Draft Local Heat & Energy Efficiency Strategy: Midlothian Council

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1. Executive Summary

Local Heat & Energy Efficiency Strategies (LHEES) are a key element to the Scottish Government's heat decarbonisation and energy efficiency plans which aim to tackle climate change. The LHEES will consist of a Strategy document that sets out what needs to be done, as well as a Delivery Plan that will specify the 'how' and 'when', and what teams will be responsible for delivering the planned works.

The purpose of this LHEES Strategy is to present the evidence base that identifies what needs to be done across the local authority to change buildings and local infrastructure by 2045, to fulfil the Scottish Government's objectives and local priorities relating to heat in buildings. The interventions as set out occur at the building level, in heat networks or in a combination of both. The Strategy reflects national and local priorities, policies and wider strategies. Where feasible, it considers local and national factors, such as the timing of planned infrastructure upgrades, access to resources, major projects, decisions over the gas grid and stakeholder/community engagement. Accompanying this LHEES Strategy is an LHEES Delivery Plan, which is an action plan that enables the local authority and its partners to work towards delivery of the changes identified in the LHEES Strategy.

LHEES will have an overarching impact on the objectives found within Midlothian's Climate Change Strategy and Single Midlothian Plan. The Council declared a climate emergency in December 2019 and stated its ambition to achieve Net Zero Carbon status by 2030[1]. A key component of the declaration is the establishment of a Citizen's Assembly to engage the community and business sectors and forge a partnership for change. The strategy acknowledges the Council's intent, reinforces the urgency for action and emphasises the necessity for change to mitigate and adapt to the impacts of climate change and global warming. These are all key components of this LHEES Strategy. The Single Midlothian Plan[2] has outcomes covering the next 4 years including, health poverty and Net Zero, all of which are improved through energy efficiency and heat decarbonisation.

To highlight the scale of the challenge, section 7 of this report outlines the baseline main heating sources for domestic properties across Midlothian. 93% of homes are currently heated by fossil fuels – mains gas, oil or LPG. This is around 37,200 properties. These all need a Net Zero heat solution, such as a connection to a district heat network (DNH). For the remaining properties, their priority should be to ensure their property is as energy efficient as possible alongside potential low carbon heat technology, such as a heat pump.

Midlothian has a unique opportunity due to their partnership with Midlothian Energy Limited (MEL)[3]. This is a 50/50 joint venture between Midlothian Council and

[1] https://www.midlothian.gov.uk/download/downloads/id/4027/midlothians_climate_change_strategy_2020.pdf
[2] The Single Midlothian Plan | Community Planning in Midlothian | Midlothian Council
[3] From waste to low-carbon heating for Midlothian homes | Midlothian Council

Vattenfall. Vattenfall are one of Europe's largest producers and retailers of electricity and heat. This joint partnership aims to invest £100 million in low-carbon energy projects, including heating, over the next 5 years. Without the rapid deployment of heat networks at scale it is simply not possible for Scotland to reach its ambitious net zero by 2045 targets. The heat is already there, all we need is the urgent deployment of low-carbon heating infrastructure to capture it and supply it to local residents and businesses.

This Strategy and the Delivery Plan focus on 6 main outcomes:

1. Midlothian's communities and property decision makers will be engaged and empowered to deliver Net Zero heating targets, this includes making homeowners and tenants aware of funding and support available to them.

2. Work with MEL to find low/zero carbon heat solutions to meet the Council's climate change targets.

3. Alleviate fuel poverty and ensure our solutions do not put people into fuel poverty or further into fuel poverty.

4. Make Midlothian's homes and buildings as energy efficient as possible using a fabric first approach where appropriate.

5. Ensure that Midlothian Council will have an awareness of investment and grant funding opportunities and be able to secure this to deliver heat decarbonisation projects.

6. Keep jobs and revenue from heat decarbonisation projects within the Midlothian economy.

Midlothian Council's LHEES sets out a strategy to provide low carbon heat that is affordable to as many households and buildings as possible. Driving low cost, low carbon heat over the expensive and challenging fabric first retrofit approach will allow us to meet our net zero targets, while abiding by our six LHEES outcomes. Keeping the focus on making buildings ready for low carbon heat will allow us to take heat further. This principle does not mean that building fabric and energy efficiency is not important, we will still endeavour to improve our buildings, however if we prioritise the fabric first approach then low carbon heating will never be rolled out at scale.

Modelling suggests the heat networks in Midlothian alone could reduce emissions by up to 90% in comparison to individual gas boilers fitted in every home. Not only that, but waste heat captured and supplied by MEL will be more reliable than alternative low-carbon sources. By 2050, MEL hope to have delivered city-wide district heating that is capable of supplying heat to the equivalent of 170,000 homes in Midlothian, Edinburgh and East Lothian - creating 900 jobs along the way[4].

[4] *From waste to low-carbon heating for Midlothian homes | Midlothian Council*

Glossary

2.1 Abbreviations

Acronym	Description
EES	Energy Efficient Scotland
EESSH	Energy Efficiency Standard for Social Housing
EPC	Energy Performance Certificate
EST	Energy Saving Trust
GIS	Geographic Information System
HEEPS:ABS	Home Energy Efficiency Programmes for Scotland: Area Based Schemes
IZ	Intermediate Zone
LA	Local Authority
LHEES	Local Heat and Energy Efficiency Strategy
LPG	Liquefied Petroleum Gas
mxd	Map Exchange Document
PEAT	Portfolio Energy Analysis Tool
SAP	Standard Assessment Procedure
ToC	Table of Contents
UPRN	Unique Property Reference Number

2.2 Terms

Terms	Description
Baselining	Baselining is the purpose of understanding at local authority or strategic level, the current status of the buildings against the LHEES Considerations, Targets and Indicators.
Building-level Pathway	As part of LHEES Stage 5, a building-level pathway is the outcome of the assessment undertaken using PEAT. It provides the likely energy efficiency retrofit technologies, as well as the low carbon heating system (where applicable) to support building level decarbonisation.
Criteria	Criteria are the settings applied to the Indicators for each Consideration in order to support Baselining, Strategic Zoning and the identification of Delivery Areas. An example of Criteria is a simple “no” applied to the Indicator of “wall insulation (Y/N)” to identify properties with uninsulated walls. Another example is the definition of an “anchor load” within the Heat Networks analysis, which applies a minimum threshold to the “heat demand” Indicator. The LHEES methodology provides a set of default Criteria that local authorities may wish to use, with flexibility to update and augment these to support local needs or for more focused analysis linked to specific actions and project identification within the Delivery Plan.
Data - Alternative	Alternative data, can overwrite the Core data to improve accuracy (national to local level of detail, e.g. local housing data to overwrite fields in Home Analytics).
Data - Core	Core data is the data that is essential to complete the minimum requirements of the LHEES analysis. Core data will come from national datasets e.g. Home Analytics or the Scotland Heat Map.
Data - Supplementary	Supplementary data allows inclusion of additional Indicators to inform specific, local basel & targets; also, Supplementary data can be used in GIS investigation to complement the Core analysis carried out in any assessment. An example of Supplementary data would be the inclusion of a constraints appraisal as part of a district heating analysis.
Data Zone	Data zones are groups output areas which have populations of around 500 to 1,000 residents.
Delivery Area	Delivery areas are at a higher granularity than Strategic Zones. These spatial zones should set out clusters of buildings within a Strategic Zone or across the whole local authority that identify potential solution(s) at a delivery level. They will be an important starting point for identifying a range of projects, regulation and actions that are within the competence of the Scottish Government, local authorities and wider partners (included as actions to be developed in the LHEES Delivery Plan).
Detailed practitioner approach	These Steps form part of the detailed practitioner approach in LHEES Stage 4, Generation of Initial Areas to set out particularly suitable heat network zones and to support project identification.
Indicator	For a given Consideration, the purpose of an Indicator is: 1) to act as a key information field to help characterise and baseline the local authority. 2) to act as a key information field to support strategic zoning and generation of initial delivery areas; 3) if suitable, to act as a key information field to measure progress against Targets over the duration of the LHEES - set out in the LHEES Delivery Plan. For some Considerations, one Indicator may be sufficient, but for others a range may be appropriate.
Intermediate Zone	Intermediate zones are a statistical geography that are designed to meet constraints on population thresholds (2,500 - 6,000 household residents), to nest within local authorities, and to be built up from aggregates of data zones.

LHEES Considerations	The LHEES Considerations are a list of technologies, building typologies and policy priorities used to identify and target interventions. They include: - Heat networks - Off-gas grid buildings - On-gas grid buildings - Poor building energy efficiency - Poor building energy efficiency as a driver for fuel poverty - Mixed-tenure, mixed-use and historic buildings
LHEES Delivery Plan	An LHEES Delivery Plan is a document setting out how a local authority proposes to support implementation of its local heat and energy efficiency strategy.
LHEES Guidance	The LHEES Guidance sets out the production and content requirements for a local authority to prepare a Local Heat and Energy Efficiency Strategy and Delivery Plan. Its purpose is to ensure that a Local Heat and Energy Efficiency Strategy and Delivery Plan contain outcomes and actions that are backed up by robust data and analysis, supported by stakeholder engagement, and that are linked to national and local priorities, plans and targets.
LHEES Methodology	The LHEES Methodology is a more detailed, step by step approach, which includes models, tools and templates, and represents best practice in how to produce an LHEES in accordance with the requirements set out in the LHEES Order and Guidance.
LHEES Stages	There are 8 LHEES Stages proposed in this methodology. The purpose of the LHEES Methodology is to enable the local authority to complete LHEES Stages 1 to 6. The completion of these Stages will provide the local authority with the data analysis and evidence base to enable them to complete their LHEES Strategy and Delivery Plan documentation. There are two LHEES reporting templates included alongside this methodology– LHEES Strategy example template and LHEES Delivery Plan example template. The completion of these two templates will satisfy the completion of LHEES Stages 7 and 8. The 8 LHEES Stages proposed in this methodology are: 1 - Policy and strategy review 2 - Data and tools library 3 - Strategic zoning and pathways 4 - Generation of initial delivery areas 5 - Building-level pathway assessment 6 - Finalisation of delivery areas 7 - LHEES Strategy 8 - LHEES Delivery Plan
LHEES Strategy	An LHEES Strategy is a long-term strategic framework for— - the improvement of the energy efficiency of buildings in the local authority's area, and - the reduction of greenhouse gas emissions resulting from the heating of such buildings
Mixed-tenure, mixed-use and historic buildings	Mixed-tenure and mixed-use buildings could include a mixture of owner occupied, private rented and social housing, and also non-domestic uses, or simply multiple ownership within the same tenure. Historic buildings include the buildings that are within conservation areas or those that are listed buildings. These categories may require established alternative approaches and regulation for the installation of low carbon heat and energy efficiency solutions and where specific advice and support might be available relating to the installation of these solutions.
Potential Zones	The analysis carried out for strategic zoning and pathways for the heat networks Consideration is to identify potential zones rather than the otherwise used naming convention of Delivery Areas. The potential zones identified are to be included in the LHEES Strategy and should inform actions around further investigation / progression within the LHEES Delivery Plan. The heat networks Consideration analysis and activity carried out within LHEES is also anticipated to support activity

	related to formal zone designation as required by the Heat Networks (Scotland) Act 2021.
Raster	A matrix of squares, or grid, used as a method of data analysis in GIS. Each cell in the grid contains a value representing information on the cell's contents.
Strategic Zone	Strategic Zones present a visualisation of the potential pathways to decarbonise the building stock at a local authority level. These could, for example, be split out by intermediate zone or data zone. They are useful to understand the baseline performance, the scale of potential and initial areas of focus, which could be used to inform Delivery Areas and follow on engagement.
Targets	Targets are the measurable aspect of the Consideration and are likely to be taken directly from national and/or local policy documentation, for example net-zero by 2045, or EPC C by 2040. Targets are likely to comprise of end-point targets and milestone targets and would sit along a timeline within (and beyond) the LHEES. This timeline would help to prioritise the types of projects undertaken within the LHEES over its duration.
Weighting	For some Considerations, one Target and Indicator may be sufficient, but for others a range of Indicators may be appropriate to contextualise and characterise performance against a Target and/or progress towards a Consideration. If multiple Indicators are used in strategic zoning or the identification of delivery areas, a Weighting can be applied based on the importance of each. The LHEES methodology sets out a core set of default Weightings for instances where multiple Indicators are suggested as a default setting. There is flexibility to update and augment these to support local needs or for more focused analysis linked to specific actions and project identification within the Delivery Plan.

3 Introduction

3.1 Overview of LHEES

Local Heat and Energy Efficiency Strategies (LHEES) are at the heart of a place based, locally-led and tailored approach to the heat transition. These local Strategies will underpin an area-based approach to heat and energy efficiency planning and delivery. This LHEES Strategy will set out the long-term plan for decarbonising heat in buildings and improving their energy efficiency across the Midlothian Council area.

LHEES are primarily driven by Scotland's statutory targets for greenhouse gas emissions reduction and fuel poverty[5]:

- Net zero emissions by 2045 and 75% reduction by 2030.
- In 2040, as far as reasonably possible, no household in Scotland is in fuel poverty.

For the Midlothian Council area, this Strategy will:

- set out how each segment of the building stock needs to change to meet national and local objectives, including achieving zero greenhouse gas emissions in the building sector, and the removal of poor energy efficiency as a driver of fuel poverty;
- identify strategic heat decarbonisation zones, and set out the principal measures for reducing buildings emissions within each zone; and
- prioritise areas for delivery, against national and local priorities.

