

# Carlisle

# Heat Network Zoning

# Zone Opportunity Report



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### Acknowledgements





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# Contents

Contents	3
Executive Summary	4
1) Introduction	6
Heat Network Zoning Pilot Methodology	7
Heat Network Zone Identification	7
Initial Zone Opportunities	8
Study Scope	9
2) Carlisle Heat Networks Context	10
2.1) Carlisle City Overview	10
2.2) Carlisle Net Zero Targets and Commitments	10
2.3) Delivering Heat Networks in Carlisle	11
2.4) Carlisle Heat Network Zones	11
3) Strategic Heat Network Zones	14
Strategic HNZs in Carlisle	14
3.1) City Centre	16
3.2) Kingstown	22
3.3) St Cuthbert's	26
4) Other Heat Network Zones	30
Appendix 1: Maps and Legends	32
A. Carlisle Typology Map	34
B. Key Heat Demands	35
C. Key Heat Sources and Potential Energy Centres	37
D. Existing and Planned Heat Networks	38
E. Physical Constraints	39
F. Off-Gas Grid Areas in Carlisle	40
Appendix 2: Data Room Resources	41

# **Executive Summary**



**About Carlisle**: Carlisle is the only city in Cumbria, with an estimated population of around 110,000 over an area of approximately 1,000km<sup>2</sup>.



**Local Energy Policy**: Cumberland Council aims for Cumbria to achieve carbon neutrality by 2037. Previously, Carlisle City Council had also committed to being a net zero city by 2037.



**Existing heat networks**: There are currently no existing district heat networks in Carlisle however local planning policy encourages heat networks for the new St Cuthbert's Garden Village development.



**Zones identified**: Nine potential heat network zones were identified in Carlisle, with an overall annual heat demand of approximately 300GWh/yr for all buildings potentially required to connect within these zones.



**Strategic heat network zones**: Three strategic heat network zones were identified in Carlisle, with an overall annual heat demand of approximately 275GWh/yr for all buildings potentially required to connect within these zones.



**Key heat demands**: The total annual heat demand for buildings connected to the initial zone opportunities identified is circa 200GWh/yr. Key buildings include Cumberland Infirmary and the Lanes Shopping Centre.



**Key heat sources**: Potential heat sources include water source heat pumps recovering heat from the River Caldew and air source heat pumps.



**Estimated CapEx**: The estimated capital expenditure for the full rollout of heat networks within identified zones is up to £500m, of which the initial zone opportunities amount to approximately £375m.



**Other heat network zones**: Smaller heat network zones have been identified where there are clusters of buildings potentially required to connect. These include schools, the Eden Valley Hospice and Kingmoor Park.



**Carbon savings**: The initial zone opportunities identified could deliver carbon savings of approximately 30ktCO<sub>2e</sub> annually.

### Figure 1: Overview of Heat Network Zones in Carlisle



# 1) Introduction

Heat networks will play a crucial role in decarbonising heat in buildings. Heat networks take heating, cooling or hot water from a central source(s) and deliver it to a variety of premises such as public buildings, shops, offices, hospitals, universities, and homes. They are also an important part of securing the UK's energy independence through local, low carbon heat sources and reducing the cost of living through efficient, affordable heating in densely populated areas. Our analysis shows that heat networks could provide about 20% of total heat by 2050. They currently provide about 3%.

The Department for Energy Security and Net Zero (DESNZ) is enabling the development of heat network infrastructure through a range of targeted funding, policy and legislative support to de-risk projects and attract investment. The Energy Act 2023 establishes the regulatory framework for heat networks in Great Britain and provides powers to introduce heat network zoning in England through secondary legislation. A heat network zone (HNZ) is a formally designated geographical area in England where heat networks are expected to provide the lowest-cost solution for decarbonising heating.

Under heat network zoning, central and local government will work with industry and local stakeholders to identify and designate areas of England where heat networks are expected to be the lowest-cost solution to decarbonising heat. Heat network zoning will be essential to speeding up the development of new heat networks and we hope to catalyse growth where it's most needed.

Heat network zoning will significantly increase private sector investment in the sector by removing the barriers which currently limit the pace of developing large scale heat networks. It will also give local communities the tools to accelerate the development of heat networks in their own areas and ensure that more homes and businesses can have access to greener, cheaper heat. It also has the potential to create tens of thousands of jobs across the country.

This report shows the Pilot programme outputs for Carlisle and is intended to showcase potential heat network zones in the city. The report indicates the heat network investment opportunity at a city scale, the potential location of heat network zones, and key opportunities for initial heat network development within those potential zones

Please note that all information presented in this report, including the location of identified heat network zones, is subject to change. These are the findings of Pilot programme that were developed alongside the emerging Heat Network Zoning policy and therefore reflect our understanding at a moment in time. As the methodology improves, we will update these reports to improve our understanding of how heat network zoning may be rolled out in each area. Any potential zones that are identified fully, or partly, in an adjacent local authority area will need to be discussed further once local zone co-ordinators are established.

# Heat Network Zoning Pilot Methodology

Heat network zones will be identified using a standardised national zoning methodology<sup>1</sup>. The Heat Network Zoning Pilot Programme (hereafter Pilot programme) set out to develop a process to identify potential zones in a consistent and standardised manner across a range of towns and cities in England. The programme was fully funded and led by DESNZ, working alongside 28 Local Authorities, and multiple consultancy firms, to develop and test this approach at a local level. As such the final outputs are supported by each Local Authority but do not reflect an approved, endorsed, or adopted position on how zones may be delivered.

