecambe West End based on EPCs (red=more dense)

High number of flats

Morecambe West End shows a notably higher proportion of flats and apartments in converted buildings (24.1%) than the national average (5%), these are typically older terraced houses subdivided into multiple dwellings, often with poor energy performance and complex ownership or tenancy structures. This housing type may be harder to upgrade on an individual basis and could benefit from building-wide or communal heating solutions.

Purpose built flats or apartments make up around 26.8% of Morecambe West End's housing stock, compared with 16.7% in England & Wales. Overall, flats of all types make up 50.9% of housing in Morecambe West End, well above the national average of 21.7%. This highlights the potential relevance of shared or communal heating systems over individual solutions in this area.

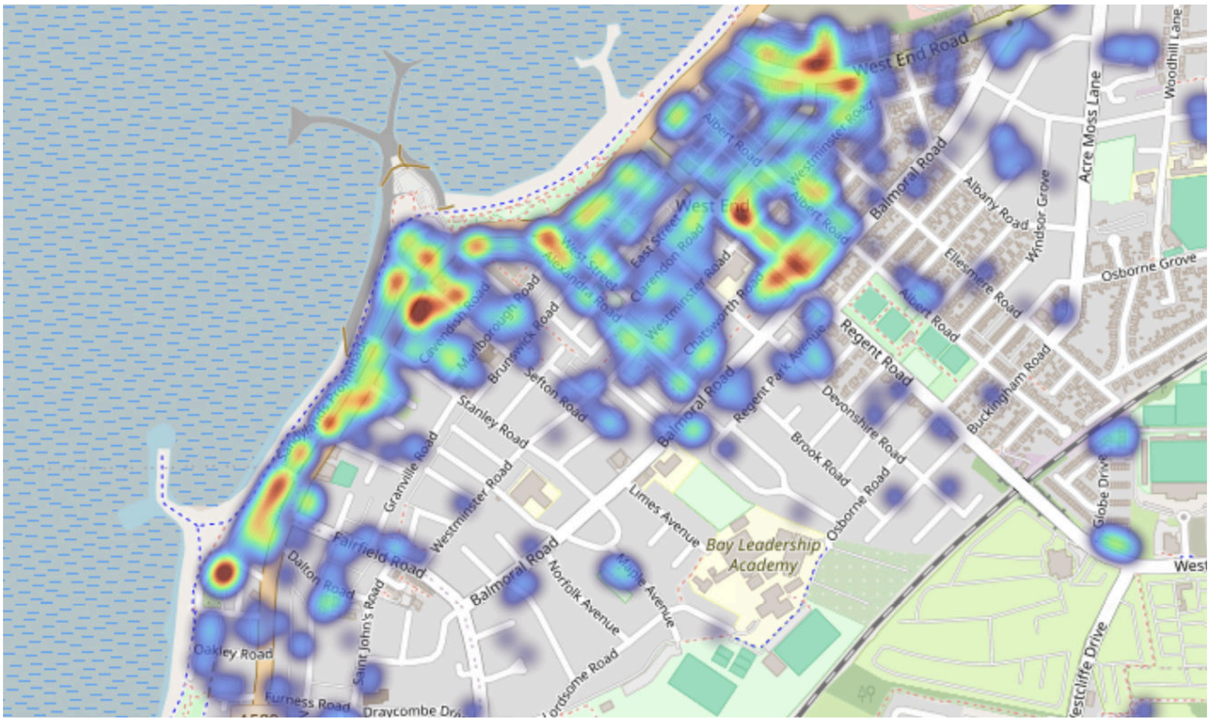

Figure 7: Density of flats in Morecambe West End based on EPCs (red=more dense)

3.3. House Tenure and Vulnerability

Table 2 presents the proportion of tenure type of buildings across the Morecambe West End focus area.

Tenure Type	Morecambe West End	England & Wales[16]
Owned	42.4%	61.6%
Shared ownership	1.6%	1%
Social rented	7.4%	17.1%
Private rented	48.6%	20.3%

Table 2: Comparison of tenure type in Morecambe West End and England & Wales

High Proportion of Rented Homes

According to the 2021 Census, 56% of homes in Morecambe West End are rented, significantly higher than the national average of 37.4% for England and Wales. Within this figure:

- 48.6% are privately rented (nationally: 20.3%)
- 7.4% are socially rented (nationally: 17.1%)

A private rental sector of this size, together with the prevalence of terraced homes and flats in converted buildings, typically reflects older housing stock, e.g. Victorian or Edwardian terraced houses, which may have poor internal layouts (due to subdivision), outdated amenities and mixed external conditions.

A low proportion of social housing (7.4% in Morecambe West End compared with 16.7% nationally) means that many residents who would qualify for social housing are pushed into the often more expensive and lower quality private rental sector. Social landlords are often key early adopters and the low proportion in Morecambe West End may mean there is less leverage from housing associations or councils as anchor clients for a heat network.

Low Proportion of Owned Homes

A lower proportion of homes in Morecambe West End are owned (42.4%) in comparison with England and Wales (61.6%), suggesting that there are fewer financially secure households with the power to opt in to a heat network or fund their own heat pump installations.

[16] 2021 Census data, Office for National Statistics, https://www.ons.gov.uk/census

3.4. Estimate of Heat Demand

An estimate of the density of annual heat demand across the heat network focus area is presented in Figure 8. The demand density is derived using datasets from the Hotmaps[17] project and Display Energy Certificates[18] using a process described in detail on the CHDU project website[19].

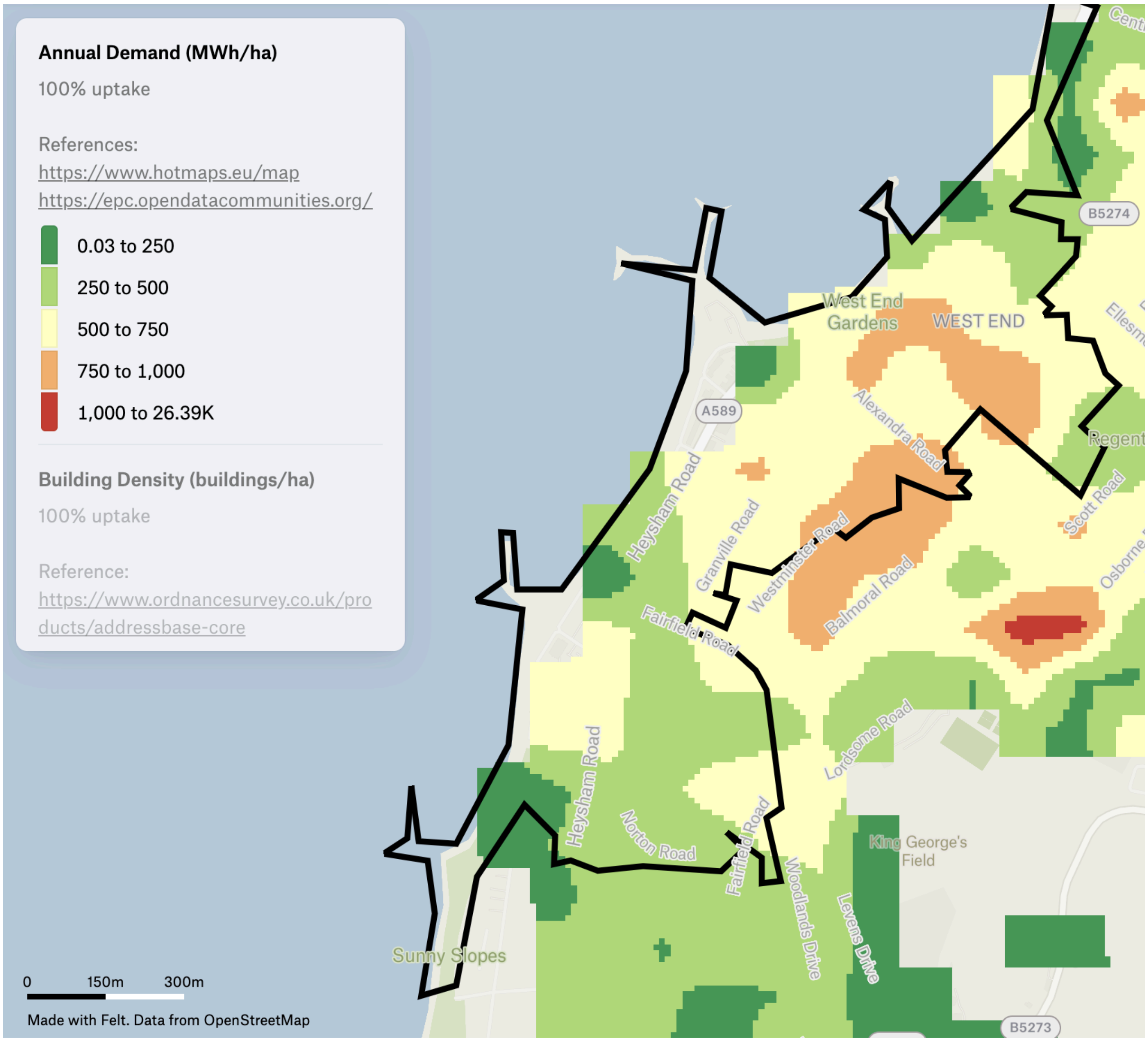

Figure 8: Heat demand density in Morecambe West End

The heat demand density suggests the heat network should be centred about the West End/Balmoral/Westminster road area with the Bay Leadership Academy and adjacent swimming pools acting as anchor loads, as identified in red to the east side of the map.