The LHEES will draw on standardised methodology provided by the Scottish Government to determine how the stock of Midlothian Council's buildings will need to change in order to meet national energy efficiency objectives and will seek to identify heat decarbonisation zones and establish priorities for the delivery of these zones.

This Strategy will be accompanied by a Delivery Plan. This will be developed in partnership with key stakeholders, and will provide a strong basis for action in local communities, and with government, investors, developers and wider stakeholders, pinpointing areas for targeted intervention.

3.2 Scope and Limitations

The full building stock, both domestic & non-domestic throughout the Midlothian Council area will be included within the scope of this strategy. It will cover a wide

[5] *Climate Change (Scotland) Act 2009 (legislation.gov.uk)*

range of buildings including private homes, Council and Registered Social Landlord owned houses, Council buildings as well as private commercial businesses.

There are limitations to the LHEES methodology provided by the Scottish Government due to data quality and reliability The data used within this strategy is mainly derived from the Home Analytics (HA) data set. This data is derived from EPC and Home Energy Scotland (HES) which is often based off assumptions and recognised as not always accurate. EPC data is constantly being updated as new certificates are issued daily, and there is a time lag between this and the updating of the HA data set. This can result in a data set that is inconsistent to the data we hold internally.

4 Background Information

4.1 LHEES Structure

As established in the Local Heat and Energy Efficiency Strategies (Scotland) Order 2022[6], LHEES should have a two-part structure – a Strategy and a Delivery Plan.

A local heat and energy efficiency **strategy** is a long-term strategic framework to address the required:

- Improvement in energy efficiency of buildings in the local authority's area, and
- The reduction of greenhouse gas emissions resulting from the heating of such buildings

The **Delivery Plan** sets out how Midlothian proposes to support implementation of its LHEES to deliver heat and energy efficiencies within the plan area.

4.2 LHEES Function

The LHEES Guidance outlines that the function and scope of the LHEES should be framed around five 'LHEES Considerations', outlined in Table1. More information on the LHEES considerations can be found in appendix 2.

Table 1: LHEES Considerations

	No.	LHEES Consideration	Description
Heat decarbonisation	1	Off-gas grid buildings	Transitioning from heating oil and LPG in off-gas areas
	2	On-gas grid buildings	On-gas grid heat decarbonisation
	3	Heat networks	Decarbonisation with heat networks
Energy efficiency and other outcomes	4	Poor building energy efficiency	Poor building energy efficiency
	5	Poor building energy efficiency as a driver for fuel poverty	Poor building energy efficiency as a driver for fuel poverty

[6] Footnotes - Local heat and energy efficiency strategies and delivery plans: guidance - gov.scot (www.gov.scot)

The Strategy will set out the long-term plan for decarbonisation of heat in buildings whilst improving their energy efficiency. This will apply across the entire local authority area and will be framed around the following LHEES Considerations (heat decarbonisation and energy efficiency).

Heat decarbonisation[7]:

This comprises identifying off-gas areas that will transition from primarily heating oil and LPG heat sources to renewable energy sources, which in urban areas might include identified viable heat networks.

By 2030 at least 1 million homes (across Scotland) will need to have switched from carbon-based heat sources such as natural gas, heating oil and LPG to zero emission renewable energy heat sources such as air, ground (or water source) heat pumps, or particularly in urban areas where possible, heat networks[8].

In Off Gas Areas the focus will be on the transition away from heat sources reliant on heating oil or LPG to air source, or ground or water source heat pumps where these are viable.

In On Gas Areas the priority will be to eventually phase out the use of natural gas entirely, and transition to zero carbon heating which could involve air source heat pumps, ground source heat pumps (where land is available) or connecting to district heating networks.

Energy efficiency[9]:

The focus will be to identify areas where building fabric is of low thermal quality as this results in a larger proportion of household income being spent on heating the home to an acceptable level. Poor building energy efficiency therefore acts as a driver of fuel poverty. In reference to the LHEES outcomes, this should not prevent the move over to low carbon heat.

4.3 Prioritising LHEES Considerations in a Local Context

Decision making on how to prioritise Considerations in Midlothian's first LHEES has been informed largely through identification of local priorities alongside analysis of the characteristics of the building stock across the Council area. An overview of Midlothian Council's priority indicators are shown in table 2.

[7] *Decarbonisation is the use of renewable electricity to generate heat in the building*

[8] *Chapter 2 A 2045 Pathway for Scotland's Homes and Buildings - Heat in buildings strategy - achieving net zero emissions: consultation - gov.scot (www.gov.scot)*

[9] *Energy efficiency is the use of less energy to perform the same task or produce the same result*

Table 2: LHEES Considerations with Midlothian Context

LHEES Consideration	Description	Midlothian Context
Heat Networks	Highlighting zones within a local authority where heat networks present a potential decarbonisation option.	Midlothian is highly suitable for heat networks from a heat demand and waste heat perspective. This Consideration is a priority focus for the LHEES.
Poor Building Energy Efficiency as a driver for fuel poverty.	Identifying possible locations at a strategic and delivery level where poor building energy efficiency acts as a driver for fuel poverty.	Midlothian's LHEES has focused on this Consideration as a mechanism of reducing fuel poverty and heat demand.
On-Gas Grid Buildings	Identifying potential on-gas heat decarbonisation pathways and opportunities at a strategic and delivery level.	Midlothian's LHEES has focused on this Consideration to better understand connection viability for heat networks and to identify decarbonisation pathways for areas not suitable for heat networks.
Poor Building Energy Efficiency	Identify possible locations at a strategic and delivery level where poor building energy efficiency exists across the local authority.	This has been incorporated into delivery of the heat networks Consideration which will need to consider domestic energy efficiency interventions in indicative Heat Network Zones.
Off-Gas Grid Buildings	Identify off-gas heat decarbonisation pathways and opportunities at a strategic level and at a delivery level.	87% of Midlothian's domestic properties are on the gas-grid. This Consideration therefore has not been prioritised for the current LHEES.

4.4 Stakeholder Engagement

Developing Midlothian's LHEES has necessitated robust stakeholder engagement. Some of the key engagement activities included –

- Initial internal meetings to advise on the scope of Midlothian's LHEES upon development of the outputs of stages 1-4 of the Methodology.
- Ongoing internal engagement with Housing and Planning officers.
- Ongoing engagement with strategic partners such as Changeworks, MEL and Vattenfall.
- Engagement with other local authorities producing LHEES through the Local Authority LHEES Forum. Engagement with the Scottish Government on the development of the LHEES Guidance and the regulations around the Heat Networks Act.

- Engagement with external stakeholders including Registered Social Landlords (RSLs), Private Landlords and Businesses.

Future engagement that is undertaken after the publication of this strategy will be critical in meeting the main outcomes. Plans for a robust community engagement campaign are in place.

More detail regarding stakeholder engagement can be found in appendix 1.

4.5 Local Authority Formalities

A full Integrated Impact Assessment (IIA)[10] has being undertaken for the LHEES Strategy. This IIA covers both the LHEES Strategy and Delivery Plan. A Strategic Environmental Assessment (SEA)[11] Screening report has also been undertaken for the LHEES Outputs specifically and results have indicated that a full SEA is not required.

4.6 Local Authority Progress

4.6.1 Local Development Plan (LDP)

The current development plan for Midlothian is made up of two plans:

- The Midlothian Local Development Plan[12], adopted 7 November 2017.
- National Planning Framework for Scotland 4[13], adopted 13 February 2023.

The 2017 Midlothian Local Development Plan sets out the development strategy for Midlothian. It sets out the detailed policies used to determine planning applications in Midlothian. The Development Plan Scheme (DPS) contains the timetable for preparing the next development plan which is due in 2017. It sets out the Council's proposed engagement activity by considering Midlothian's second Local Development Plan, and seeks feedback on the Council's proposed engagement activity.

The LHEES Lead will work closely with planning officers to ensure the LHEES priorities are met in the next publication of the LDP.

[10] *Equality and Diversity reports | Section 4 integrated impact assessment (midlothian.gov.uk)*
[11] *https://www.midlothian.gov.uk/download/downloads/id/2508/development_sites_assessment_technical_note.pdf*
[12] *Midlothian Local Development Plan 2 | Development plans and policies | Midlothian Council*
[13] *https://www.midlothian.gov.uk/download/downloads/id/4961/national_planning_framework_4_npf4_info.pdf*

4.6.2 Energy Efficiency Standard for Social Housing (EESSH)

Changeworks was commissioned to carry out a baseline energy efficiency stock analysis on Midlothian Council's domestic housing stock and how compliant the properties are with the Scottish Government's Energy Efficiency Standard for Social Housing 2 (EESSH2)[14]. At the time of commissioning, EESSH2 guidance required all social housing to meet the Scottish Government's ambitious target of an Energy Efficiency (EE) rating of 81, equivalent to an EE band B by 2032 within the limits of cost, technology and necessary consent.

The average EE rating across the 6,945 analysed properties from Midlothian Council is 70, which is equivalent to a 'low' EE band C. This is 3 points higher than the average score of 67 for Scottish local authorities. Over half (57%) of the Council's properties have an EE band C (3,956 properties) and one-third (32%) are in the lower bands D to G (2,205 properties).

To increase the energy efficiency of the stock, the following measures were identified:

• Loft and roof insulation measures are applicable for 850 properties (12% of the stock)

• Wall insulation measures are applicable for 714 properties (10% of the stock)

• High efficiency glazing is applicable for 3,290 properties (47% of the stock)

• Floor insulation measures are applicable for 4,764 properties (69% of the stock)

• Heating upgrade measures are applicable for 1,066 properties (15% of the stock)

• Solar PV for 2,907 properties (42%)

• Solar thermal for 67 properties (1%)

The next steps for social housing will involve a more in-depth analysis of the housing stock, taking each property individually and assessing the measures required.

4.6.3 Local Housing Strategy (LHS)

The Housing (Scotland) Act 2001 requires local authorities to prepare a Local Housing Strategy (LHS) for their area. The Local Housing Strategy's strategic vision for housing in Midlothian is that: *"All households in Midlothian will be able to access housing that is affordable and of good quality in sustainable communities".*

LHS Outcomes 2021-2026:

- Access to housing and the supply of new housing has increased across all tenures in Midlothian.

[14] *Energy efficiency in social housing - Home energy and fuel poverty - gov.scot (www.gov.scot)*

- Improve Place Making in Midlothian.
- Homeless households and those threatened with homelessness are able to access support and advice services and all unintentionally homeless households will be able to access settled accommodation.
- The needs of households with particular needs will be addressed and all households will have equal access to housing and housing services.
- Housing in all tenures will be more energy efficient and fewer households will live in, or be at risk of, fuel poverty.
- The condition of housing across all tenures is improved.
- Integration of Housing, Health and Social Care in Midlothian is improved.

The LHEES Lead will work closely with housing officers to ensure the LHEES priorities are met in the next publication of the LHS.

4.6.4 Energy Efficient Scotland: Area based Schemes

Midlothian Council officers are working closely with Changeworks to deliver the EES:ABS[15] projects across Midlothian. The LHEES lead is working with the individuals responsible for these projects to ensure that they are in line with LHEES priorities. EES: ABS projects with Midlothian Council include solar panels, battery storage and/or external wall insulation.

So far Changeworks have installed measures in over 1038 properties across the council. Around 650 of these are EWI projects in Mayfield, Penicuik and Bonnyrigg. Around 334 properties across Penicuik, Woodburn, Gorebridge, Danderhall and rural areas (Cousland) have had Solar PV installed. In addition to these projects some properties have had underfloor insulation where suitable.

4.6.5 Heat network Activity

Midlothian has a unique opportunity due to their partnership with Midlothian Energy Limited (MEL). This is a 50/50 joint venture between Midlothian Council and Vattenfall. Vattenfall are one of Europe's largest producers and retailers of electricity and heat. The 50/50 joint venture is currently delivering low carbon energy projects across the council.

The first project is a low carbon district heating network supplying the new Shawfair town in the north of the council area. Zero Waste contractor FCC Environment, which operates Edinburgh and Midlothian councils' energy from waste facility (EfW) near Millerhill, supplies low carbon heat to the DHN. The EfW plant is fuelled by residual waste collected by Midlothian, Edinburgh and East Lothian council's. The first phase of the project is supply 3,000 homes, education and retail properties at

[15] *Energy Efficient Scotland: Area Based Schemes | Changeworks*

Shawfair Town, saving over 2,500 tonnes of CO2 per year. **Heat, which is generated by the energy centre, is schedule to be switched on in July 2024, with heat coming from the EfW plant expected in 2025.**

MLC has also signed a 40 year agreement with the MEL to supply heat to new public buildings that are built within the new Shawfair town. MEL will negotiate final contracts with its main initial partners, FCC Environment[16] and Shawfair LLP[17]. FCC will supply the low carbon heat and Shawfair LLP will facilitate the connections to new domestic and commercial developments in the town.

Additionally, there is a small heat network within the town of Bonnyrigg. This was one of the first in Scotland and was renewed and upgraded to a CHP system in 2003. It provides 215 homes with heating and hot water through 4km of underground pipes.

This LHEES report will outline the future for heat networks across the Midlothian.

4.6.6 LHEES Pilot

Changeworks were procured as consultants to undertake the phase 2 LHEES pilot study for Midlothian. The primary aim of the LHEES Phase 2 pilots were to test and develop methods for creating an LHEES, identify relevant sources of data (and any data gaps), and gain a fuller understanding of the resources and capabilities required to deliver an LHEES.