Lessons from the Pilot have been used to inform the development of the Heat Network Zoning policy. This includes improvements to the identification approach itself, but also wider policy design relating to the number and size of potential zones; existing heat networks; and the impacts of the policy on a range of stakeholders. Once the response to the heat network zoning consultation is published, we will update the methodology to reflect the final policy position.

The key concepts, definitions and complementary workstreams relevant to this report are introduced below. For a fuller description of the Heat Network Zoning policy, and up to date information regarding its implementation, please visit <a href="https://www.gov.uk/government/collections/heat-network-zoning">https://www.gov.uk/government/collections/heat-network-zoning</a>.

# Heat Network Zone Identification

Heat network zones will be identified using a standardised national zoning methodology. The <u>December 2023 consultation on Heat Network Zoning</u> proposes that the methodology will consist of two stages:

- 1. a national mapping exercise (using a data-led spatial energy model the National Zoning Model, (or NZM), to identify indicative heat network zones across England;
- 2. a refinement stage where relevant local stakeholders will input to the review and refinement of potential heat network zones prior to formal designation.

For the purposes of this study, indicative heat network zones have been identified using a prototype version of the NZM. These indicative zones were then refined by technical consultants with input from local stakeholders. The NZM outputs are already of considerably higher quality than those shared for this work and therefore these reports will improve over time.

This study split heat network zones into two different categories. These are **'strategic'** zones – the largest zones which are generally seen as strategically significant to developing heat networks in an area; and **'other'** zones – which are generally smaller and discrete. These are terms specific to the Pilot programme and the report focuses primarily on the strategic zones.

<sup>&</sup>lt;sup>1</sup> More information can be found in the Heat Network Zoning Methodology Statements (Appendix 3, 4 & 5)

# **Initial Zone Opportunities**

Alongside the identification of potential heat network zones, the Pilot programme has attempted to define areas within zones where the most attractive heat network development opportunities might exist. For the purposes of this programme *only* these are called an "initial zone opportunity" (or IZO). The approach considered economic viability, investment scale and returns, decarbonisation impact and deliverability. They were developed solely around buildings which could be potentially required to connect<sup>2</sup> under the proposed Heat Network Zoning policy and did not consider potential voluntary connections.

Initial zone opportunity design targeted a linear heat density (LHD) of 4MWh/m/yr, for the existing built environment. This is considered a relatively low proxy for economic viability with the heat network sector in England. A more flexible approach was used for new development sites, where different economic success criteria are likely to be applied. To standardise the way opportunities were assessed, the IZOs presented in this report may differ from, or overlap with, existing or planned heat network infrastructure. Campus style heat networks (e.g. in hospitals or university campuses) were considered as potential heat loads with a single point connection. Figure 2 below shows an example of a heat network zone and an IZO.





<sup>&</sup>lt;sup>2</sup> The building categories being considered as potentially required to connect include new developments, large non-domestic buildings, and communally heated residential blocks as described in Heat Network Zoning Consultation (2023)

# Study Scope

This document is presented as a zone opportunity report as it was developed in advance of the final policy design. As such, the report does not include:

- references to the central authority or zoning co-ordinator roles;
- assumptions about rights of existing heat networks, or zone delivery areas;
- an options appraisal on which routes to market may be taken;
- calculations on the cost of heat (connection/tariffs) to specific buildings;
- any inferences as the suitability for public/private sector delivery unless it's matter of fact (existing network or Heat Network Investment Project/Green Heat Network Fund project);
- references to **local community benefit** or **consumer protection** (subject to a live consultation).

In the future, it is intended that a document, similar in style, will be produced to incorporate these policy design aspects and be used as a Zone Market Prospectus (ZMP) to market heat network zoning opportunities in an area. Further detail on the methodology and initial zone opportunity criteria is provided in Appendix 4 and Appendix 5.

# 2) Carlisle Heat Networks Context

# 2.1) Carlisle City Overview

Carlisle is the only city within the county of Cumbria situated in northwest England. The city has an estimated population of over 110,000<sup>3</sup> (2021 census) distributed over an area of approximately 1,042km<sup>2</sup> and is divided into 13 wards. Carlisle is governed by Cumberland Council (CC) which is a new unitary authority formed in 2023 following structural changes to local government in England. These changes merged four local authorities, including Carlisle City Council (CCC).

Located 40 miles northwest of the Lake District National Park, Carlisle is situated at the confluence of the rivers Eden, Caldew, and Petteril.

A large proportion of domestic heat demand in the city is from social housing properties. Social housing in Carlisle is delivered by a total of 21 private registered providers who own more than 8,000 low-cost rental and supported housing within the city<sup>4</sup>. The largest social housing provider in the city is The Riverside Group Limited who operates more than 80% of the social housing stock.

# 2.2) Carlisle Net Zero Targets and Commitments

Cumberland Council's comprehensive Climate and Nature Strategy, includes a Carbon and Energy Management Plan<sup>5</sup>, and was adopted by the Executive in July 2024. The strategy proposes to make Cumbria carbon neutral by 2037<sup>6</sup>.

Carlisle City Council, the former local authority, set out a "Vision for 2030" which outlined an ambition to make Carlisle an exemplar city in clean growth by placing environmental sustainability at the heart of all investment. CCC previously made a commitment to being net zero by 2037. CCC has also developed a Heat Decarbonisation Plan (2022) to look at how to improve the energy efficiency of its portfolio. The Heat Decarbonisation Plan provides advice on how carbon reduction improvements can be made to key buildings and also identifies eight priority actions for improvement of the Council's energy management practices along with associated costings, savings and payback periods.