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[17] https://www.hotmaps-project.eu
[18] https://epc.opendatacommunities.org
[19] https://communityheat.org.uk/interactive-map/thermal-demand-mapping/

4. Community and Stakeholder Engagement

A public event in Morecambe was organised where the CHDU project and proposed heat network was discussed in addition to Morecambe Bay Community Renewables (MORE Renewables) presenting their community energy projects. The event was poorly attended with only 3 attendees from the local area, including representation from MORE Renewables, Green Rose CIC[20] and the County Councillor for Morecambe Central, Mr Gary Kniveton. This is despite approximately 400 leaflets being delivered to residents in the local area and a press release shared by local organisations. The attendees were generally supportive of the proposed scheme however there is clearly significant work to be done to share the heat network concept with local residents, and establish local support.

Numerous attempts have been made to contact the leadership team at Bay Leadership Academy, Make a Splash and the Climate Change team at Lancaster City Council without any success. The importance of involving the Bay Leadership Academy in the proposed heat network is discussed later in this document.

5. Community Benefits

The proposed community heat network in Morecambe offers a wide range of social, economic, and environmental benefits. These are particularly significant for areas experiencing higher rates of fuel poverty, limited heating infrastructure, and economic challenges.

5.1. Affordable, Stable Heating Costs

The network aims to deliver heat at a price comparable to traditional gas heating, which will be significantly cheaper for households currently reliant on electric heating:

- Local census data reveals a higher-than-average density of electric storage heaters in the area, particularly in the Morecambe West End. These homes stand to benefit the most from joining a district heat network.

[20] https://greenrose.org.uk

- Locally generated renewable electricity used within the network will help shield residents from spikes in national energy prices, offering long-term price stability.

The table below shows the percentage of households with different heating systems in the proposed location:

Type of central heating in household	Morecambe West End	England & Wales
No central heating	3.8%	1.5%
Mains gas only	73.6%	73.8%
Tank or bottled gas only	0.4%	1.0%
Electric only	12.5%	8.5%
Oil only	0.2%	3.5%
Wood only	0.1%	0.1%
Solid fuel only	0.1%	0.2%
Renewable energy only	0.0%	0.4%
District or communal heat networks only	0.2%	0.9%
Other central heating only	0.9%	0.9%
Two or more types of central heating (not including renewable energy)	8.0%	8.5%
Two or more types of central heating (including renewable energy)	0.2%	0.5%

Table 3: 2021 Census statistics on existing heating systems in the focus area

The majority of properties have gas central heating (73.6%) which are likely compatible with connecting to a low carbon heat network, requiring minimal intervention. The area also shows a higher reliance on electric systems (over 20% in some areas of Morecambe West End vs 8.5% nationally). This makes the area a prime candidate for alternative, more efficient heating systems, although the cost of connecting buildings without existing wet heating systems to a heat network is higher.

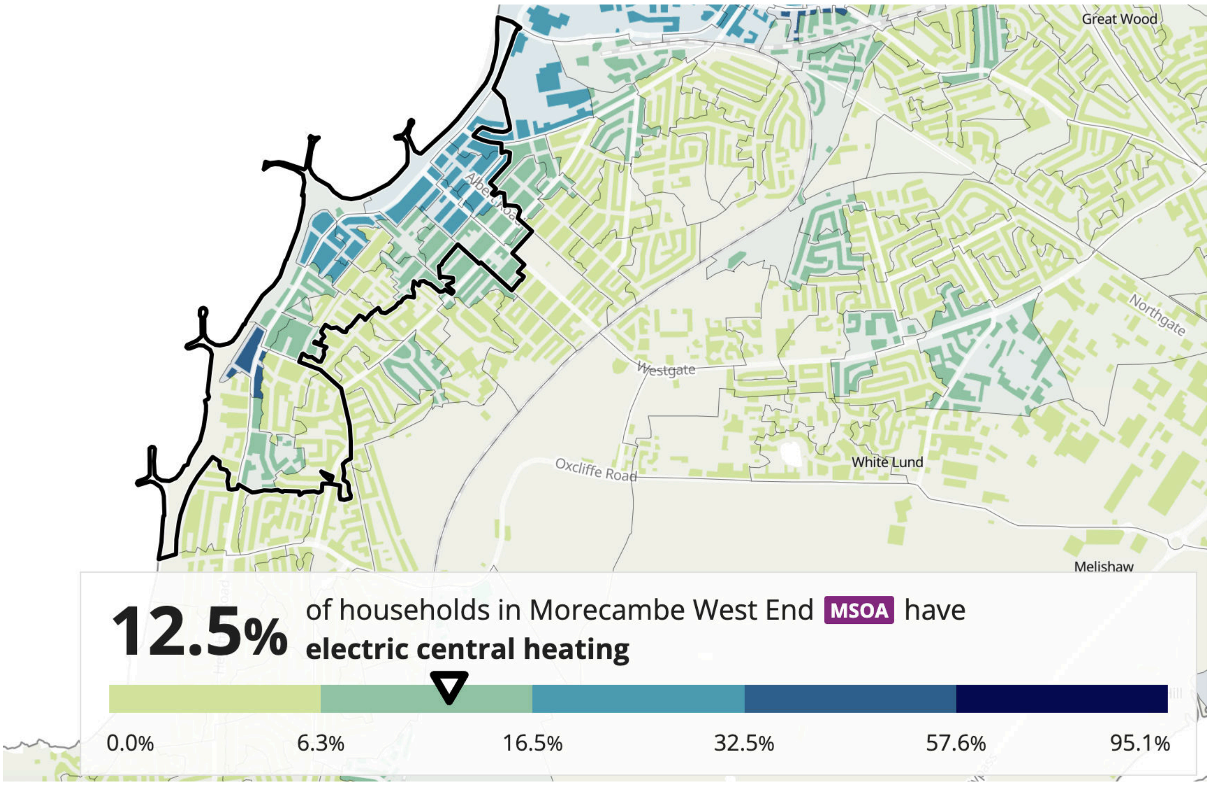

Figure 9: Density of buildings on electric storage or room heaters

There is a strong correlation between houses on electric storage or room heaters and houses which are privately rented. Joining the proposed heat network benefits landlords of electrically heated properties two fold since it will improve the EPC ratings of the buildings whilst providing some of the funding to install the heat interface unit and network connection up front.

5.2. Tackling Fuel Poverty

Fuel poverty is a significant local issue, with rates in Morecambe West End at 13%[21], slightly higher than the national average of 11%[22]. Properties with gas or electric heating are exposed to fluctuations and price spikes in the global energy markets, such as those experienced in 2022 when Russia invaded Ukraine. A community led centralised heat network which uses local wind generation to supply much of the electricity to the heat pumps, insulates customers from price shocks and offers them improved cost certainty.

Well designed wet heating systems should improve the comfort of residents compared to electric storage heaters and reduce their daily heating costs. The

[21] http://www.domesticenergymap.uk/ 2023 data
[22] https://www.gov.uk/government/statistics/fuel-poverty-detailed-tables-2025-2024-data 2024 data

heat network connection offer of supplying each customer with a heat interface unit and connecting their property to the heat main reduces the upfront cost of a landlord or owner-occupier looking to upgrade their heating system.

5.3. Reliable, Low Carbon Heat

Community heat networks can offer greater reliability than aging individual heating systems. The use of renewables and low-carbon infrastructure contributes to lower greenhouse gas emissions and supports the broader goal of balancing carbon production and reduction. Air quality in Morecambe is generally considered good, but a reduction in gas boiler usage may offer additional local benefits.

5.4. Social and Economic Impact

Local job creation may be supported through construction, operations, and maintenance. With high unemployment rates in parts of Morecambe, community infrastructure projects can provide training and employment pathways. Community ownership and participation in the project fosters local pride, collaboration, and cohesion, helping to strengthen neighbourhood resilience.

While the project contributes to national climate goals, its primary aim is local: to provide affordable, clean, and dependable heating for the residents of Morecambe.

6. The Heat Demands and Opportunity

6.1. Why Install a Heat Network?

'Heat Network' is the term now used for 'district heating' (DH) or 'community heating'. Heat Networks are the interconnection of heat loads such that they can be served from centralised heat sources.

Heat Networks currently provide 2% of UK heat demand and the Committee on Climate Change estimated in 2015 that with Government support, they could provide 18% of heat demand by 2050 in a least-cost pathway to meeting carbon targets.

Heat Network advantages include:

- The load diversification across a Heat Network and the use of thermal storage means the capacity of the central Energy Centre is smaller than the sum of the capacities of plant installed for heating each building.
- Flexibility to change the heat source, and scope to locate plant at an optimum location e.g. a heat pump that takes heat from a river can be located near to that river; a Heat Network initially heated by biomass can be switched to heat pumps at a later date.
- Enables removal of individual boilers in each building which may then enable removal of the gas supply.
- Heat network connection equipment in each building requires very little maintenance and no legally required gas safety check, as is required for gas boilers.
- Allows for simpler inclusion of thermal storage. Thermal storage is a tried and tested, low risk technology, and can be up to 100 times cheaper per unit of energy stored than batteries.

Larger/centralised plants offer a number of advantages:

- Can be cheaper to build and operate than boilers/heat pumps in each building.
- The higher operating efficiencies of centralised plant mean low-temperature 4th generation heat networks (~65℃ flow temperature) can be more efficient than individual systems and should be able to make use of existing heating systems within buildings without the need for expensive and disruptive retrofit.
- Maintenance costs usually lower per unit of heat generated.
- Easier to achieve direct supply of cheaper electricity from local renewable generation to heat pump.

Heat Networks are an established technology, although more common in other countries. For example, over 60% of homes in Denmark are heated from a Heat Network, and many of these are community owned. In the UK Heat Networks are less common and tend to be in cities, e.g. in London Battersea Power station used to heat thousands of homes in Westminster before it closed, and all the sports and other buildings on the Olympic Park in east London are on a Heat

Network. On a smaller scale the best example is the Heat Network installed in the village of Swaffham Prior[23], east of Cambridge.