For Midlothian the focus was on energy efficiency in able to pay[18] (domestic and non-domestic) and domestic private rented sector across the whole local authority area. The project included baseline data reporting, objectives and targeting, measures evaluation, stakeholder engagement, socio-economic analysis and an implementation plan.

[16] *Home Page - Millerhill (fccenvironment.co.uk)*
[17] *Welcome to Shawfair - New Homes, Offices, Retail in Edinburgh - Shawfair*
[18] *Decision maker should be able and willing to carry out energy efficiency improvements.*

5 Policy & Strategy Context

The Scottish Government's Energy Efficient Scotland route map[19] sets out two key objectives:

1. Removing energy efficiency as a driver for fuel poverty
2. Removing GHG emissions through energy efficient buildings and decarbonising the heat supply.

In attempt to meet these objectives the Government is encouraging targeted area-based schemes led by LAs. LHEES are in place to set the framework and delivery programme for how each LA will reduce energy demand and decarbonise the heat supply in their area.

The national heat and energy efficiency policy landscape in the Scotland is well developed and LHEES will form part of this jigsaw. The Heat Networks (Scotland) Act[20] places a duty on local authorities to carry out a review to consider areas within its boundaries that are likely to be suitable for heat network construction. Although this guidance sits outside the scope of LHEES, the LHEES strategy and delivery plan will support consideration and presentation of evidence relating to the matters set out within Section 48 of the Heat Networks (Scotland) Act 2019. Therefore, LHEES and the duties of the Heat Network Scotland Act interact.

The Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019[21] will shape the LHEES due to reducing energy efficiency as a driver for fuel poverty being a key objective. The targets from this strategy will form an important aspect of each local authorities LHEES plans. LHEES will also sit within the Energy Efficiency Standard for Social Housing (EESSH 1&2) and The Planning (Listed Building Consent and Conservation Area Consent Procedure) (Scotland) Regulations 2015[22] as these regulations directly apply to the approaches domestic properties are being constructed by.

LHEES must feed into the policy landscape to ensure energy and heat decarbonisation is recognised as a priority across the local authority area.

[19] *Energy Efficient Scotland: route map - gov.scot (www.gov.scot)*
[20] *Heat Networks (Scotland) Act 2021 (legislation.gov.uk)*
[21] *Fuel poverty - Home energy and fuel poverty - gov.scot (www.gov.scot)*
[22] *The Planning (Listed Building Consent and Conservation Area Consent Procedure) (Scotland) Regulations 2015 (legislation.gov.uk)*

5.1 National Policy & Strategy

The main national policies are detailed in table 3. These will be regularly reviewed for future iterations to highlight any changes, and how they influence ongoing delivery.

Table 3: National Policy Summary

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019	Targets to reduce Scotland's emissions of all GHGs to net-zero. Net-zero by 2045; 56% by 2020; 75% by 2030; 90% by 2040
The Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019	The Bill sets out a new target relating to the eradication of fuel poverty, as well as providing a revised definition of fuel poverty. By 2040: no more than 5% of households in Scotland are in fuel poverty; no more than 1% of households in Scotland are in extreme fuel poverty. By 2030: 15% (FP); 5% (EFP) and by 2035: 10% (FP); 3% (EFP)
The Heat in Buildings Strategy (2021)	Updates the Energy Efficient Scotland route map and commits to putting in place standards and regulation for heat and energy efficiency to ensure that all buildings are energy efficient by 2035 and use zero emission heating and cooling systems by 2045. By 2030 over 1 million homes and 50,000 non-domestic buildings to convert to using zero or low emissions heating systems.
Energy Efficiency Standard for Social Housing (EESSH 1&2)	The Standard aims to improve the energy efficiency of social housing in Scotland. Proposed a target to maximise the number of homes in the social rented sector achieving EPC B by 2032
The National Planning Framework	The National Planning Framework (NPF) sets the context for development planning in Scotland and provides a framework for the spatial development of Scotland as a whole.
Heat Networks (Scotland) Act 2021	Regulates heat networks, supporting objectives in the Heat in Buildings Strategy to grow heat network opportunities. This strategy helps Midlothian Council meet part of its duty within the Act by identifying potential heat network zones. Other duties excluded from this strategy are identifying non-domestic building connections; designating zones; setting up permitting, regulation, and licencing processes; and developing a cost strategy.

5.2. Heat in Buildings Strategy

The Heat in Buildings Strategy is the document where the LHEES concept has derived from, therefore making it one of the key pieces of legislation relevant to this strategy. The key targets of this strategy are displayed below in figure 1.

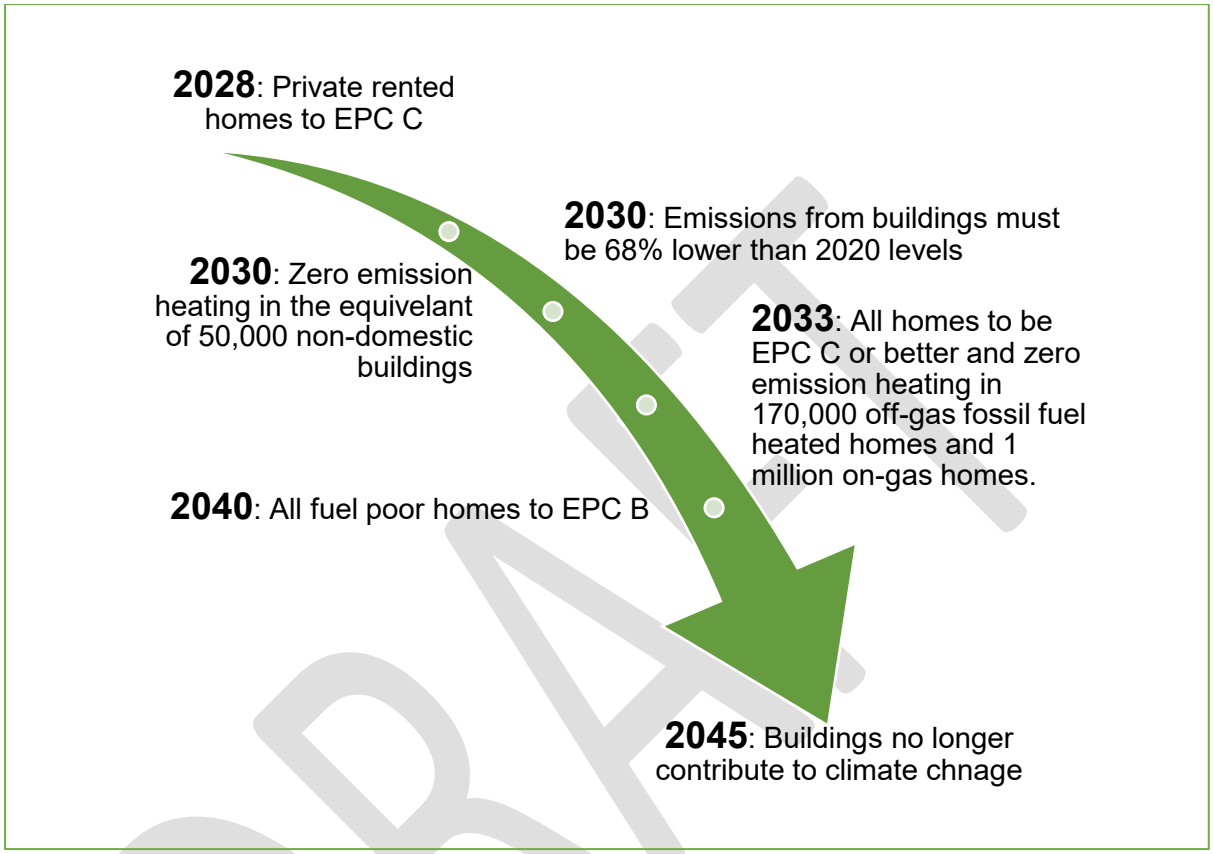


Figure 1: Key Heat in Building Strategy targets

5.3 Local Policy & Strategy

Midlothian Council declared a climate emergency in December 2019 and stated its ambition to achieve Net Zero Carbon status by 2030.

Table 3 provides an overview of the local policy landscape in relation to Midlothian council specifically. These strategies and plans will be considered when developing and implementing the LHEES. LHEES will have an interaction with the Local Housing Strategies (LHS), specifically section 11 of the LHS guidance which makes reference to LHEES. Although LHEES will not change the reporting duties on fuel poverty, energy efficiency and climate change, the analysis required to produce LHEES, along with the resulting Strategy and Delivery Plan documents will provide key evidence to support reporting in the LHS. At the same time, the outcomes and actions set out in the LHS (due for renewal in 2026), will feed into and shape

LHEES. LHEES will have a similar interaction with Midlothian's Local Development Plan (LDP).

The draft Fourth National Performance Framework (NPF4) states that: 'In taking forward national developments we expect delivery partners to consider how the development interacts with the provision of heat for the surrounding area, potentially in connection with LHEES and emerging plans for the heat sector in the longer term'. Midlothian's LDP, which is due in line with the LHS in 2026, should take into account the area's LHEES and areas of heat network potential and any designated heat network zones when allocating land'. LDP sites should be considered when undertaking zoning as part of LHEES, in particular feeding into potential heat network zones. These local strategies will feed into LHEES directly, however the additional strategies and plans outlined in table 4 will also have a relation.

Table 4: Local Policy & Strategy Review

Singe Midlothian Plan	Community Planning Partnerships (CPPs) draw together public, voluntary and private sector bodies, and local communities. CPPs deliver a shared 'plan' based on evidence to improve the lives of local people. Relevant objectives include: 'To explore the exploration of ground and roof mounted solar panels on Council owned land and property' and 'increase renewable energy'.
Midlothian Climate Change Strategy	Midlothian Council aims to lead by example and has developed a Climate Change strategy. The strategy outlines the challenges and provides an action plan to achieve targets and contribute to a net zero position. Objectives include raising awareness of climate impacts and taking a 'One Council' Approach to reducing carbon emissions.
Local Development Plan 2017	There were no targets regarding private housing however this plan seeks to mitigate greenhouse gas emissions arising from the use of buildings by limiting energy use, improving energy efficiency and requiring the use of low and zero carbon heat.
Local Housing Strategy 2021-2026	The Housing (Scotland) Act 2001 requires local authorities to prepare a Local Housing Strategy (LHS) for their area, supported by an assessment of housing need and demand.
Strategic Housing Investment Plan 2023/24	The purpose of Midlothian's Strategic Housing Investment Plan (SHIP) is to set out strategic investment priorities for affordable housing over a 5 year period to achieve the outcomes set out in the Local Housing Strategy (LHS). The SHIP priorities are clearly aligned with the LHS Outcomes Action Plan 2021-2026
Energy Efficiency Standard for Social Housing 2023/24	Aim to reduce energy consumption, fuel poverty and greenhouse gas emissions. Target to make a significant contribution to reduce carbon emissions by 80% by 2050 in line with the requirements set out in the Climate Change (Scotland) Act 2009

5.4 Resources

In Scotland there are several useful resources for advice and funding for energy efficiency measures. Home Energy Scotland[23] is funded by the Scottish Government and is the main supplier of energy advice and grant funding in Scotland. Their email and phone service along with their website provides users with detailed advice on energy efficiency measures and low carbon renewable technologies. Funding includes interest free loans and full or part funded grants for householders and landlords.

The Warmer Home Scotland[24] Scheme delivered by Warmworks is another government funded scheme to assist with energy efficiency. This scheme is means tested[25] and can provide the householder with an improved heating system, renewable technology and insulation.

Home Energy Efficiency Programmes for Scotland (HEEPS) is another funding platform to tackle fuel poverty and increase energy efficiency. Householders can benefit from insulation measures and sometimes heat pump installation either fully or part funded.

Business Energy Scotland[26] and Zero Waste Scotland also provide funding and support to small local businesses across Scotland.

6 Baselining - Domestic

Core datasets used in this LHEES analysis are:

Home Analytics (domestic): Home Analytics is a dataset delivered by Energy Saving Trust, which pulls together data on residential properties throughout Great Britain. It combines energy efficiency metrics with a range of property attributes, geographical factors and socio-demographic information. The dataset provides detail available at individual property level and combines both actual and modelled values. It should be noted that the data is not 100% accurate, as the characteristics of some properties are based on extrapolated data. In LHEES analysis, this dataset is used for the domestic building stock assessment.

[23] Home Energy Scotland

[24] *Warmer Homes Scotland • Warmworks • Bringing warmth to homes and communities.*

[25] *A means test is a determination of whether an individual or family is eligible for government assistance or welfare*

[26] *Business Energy Scotland · Make Your Business Greener*

Scotland Heat Map[27]: The Scotland Heat Map consists of a number of separate layers mapping energy consumption. The purpose of the map is to determine heat demand and heat sources across Scotland to facilitate the optimisation of energy supplies and infrastructure investment. For the GIS analysis elements of the LHEES approach, the Scotland Heat Map "Geographic Boundaries" dataset is used to provide precise geographic areas, with Data Zones utilised within this methodology.

One Scotland Gazetteer's Address Gazetteer[28]: The One Scotland Gazetteer (OSG) is a national land, property and address dataset that comprises data from each local authority in Scotland. In LHEES analysis, it is used for non-domestic properties that fall in mixed (domestic and non-domestic) and non-domestic shared buildings.

Green Heat in Greenspaces (GHiGs) - GIS layer: The Green Heat in Greenspaces dataset has been produced by Greenspace Scotland to explore how areas of greenspace across Scotland can contribute to transforming the urban landscape of the future to one based on low carbon heat. In particular, it focuses on the potential of greenspaces to host solutions using heat pump technology and district heat networks based on their physical characteristics and proximity of location in relation to heat demand. The GHiGs layer was used to identify areas with potential use of ground source heat pump networks and in conjunction with heat network zones identification.