<sup>4</sup> Regulator of Social Housing's Local Authority Data (2023) Available at:

https://www.gov.uk/government/collections/registered-provider-social-housing-stock-and-rents-in-england <sup>5</sup> Cumberland County Council Carbon and Energy Management Plan 2024-2027 (2024) Available at: https://cumberland.moderngov.co.uk/documents/s18177/Appendix%20B%20-

%20Draft%20Carbon%20and%20Energy%20Management%20Plan%20v0.5.pdf <sup>6</sup> Cumberland Council Climate and Nature Strategy Appendix A (2024) Available at:

https://cumberland.moderngov.co.uk/documents/s20181/Climate%20and%20Nature%20Strategy%20Executive% 20Report.pdf

<sup>&</sup>lt;sup>3</sup> ONS 2021 Census Results (2021) Available at:

https://www.ons.gov.uk/visualisations/censuspopulationchange/E07000028/

Figure 3 below summarises key dates in CCC's and subsequently CC's plans for decarbonisation.





# 2.3) Delivering Heat Networks in Carlisle

There are currently no existing district heat networks in Carlisle, however heat networks are being considered for a new proposed development called St Cuthbert's Garden Village.

Please refer to Appendix 2 for further information about the evidence compiled during the Pilot programme and held by DESNZ for Carlisle. This includes a fully populated stakeholder directory and records of interactions with those stakeholders as well key studies and reports shared with DESNZ.

# 2.4) Carlisle Heat Network Zones

A total of nine potential HNZs were identified in Carlisle, with three considered strategic HNZs. shows the study area boundary as well as the boundaries of all HNZs identified within Carlisle. Strategic HNZs have been allocated a meaningful name agreed as relevant from a local perspective whilst Other HNZs have a reference number allocated instead. In both cases, these names/references are shown on the map.

Please see Appendix 1 for the following maps giving more detail:

- A: City Typology Map shows building typologies which dominate by area.
- B: Key Heat Loads Map highlights key potentially required to connect buildings by heat demand.
- C: Key Heat Sources and Potential Energy Centres highlights key heat sources by type and potential energy centre locations as well as any existing district heat network energy centres.
- D: Existing / Planned Heat Networks Map shows existing HNs and planned extensions to them as well as any planned HNs in advanced stages of development.
- E: Key Constraints Map shows key topographical constraints identified.
- F: Off Gas Grid presents areas with differing levels of properties off the gas grid within the study area.

### Figure 4: Heat Network Zones Identified within the Carlisle Study Area



# 3) Strategic Heat Network Zones

# Strategic HNZs in Carlisle

This section examines each Strategic HNZ and the IZOs identified within each. This covers the key heat demands, heat sources, energy centre locations and potential constraints for each IZO identified. Heat network distribution routes are conceptual and designed to illustrate the potential size and scale of the heat network opportunity that may be realised as part of the upcoming Heat Network Zoning policy. Other heat network zones are listed in Section 4.

Table 1 presents a high-level estimate of the scale of opportunities across Carlisle. Please refer to Appendix 4 for more detail.

Scope	Annual heat demand (GWh/yr)
All buildings required to connect in all zones <sup>7</sup>	300
All buildings required to connect in strategic zones	275
All buildings connected to the IZOs	200

# Table 1: Annual Heat Demand for Buildings in All Zones, Strategic Zones and IZOs

Existing/planned heat networks that overlap with IZOs are described, though their locations may vary due to different approaches. The Pilot programme applied a standard set of technical and economic assumptions across each of the 28 areas that participated in the programme and uses a proxy for economic viability (see Section 1 and Appendix 4 for more detail). Existing and planned networks will often be based on more detailed design work and have taken account of strategic and commercial considerations that were relevant at the time of their development. Future iterations of this report will consider how to better align local studies whilst retaining a nationally consistent approach.

The three strategic zones are summarised below. Figure 5 illustrates the size of each, alongside the key potential heat source and the proportion of buildings that may be required to connect.

**City Centre** is the largest potential zone identified by heat demand, covering much of the city centre extending from Burgh Road Industrial Estate in the west to Rosehill Industrial Estate in the east. The zone includes the River Eden in the north. The West Coast Main Line bisects the zone from north to south. There is a mix of building typologies including clusters of commercial and business districts to the west of the railway line and retail units to the east. Key loads

<sup>&</sup>lt;sup>7</sup> Row 1 is an estimate of heat demand across buildings potentially required to connect in all zones identified. Row 2 is as per row 1, but only within strategic zones. Row 3 includes buildings connected to the IZOs described and largely comprise of buildings potentially required to connect. Figures are generally rounded up to the nearest 25 or 50GWh/yr.

include units within The Lanes Shopping Centre, Coventry Railway Station, Englishgate Plaza, Cumbria Infirmary, and Newman RC High School. For more information, please see Section 3.1.

**Kingstown** is located approximately 1.5km to the north of the City Centre HNZ and contains several commercial/business office districts and industrial areas. Key anchor loads include an office block along Chandler Way and two sites within Kingstown Industrial Estate. For more information, please see Section 3.2.

**St Cuthbert's** is the largest zone by area and is primarily greenspace with few existing buildings potentially required to connect. Proposals have been submitted to develop the area as a Garden Village to include new homes, employment opportunities and improve infrastructure in the area. For more information, please see Section 3.3.



Figure 5: Summary of Heat Demands in all Strategic HNZs Identified

# 3.1) City Centre

# 3.1.1) City Centre – HNZ Summary

The City Centre is the largest zone identified by heat demand. It covers most of the city centre, as shown in Figure 4, stretching from the A689 in the west to the M6 in the east. It is constrained by the River Eden in the north and West Coast Main Line in the south. Both a principal railway line and the River Caldew bisect it. The western area of this division contains several commercial/business office districts, while the city centre lies to the east. The fringes of the zone contain industrial estates. Potential constraints include the River Eden, River Caldew and the West Coast Railway Line.