6.2. Energy Performance Certificates

6.2.1. What is an EPC?

An Energy Performance Certificate (EPC) rates the energy efficiency of a building on a scale from A (most efficient) to G (least efficient). EPCs are legally required when a property is built, sold, or rented. The rating is based on the building's construction and energy systems, such as insulation, heating, and lighting, not on how energy is actually used by its current occupants.

While EPCs are now widely available, it's important to note that not all properties have one, particularly older homes that haven't changed hands or been rented in recent years. Owner-occupied homes, especially those owned long-term by older residents, may be underrepresented in EPC datasets. Homes with EPCs may not represent all homes in an area, but because EPCs are required for sale or rental, they are likely to form a broadly representative sample of the local housing stock.

EPC data can still provide valuable insights into overall housing efficiency and help identify areas that may benefit most from energy improvements, like those targeted by a community heat network.

6.2.2. EPCs in the Proposed Heat Network Location

The table below shows the percentage of households by EPC rating:

EPC energy rating	Morecambe West End MSOA[24]	England & Wales
A (Most Efficient)	0%	0.3%
B	3.7%	14.1%
C	29.8%	31.0%
D	36.4%	38.6%

[23] Swaffham Prior Heat Network

[24] Office for National Statistics, 2024 Energy Efficiency in Housing dataset,

EPC energy rating	Morecambe West End MSOA[24]	England & Wales
E	24.4%	13.0%
F	3.4%	2.3%
G (Least Efficient)	2.3%	0.7%

Table 4: 2024 domestic EPC ratings in Morecambe West End and England & Wales

Very Low Proportion of High-Efficiency Homes

As of 2024 (the latest data), only 3.7% of homes in Morecambe West End are rated B or above, compared to 14.4% nationally. No homes are rated A, compared with a small but non-zero 0.3% nationally. This shows a significant underrepresentation of highly efficient homes, which typically include newer builds or homes with major retrofits (e.g. insulation, efficient heating systems, solar PV).

Majority of Homes Rated C or D

A combined 66.2% of homes are rated C or D, roughly in line with the national average (69.6%). D rated homes are the most common, with 36.4% of homes in this band. While C-D ratings are considered "average" efficiency, C is now the target minimum rating for future energy efficiency policy for landlords, from 2030.

High Proportion of Low-Efficiency Homes

A notable 30.1% of homes in Morecambe West End are rated E, F or G compared with 16.0% nationally, almost double the national figure.
E rated homes alone make up nearly a quarter (24.4%) of the housing stock. An E rating is currently the minimum required EPC rating for private rental properties. F and G rated homes, which are considered very inefficient, make up 5.7% of properties in Morecambe West End with an EPC, versus 3.0% nationally.

Morecambe West End's housing stock is significantly less energy efficient than the national average, with almost no high efficiency homes (A-B), and a higher-than-average number of low-rated properties (E-G), reflecting a legacy of older housing, limited investment in retrofit, and potentially a high proportion of rented or subdivided homes.

6.3. Existing Heating Systems

There are pros and cons to connecting any existing heating system to a new heat network. As reported in Table 3 the majority of houses in the case study area have gas central heating (73.6%) or electric heating (12.5%).

6.3.1. Gas central heating

A gas central heating system typically consists of a gas boiler and radiators. Gas central heating already has a wet system (radiators and pipes) in place, and they can often be reused. These systems are common in the UK, so retrofit experience is well developed and the systems will be familiar to installers, meaning that it will generally be relatively straightforward to swap the existing gas boiler with a heat interface unit (HIU). Low-temperature heat networks operating at ~65℃ should be able to make use of the existing heating systems of individual buildings without the need for expensive and disruptive retrofit.

The disadvantages of connecting an existing gas central heating system to a centralised heat network are that gas disconnection and boiler removal will be required.

6.3.2. Direct Electric Heating

Direct electric heating systems include storage heaters, panel heaters or fan heaters. They are often installed in flats or hard-to-retrofit homes where the installer wants to avoid fitting pipes and are more common in fuel-poor or hard-to-heat homes. As they do not have existing pipework or radiators, full installation of a wet system will be required, which may be costly and disruptive due to the potential need to open up walls and floors.

6.4. Heat Anchor Loads

Anchor loads are buildings with a large, consistent heat demand, giving a predictable baseline heat consumption. Heat networks are most efficient when operating steadily, and a consistent anchor load helps to ensure that heat pumps run at optimal levels. Anchor loads can also provide financial stability, making the business case stronger and providing revenue to cover fixed costs or cheaper tariffs for smaller customers. Anchor customers are often public-sector organisations (e.g. schools, NHS) with long-term energy contracts, reducing the risk of demand loss. Heat networks can be built around the anchor load and then expanded over time to connect more homes or businesses, which may be lower risk and more manageable than connecting everything at once.

The best anchor loads in the area are the Bay Leadership Academy and adjacent swimming pool. While the academy is located on the edge of the focus area, its high heat demand and location indicate it is a potential location for the heat network energy centre. This is discussed later in this document. Other anchor loads in the area include Sandylands School Nursery, West End Primary School, More Music and the Bay Medical Group West End.

7. Technology

7.1. Air Source Heat Pumps

7.1.1. What are Air Source Heat Pumps?

The CHDU heat network model uses large multi-stage air source heat pumps (ASHPs) to provide most of the heat to the network. These heat pumps use electrically powered pumps to move heat from the air into the heat network.

The efficiency of heat pumps at a single point in time is referred to as their coefficient of performance (COP) which is the ratio of the heat energy emitted to the electrical energy consumed. The instantaneous COP of an ASHP varies due to operating conditions such as the temperature of the air entering the unit, typically the outdoor ambient air temperature, and the temperatures of the incoming and outgoing coolant. The seasonal COP (SCOP) of the heat pump is calculated by dividing total heat energy generated within a calendar year by the total electrical energy consumed.

Figure 10: Vestervig Fjernvarme[25] 1.2MW ASHP (highlighted) and biomass energy centre

ASHPs connected to a low temperature centralised district heat network at Morecambe, producing heat at an average annual temperature of approximately 65℃, are expected to operate at a SCOP of 3.09. Providing heat to a network at this temperature means that individual buildings shouldn't need to upgrade the pipework and radiators connected to their existing gas central heating systems.

7.1.2. Why choose air source heat pumps?

ASHPs have been selected for these case studies instead of other heat sources since they are more affordable than other heat pumps such as ground or water source systems and less reliant on specific local conditions, meaning they can be installed with fewer restrictions and disruptions. Other technologies could be explored when specific areas are given further consideration.

7.2. Thermal Storage

An example of a thermal storage tank used in a district heat network is visible in Figure 11.

[25] https://segenergy.dk/en/vestervig-fjernvarme

Figure 11: Example of a thermal store

7.2.1. Why use thermal energy storage?

Heat pumps don't always produce heat at exactly the moment people need it. Thermal stores allow the system to generate heat when it's most efficient to do so (e.g. during off-peak electricity hours or when the wind turbine is generating), and use it later when demand peaks. If the heat pump can't temporarily meet demand (e.g. in very cold weather), the system can draw on stored heat. This reduces how often the network needs to use a backup boiler, which is more expensive and higher in carbon emissions. Thermal storage also means that any heat generated that is not used immediately can be captured and used later, avoiding waste and improving overall system efficiency.

7.3. Back Up Plant

7.3.1. Why are backup boilers needed?

ASHPs rely on electricity and external ambient temperature to generate heat efficiently, however they are vulnerable to performance degradation in very low temperatures, grid outages and technical faults. As a heat network needs to be able to supply heat reliably, it is important to have a contingency system in place that can maintain internal temperatures and avoid disruption in heating services if the ASHP becomes inoperable.

The backup boilers can also top up the heat generated by the ASHPs to meet peak demand during the colder months. Using backup boilers in this way is financially beneficial to the network since the much more expensive ASHP could be reduced in size, compared to if it was required to meet 100% of the peak heat demand. For example, sizing the ASHP to meet 80% of the total annual heat demand means that it can have approximately 50% of the capacity compared to if it were sized to meet the peak heat demand. This is illustrated in Figure 12.

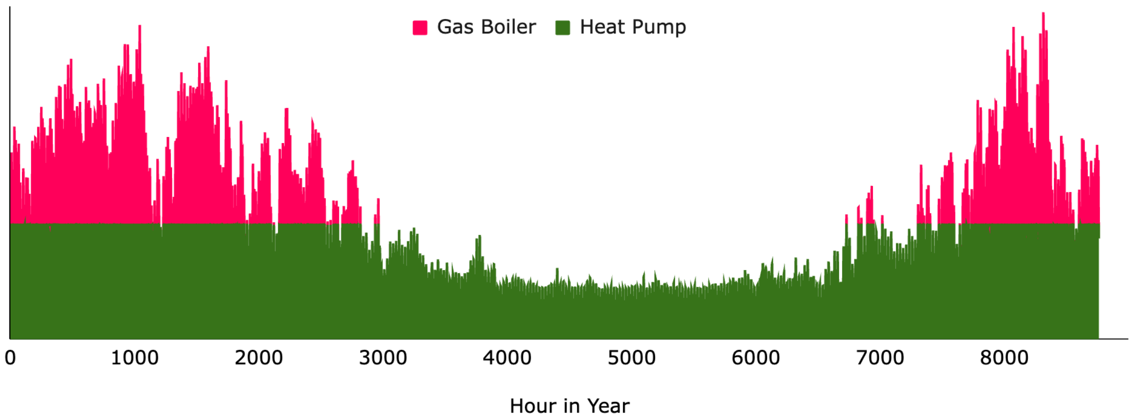

Figure 12: Split of heat supply throughout a year, 20% of heat from gas

The gas back-up boilers can be replaced by electric boilers in the future if the price of electricity reduces to further reduce the emissions of the network.