[27] *Scotland Heat Map (data.gov.scot)*
[28] *OSG | One Scotland Gazetteer*

7.1 Summary

Midlothian is a relatively small local authority with around 40,000 domestic properties. The majority (73%) were built pre-1984, this is similar to the national average (70%). The older housing is typically located in the smaller mining villages. 8% of homes are in conservation areas with only 2% being listed. Midlothian has a wide range of property types (figure 2). The majority of dwellings are houses (75%), compared with 25% being flats. This is lower than the national average of 40%. The tenure profile highlights that the majority (75%) are owner occupied, 11% council housing and 10% privately rented.

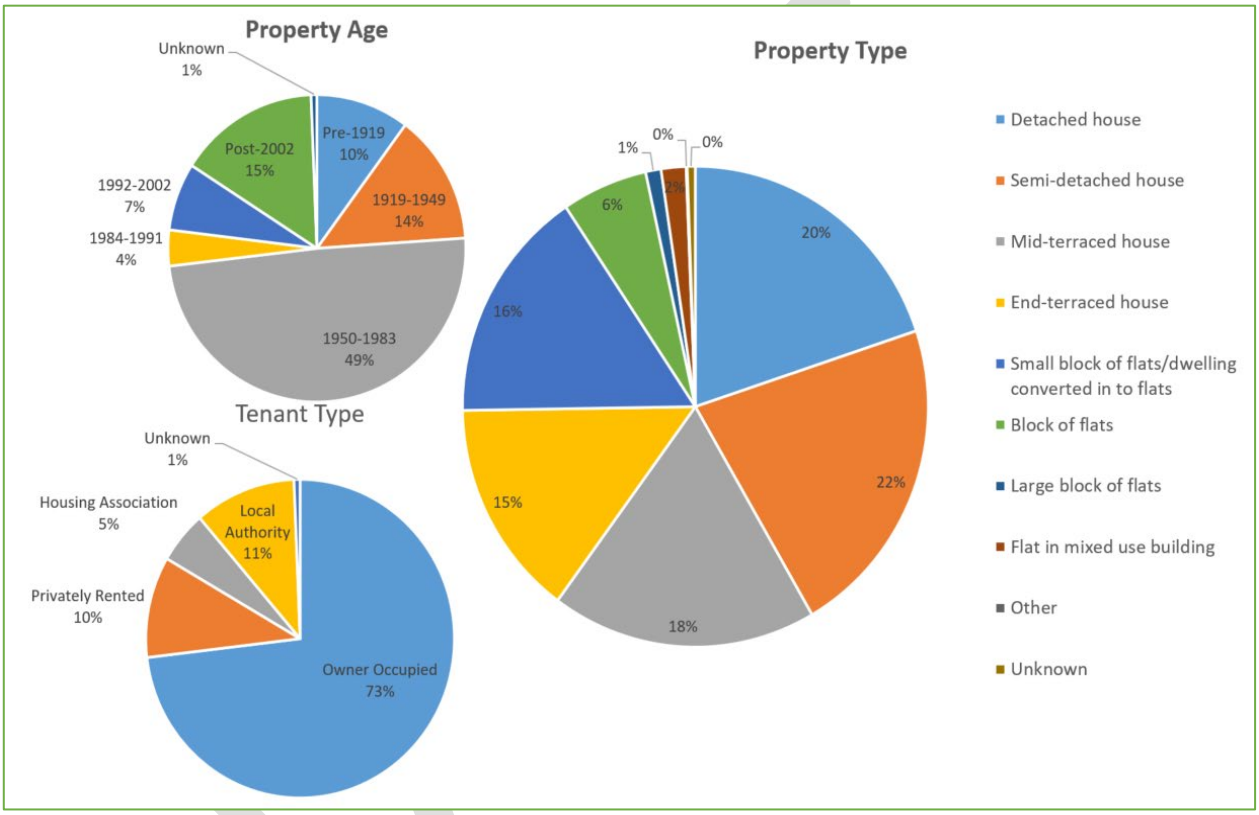


Figure 2: Domestic Stock Overview (Baseline Tool, 2023)

The baseline data for Midlothian also considers energy efficiency and fuel type (figure 3). 49% of homes have an EPC of C or above, while 50% of homes have an EPC of D or below, this is in line with the national average. The majority (89%) of homes are connected to the gas grid, this is higher than the national average (83%). Of those who are not on mains gas, 4% are heated using electricity, 3% use oil, 2% biomass and 1% LPG.

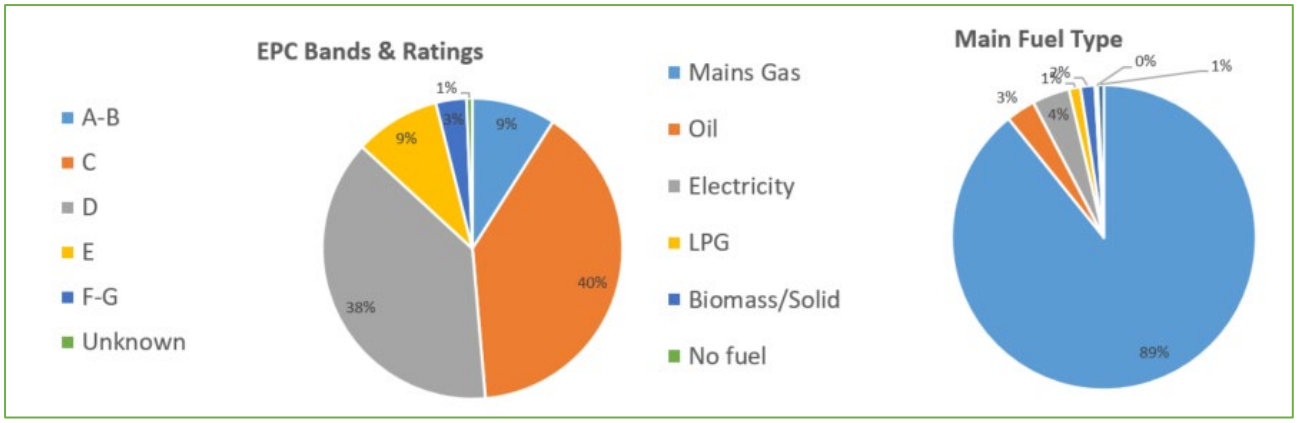


Figure 3: Domestic EPC and Fuel Overview (Baseline Tool, 2023)

In terms of the fabric of the buildings across Midlothian (figure 4), the majority (59%) of properties are of cavity construction, however only 45% of these have been insulated. This is lower than the national average of 73%. 15% of homes are of solid wall construction, with 11% of these being insulated. This is lower than the national average of 17%. The majority (54%) of homes have 250mm of loft insulation or more with only 5% having 99mm of loft insulation or less, this is on par with the national average. Midlothian has good levels of window fabric, with 91% of properties being double or triple glazed.

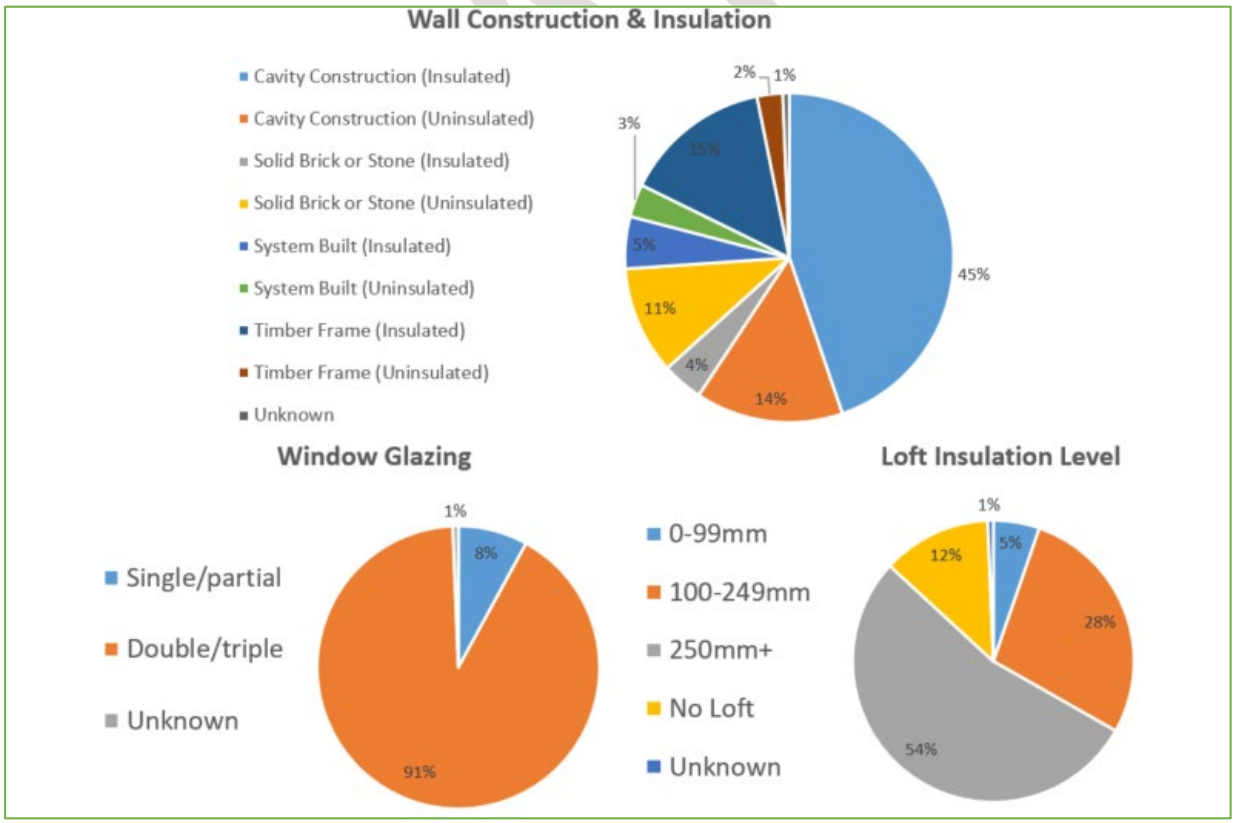


Figure 4: Fabric Overview (Baseline Tool, 2023)

Finally, figure 5 presents a summary of Midlothian's baseline. The heat demand statistics will be used within the heat zoning section of the LHEES Strategy. The key points derived from this summary that will be a focus point in this strategy are:

- 30% of homes are uninsulated.
- 55.6% of homes have EPC D-G.
- 19.4% of households are in fuel poverty.
- 7.6% of households are in extreme fuel poverty.

Although levels of fuel poverty are high, they are below the average of 24.6% and 12.4% respectively.

Insulation	Percentage	Number of properties
Uninsulated walls	30.89%	12,592
Loft insulation <100mm	5.32%	2,168
Single glazed windows	7.97%	3,248

Energy and heat demand	
Heat demand per dwelling (kWh/dwelling/year)	12,767
Energy demand per dwelling	20,753

EPC Rating	Percentage	Number of properties
EPC F-G	4.44%	1,809
EPC D-G	55.63%	22,675

Income	Percentage	Number of properties
Estimate of households in fuel poverty (fuel bill>10% of income)	19.49%	7,944
Estimate of households in extreme fuel poverty (fuel bill>20% of income)	7.64%	3,113
Council Tax Band A-C	40.51%	16,515

Figure 5: Baseline Overview

7.2 Core Indicators

This section further examines the Baseline data across Midlothian's 22 Intermediate Zones. Taking key information from the previous section, focus will be given to energy efficiency, fuel poverty and fuel type. Relevant core indicators[29] will be used for each analysis and explanation will be provided as to why each indicator and weighting[30] has been used. Recommendations and conclusions will be serviced across strategic zones.

7.2.1 Energy Efficiency

When assessing energy efficiency, three core indicators are used; loft insulation (between 0-99mm), single glazed windows and wall insulation (all constructions). The weightings for these indicators have been given consideration to the home heat loss figures discussed in section 5. Wall insulation has been given a higher weighting, followed by loft insulation and then window glazing as this corresponds

[29] *Indicators are applicable across LHEES considerations and are structured around maters such as building characteristics, energy efficiency and tenure.*
[30] *If multiple Indicators are used in strategic zoning or the identification of delivery areas, a Weighting can be applied based on the importance of each*

with the level of heat that can escape from a typical building. At this stage only the individual indicators are shown and explained in the following sections. Figure 6 presents a spatial overview of Energy Efficiency within the intermediate zones, highlighting that **Straiton, Rural South Midlothian, Eskbank and Roslin and Bilston** are the areas with the highest level of poor energy efficiency (shown in dark blue).