The estimated total annual heat demand is approximately 275GWh/yr, with approximately 220 buildings identified as potentially required to connect to a heat network. Water source heat pumps (WSHPs) have been identified as a key potential low-carbon heat source.

# 3.1.2) City Centre - Existing Heat Networks

There are currently no operational, planned or proposed heat networks in this HNZ.

# 3.1.3) City Centre - Initial Zone Opportunities

A single IZO was identified in the City Centre zone. Potential routing<sup>8</sup> is shown in Figure 6 and summary statistics provided in Table 2.

Table 2: City C	Centre - Summary	Statistics for In	itial Zone O	pportunities
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СарЕх	Heat	Network	CO₂e savings	Linear Heat Density	Heat Sources
£150m	110GWh/yr	15km	15ktCO <sub>2e</sub> /yr	7MWh/m	WSHP

The IZO has been identified as a good opportunity to develop heat networks due to the high heat density around Carlisle city centre. To the east of the railway station, buildings potentially required to connect include Carlisle Cathedral, retail units within Lanes Shopping Centre and English Street and Carlisle College. To the west of the railway station, buildings potentially required to connect are predominately offices, industrial loads and Cumberland Infirmary. WSHPs recovering heat from the River Caldew have been identified as a potential low carbon heat source.

<sup>&</sup>lt;sup>8</sup> Routes can be expected to change as a better understanding of local constraints is developed through design.

# Figure 6: Initial Zone Opportunities in City Centre HNZ



# Carlisle

Local Authority Boundary C\_\_\_\_ Other Local Authority Boundary

Other Heat Network Zones

----- Initial Zone Opportunity Network Existing and Planned Heat Network

▲ Industrial Waste Heat Existing and Planned - Communal Existing and Planned - District

Buildings Required to Connect

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# 3.1.4) City Centre – IZO Heat Demands

The heat demands identified are described below. The Pilot programme used several sources including local data collected from building owners; national energy demand datasets; benchmarks applied via the National Zoning Model (NZM); and a standardised approach to estimate the potential heat demands of new development sites. More information is provided in Appendix 4.

Where there are different values between datasets, the methodology prioritised the use of the early prototype version of the National Zoning Model, for consistency. This has led to an overestimation of some commercial and light industrial heat demands presented in this report. Large anchor loads that are already connected to existing district-scale heat networks are not listed.

There are a diverse range of building typologies including non-domestic, public sector and residential buildings. Non-domestic buildings account for more than 80% of the heat demand potentially required to connect and comprise of 213 buildings including offices and industrial buildings.

A breakdown of the categorisation of heat demand can be found in Figure 7. Further details of the key heat demands are provided in Table 3.

# Figure 7: City Centre - Categorisation of Heat Demand for Buildings Potentially Required to Connect in the IZO



Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
Cumberland Infirmary	Public sector	1	9,200	ERIC - 2023/24 – Site Data (assumed 80% boiler efficiency)
The Lanes Shopping Centre	Non-domestic	>1	9,100	Benchmark (NZM)
Citadel Railway Station	Railway Public Sector 1 5,550		Benchmark (NZM)	
Carlisle Market	Non-domestic	1	2,710	Benchmark (NZM)
Gleneden Mill	Non-domestic	1	2,070	Benchmark (NZM)
English Gate Plaza	Non-domestic	1	1,910	Benchmark (NZM)
Carlisle College	Public sector	1	1,840	Benchmark (NZM)
Denton Ironworks	Non-domestic	1	1,790	Benchmark (NZM)
Carlisle Dental Centre	Public sector	1	1,750	Benchmark (NZM)
Vue	Non-domestic	1	1,500	Benchmark (NZM)

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The total heat demand of the top ten largest buildings identified is over 35GWh/yr, which is around 33% of the total heat demand of buildings potentially required to connect.

# 3.1.5) City Centre – IZO Heat Sources

This IZO is in close proximity to the River Caldew which has been identified as a potential low carbon heat source to supply a heat network. An estimated 28MWth capacity would be

<sup>&</sup>lt;sup>9</sup> Please refer to Appendix 3 for definitions related to building categories in this table.

required to supply this IZO. An energy centre for this heat source is proposed between the A595 and Viaduct Estate Road (E1).

Table 4 and Table 5 summarise the key heat sources and potential energy centre locations identified. These are also shown in Figure 6 in Section 3.1.3 above and Map C in Appendix 1.

Heat source type	Supplied Capacity (kWp) <sup>10</sup>	Temperature (Degrees Centigrade)	Potential Energy Centre (Ref number)
WSHP	27,600	70-90 °C <sup>11</sup>	E1

# Table 4: City Centre - Key Heat Source Opportunities for the IZO

# Table 5: City Centre - Potential IZO Energy Centre Locations

EC Ref number	Site type	Size (m²)	Ownership	Heat Source
E1	Land	650	Carlise Council	WSHP

# 3.1.6) City Centre – IZO Heat Distribution

The approach to developing the heat network route considered economic viability, investment scale and returns, decarbonisation impact and deliverability. These criteria were applied in a standardised manner across all opportunities identified in the Pilot programme and therefore may not reflect detailed designs or proposed routes identified in more detailed feasibility work. Routing within the site boundary of a building or campus may not have been included if insufficient information was available. The routing was developed solely around buildings which could be required to connect and did not consider potential voluntary connections.