7.3.2. Technology

Morecambe is connected to the national gas network so a gas boiler would be most suitable to provide backup heat. Gas boilers connected to the mains gas network typically have several advantages over an oil boiler, providing quicker start-up times, lower maintenance requirements and no storage requirements. Gas boilers also have lower CO_2 emissions and fewer particulates, making them a cleaner choice for low-carbon strategies.

In the future, these gas boilers could be replaced by electric boilers to further decarbonise the heat network, but this would require a reduction in the price differential between gas and electricity (the “spark gap”) to maintain the financial viability of the network.

7.4. Renewable Electricity Source

7.4.1. Key Benefits of 'Onsite' Renewable Generation

The financial viability of a heat network which uses ASHPs to supply much of the heat is directly related to the price of electricity used to power the heat pump and other core infrastructure including water pumps and circulation systems, and control and monitoring systems.

Generating electricity from renewable sources is cheaper than importing electricity from the grid, particularly as energy prices rise, and ensures a more stable cost of heat generation since it is decoupled from global fossil fuel prices. This also opens up the potential for secondary income streams since surplus electricity could be sold to a local offtaker through a private wire agreement, offering a more favourable price than their existing supplier, or exported to the national grid though typically at a much lower price.

Using onsite renewable generation to power the network energy centre reduces carbon emissions compared to importing electricity from the grid, and the export of electricity potentially pushes gas generation off the grid, reducing the carbon intensity of grid electricity.

7.4.2. Available Options

Wind power

Wind has the advantage that its generation profile is better aligned with heat demand compared to solar: wind speeds (and therefore output) are typically higher in autumn and winter, which corresponds to peak heating needs.

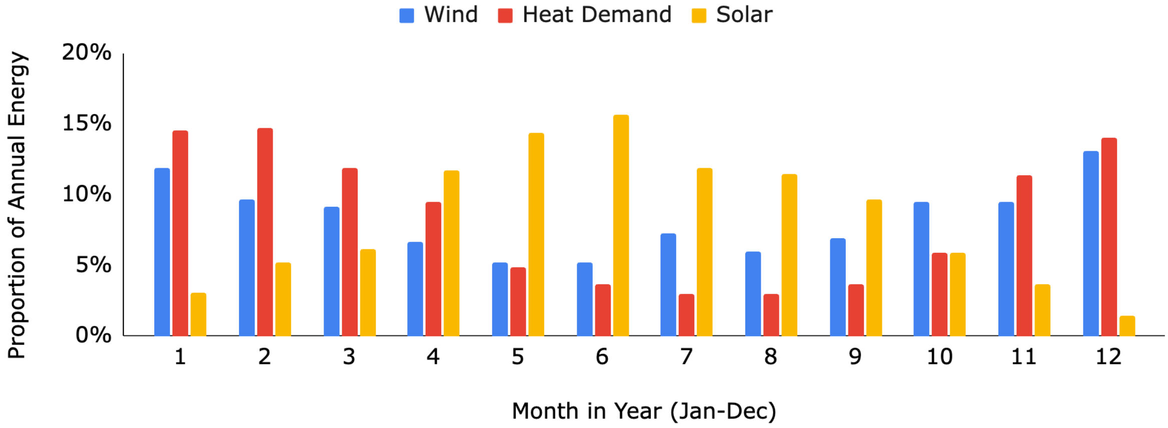

Figure 13: Monthly Wind and Solar Generation vs Heat Demand

For example, a 3MW wind turbine can produce approximately 3x more electricity than an equivalent capacity in solar PV over the course of a year; higher generation means more energy to use onsite or sell to others, improving the economic case. However planning permission for onshore wind remains difficult to obtain in many areas, and careful consideration needs to be given to landscape and noise considerations - site-specific wind resource assessment is essential for viability.

Solar PV

Solar PV generally has lower capital costs than wind, and has historically been easier to gain planning permission, however solar generation is highest in summer and during daylight hours, when heating demand is lowest, creating a mismatch with energy use. Site selection work indicates that, where feasible, wind power is strongly preferable due to better seasonal alignment with the heat network's electricity needs.

7.5. Network Pipework and Building Connections

Pipework forms the physical backbone of a heat network. It is used to transport heated water from the energy centre to individual buildings and for returning cooler water back to the energy centre.

Pipes are typically pre-insulated steel or plastic, designed to minimise heat loss through effective insulation, withstand high temperatures and pressures, and resist corrosion and external damage. Steel pipes are often used for high-temperature, high-pressure main distribution pipes, while plastic options may be suitable for lower-temperature branches. Typical diameters vary from small branch pipes (~25–50 mm) to large distribution mains (up to 400 mm or more), depending on the heat load and the number of buildings being served.

7.5.1. Installation Considerations

The installation cost of pipework is normally the largest capital expense in a heat network project. The most significant factor is not the pipe itself but the cost of digging and laying the trench. Often referred to as the "civil works" portion of the project, trenching costs include excavation, pipe laying, backfilling, and reinstatement.

The term 'soft dig' refers to trenching through open ground such as fields, parks, or gardens, and 'hard dig' to refer to trenching under roads, pavements, and other built-up areas. Hard dig is significantly more expensive than soft dig, highly disruptive to traffic and local access, and may require road closures, traffic management and longer working times. Proper planning and route optimisation can help reduce costs by favouring soft dig areas where feasible.

7.5.2. Connection to Existing Buildings

To connect each property to the heat network, new pipework will need to be installed between the main network pipe running along the road and the property's internal heating system. Where properties have a front garden, these pipes will need to be buried underground as they pass through it. A suitable entry point to the house will then be identified. For properties with a basement, installation is typically more straightforward: the pipes can enter at the most convenient location and run through the basement to the area nearest the current boiler.

The actual connection between the heat network and the property is via a Heat Interface Unit (HIU), also known as a Hydraulic Interface Unit. This unit would typically be installed where the property's existing boiler is located (replacing the boiler), as this area usually has the necessary space and provides the simplest access to the existing heating and hot water systems.

However, if the current boiler is situated outside or in an unheated space (such as a shed), the HIU would be relocated inside the property to avoid any risk of freezing. Unlike a traditional boiler, an HIU does not require ventilation or a flue, produces no noise or odour, and is generally more suitable for indoor installation. This flexibility allows for a wider range of potential locations within the home. Ideally, the HIU would be installed in a basement, as this provides easy access to the heat network pipes running beneath the road or pavement.

The HIU itself is wall-mounted and roughly the same size as a gas combination boiler. It requires a mains electricity supply to power the circulation pump and internal controls. HIUs are typically encased in a white metal or durable grey polystyrene cover.

Figure 14: HIU located in a property

Each HIU includes a heat meter that measures the amount of heat drawn from the network. This meter is read automatically, with the data also used to help identify any faults within the HIU or the wider system.

Heating system compatibility and installation

The heat network is designed to work with a standard "wet" heating system, where hot water is circulated through radiators or underfloor heating to provide space heating. In properties that already have a wet system in place, it may be possible to retain and connect it to the new HIU, provided it is in good condition and compatible with the heat network's lower flow temperatures. The HIU contains a plate heat exchanger, which ensures the radiators can continue to operate at their existing pressure. A report by Marches Energy Agency[26] has shown that for a heat network flow temperature of 65-70℃, no building upgrades should be necessary.

For properties that currently rely on a "dry" heating system, such as electric panel heaters or storage heaters, a new wet system would need to be installed. This involves fitting radiators or underfloor heating, as well as the associated pipework. Although this represents a more significant installation effort, it enables the property to benefit from more efficient and controllable heating through the heat network, often with lower ongoing energy costs compared to electric heating.

8. Proposed Heat Network

8.1. Network Layout

A district heat network is designed to efficiently distribute low-carbon heat from the centralised heat source (in this case an ASHP and backup boiler) to connected buildings across the site. The proposed layout reflects both engineering best practices and site-specific constraints to optimise performance and minimise costs.