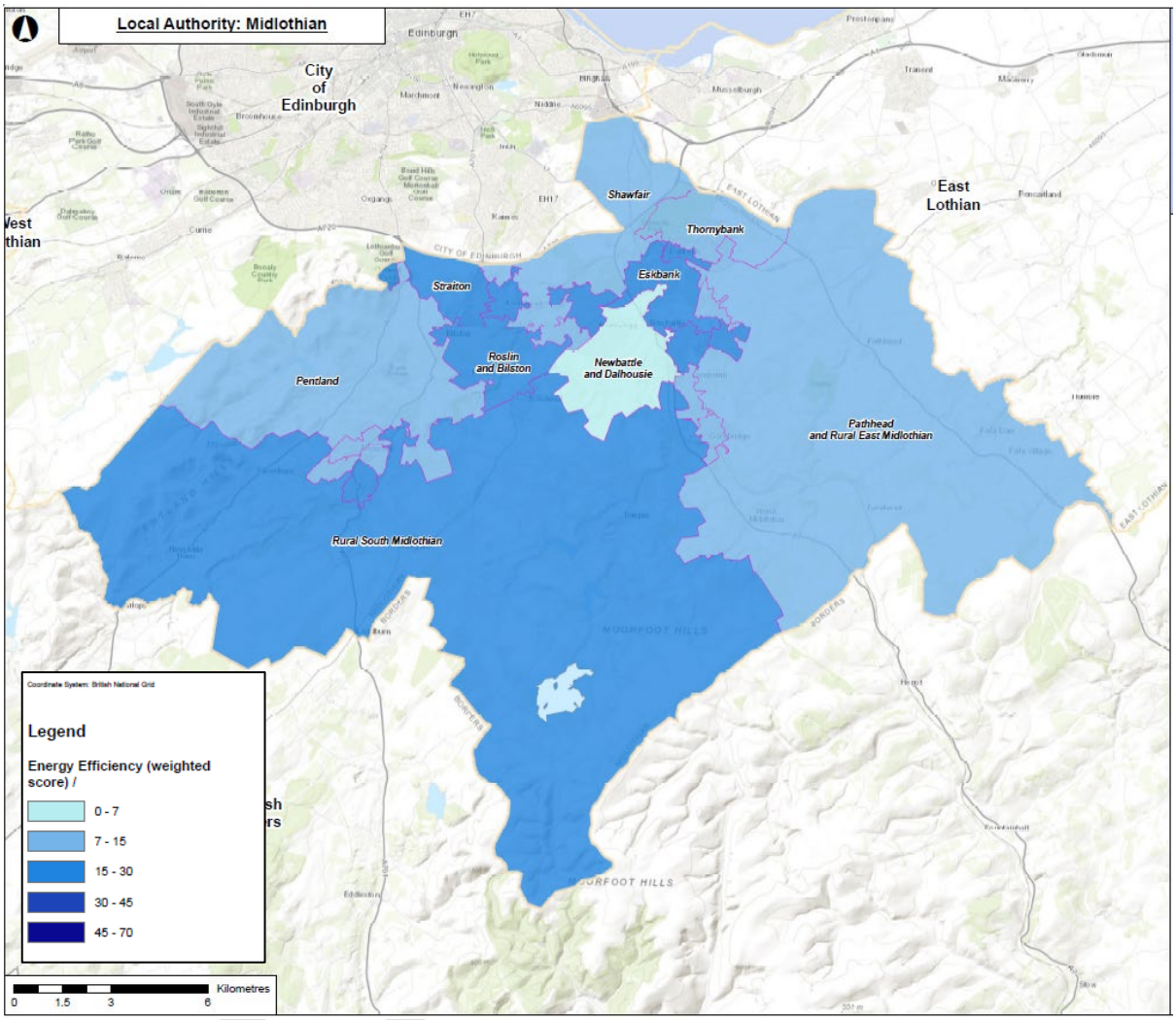


Figure 6: Energy Efficiency cross intermediate Zones (National Assessment, 2022)

7.2.1.1 Wall Insulation

As seen in figure 7, Midlothian has substantially higher wall insulation rates as compared to the rest of the country (only 29% of properties are uninsulated in MLC vs. 41% nationally).

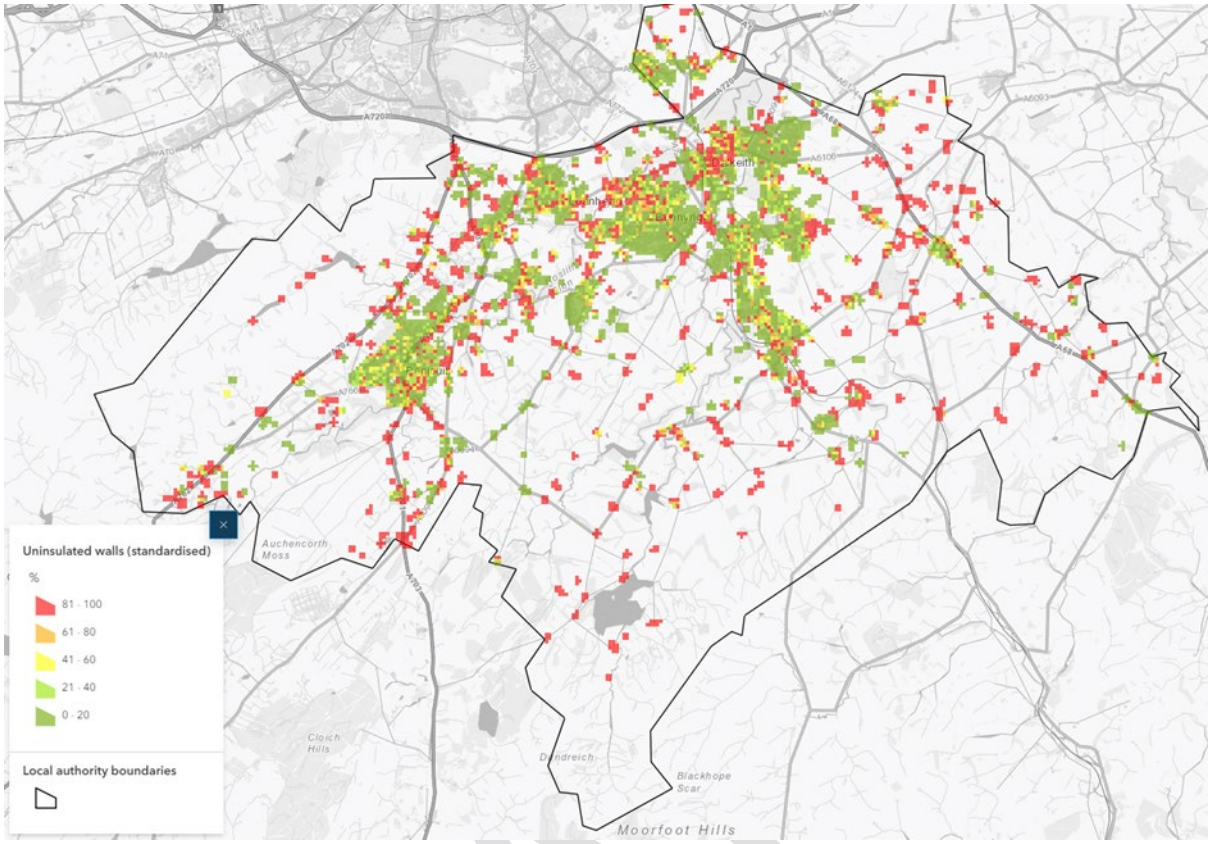


Figure 7: MLC Uninsulated Walls (Changeworks, 2023)

The majority of uninsulated walls are cavity wall properties (46% of the total uninsulated walls, as compared to 27% nationally). As uninsulated cavity wall properties in MLC represent 13% of the total area. Increasing the insulation of cavity walls in the owner occupied and privately rented tenures will be important. Data Zones with the highest density of uninsulated cavity wall properties are **Penicuik North, Roslin and Bilston and Newbattle and Dalhousie**. Some of the needed cavity wall insulation could be planned for through EESABS projects, at least in appropriate areas (i.e. with high fuel poverty levels).

The second driver for uninsulated walls is solid brick or stone wall properties, which represent 34% of uninsulated walls and 10% of total the properties in the area. Data Zones with the highest density of uninsulated solid brick or stone wall properties are **Dalkeith, Eskbank, Penicuik Southeast and Roslin and Bilston**. Some of the needed solid wall insulation could be planned for through EESABS projects, at least in areas with high fuel poverty levels.

7.2.1.2 Loft Insulation

The map in figure 8 shows standardised probability of loft insulation levels being less than 100mm. Loft insulation rates are higher than the national average. 63% of properties with lofts have loft insulation over 250mm, this is higher than the national average of 48%. Privately rented properties with lofts had the lowest levels of loft

insulation over 250mm (57%). This highlights potential need for landlord engagement. Data Zones with the highest density of loft insulation below 99mm are **Straiton, Eskbank and Loanhead**.

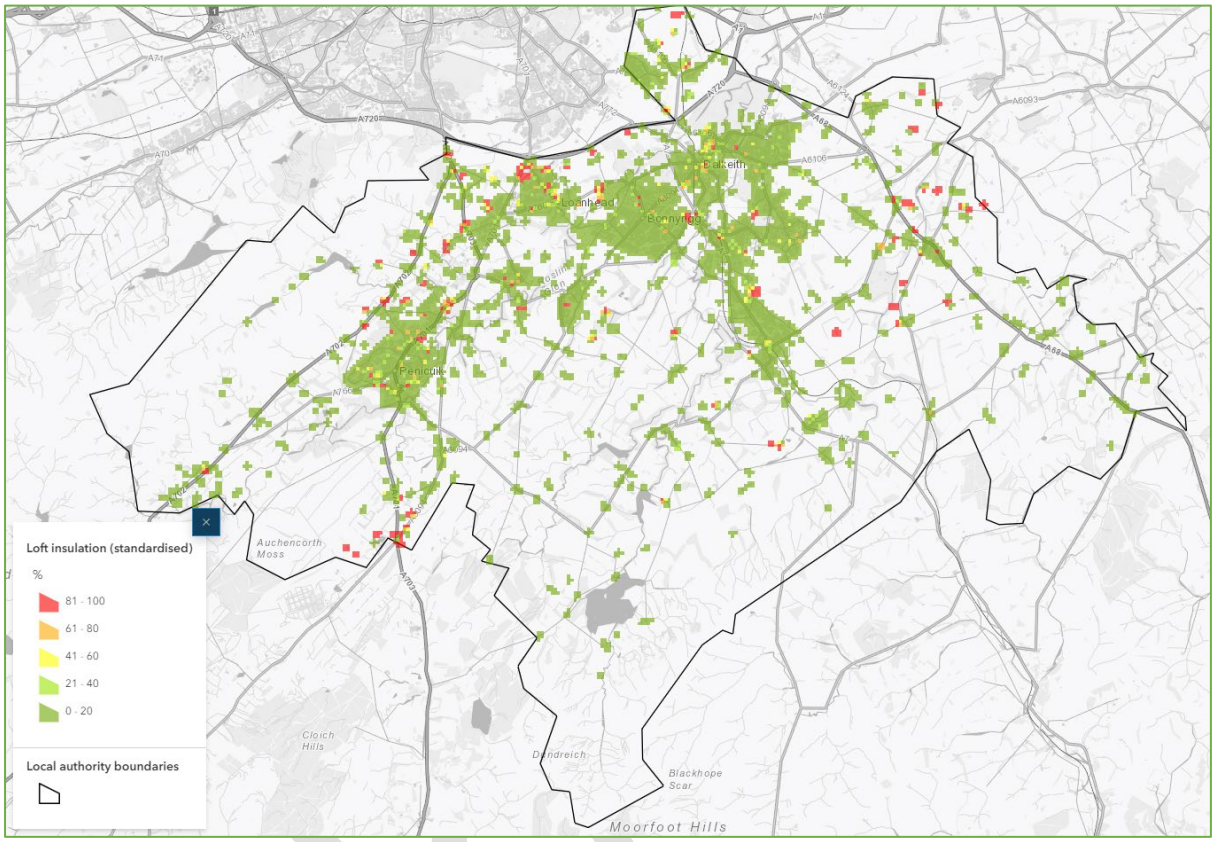


Figure 8: MLC Loft Insulation (Changeworks, 2023)

7.2.1.3 Single Glazing

MLC has a high level of double and triple glazing (91%). Data Zones with the highest level of single glazing are **Newtongrange, Dalkeith and Rural Midlothian South**. Potential reasons for this could be that these Intermediate Zones have a large proportion of properties that are owner occupied, rural and/or listed, making intervention difficult. Some of the needed glazing improvements could be planned for through EESABS projects, at least in areas with high fuel poverty levels.

7.2.2 Fuel Poverty

The fuel poverty rate in MLC is 19% which is an improvement on the nationwide figure of 24.6% reported in the Scottish house condition survey in 2021[31]. Average annual fuel costs for combined gas and electricity is £1,424, based on the 2017 energy data provided by BEIS[32]. This is lower than the national average of £1,634.

[31] *Introduction - Scottish House Condition Survey: 2021 Key Findings - gov.scot (www.gov.scot)*
[32] *https://assets.publishing.service.gov.uk/media/5a82a3ffed915d74e6236e1c/UK_Energy_in_Brief_2017.pdf*

The top Data Zones where energy efficiency is likely to be a driver for fuel poverty are **Dalkeith, Mayfield and Newtongrange** (figure 9).