The purpose of the concept heat network route is to define the scale, potential routing and identified associated constraints within the zone. Further work will be required to undertake a more detailed route assessment to take account of the buried utilities, building connections and other local strategic and local planning considerations. Table 6 below, shows the network statistics including the network length and associated cost. Please see Appendix 5 for related methodology statements and assumptions.

The network length is approximately 15km long. The network routing extends from the Cumberland Infirmary, following the A595 east across the River Caldew before then going south towards St Nicholas Gate Retail Park via St Nicholas Trading Estate, connecting to various key anchor loads along the way. These include Carlisle Railway station, Carlisle Cathedral, commercial units within Lanes Shopping Centre, Carlisle Market and larger retail

<sup>&</sup>lt;sup>10</sup> The supplied capacity stated is the estimated required capacity for a high temperature IZO from the technoeconomic model. Lower temperatures may be achieved over time.

<sup>&</sup>lt;sup>11</sup> The temperature at which heat will be distributed to heat offtakers, after upgrade processes.

units in business parks. It also extends east along Strand Road connecting Carlisle College and surrounding public buildings.

Table 6: City Centre - Indicative Heat Network Statistics for the la	ZO
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IZO Heat Network description	Network length (km)	Network cost (£m)
City Centre	15	60

# 3.1.7) City Centre - IZO Key Constraints and Mitigations

**[C2] River Caldew**: This river runs from north to south through the centre of the IZO, forming a partial barrier between the east and west area of the IZO. A feasibility assessment would be required to investigate options for heat network pipework to cross the river.

**[C3] West Coast Main Line**: This river runs from north to south in the centre of the IZO and is a partial barrier between the east and west area of the IZO. A feasibility assessment would be required to investigate options for heat network pipework to cross the railway line.

# 3.2) Kingstown

# 3.2.1) Kingstown - HNZ Summary

The Kingstown HNZ is located approximately 1.5km to the north of the City Centre HNZ, as shown in Figure 4. The zone encompasses Kingmoor Park and Kingstown Industrial Estate, featuring a mix of office and industrial buildings. The largest buildings include an office block along Chandler Way and two large industrial buildings within Kingstown Industrial Estate. The zone stretches from Kingstown Broadway in the south to Kingmoor Park in the north and is flanked by the A7 and M6 to the east. The estimated annual heat demand in the zone is over 50GWh/yr.

# 3.2.2) Kingstown - Existing Heat Networks

There are currently no operational, planned or proposed heat networks in this HNZ.

# 3.2.3) Kingstown – Initial Zone Opportunities

A single IZO was identified in the Kingstown zone. Potential routing<sup>12</sup> is shown in Figure 8 and summary statistics are provided in Table 7.

CapEx	Heat	Network	CO₂e savings	Linear Heat Density	Heat Sources
£50m	45GWh/yr	11km	5ktCO <sub>2e</sub> /yr	4MWh/m	ASHP

The IZO almost spans the entirety of the zone. It encompasses several industrial estates and business parks including Kingstown Industrial Estate and Kingmoor Park, as well as large retail units within Parkhouse. There are 96 buildings that are identified as potentially required to connect to a heat network, with a heat demand of over 45GWh/yr. Air source heat pumps (ASHPs) have been identified as the primary low-carbon heat source.

<sup>&</sup>lt;sup>12</sup> Routes can be expected to change as a better understanding of local constraints is developed through design.

# Figure 8: Initial Zone Opportunity in Kingstown HNZ



# Carlisle

### Zone: Kingstown

- Local Authority Boundary
- C\_\_\_\_ Other Local Authority Boundary
- Heat Network Zone
- Other Heat Network Zones

----- Initial Zone Opportunity Network 

- ▲ Industrial Waste Heat
- 🛆 Other Waste Heat

### **Key Area Heat Sources**

- Deep Geothermal

- Existing and Planned Communal Existing and Planned - District
- Buildings Required to Connect

0.3

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# 3.2.4) Kingstown - IZO Heat Demands

Figure 9 shows that all of the heat demand connected to the IZO is comprised of non-domestic buildings. This is shared between office buildings which account for ~40% of the heat demand, industrial buildings (~30%), retail buildings (~25%) and hotels (~5%). Further details of the key heat demands for buildings that may be required to connect are provided in Table 8.

# Figure 9: Kingstown - Categorisation of Heat Demand for Buildings Potentially Required to Connect in the IZO

![](_page_23_Figure_4.jpeg)

Non-domestic

# Table 8: Kingstown - Key Heat Demands Required to Connect in the IZO

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
Travelex Agency Services Ltd	Non-domestic	1	2,850	Benchmark (NZM)
Bendalls Engineering	Non-domestic	1	2,350	Benchmark (NZM)
W.A Development	Non-domestic	1	1,950	Benchmark (NZM)
Stobart Group	Non-domestic	1	1,850	Benchmark (NZM)
Zoo Hardware	Non-domestic	1	1,530	Benchmark (NZM)
Lafarge Aggregates	Non-domestic	1	1,400	Benchmark (NZM)
Kingstown Retail Park	Non-domestic	>1	1,200	Benchmark (NZM)
Forte Posthouse	Non-domestic	1	1,150	Benchmark (NZM)

# 3.2.5) Kingstown - IZO Heat Sources

The proposed heat source to supply the IZO is a large scale ASHP which could be installed on the green space adjacent to Elliot Drive (E2). Table 9 and Table 10 summarise the key heat sources and potential energy centre locations identified. These are also shown in Figure 8 in Section 3.2.3 above and Map C in Appendix 1.