[26] https://mea.org.uk/

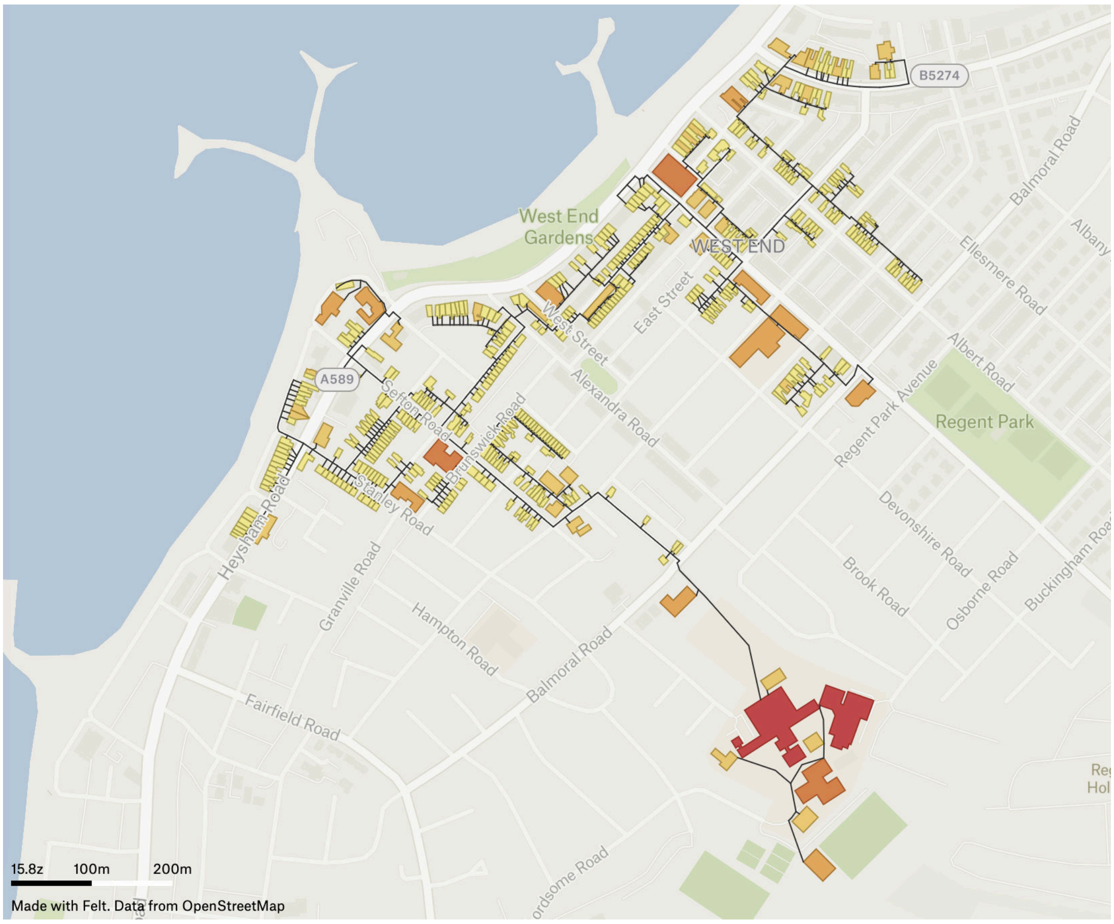

Figure 15: Proposed initial network layout

The heat network is projected to connect to a total of **614** properties split across 466 buildings. This includes 555 domestic properties, of which about a third are flats, and 59 non-domestic properties. The network length is estimated to be 7.59km.

There is scope to expand the network in the future if the cost of connecting buildings or the cost of generating heat could be reduced. The network presented in Figure 16 illustrates a larger network (9.05km) which extends further into the West End to connect **810** properties split across 580 buildings. It is expected that the cost of generating heat and operating the network would need to be reduced by approximately 10% to enable the network to expand to this extent.

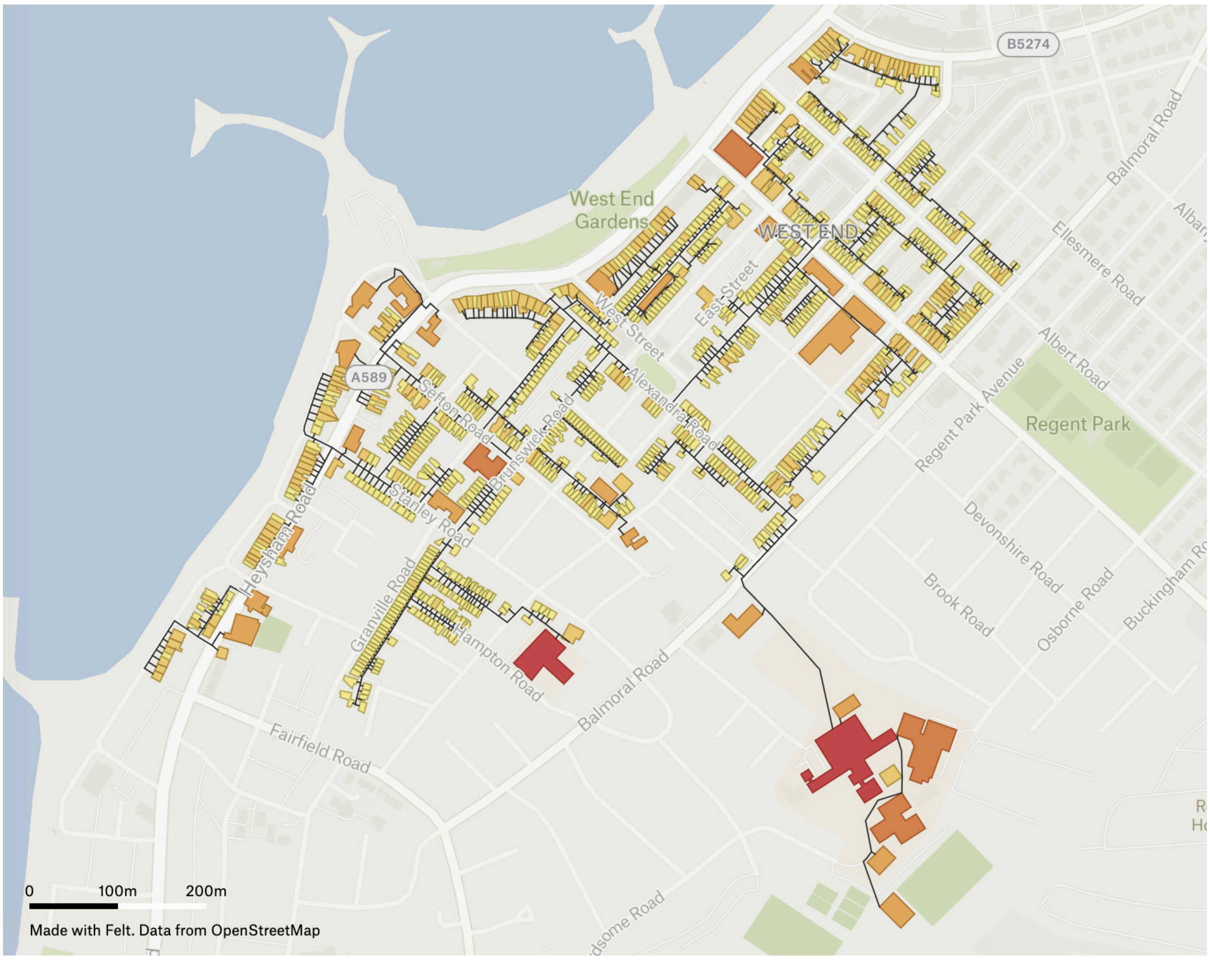

Figure 16: Potential expanded future network layout

8.2. Heat Demands

The total annual heat demand of buildings connected to the network is 13.28GWh. Table 6 lists the heat demands associated with buildings in the proposed network.

Domestic Properties	
Domestic Properties	6,740 MWh
Non-Domestic Properties	
Bay Leadership Academy	1,266 MWh
Make a Splash!	374 MWh
Sandylands School Nursery	146 MWh

Domestic Properties	
West End School	169 MWh
Bay Medical Group West End	51 MWh
Other non-domestic	3,530 MWh
Sub-total	*6,540 MWh*
Heat Network Losses	1,510 MWh
Total	**14,790 MWh**

Table 6: Annual Heat Demand of Buildings in Network

Approximately one third of the domestic properties within the proposed initial network layout are understood to be flats, most of which are 2 bedroom, single floor dwellings converted from 3 or 4 storey terrace houses. The remaining properties are mostly Victorian terraced houses, many of which are at least 3 storeys. Using EPC data and the THERMOS software, the average heat demand per property is estimated to be 12,144 kWh per year.

The annual heat demand of non-domestic properties have been estimated from a combination of Display Energy Certificate (DEC) data and the THERMOS software. The annual heat demand of domestic properties has been derived using EPC data, using estimates from THERMOS where EPC data is unavailable.

8.3. Energy Centre

8.3.1. Proposed Site

A suitable location for the energy centre containing the ASHP might be in the grounds of Bay Leadership Academy, a secondary school on the edge of the proposed network. The school is likely to have sufficient space to site the energy centre, an important consideration in an urban area where space may be limited, and is a significant consumer of electricity within the area of the proposed network. As well as potentially connecting to the heat network, the school may have the opportunity to become an offtaker of any surplus wind-generated electricity, providing both a discount to the school and income to the heat network.

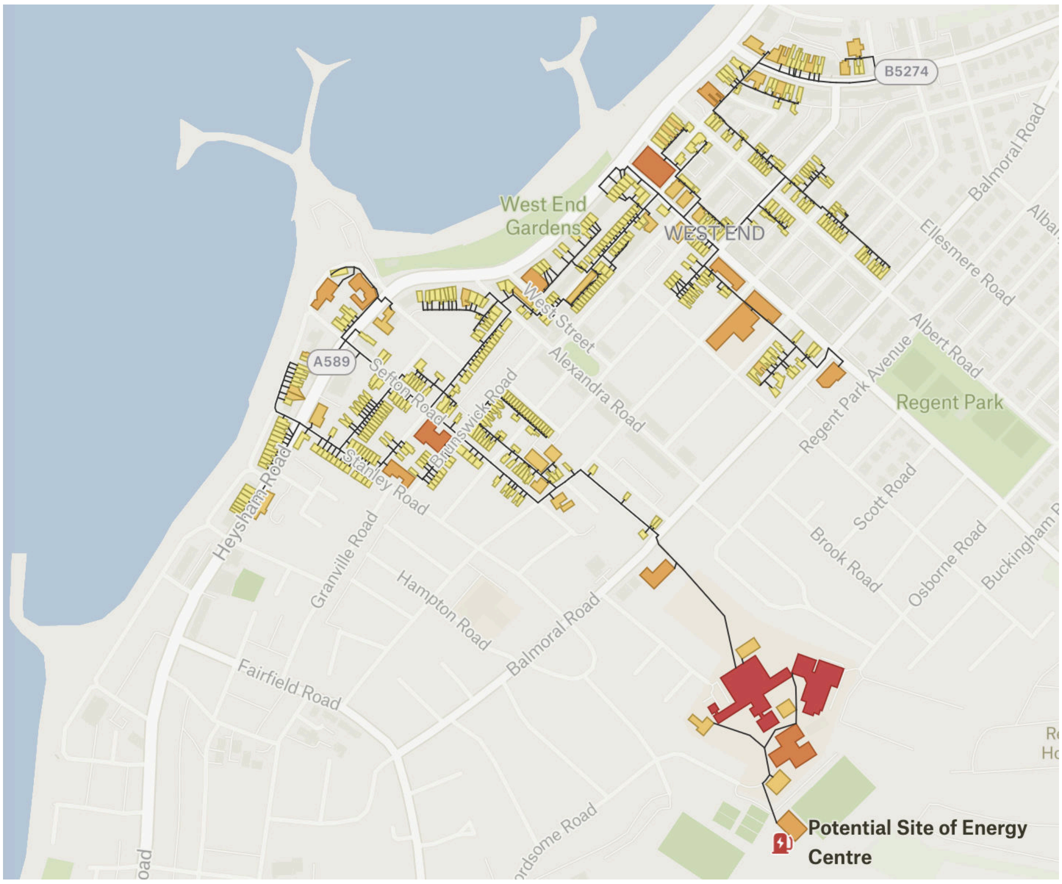

Figure 17: Proposed location of ASHP at Bay Leadership Academy

Attempts have been made to contact the Bay Leadership Academy leadership however it is currently unclear whether the Academy is keen to become a customer of the proposed scheme.