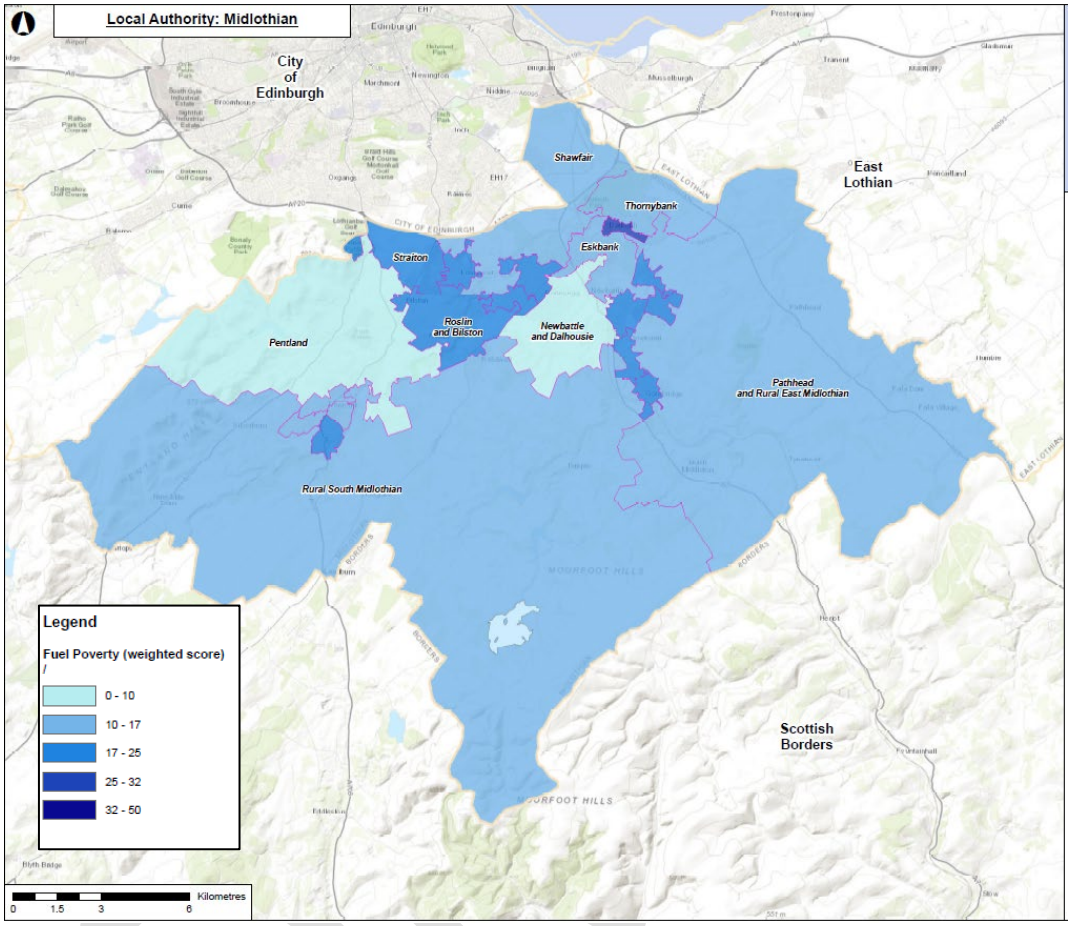


Figure 9: MLC Fuel Poverty Overview (Changeworks,2023)

7.2.3 Fuel Type

7.2.3.1 Off-Gas Grid

This section highlights potential Delivery Areas for transition from heating oil and LPG to low regrets[33] heat pump installations. A total of 3,490 properties fall within the off-gas grid category, this is equivalent to 8% of the total housing stock assessed.

In MLC less than 150 properties have been categorised as Category 0[34]. This covers properties which already utilise a heat pump or communal heating system. The two areas with the highest density are around **Penicuik and Kippilaw Steading**. With

[33] *Low-regret actions are relatively low cost and provide relatively large benefits under predicted future climates*

[34] *Category 0 identifies properties that currently have a low or zero emissions heating system*

142 identified properties, the extent of Category 0 properties is limited. These properties are spread across the local authority, indicating that to date, retrofit initiatives have been driven primarily by individual property owners. This reflects a lack of cohesive retrofit strategies as well as the fact that there are very few communal oil or LPG heating systems.

For the off-gas areas in MLC, less than 1,300 properties are considered to be 'heat-pump ready'. This covers properties which considered to be highly suited to a heat pump solution, as there is an existing wet heating system and the property is well insulated. Examples of priority areas for Category 1[35] include **Pathhead, Gorebridge and Woodburn/Whitehall** (figure 10).

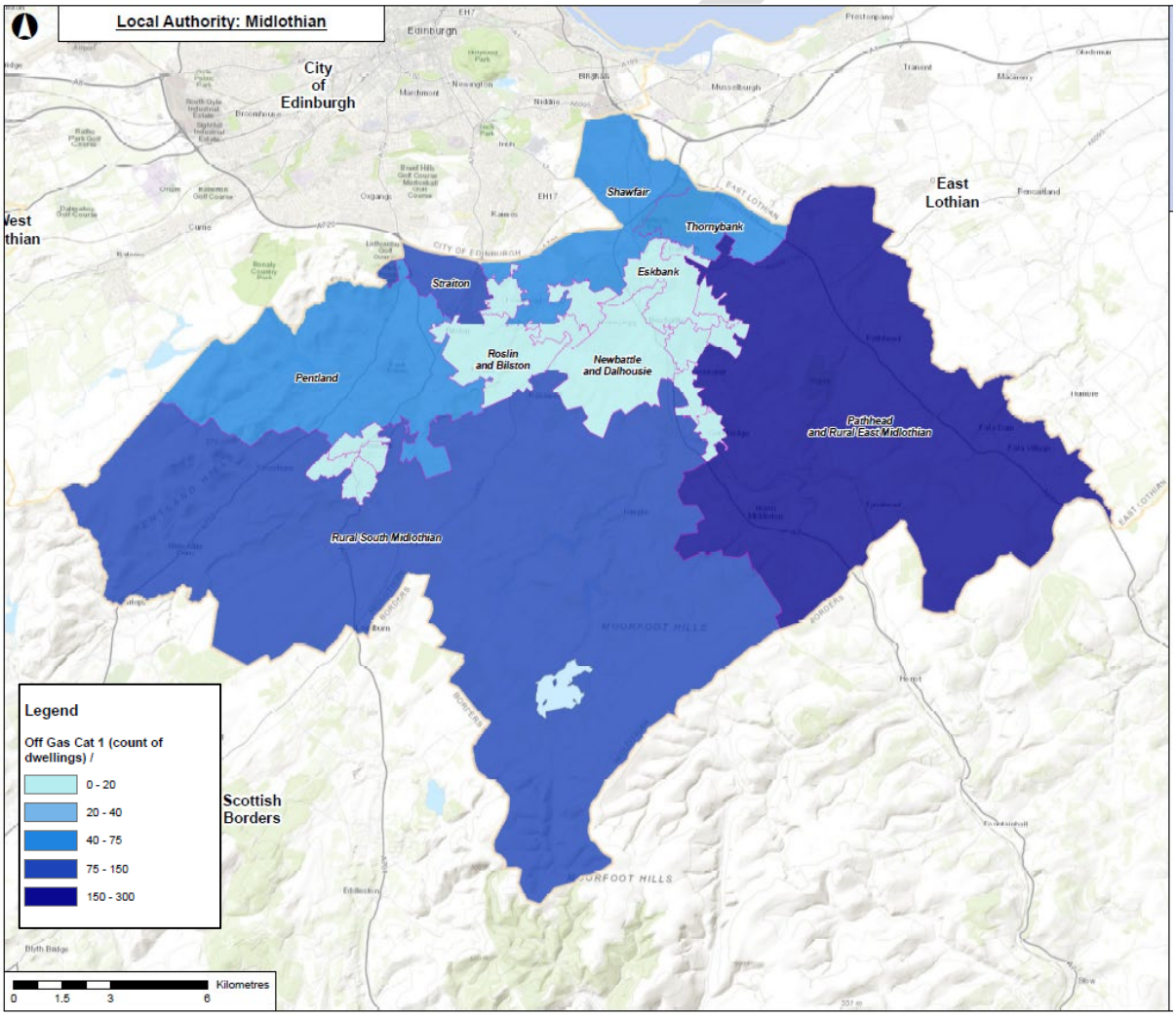


Figure 10: Intermediate zone overview of Off-gas Category 1(National Assessment, 2022)

[35] *Those considered highly suited for heat pump retrofit (i.e. well insulated properties with a wet heating system, excluding any consideration of electricity network impacts or costs of any network upgrades)*

Just a little over 700 properties have been categorised as Category 2[36]. This covers properties with a wet heating system that will require retrofitting to the building fabric to become heat pump ready, but at a less extensive level than Category 3 properties. Examples of priority areas for Category 2 include **Pathhead, Gorebridge and Dalkeith**.

In MLC just around 1,400 properties are classified as Category 3[37], which constitutes only 3 % of the total housing stock. This covers properties which could either become suitable for heat pump technology (following significant fabric/heat distribution system upgrade), or have either electric or biomass viable decarbonisation technology. Examples of priority areas for Category 3 include **Dalkeith, Cousland and Pathhead.**

7.2.3.2 On-Gas Grid

This section highlights potential Delivery Areas for transition from gas heating systems to low regrets heat pump installations or communal heating. A total of 38,305 properties fall within the on-gas grid category, this is equivalent to 90% of the total housing stock assessed (figure 11).

Around 400 on-gas properties have been categorised as Category 0 in MLC. This covers properties which already utilise communal heating systems. Examples of priority zones for Category 0 are around Bonnyrigg, Penicuik and Dalkeith.

Close to 26,500 on-gas properties have been categorised as Category 1 in MLC. This represents 63% of the total assessed housing stock. This covers properties where minimal fabric upgrade is needed prior to heat pump installation and they have a wet heating system. Examples of priority areas include **Dalkeith, Bonnyrigg and Penicuik**.

[36] Those with secondary potential for heat pump retrofit (i.e. properties in need of moderate fabric upgrade and / or addition of wet distribution system to be heat pump ready)
[37] Those with tertiary potential for heat pump retrofit (i.e. properties in need of significant fabric upgrade to be heat pump ready).

Figure 11: On-gas Category 1 Overview (Changeworks, 2023)

12% of the total assessed stock has been identified as Category 2. This covers properties with a wet heating system that will require retrofitting to the building fabric to become heat pump ready. Examples of priority areas include **Dalkeith and Newtongrange**.

Close to 6,500 properties have been identified as Category 3, which is 15% of the total assessed stock. This covers properties with a tertiary potential for heat pump retrofit or those buildings not suited to heat pump technology. Examples of priority areas include **Dalkeith, Roslin and Mayfield**

8 Heat Network Zones

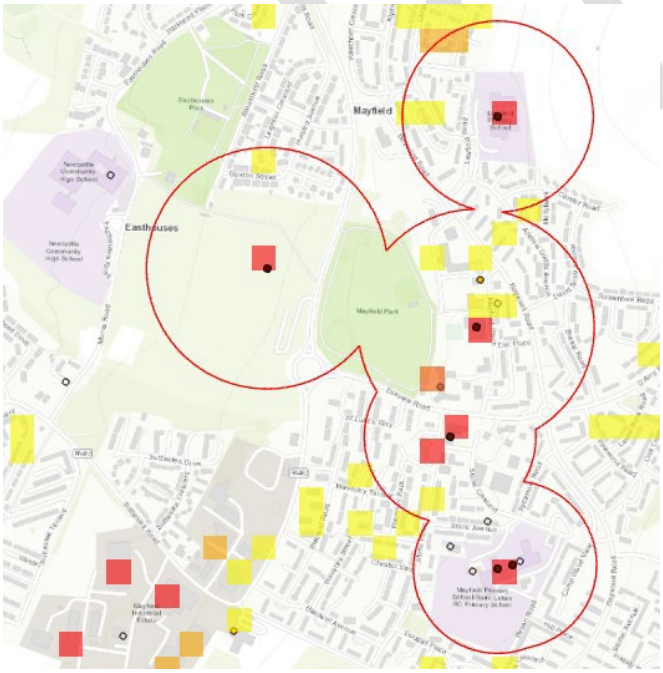
8.1 LHEES Analysis

This section shows where heat networks present a potential decarbonisation pathway that could be of strategic importance for MLC, using the LHEES guidance and methodology. Six prioritised clusters were identified. The areas of greatest potential were identified using linear heat density metrics[38], anchor load[39] threshold criteria and a 100m resolution raster heat density layer. To make the analysis more detailed than the standard methodology, Heat Data Point non-domestic properties were filtered to only include semi-public and public buildings.

Additionally, a sense check of building names was carried out to identify any indication of a building being Council-owned. If that was the case, they were added to analysis. This approach was chosen so that only non-domestic buildings that the Council has full or partial control over are treated as potential anchor loads in the heat network zoning. When defining anchor loads, public and Council-owned buildings have been prioritised as the Council has greater control over the operation of these buildings.

8.1.1 Priority Cluster 1 – Easthouses/Mayfield

This cluster has the most anchor loads and good potential heat demand from nearby properties. Six anchor loads have been identified for this cluster (figure 12):



- Mayfield Primary School
- Saint Lukes RC Primary School
- Mayfield Community Club
- Lawfield Primary School
- Mayfield Leisure Centre
- Newbattle High School.

Figure 12: Easthouses/Mayfield cluster (Changeworks, 2023)

[38] Linear heat density is a measure of heat load per meter of district heating pipework
[39] Anchor loads are significant heat demands that have high potential to be one of the first connected demands on a network

Due to the high number of anchor loads, there may be scope to develop the heat network as part of a phased installation strategy to mitigate local disruption and work within budget constraints. For example, an initial network could be developed in the north of the cluster as the anchor load has a relatively high density of residential buildings in close proximity for connection. There is a significant area of greenspace to the northwest of the cluster which could be utilised for a ground source heat pump (GSHP) system. The large area of greenspace will also mean that the construction process in these areas is likely to be quicker, cheaper and simpler as there will be minimal coordination with existing buried services.

There is one existing heat network within this zone: Salisbury View, which is a communal heating system serving 42 flats within a social housing facility.