# Table 9: Kingstown - Key Heat Source Opportunities for the IZO

Heat source type	Supplied Capacity (kWp) <sup>13</sup>	Temperature (Degrees Centigrade)	Potential Energy Centre (Ref number)
ASHP	11,300	70-90 <sup>14</sup>	E2

# Table 10: Kingstown - Potential IZO Energy Centre Locations

EC Ref number	Site type	Size (m²)	Ownership	Heat Source
E2	Land	650	ТВС	ASHP

# 3.2.6) Kingstown - IZO Heat Distribution

Table 11 shows the network statistics including the network length and associated costs. Please refer to Section 3.1.6 and Appendix 5 for the assumptions used .

### Table 11: Kingstown - Indicative Heat Network statistics for the IZO

IZO Heat Network description	Network length (km)	Network cost (£m)
Kingstown	11	25

# 3.2.7) Kingstown – IZO Key Constraints and Mitigations

There are no major constraints identified for the proposed network route.

<sup>&</sup>lt;sup>13</sup> The supplied capacity stated is the estimated required capacity for a high-temperature IZO

<sup>&</sup>lt;sup>14</sup> The temperature at which heat will be distributed to heat offtakers, after upgrade processes.

# 3.3) St Cuthbert's

# 3.3.1) St Cuthbert's - HNZ Summary

St Cuthbert's HNZ is located south of the city centre. It is the largest zone by area and is primarily greenspace with very few existing buildings, as shown in Figure 10. Proposals have been submitted to develop the area as a Garden Village which would include new homes, employment opportunities and improved infrastructure in the area. The estimated annual heat demand in the zone, including the planned new developments, is about 50GWh/yr.

# 3.3.2) St Cuthbert's - Existing Heat Networks

There are no existing heat networks or formal proposals for a heat network in the zone. However, the development and delivery of a heat network(s) is encouraged for the new development called St Cuthbert's Garden Village through the Regulation 19 Publication Draft of St Cuthbert's Local Plan<sup>15</sup>. The development is close to the four existing villages of Cummersdale, Durdar, Blackwell and Carleton.

# 3.3.3) St Cuthbert's - Initial Zone Opportunities

A single IZO was identified in the St Cuthbert's zone. Potential routing<sup>16</sup> is shown in Figure 10 and summary statistics provided in Table 12. It encompasses the entirety of the zone and connects to more than 10,000 buildings that are identified as potentially required to connect, including homes on the proposed new development. These buildings account for about 50GWh/yr of heat demand. The key heat source opportunity lies in utilising a WSHP.

Table 12: St Cuthbert's - Sum	mary Statistics for In	itial Zone Opportunities
-------------------------------	------------------------	--------------------------

CapEx	Heat	Network	CO₂e savings	Linear Heat Density	Heat Sources
£200m	50GWh/yr	75km	10ktCO <sub>2e</sub> /yr	1MWh/m	WSHP

<sup>&</sup>lt;sup>15</sup> <u>https://www.stcuthbertsgv.co.uk/LOCAL-PLAN</u>

<sup>&</sup>lt;sup>16</sup> Routes can be expected to change as a better understanding of local constraints is developed through design.

# Figure 10: Initial Zone Opportunity in St Cuthbert's HNZ

![](_page_26_Figure_2.jpeg)

# Carlisle

# 3.3.4) St Cuthbert's - IZO Heat Demands

Figure 11 shows the distribution of estimated annual heat demand between new developments and existing non-domestic buildings. New developments account for around 95% of the heat demand. Further details of the key heat demands are provided in Table 13 below.

# Figure 11: St Cuthbert's - Categorisation of Heat Demand for Buildings Potentially Required to Connect in the IZO

![](_page_27_Figure_4.jpeg)

Table 13: St Cuthbert's - Key Heat Demands Required to Connect in the IZO

Building name	Building category	Number of connections	Annual Heat Demand (MWh)	Data Source
Residential Units	New development	10,325	31,000	Benchmark (NZM)
Schools	New development	Unknown	14,800	Benchmark (NZM)
Employment	New development	Unknown	2,500	Benchmark (NZM)
Carleton Clinic	Public building	Unknown	2,200	Benchmark (NZM)

# 3.3.5) St Cuthbert's - IZO Heat Sources

This IZO is in close proximity to the River Caldew which has been identified as a potential heat source. It is proposed that an energy centre be installed near the river by the Carlisle Southern Link Road (E3). Table 14 and Table 15 summarise the key heat sources and potential energy centre locations identified. These are also shown in Figure 10 in Section 3.3.3 above and on Map C in Appendix 1.

Heat source type	Supplied Capacity (kWp) <sup>17</sup>	Temperature (Degrees Centigrade)	Potential Energy Centre (Ref number)
WSHP	11,200	70-90 °C <sup>18</sup>	E3

# Table 14: St Cuthbert's - Key Heat Source Opportunities for the IZO

# Table 15: St Cuthbert's - Potential IZO Energy Centre Locations

EC Ref number	Site type	Size (m²)	Ownership	Heat Source
E3	Land	650	Unknown	WSHP

# 3.3.6) St Cuthbert's - IZO Heat Distribution

Table 16 shows the network statistics including the network length and associated costs. Please refer to Section 3.1.6 and Appendix 5 for the assumptions used.

# Table 16: St Cuthbert's - Indicative Heat Network Statistics for the IZO

IZO Heat Network description	Network length (km)	Network cost (£m)
St Cuthbert's	75	150

# 3.2.7) St Cuthbert's - IZO Key Constraints and Mitigations

**[C4] Cumbrian Coast Railway Line**: This railway line runs from north to south in the west of the IZO. A feasibility assessment would be required to investigate options for heat network pipework to cross the railway line.

**[C5] River Caldew**: This river runs from north to south in the west of the IZO. An energy centre is proposed along this river to serve the loads here. A feasibility assessment would be required to investigate options for heat network pipework to cross the river.