8.3.2. ASHP, Thermal Storage and Gas Back-up Boilers

A sensitivity analysis has been conducted by Carbon Alternatives using EnergyPro[27] to assess the most optimal combination of ASHP size and thermal storage volume while achieving carbon savings which exceed the requirements of the Green Heat Network Fund.

The air source heat pump connected to the heat network would be sized to provide 80% of the total annual heat demand of the network customers, with the remaining 20% of heat demand provided by gas backup boilers. The peak heat demand in the proposed network area in Morecambe is estimated to be approximately 5MW, however the ability of a 600m^3 thermal store and back-up boilers to help the ASHP meet this peak demand means the ASHP is sized to meet a peak thermal output of 2.25MWth.

[27] https://www.emd-international.com/software/energypro

The gas backup boiler is sized to meet 100% of the peak heat demand ensuring security of supply during periods of high demand or ASHP downtime. The gas backup boilers would need to be placed in proximity to the ASHP hydraulic interface for efficient system integration, and would require flue installation and connection to the mains gas network. The gas boilers could be replaced with electric boilers in the future to further decarbonise the network.

8.4. Renewable Generation

A wind turbine with a peak power output of 4.26MW is under consideration. A community owned wind turbine of this scale has been developed in England before by Ambition Community Energy[28] in Lawrence Weston, Bristol. Ideally this would be sited close to the heat network energy centre to minimise the length of the power cable to the heat pumps and grid connection. Two potential sites which could accommodate a wind turbine with a tip height of 150m are presented in Figure 18.

Figure 18: Potential wind turbine locations (highlighted blue)

Land owners at these potential sites have not yet been consulted about leasing their land for a wind installation but this is an important next step if the proposed heat and wind project were to proceed.

[28] https://ambitioncommunityenergy.org

Note that there are existing wind turbines installed to the south west of the sites proposed in Figure 18. A single 1.5MW turbine is operated by Blue Energy at their Heysham Moss site[29], and 3 x 2.5MW turbines are operated by OnPath Energy[30]. A scenario has been considered where a private wire is installed to use electricity generated by some of these turbines directly in the heat network ASHPs, however this setup is of little benefit to the overall scheme finances, despite considerably less capital investment being required, since the sale of excess wind generation from the proposed new turbine to the national electricity network and local offtaker is a key income stream for the project.

8.5. Grid Connection

Electricity North West (ENWL) hosted a grid connection surgery call to discuss the feasibility of connecting a 4.26MW wind turbine and 2.25MWth ASHP to the local distribution network. The aim is to connect both the generator and ASHP to the local 6.6kV network using the grid connection point at the Bay Leadership Academy. This enables the wind turbine to provide much of the power to the ASHPs via a direct wire, and the potential to supply electricity to the Bay Leadership Academy behind the meter.

ENWL have advised that this configuration would require the current low voltage grid connection used by the Bay Leadership Academy to be upgraded to 6.6kV. ENWL have also advised that they would need to produce a connection feasibility report following a G99 application before being able to comment on the possibility of connecting a 4.26MW generator to the local 6.6kV network or provide a quote.

It is important to note that while the straight-line distance from the potential wind turbine site to the Bay Leadership Academy is relatively short, there is a railway line separating the two. ENWL have indicated that they will not cross railway lines due to having to accept exclusive liability for any consequences related to the cabling. Avoiding the railway line requires installation of a ~2km trenched cable to connect the wind turbine to the connection point at Bay Leadership Academy in addition to crossing an existing bridge.

[29] https://www.blue-energyco.com/our-projects/heysham
[30] https://www.onpathenergy.com/heysham-south/

A cost of £1.1m has been allowed for in the financial calculations presented in this report which covers installation of the cabling and upgrading the grid connection at Bay Leadership Academy. This cost would need to be reviewed alongside the outcome of the G99 grid connection application if this project were to progress to detailed feasibility.

8.6. Electricity Offtaker

One of the benefits of locating the heat network energy centre at the Bay Leadership Academy is that excess electricity generated by the wind turbine could be sold directly to the school and/or used in the network ASHPs. This is mutually beneficial since the school could purchase electricity at a discounted rate compared to importing electricity from the grid, and the heat network scheme could receive more income compared to exporting electricity to the grid. It is estimated that approximately 90% of the school's 490 MWh annual electrical demand could be met by the wind turbine.

8.7. Summary of Energy Usage

Annual Energy Usage Summary (MWh)	
Wind Turbine Generation	11,195
Generation Consumed by Network	3,850
Generation Consumed by Offtaker	453
% Generation Consumed by Network	34%
% of Network Heat from Generation	73%
Generation Exported to Grid	6,892
Electricity Imported	340
Gas Consumed	2,906

Table 7: Annual energy usage

9. Financial Performance of Heat Network

9.1. Assumptions Made

9.1.1. Tariffs

The electricity tariffs detailed in Table 8 have been used in the financial modelling of the proposed Morecambe heat network.

Tariffs	
Heat Sales Unit Price	7.43p/kWh[31]
Heat Sales Standing Charge	£375/annum[32]
Gas Purchase	6.24p/kWh
Unit Price of Exported Wind Generation	9.5p/kWh[33]
Wind Generation Private Wire Sales	20p/kWh
Grid Import for use in ASHP	23p/kWh[34]

Table 8: Energy Tariffs used in Techno-Economic Modelling

9.1.2. Green Heat Network Fund Grant

The Green Heat Network Fund (GHNF) is a capital grant programme that initially opened to applicants in 2022 with additional funding available until 2027/28. A successor to the Heat Networks Investment Project, it is a core element of the Government's support for low and zero carbon (LZC) heating and cooling networks. The GHNF provides support for eligible commercialisation and construction costs. Prospective projects are assessed for funding using a range of criteria[35]:

- A carbon gate of 100gCO2e/kWh thermal energy delivered to consumers

[31] To match domestic customers' current gas heating cost. Based on a gas price of 6.24p/kWh and gas boiler efficiency of 84%.
[32] Equivalent to annualised cost of replacing (£2,750) and maintaining (£100/annum) a gas boiler over 10 years.
[33] Income from exported electricity sales consists of an export PPA price, embedded generator benefits and benefits related to license exempt supply (BSC Modification P442).
[34] Average of dual day/night tariff.
[35] Green Heat Network Fund (GHNF): Scheme Overview, 2022

- Domestic and micro-businesses must be offered a price of heat lower than a low carbon counterfactual for new buildings and a gas/oil counterfactual for existing buildings
- Demonstration of a Social IRR of 3.5% over 40 years
- Urban networks need a minimum end customer demand of 2GWh/year, rural off-gas-grid networks need a minimum of 100 dwelling
- Maximum grant requested up to but not including 50% of the combined total commercialisation + construction costs (with an upper limit of £1million for commercialisation)
- The total 15-year kWh of heat/cooling forecast to be delivered will not exceed 4.5 pence of grant per kWh delivered (at time of writing)
- Where projects include wider energy infrastructure in their application, income generated/costs saved/wider subsidy obtained should be greater than or equal to the included costs

Of those criteria, the nominal upper benchmark of 4.5p/kWh is the main limiting factor, with this figure functioning more as a ceiling than as a target. The competitive nature of the fund means that only the most economically efficient projects are likely to exceed. As a result, the GHNF has only been funding schemes asking for 2.5p/kWh or less, which effectively halves the amount of grant available. Schemes which can target this level of grant funding are often focussed on non-domestic buildings and are able to charge significant fees to non-domestic buildings wishing to connect to the network or access other funding pots such as the Public Sector Decarbonisation Scheme (PSDS). This is not an option for most of the domestic connections included in the proposed scheme in Morecambe and the analysis reported here assumes that the full 4.5p/kWh is available either through the revised GHNF or some other sources.

The sensitivity of the financial performance of the proposed heat network scheme to the p/kWh of GHNF funding is reported on in section 9.5 of this report.

9.1.3. Equity and Debt

Development Loan

During the construction and early development stage, the project may require short-term working capital through a development load, with an assumed interest rate of **8.0%**. This loan covers pre-revenue expenditure and would typically be repaid or refinanced upon completion.

Long-Term Loan

Following commissioning, a large portion of the capital costs will be refinanced through a long-term loan. Loan rates aligned with the National Wealth Fund[36] have been assumed, which at the time of writing are set at gilt pricing +40bps. This assumes that the Local Authority will be at least partially involved in developing and owning the scheme. The loan for purchasing and installing the pipework is modelled as having a term of **50 years** and an interest rate of **5.35%**. The loan for purchasing and installing the network energy centre, household connections and renewable generation is modelled as having a term of **25 years** and an interest rate of **5.95%**. Both loans are modelled as annuities. This debt is structured to be repaid from operational income (heat and electricity sales) and sized to ensure sufficient headroom for contingencies and maintenance reserves.

Community Shares

A further share of capital may be raised through community shares, allowing local residents and supporters to invest directly in the project. While shares have not been included in our techno-economic model, it's likely that a proportion of the capital would be financed through community share raising, with an interest rate of 4% to 5% in line with typical expectations for community energy investments. Community shares are non-transferable and interest is not guaranteed, but still represent a key engagement and financing tool.