8.1.2 Priority Cluster 2 – Loanhead

This zone in Loanhead includes a number of anchor loads with a higher residential heat demand density from nearby properties. Four anchor loads have been identified for this cluster (figure 13):

Figure 13: Loanhead Cluster (Changeworks, 2023)

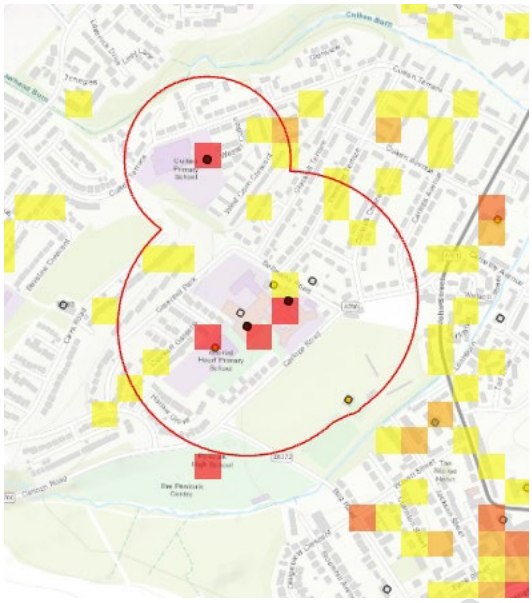
- Paradykes Primary School
- Loanhead Leisure Centre/ Loanhead Medical Practice
- Loanhead Primary School
- St Margaret's Roman Catholic Primary School.

Cluster 2 has a lower total number of anchor loads; however, there is a higher density of residential heat density loads in close proximity which improves network expansion viability. Two of the anchor loads are surrounded by greenspaces which may be suited to a GSHP installation or this area could be used to house a centralised energy centre serving the area. Buried pipework routes will likely be simpler to install in these areas.

There is one existing heat network less than 100m away from the cluster: Hawthorn Gardens, which is a communal heating system serving 35 flats within a social housing facility. There are no major obstacles, motorways or waterways.

8.1.3 Priority Cluster 3 – Penicuik A

Three potential anchor loads were identified for this cluster (figure 14):



- Cuiken Primary School
- The Penicuik Centre
- Penicuik High School.

Figure 14: Priority Cluster 3 (Changeworks, 2023)

There is one existing heat network less than 120m away from the cluster: Heinsberg House, which is a communal heating system serving 36 flats within a social housing facility. There are no major obstacles, motorways or waterways. There are high potential green spaces within the cluster which could be utilised for low carbon heat systems and distribution pipework.

8.1.4 Priority cluster 4 – Penicuik B

Priority cluster 4 was also located in Penicuik. Three potential anchor loads were identified for this cluster (figure 15):

- Beeslack High School
- Strathesk Primary School
- Eastfield Medical Centre.

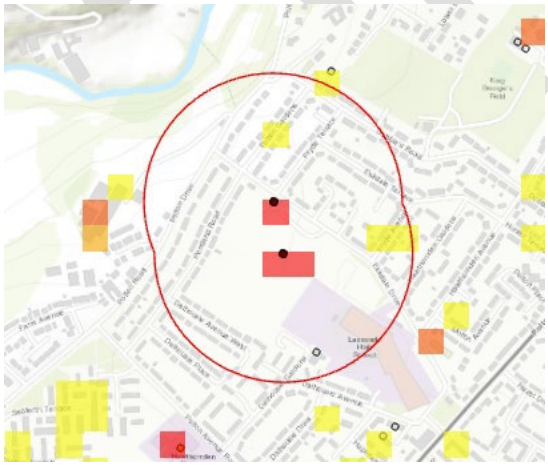
Figure 15: Priority Cluster 4 Penicuik (Changeworks, 2023)

No existing heat networks have been identified in the area for potential connection or extension. This cluster includes two major obstacles which will inhibit the development of a heat network connecting all anchor loads: the Loan Burn stream and the A701. Isolated Beeslack High School anchor load may be more suited to a standalone system upgrade, while the other two anchor loads may suit a shared energy centre.

There are high potential green spaces in the area, especially in the north of the cluster which could be utilised for low carbon heat systems and distribution pipework.

8.1.5 Priority Cluster 5 – Bonnyrigg

Two anchor loads in close proximity have been identified for this cluster (figure 16):



- City of Edinburgh Trampoline club
- Lasswade High School.

Figure 16: Priority Cluster 5 Bonnyrigg (Changeworks, 2023)

There are no existing heat networks that have been identified in the area for potential connection or extension. There are also no major obstacles, motorways or waterways intersecting this zone which might impact pipework distribution route planning.

Similar to cluster 5, the close proximity of anchor loads may suit a shared energy centre to improve ease of maintenance and reduce costs.

8.1.6 Priority Cluster 6 – Dalkeith

Three public anchor loads were identified for this cluster (figure 17):

- Saltersgate School
- St David's Roman Catholic High School
- Dalkeith High School.

Figure 17: Priortiy Cluster 6 Dalkeith (Changeworks, 2023)

No existing heat networks or major obstacles, motorways or waterways, have been identified within or in the proximity of the cluster. There are high potential green spaces in the area.

There are no Council-owned residential heat loads near the anchor loads meaning that further engagement with private owners and landlords will be an important factor in determining heat network viability in this area.

Similar to the first two clusters, two of the anchor loads in cluster 6 are situated close to greenspaces which may favour a GSHP installation or this area could be used to house a centralised energy centre serving the area. Buried pipework routes will likely be simpler to install in these areas as well.

8.2 MEL/Vattenfall Analysis

MLC and their partnership with MEL have conducted a heat network review separate from the LHEES Methodology. This review has highlighted current heat networks and potential zones that the LHEES methodology did not, this is due to some buildings OS Addresses not being included in the LHEES analysis and several anchor loads were not deemed enough to form a cluster. Many of the zones that will be taken forward into the LHEES Delivery plan are from the MEL analysis as they are deemed more practical and more likely to gain traction. This highlights the importance of using accurate and relevant classification codes for buildings and using an approach which is relevant to the Local Authority.

The basis of this study was to take the key waste heat opportunities in the area and assess whether they could serve heat to the following areas. The top waste heat opportunities in Midlothian are (figure 18):

- Millerhill Energy from waste (EFW) Plant
- Advanced Computing Facility (ACF) at Easter Bush
- Penicuik Estate redevelopment
- Dalkeith Mine water treatment site (MWTS)
- Shallow mine water opportunities

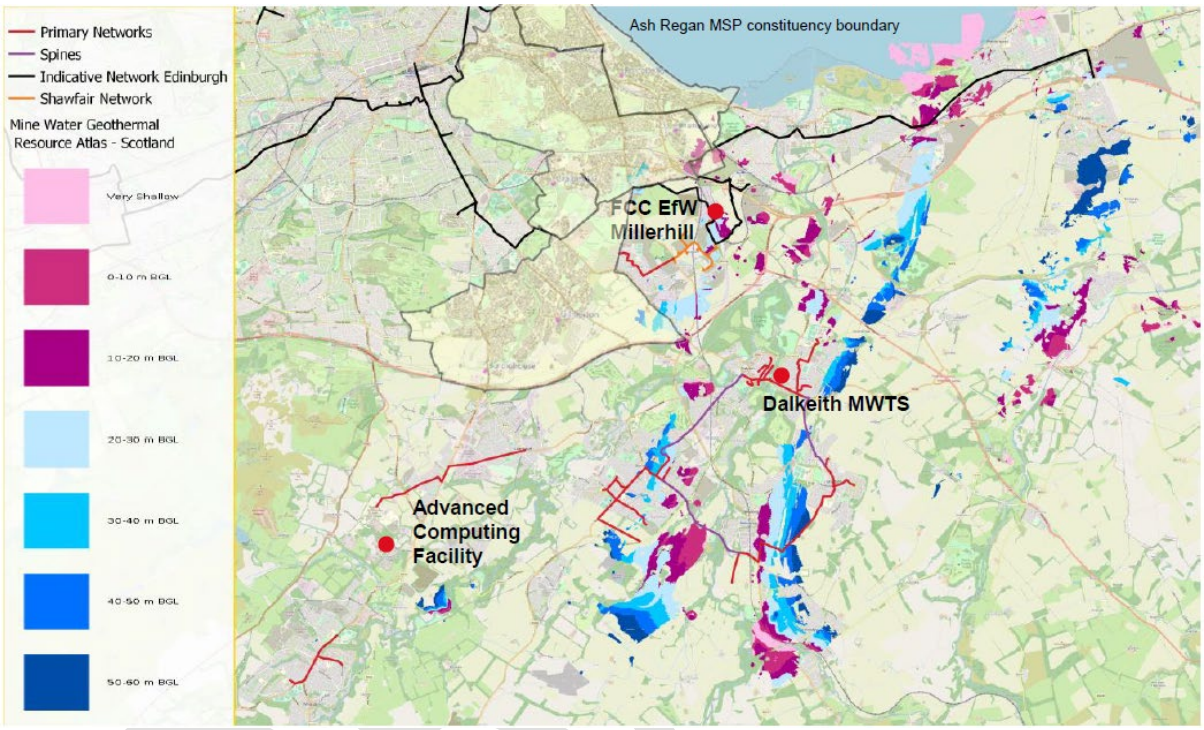


Figure 18: Waste Heat & Environmental Sources of Heat Midlothian (Vattenfall, 2023)

Based on the review of waste heat in and around Midlothian, Vattenfall (on behalf of MEL) then measured the areas where MEL could consider investment in district heating. 4 investment areas were defined:

- Shawfair and Danderhall
- Dalkeith including Eskbank and Woodburn / Bonnyrigg, Lasswade/Mayfield, Lingerwood and Newtongrange
- Easter Bush, Straiton and Loanhead
- Penicuik

These areas of potential Heat network expansion across Midlothian are presented visually in figure 19.

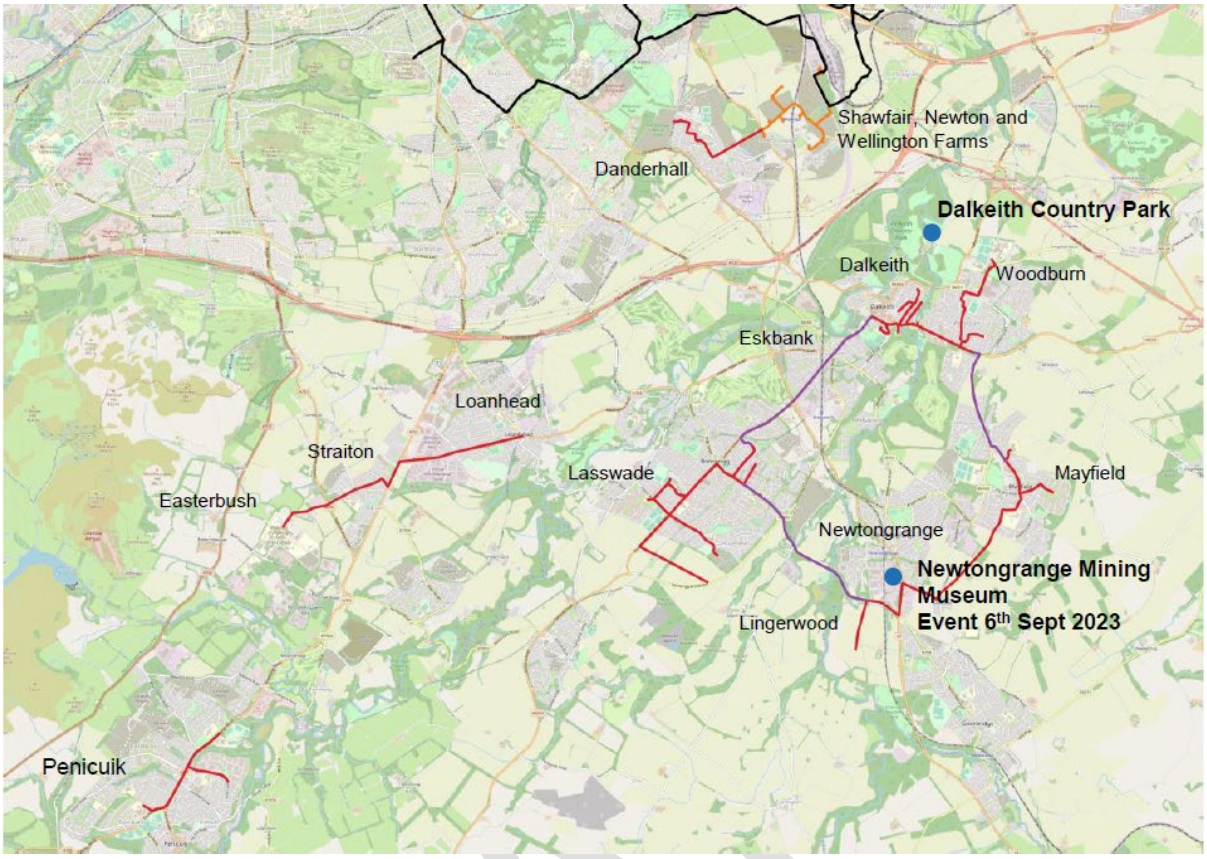


Figure 19:Map highlighting HN Expansion across Midlothain (Vattenfall, 2023)

8.2.1 Zone 1- Shawfair and Danderhall

8.2.1.1 Shawfair and Bio-quarter Extension

The ESCo, a 50/50 joint venture between MEL and Vattenfall is currently delivering low carbon energy projects across the council. The first project is a low carbon district heating network supplying the new Shawfair town. The EfW facility near Millerhill, supplies low carbon heat to the DHN. The EfW is fuelled by residual waste collected by Midlothian, Edinburgh and East Lothian councils. MLC has also signed a 40 year agreement with the MEL to supply heat to new public buildings that are built at the new Shawfair town.