**[C6] West Coast Main Line**: This railway line runs from north to south in the east of the IZO. A feasibility assessment would be required to investigate options for heat network pipework to cross the railway line.

**[C7] River Petteril**: This railway line runs from north to south in the east of the IZO adjacent to the West Coast Main Line. A feasibility assessment would be required to investigate options for heat network pipework to cross the river.

<sup>&</sup>lt;sup>17</sup> The supplied capacity stated is the estimated required capacity for a high-temperature IZO from the technoeconomic model. Lower temperatures may be achieved for new build properties.

<sup>&</sup>lt;sup>18</sup> The temperature at which heat will be distributed to heat offtakers, after upgrade processes.

# 4) Other Heat Network Zones

This section describes the 'Other' potential heat network zones that were identified in Carlisle. These are areas where heat networks were deemed to offer the lowest carbon route to decarbonising heat, but are often much smaller or discrete in nature than the 'Strategic' heat network zones identified. The approach taken in the Pilot programme did not apply a minimum threshold for zone identification and therefore future work will need to consider factors such as size and aggregation to ensure efficient and effective delivery of heat networks in the area.

Figure 12 illustrates the total annual heat demand, and the proportion of which is associated with buildings that may be required to connect within each zone. Where potential heat sources have been identified these are labelled against each bar. A map of all zones can be found in Figure 4.

![](_page_29_Figure_4.jpeg)

Figure 12: Total Heat Demand and Proportion Required to Connect in Other HNZs

In addition to the three Strategic HNZs described in Section 3.1 to Section 3.3, six other HNZs were identified in Carlisle, as described below:

**Richard Rose Morton Academy (CARL\_010)**: can be connected to either city centre or St Cuthbert's HNZ in the future.

**Kingmoor Park Central (CARL\_004)**: is situated west of Kingstown HNZ and could potentially be connected to the neighbouring zone.

**Pennine Way School (CARL\_009):** is situated east of the city centre and includes Pennine Way Primary School and Gillford Centre Pupil Referral Unit.

**Inglewood Primary School (CARL\_014)**: is situated southeast of the city centre with potential to be connected to the City Centre HNZ in the future.

**Eden Valley Hospice (CARL\_012)**: is situated south of the city centre just north of St Cuthbert's Garden Village. There may be opportunities to extend St Cuthbert's HNZ to connect to this hospice in the future.

**Newlaithes Primary School (CARL\_005)**: is situated between the City Centre and St Cuthbert's HNZs with the potential to be connected to either zone in the future.

# Appendix 1: Maps and Legends

This section provides guidance on interpreting the icons and legends used throughout this report and Maps A-F that follow:

Legend / icon	Relevant map(s)	What this represents on the map	Comments on interpretation
0.13	Report maps	Study boundary	Extends 1km beyond Local Authority boundary to includ
	Report maps	Local Authority boundary	
513	Report maps	Other Local Authority boundary	
	Report maps	Heat network zones	This includes both Strategic HNZs and Other HNZs.
	Report maps	Other heat network zones	Smaller or discrete heat network zone opportunities
	Report maps	New developments	New development within heat network zones and IZOs t
Gates Hill	Report maps	Heat network zone name / reference number	'Strategic' zones are named; 'Other' zones are represen
	Report maps	Buildings potentially required to connect	Buildings that could be required to connect (as describe
E13	Report maps	Campuses	Multiple buildings owned and operated by the same orga
	Report maps	Initial Zone Opportunity concept network route	Conceptual heat network pipe routes between buildings
	Report maps	Existing and Planned Heat Networks	Known existing or planned heat network pipe routes as
	Report maps	Potential energy centre - IZO	Potential energy centre location for an IZO (see section
	Report maps	Existing/planned energy centre - Communal HNs	'Communal' energy centres are those operated within a
	Report maps	Existing/planned energy centre - District HNs	'District' energy centres supply multiple buildings across
Appendix 1: A – Typology map			•
	Appendix 1: Map A	Dense City Centre	Locally recognised as the City or Town centre, where bu
	Appendix 1: Map A	City Centre Fringe	Around the City or Town Centre or at its outskirts, where
	Appendix 1: Map A	Mixed Use District	A variety of building typologies, with no single typology p
	Appendix 1: Map A	Social Housing	Public, private and third sector social housing
	Appendix 1: Map A	Campus (health / education)	Buildings that are owned and operated together (e.g. Ur

le	cross	boundary	opportunities

that will still be in construction post-2025

nted by a reference number

ed in the HNZ Consultation 2023)

anisation (e.g. Universities, Hospitals)

that could be required to connect

provided by local stakeholders

3)

single building or across a campus

s multiple sites

uildings development is most dense

e both building density reduces

prevailing in the area

niversities, Hospitals)