9.1.4. Inflation

Inflation has been modelled using the CPIH value of **2.5%** annually for the escalation of operational costs, replacement capital costs and heat pricing.

9.1.5. Project Lifespan

The financial model assumes a total project lifetime of **50** years, which aligns with the expected minimum operational lifespan of the heat network pipework. For simplicity, major plant replacements (e.g. ASHPs and the wind turbine) are modelled as occurring after 25 years.

[36] https://www.nationalwealthfund.org.uk/local-authority-services/our-lending-offer

9.2. Capital Costs

Capital costs include the costs of the materials and components needed in the development of the heat network, and the costs of installing them. Reasonable estimates of capital costs are reported here using publicly available sources and previous project experience, however more detailed feasibility work would need to be completed in order to gain quotes from potential suppliers. Further details of how the capital costs have been derived are available on the CHDU project website[37].

The capital costs for the proposed heat network in Morecambe's West End are presented below.

Energy Centre (£k)	
Heat pumps	£2,154
Coolant pumps / water treatment	£250
Backup boilers	£597
Thermal storage	£229
Energy Centre Building	£450
Network Pipework	
Pipework	£1,484
Trenching and Installation	£5,727
Customer Connections and HIUs	
Internal works and HIUs (£6,500 per property)	£3,991
Renewables	
Wind turbine purchase and installation	£5,741
Cabling between generator and connection point	£300
Grid connection	£710

[37] https://communityheat.org.uk/techno-economic-model/network-capex-costs/

Planning, design & regulatory costs	
Commissioning costs (5%)	£1,082
Design & Project Management (10%)	£2,163

Table 9: Details of CAPEX costs (£k)

The total CAPEX costs are reported in Table 10 alongside the total amount of GHNF that may be available.

Summary of CAPEX Costs	
Energy Centre	£3,680
Network Pipework and Trenching	£7,211
Customer Connections	£3,991
Renewables	£6,751
Commercialisation Costs	£3,245
Contingency (10%)	£2,163
Total	**£27,042**
Eligible for GHNF grant	£24,797
GHNF grant amount (4.5p/kWh)	£8,964
Total excluding GHNF grant	**£18,078**

Table 10: Summary of CAPEX costs (£k)

9.3. Replacement Costs

Energy Centre (£k)	
Heat pumps	£2,153
Network pumps	£250
Backup boilers	£597
Thermal storage	£229

Customer Connections and HIUs (£k)	
Internal works and HIUs	£1,658
Renewables (£k)	
Wind turbine purchase and installation	£5,741
Total	**£10,629**

Table 11: Summary of REPEX costs (£k)

9.4. Ongoing Costs

9.4.1. Administration

The cost of running a Community Benefit Society (CBS) will vary depending on whether the day to day administration is carried out by the organisation's Directors or externally by an administrative service. It is recommended that a scheme of this size and complexity should use external administrators. The annual cost of running a CBS set-up to own the proposed Morecambe heat network is estimated to be around £10,000.

9.4.2. Metering and Billing

The staff costs for metering the system and billing customers are assumed to be approximately £95.00 per connection per year. In Morecambe the annual costs for metering and billing is expected to be around £58,300.

9.4.3. Insurance

Insurance costs for renewable energy assets vary depending on the technology. For wind installations, insurance is typically around £2,993/MW[38]. In addition, insurance for the heat network is estimated at £5,000 per year.

9.4.4. Rent and Rates

For energy centre

An allowance of £1,000pcm has been included. It is understood that buildings whose main use is for a 'heat network' are exempt from business rates.

[38] Inflated to 2025 prices from [Solar and Wind Insurance Costs: Onshore wind and solar PV costs review, BEIS/WSP, 2020]

Land required for renewable generation

The land required for any connected renewable generation will also be subject to rent. For wind, a rate of £10,000 per MW of capacity of the wind turbine. Annual land rent for a 4.2MW wind turbine in Morecambe is estimated to cost around £42,000. Business rates for the 4.26MW wind turbine are assumed to be £10,650 per year.

9.4.5. Maintenance

Regular maintenance of the components of a heat network are essential to keep it operating efficiently and reliably over its lifetime. Annual maintenance costs for the proposed network in Morecambe include:

Energy Centre	
Component	Total annual cost (£)
1 % of the capital expenditure on thermal storage	£2,290
1% of CAPEX backup boilers and network pumps	£8,470
Heat pump	£8,000
Total	£18,760

Table 12: Annual maintenance costs for components in the Energy Centre

Network		
	£/MWh	Total annual cost (£)
Network (pipes etc)	£0.60/MWh	£8,870[39]
HIUs	£80/connection	£49,120
Total		£57,990

Table 13: Annual maintenance costs for components in the network

Renewables	
Wind	£118,330

Table 14: Annual maintenance costs for renewables

[39] Includes total demand + pipework losses

9.4.6. Cost of finance

Loans have been modelled at the following rates and terms:

Loan type/purpose	**Rate**	**Term**
Development loan	8%	2 years
Equipment loan	5.95%	25 years
Pipework loan	5.35%	50 years

Table 15: Assumed loan rates and terms

9.5. Overall Financial Performance of Heat Network

9.5.1. Year 1 Cashflow

The expected year 1 cashflow is detailed in Table 16.

Income (£k)	
Electricity sales to grid	£649
Electricity sales to offtaker via direct wire	£91
Heat unit sales	£987
Heat network standing charge sales	£230
Sub-total	£1,957
Outgoings	
Operations, Maintenance and Administration	£346
Electricity purchase from grid	£77
Gas purchase for back-up boilers	£181
Loan repayments (capital and interest)	£1,323
Sub-total	£1,928
Year 1 Cashflow	£29

Table 16: Year 1 Cashflow (£k)

9.5.2. Payback Period and IRR

The Internal Rate of Return (IRR) is a financial tool used to assess the economic viability of a project. It represents the overall rate of return the project is expected to generate over its lifetime. If IRR exceeds the required rate of return, such as the cost of capital, it suggests the project is likely to:

- Cover its costs
- Remain financially stable over time
- Offer modest returns to shareholders, helping justify community investment
- Strengthen the case funding or grant applications.

Conversely, if the IRR falls below the required rate of return, the project may struggle to meet its financial obligations and may be considered financially unviable.

The project IRR for the proposed heat network in Morecambe is **6.6%**, assuming the £8.9M capital grant funding, indicating that the project is expected to generate a return just above the cost of capital. This suggests the project is borderline financially viable, with the potential to cover its costs, maintain financial stability, and deliver modest returns to community shareholders.

Financial Performance at Different Levels of Grant Funding			
GHNF Rate (p/kWh, 15 years)	4.5	3.5	2.5
Grant as proportion of CAPEX	33%	26%	18%
(excluding renewable generation)	50%	39%	28%
Loan Repayments (£k)	£1,323	£1,466	£1,609
Year 1 Cashflow (£k)	£29	-£114	-£257
Initial Payback Period (years)	24	39	43
25 Year IRR	6.6%	5.5%	4.7%
50 Year IRR	7.7%	7.0%	6.3%

Table 17: Viability at different levels of grant funding

Table 17 presents the financial viability of the scheme at different levels of GHNF grant funding. The scheme is only expected to be financially viable if the maximum level of funding is awarded, 4.5p/kWh.

Note that if the Boiler Upgrade Scheme were to be made available to fund the connection of domestic properties to the heat network, the average cost the scheme would have to pay to connect each domestic customer to the heat network would pessimistically be £1,589 (based on inflated Buro Happold[40] connection costs for a house, less the £7,500 grant). This would result in the scheme being financially viable, with a payback period of 24 years and 25 year IRR of 6.5%, even if the grant awarded to the scheme was based on a rate of 2.5p/kWh.

10. Carbon Projections

10.1. Establishing the Counterfactual

To assess the carbon savings from a heat network, the first step is to define the baseline, i.e. what emissions would have been generated if the heat network were not built, based on the existing heating mix in the focus area. This is compared to the following scenarios:

- The proposed low-carbon heat network scheme.
- Individual ASHPs.

Assumptions used:

- Number of properties connecting to the network: 614 (555 domestic, 59 non-domestic)
- Total annual heat demand: 13.3 GWh
- Average demand per domestic building: 12.1 MWh
- Average demand per non-domestic building: 110.8 MWh
- Emissions calculated using 2025 UK Government GHG conversion factors (kg CO_2/kWh)

40 https://www.usdn.org/uploads/cms/documents/161214_-_connecting_existing_buildings_to_dhns_-_technical_report_00.pdf

10.2. Emissions from Existing Heating Systems

The mix of heating systems in the proposed Morecambe heat network focus area is discussed in section 5.1, using data from the 2021 Census. The emissions factors for the different heating systems in the network focus area, adjusted for fuel efficiencies, are presented in Table 18.

Heating type	Proportion of Properties	Fuel CO2 emissions (kg CO2e)	% Assumed efficiency	Emissions per kWh heat (kg CO2e)
Mains gas only	73.6%	0.183	90%	0.203
Electric only	12.5%	0.2072	100%	0.207
Tank/bottled gas only (LPG)	0.4%	0.2145	85%	0.252
Oil only	0.2%	0.26813	85%	0.315
Wood only	0.1%	0.0115	75%	0.015
Solid fuel only	0.1%	0.34721	85%	0.408
No central heating	3.8%	Left out as baseline undefined		
Mixed/Other	9.1%	0.22	100%	0.220

Table 18: Emissions factors and efficiencies for heating types in Morecambe West End

Baseline carbon intensity: 0.180 kg CO_2/kWh heat
Annual emissions: 2,396,169 kg CO_2
Per building: 3,903 kg CO_2

10.3. Comparison of Heat Scenarios

Table 19 presents the annual CO_2 emissions of buildings included in the proposed Morecambe heat network. The carbon intensity of electricity consumed from the grid has been averaged across the 50 year project lifetime using projections of grid carbon intensity published in the UK Government Treasury's Green Book[41].

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

Scenario	Total annual emissions (tonne CO_2e)	Per building on network (kg CO_2e)	g/CO_2e per kWh of heat
Existing heating mix	2,396	3,903	180
Heat Network Current Grid[42]	602	980	45
Heat Network Future Grid	540	880	41
Individual ASHPs Current Grid[43]	849	1381	64
Individual ASHPs Future Grid	105	170	8

Table 19: Annual emissions of the buildings including in the proposed heat network, averaged over 50 year project lifetime

The analysis shows that developing a low carbon heat network in the West End of Morecambe is expected to reduce annual CO_2 emissions by 77%. Each year, the heat network is expected to save 1,856 tonnes of CO_2 emissions which equates to 92,800 tonnes across the 50 year lifetime of the network.

The heat network offers carbon savings over individual ASHPs of 30% assuming the carbon intensity of the grid remains at 2025 levels. However, it is anticipated that over the 50 year project lifetime individual ASHPs would reduce CO_2 emissions more than the heat network based on the projected trend of grid decarbonisation. This is due to the network's use of back-up / top-up gas boilers to provide 20% of the network's annual heat demand, however these could be replaced by electric boilers in the future as the relative cost of electricity vs gas reduces. It is worth noting that most of the buildings on the proposed Morecambe heat network route would struggle to install individual ASHPs which achieve a SCOP of 3.24 due to the limited availability of outdoor space making it hard to install an ASHP and meet building regulations, and the difficulty in successfully insulating properties which were constructed pre-1900s.

The Green Heat Network Fund grant requires heat network projects to demonstrate carbon emissions of less than 100gCO_2e/kWh but does not explicitly promote projects offering significantly greater carbon savings. The

[42] Assuming an ASHP SCOP of 2.85.
[43] Assuming a SCOP of 3.24.

proposed heat network at Morecambe is expected to reduce carbon emissions to a level which is 41% of the maximum emissions required by the GHNF.

11. Planning and Permitting

11.1. Current Planning and Permitting Regulations

Community-scale heat networks are subject to a combination of national planning policy, local planning regulations and environmental permitting requirements.. While there is currently no single unified permitting process for heat networks, key regulatory considerations include:

- Underground works: consent may be required for trenching and pipe-laying under highways or public land.
- Above-ground infrastructure: the energy centre may require full or prior approval from the local planning authority
- Environmental and noise assessments: particularly as the energy centre includes a large heat pump.
- Building interfaces: if retrofitting public or private buildings, additional listed building consents or landlord approvals may be required.

11.2. Heat Zoning: Current Context and Future Direction

The Department for Energy Security and Net Zero (DESNZ, formerly BEIS) has been developing heat zoning as a key policy tool to support the decarbonisation of heat, focusing public and private investment on areas where heat networks are likely to be the most viable and cost-effective solution (when compared against on-grid gas central heating as a counterfactual).

Preliminary national analysis has identified Lancaster as a potential future heat network zone, based on building density, heat demand and the presence of suitable anchor loads. However it is currently not known whether Morecambe is expected to fall within a heat network zone.

This has important implications for future development. Under the forthcoming statutory zoning framework (expected imminently), only designated heat network zones will be actively supported and potentially prioritised for:

- Mandatory building connections,
- Targeted funding,

- Streamlined planning,
- Regulatory oversight, and
- Centralised delivery support.

As such, projects outside these designated zones may not be considered part of the government's formal heat decarbonisation strategy. This could mean reduced access to policy support, funding opportunities, and regulatory mechanisms intended to accelerate network deployment within zones.
While the proposed Morecambe heat network demonstrates strong local and environmental value, particularly through community-led ownership and place-based benefits, its location being potentially outside a designated heat zone may present additional challenges, including a more complex or fragmented planning and permitting route, lower priority in funding or investing pipelines, and the absence of regulatory levers (e.g. mandatory connections) that improve viability in zoned areas.

12. Operation and Governance

If the scheme progresses, there are five options:

1. Set up a new, local, Community Benefit Society (CBS). A CBS would enable a share offer to be launched giving community ownership for the scheme. This CBS could also own the new wind turbine. This would however be a big commitment for a group of volunteers, on a project with a 50 years lifespan, even if admin support was provided as has been allowed in the costings. It would also be a relatively risky investment for the investors as there is very little leeway in the finances for extra costs or reduced revenues.
2. Partner with an existing local CBS, such as Morecambe Bay Community Renewables (MORE Renewables) although they have not suggested they would take on such a scheme. The advantage of using an existing CBS rather than a new CBS is that they have access to wider resources and expertise and could then consider delivering similar schemes elsewhere.
3. Partner with a specific Heat Network CBS. If a local CBS were to develop a heat network in Morecambe, they will need a high degree of support. We envisage a federated system where multiple individual societies are supported by a specialised centralised development, advice and administration service with the addition of well supported peer to peer learning between the societies.

4. Partner with a Local Authority who can take the lead and raise the capital required. This is how the Swaffham Prior scheme is being delivered. At the moment only Local Authorities have the power to dig up roads for installing Heat Network pipes so some sort of council partnership may be required anyway. This arrangement would relieve the pressure on the local volunteers and remove the risk from the shareholders, but the scheme could then be bound up in the workings of local government.
5. Partner with a private sector company to deliver and run the scheme on a commercial basis. This would reduce the workload and responsibility for community volunteers but would also give less local control. The rates of return are also not likely to be attractive enough to a private enterprise.

13. Alternative Local Energy Scheme

While the Community Heat Development Unit project focuses on centralised district heat networks, an alternative approach has been identified in the Bishop's Castle case study[44]. This model adapts the Energy Local[45] concept, with a locally installed wind turbine supplying much of the electricity consumed by participating households. Revenue from electricity sales would then be used to service loans taken out to cover the part of the cost of individual ASHPs installations in domestic properties. Morecambe's West End is theoretically well suited to the proposed distributed heat and wind scheme since much of the area is supplied with electricity from a single primary distribution substation, meaning that electricity generated by the proposed wind turbine could be distributed locally. This style of scheme is dependent on the P441[46] modification to the local energy trading rules being finalised and approved, without which it could not be implemented.

Further details of such a scheme are discussed in the CHDU Bishop's Castle case study report. It is anticipated that an equivalent scheme in Morecambe could be more financially viable, and support more homes, due to the proposal of installing a larger, multi-megawatt wind turbine.

[44] https://stcenergy.org.uk/bishops-castle-heat-and-wind-project/
[45] https://energylocal.org.uk
[46] https://www.ofgem.gov.uk/decision/dcp441-proposal-increase-number-allowed-change-report-alternative-variations-two-three-authority-decision

14. Next Steps

As reported in section 9.5, even with a substantial grant the scheme is only marginally viable. The scheme requires grant support amounting to 33% of the total project capital costs, which is equivalent to around 50% of the heat network infrastructure and commercialisation costs eligible for funding by the Green Heat Network Fund (which is capped at 50%). It is currently unlikely that this level of grant could be accessed due to the competitive nature of the scheme prioritising applications which request lower levels of grant funding. This is despite the proposed community owned scheme offering carbon savings which are 60% less than the GHNF threshold, pushing 7.3GWh of gas generated electricity off the grid due to exported wind generation and delivering significant social value through community ownership.

The remaining funding would need to be raised through loans, community mechanisms such as share offers or community bonds and investment from non-domestic customers such as private landlords, housing associations and the local authority to fund their connection to the proposed network. If the Boiler Upgrade Scheme (which partially funds domestic heat pump installations) were to be expanded to fund connection of households to a heat network, the scheme finances would improve significantly and would only require 18% of their capital costs to be funded by the GHNF.

The two main priorities should be establishing local support and progressing the development of the community owned wind turbine. It is essential that local community support is demonstrated for a community owned heat network scheme to progress. An evening workshop event in Morecambe organised by More Renewables and Sharenergy was very poorly attended despite extensive flyering in the local area and online marketing. It is anticipated that attendance of scheme advocates at local events will be essential in establishing local support. Local advocates for such a scheme should get in touch via chdu@sharenergy.coop to register their interest.

Developing a community owned, multi-megawatt wind turbine is essential to the heat network scheme finances and potentially a viable standalone community energy project. Engagement with landowners at the preferential wind sites to the south east of the town should be a priority to establish the options for development.

Involvement of the Bay Leadership Academy in the scheme is essential to the scheme's success since it has the potential to be a good customer for heat and electricity sales while also being a potential site for the heat network energy centre. Attempts have been made to contact the Bay Leadership Academy leadership however it is currently unclear whether the Academy is keen to become a customer of the proposed scheme. Engagement with the academy's leadership team should be a priority.

If local support for a heat network is established, a detailed feasibility report should be commissioned. This would aim to enable a submission of the proposed heat network to the Green Heat Network fund and would need to include and expand upon:

- Detailed quotes for heat network pipework purchased and installation.
- Submission of a G99 grid connection application to Electricity North West for the wind turbine and heat network energy centre.
- Statements of interest from domestic and non-domestic users who are interested in connecting to the proposed network, and recording of accurate heat demand data based on individual gas and/or electricity consumption data.
- Detailed wind assessment and environment impact report.
- Submission of a planning application for development of the community-owned wind turbine.
- Detailed noise assessment of the network energy centre and ASHP.
- Explore support available from other organisations to develop and run a community heat network, including the CHDU.
- Consideration of a distributed electricity model as an alternative to a full scale heat network.

The funding for this body of work from the Energy Redress Fund has come to an end. Sharenergy are currently considering what role they can play in further work on community heat networks and further funding options to enable them to do so.