# Heat Network Zoning Opportunity Report: Carlisle

	Appendix 1: Map A	Commercial / business office	Public & private office space		
	Appendix 1: Map A	Industrial areas	Primarily used for manufacturing, engineering, and ware		
Appendix 1: B – Key heat dema	nds		1		
۲	Appendix 1: Map B	Top 10 Heat Demands	The largest (anchor) heat loads within the Pilot program		
	Appendix 1: Map B	Local Authority	Buildings owned or operated by the Local Authority		
	Appendix 1: Map B	Other public sector	Other buildings owned or operated by the public sector		
	Appendix 1: Map B	Residential with existing communal heating	Residential buildings with existing communal heating sy		
	Appendix 1: Map B	Non-domestic private	Non-domestic private buildings (e.g. commercial, offices		
	Appendix 1: Map B	Industrial	Mixed industrial sites (e.g. light or heavy industry, manu		
<u> </u>	Appendix 1: Map B	Building heat demand (MWh/yr)	Circle size increases with size of heat demand		
Appendix 1: C – Key Heat Sour	ces and Potential Energy	y Centres			
	Appendix 1: Map C	EfW plant	Point heat sources have known or likely points of heat		
	Appendix 1: Map C	Industrial Waste Heat	Mine water and water source 'points' indicate potential		
	Appendix 1: Map C	Mine water			
$\triangle$	Appendix 1: Map C	Other Waste Heat	Other waste heat sources include sewers, electrical se for more detail on heat source capacities, where know		
	Appendix 1: Map C	Water Source			
	Appendix 1: Map C	Waste Water Treatment	On the City-level Map C only, the heat waste symbol is		
	Appendix 1: Map C	Deep geothermal or mine water heat	Area heat sources differ from point-heat sources in that		
C13	Appendix 1: Map C	Ground source	resource is not yet determined		
013	Appendix 1: Map C	Water source			
Appendix 1: D – Existing and p	anned heat networks		1		
$\bigcirc$	Appendix 1: Map D	Existing and planned heat networks	At this scale the route of an existing HN cannot be displa		
Appendix 1: E – Physical const	raints				
	Appendix 1: Map E	Key constraints	Key heat network routing constraints as described in sec		

### housing

me study area (see Section 3)

(e.g. hospital, universities, Govt. estates)

stems installed

)

facturing, warehouses and distribution)

offtake/abstraction

abstraction points.

stations and other sources of heat. See section 3

sized according to its scale in GWh/yr

t the exact location for extracting heat from the

ayed, so an area outline is used instead

ction 3

# A.Carlisle Typology Map

![](_page_33_Picture_2.jpeg)

This document was prepared by on behalf of DESNZ in connection with the Heat Network Zoning Pilot Programme. It takes into account DESNZ' particular instructions and requirements and addresses priorities at the time of publication. This document is not intended for, and should not be relied on by, any third party and no responsibility is undertaken to any third party in relation to it.

# B. Key Heat Demands

![](_page_34_Picture_2.jpeg)

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# Table 17: Heat Demand split further by Building Categories across all Initial Zone Opportunities identified in Strategic HNZs in the Study Area

Building category	Number of buildings required to connect in this category	Annual Heat Demand of buildings required to connect across IZOs (MWh)		) buildi	Carlisle heat	demand split summed for al	by II ŀ
Domestic	2	540	100% -	12,360 —			∎ F n
Education (schools & higher education)	6	3,305	90%	■ 540 - 3,305 -	22,863	<ul><li>■ 1,909</li><li>■ 4,202</li></ul>	
Entertainment	3	658		■ 658 –		└ ■ 3,835	e
Hospitals and residential/nursing homes	7	12,360	– 70% – سو 60% –		45,907		■E
Hotels	3	1,909	ue de				•5
Industrial buildings	52	22,863	of tota		18 305		_ [
Offices	122	45,907	3 40% — %	46,303	40,000		
Public buildings	12	3,835	30% —				
Retail	126	58,217	20% —		58,217		
Sports and recreation	6	4,202	10%				
New Developments	10,330	48,305	0%				∎F
Totals	10,669	202,101	Heat demand (MWhs)				

Note: In Carlisle there are three Strategic HNZs with a total of three IZOs identified across them. The table and graph above summarise the heat demand for buildings potentially required to connect to these IZOs.

# INZs

- lospitals and residential / ursing homes )omestic
- ducation (schools & higher ducation)
- Intertainment
- lotels
- Sports and recreation
- Public buildings
- ndustrial buildings
- ffices
- lew Developments
- Retail

# C. Key Heat Sources and Potential Energy Centres

![](_page_36_Figure_2.jpeg)

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![](_page_36_Figure_4.jpeg)

# D. Existing and Planned Heat Networks

No relevant information available.

38

# E. Physical Constraints

![](_page_38_Picture_2.jpeg)

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# F. Off-Gas Grid Areas in Carlisle

![](_page_39_Figure_2.jpeg)

# Appendix 2: Data Room Resources

Throughout the delivery of the Pilot programme, information resources have been compiled for future use in relation to the development of heat network zones.

These resources will remain restricted to DESNZ and the local authority. This is to ensure that the department remains within its Data Privacy Notice as shared with stakeholders providing the information. GIS outputs are not being published alongside the report as they are subject to change.

Information resource	Description of resource
Stakeholder Directory	A directory listing key stakeholders identified and approached during the HNZPP project, including organisation name, address, or website, contact names, work title and contact details.
Stakeholder meetings log and records	A log of key meetings held and related meeting records.
Datasets Directory	A list of datasets / reports shared by stakeholders cross-referencing who provided the item from the stakeholder directory and a description of the dataset.
Geospatial packages and related geo-coded datasets	Geo-coded datasets and descriptions related to maps produced in this report.

# **Table 18: Pilot Programme Standardised Information Resources**

# Table 19: Pilot Programme Study-Area-Specific Information Resources

Information resource	Description of resource
Carlisle City Council and Homes England	St Cuthbert's Garden Village Energy Masterplanning and Heat Network Feasibility study
Carlisle City Council Heat Decarbonisation Report	Heat decarbonisation plan to improve the efficiency of the Council's portfolio
Carlisle Climate Change Strategy	Strategy for Climate Change Action in the City

This publication is available from: <u>https://www.gov.uk/government/collections/heat-networks</u>

If you need a version of this document in a more accessible format, please email <u>alt.formats@energysecurity.gov.uk</u>. Please tell us what format you need. It will help us if you say what assistive technology you use.