The first phase of the project is supply 3,000 homes, education and retail properties at Shawfair Town, saving over 2,500 tonnes of CO2 per year. The project will benefit from up to £7.3m from the Scottish Government's Low Carbon Infrastructure Transformation Project (LCITP). The first pipes to supply the Shawfair Town with low-carbon heating have been installed in 2023, with construction on the site now well-underway. Heat is expected to be delivered to homes by July 2024.

In addition to the Shawfair Network, MEL are working on a business case to take heat to Edinburgh's Bio-Quarter. This is proposed to serve new buildings on

Edinburgh's BioQuarter site masterplan, with connection to existing buildings on site in due course, including the NHS Royal Infirmary of Edinburgh and the Royal Hospital for Children and Young People, and the potential to serve social housing off-site. The study examines the potential for a connection to the Shawfair Heat Network.

8.2.1.2 Danderhall

Figure 20 illustrates the expansion of the Shawfair project to connect the council owned housing in Danderhall. Danderhall is located 600m from the main Shawfair Strategic heat network area, immediately to the west of Shawfair Town and to the east of the Bio Quarter and the Edmonstone Road development. It represents a suitable domestic and non-domestic heat load, over 5GWh. Given the suitability load and location it also provides MEL with a compelling reason to develop a 'replacement heating' option which will be instrumental in making Danderhall a low carbon town.

Danderhall is a small mining village with a high proportion of council housing. Changeworks are undergoing the first phase of a EWI project in the area which is using funding from the Net Zero Heat Fund. MLC, Changeworks and MEL are working together to coordinate fabric improvements alongside heat network connections in the area.

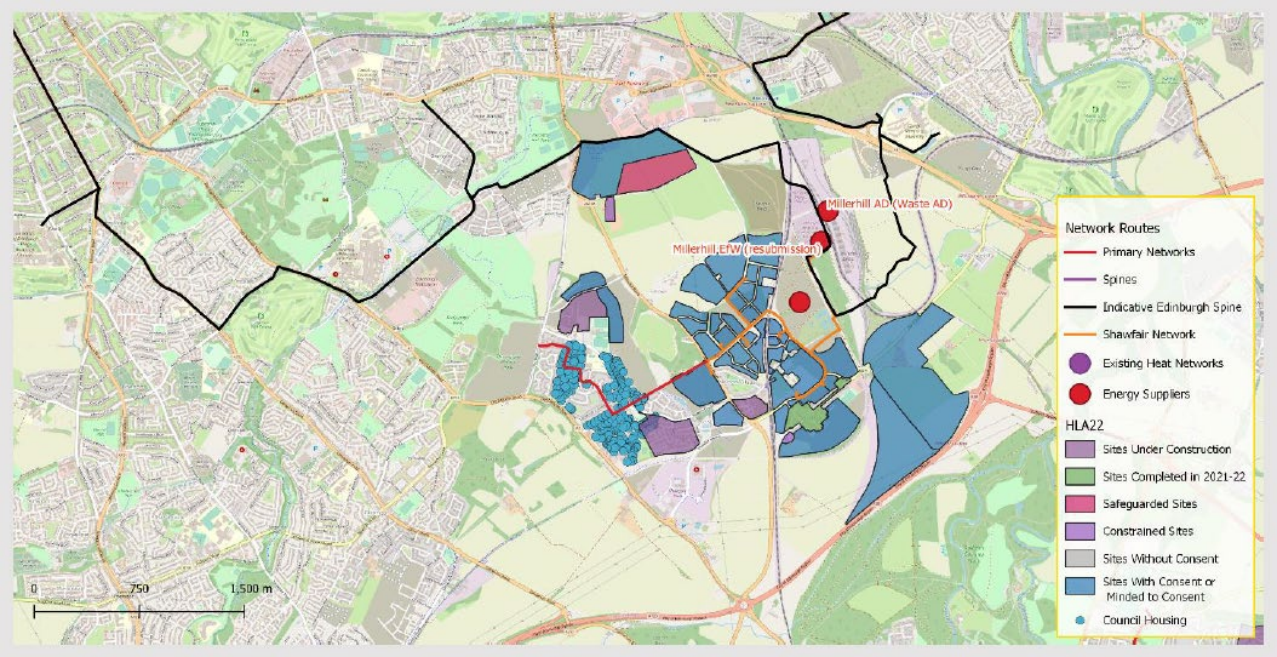


Figure 20: Danderhall Heat Network Expansion (Vattenfall, 2023)

8.2.2 Zone 2 - Dalkeith and surrounding areas

The Dalkeith MWTS has the potential to serve Dalkeith, Woodburn and beyond. This will include MEL taking over the current district heat network at Bonnyrigg (figure 21).

The coal mines once supplied the energy and raw materials that powered industry in the 19th and 20th centuries, and the fuel to heat domestic properties. Once coal mines have closed and the pumps are stopped, they fill with water which is heated through natural geothermal processes. Heat can be transferred from the mine water to clean water in a district heating network to heat local homes and businesses. Once a huge contributor to climate change, these coalfields are now being used to decarbonise heat supply supporting a low carbon future. MEL are working with the Coal Authority to explore using heat from a planned mine water treatment scheme at Dalkeith, one of the first pioneering mine water heat projects under consideration in Scotland.

During this assessment there has been several barriers. The water precipitating out of the shaft at Dalkeith has high levels of oxidised iron that will clog up a heat exchanger or otherwise adhere to any heat exchange surface. Once it's been through the treatment process this could drop, however levels will still be too high for a heat exchanger. The best way to get the mine water is before the oxygen has had time to react with the iron in the water. Unreacted iron is dissolved and passes straight through the heat exchanger. As the water at Dalkeith arrives at the end of an open channel it's fully oxygenated and unfortunately, unusable. Therefore, an option is to drill down a new sealed shaft and pump up mine water that still has lots of iron, but not oxygenated. This however has risks. Additionally, the cost of accessing the water at this stage is highlighting that this may not be an option.

If this is not a feasible option due to the costs and chemicals found within the mine water, then MEL will undertake further studies into potential waste heat sources. The council are aware that Dalkeith has the largest heat demand within Midlothian and is also an area with high levels of fuel poverty, therefore this area and it’s surrounding settlements (Eskbank, Woodburn, Bonnyrigg, Mayfield, Lingerwood and Newtongrange) are a priority for a DNH.

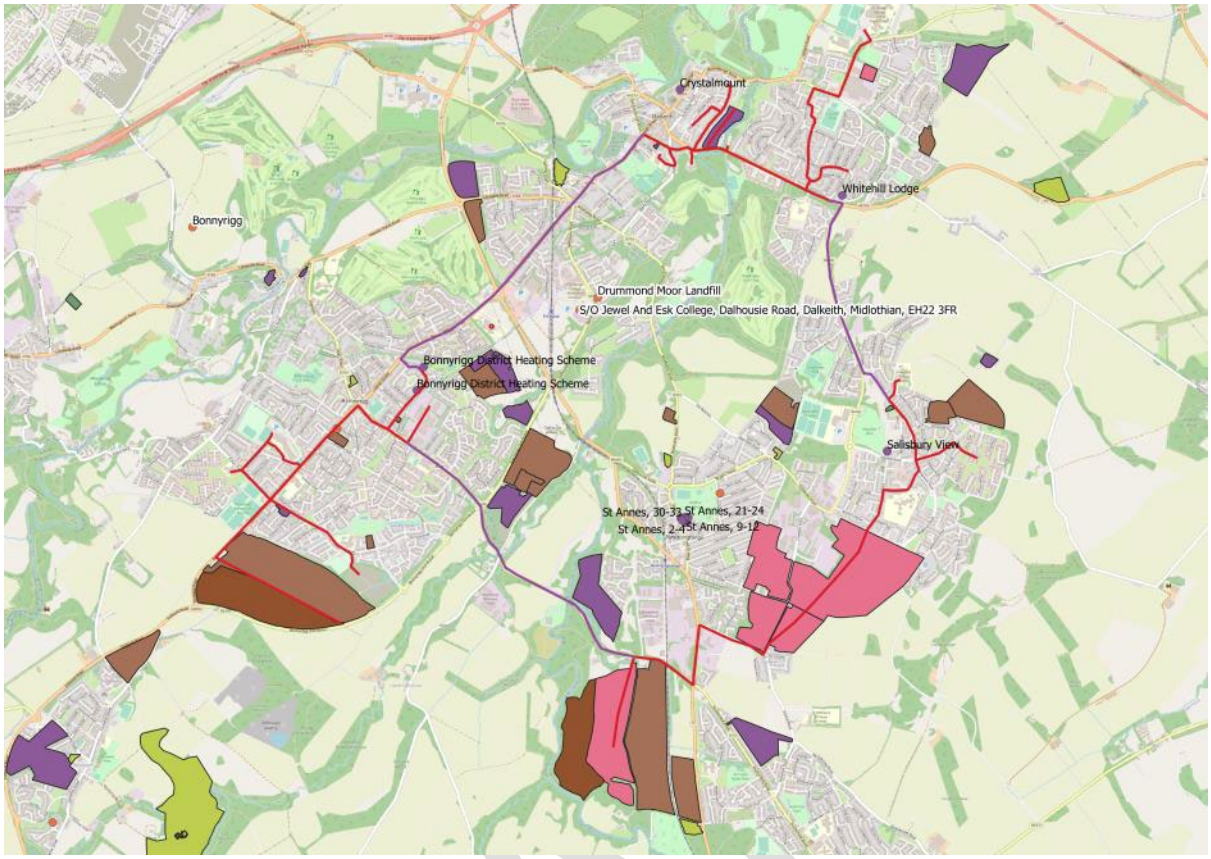


Figure 21: Area with Housing, Existing Networks and Heat Sources (Vattenfall, 2023)

8.2.3 Zone 3 - Easterbush

The current expansion of The University of Edinburgh's Easter Bush Campus includes a potential connection to the proposed advanced computing facility (AFC) at this location. The new computer is called Exascale and is one of only a handful of its kind globally. Funded by the Department of Science, Innovation and Technology through UK Research and Innovation (UKRI), it will be managed by the University of Edinburgh's supercomputing centre. Installation of the first phase is due to start in 2025.

The ACF at Easter Bush has the potential to supply heat to the existing the University of Edinburgh network at the campus and to extend to Beeslack High School and Bilston, Straiton (figure 22). Beeslack is a new High School being built at passivhaus standard. If MEL can demonstrate housing retrofit at Danderhall then consideration can be given to further expansion to Loanhead and Straiton.

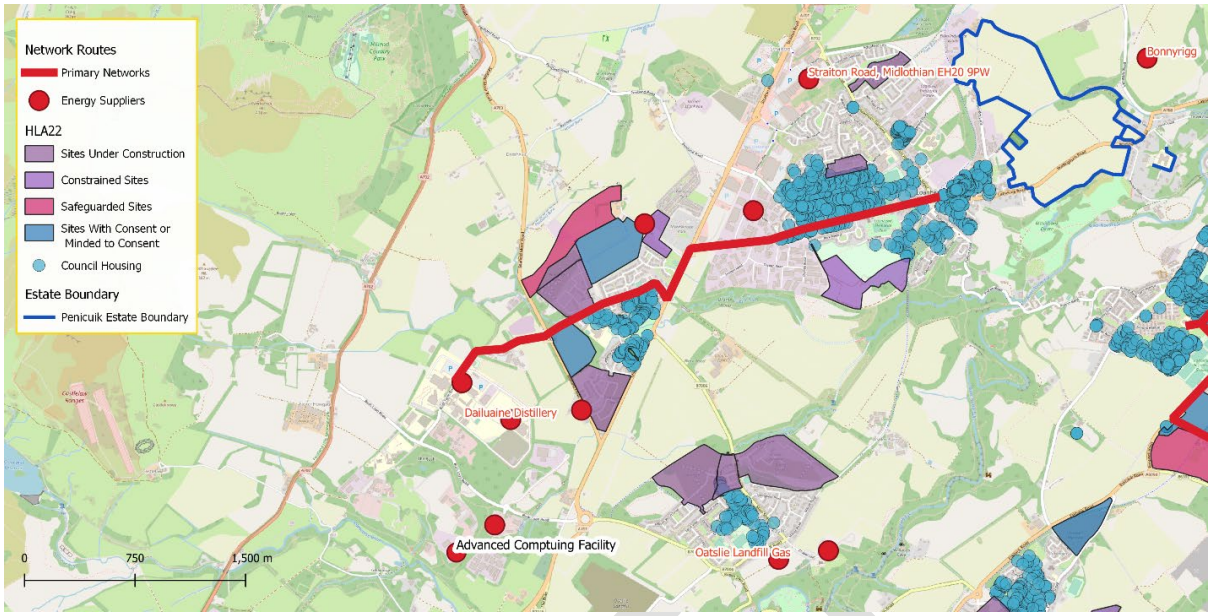


Figure 22: DHN Expansion at Easterbush (Vattenfall, 2023)

8.2.4 Zone 4 - Penicuik Estate

Penicuik Estate is reforming itself and wants to produce renewable energy on the estate to send to Penicuik Town. It is currently in the process of setting a 50-year vision. The ambition is a leading rural business with a focus on the environment. They currently heat their buildings with Biomass and they are exploring low carbon options, alongside MEL, and wish to extend this down to Penicuik to supply both existing and new build housing, in attempt to regenerate the town centre. They plan to build around 400 new homes and a leisure facility within the Estate.

If MEL can demonstrate the housing retrofit proposition in Danderhall then Penicuik Estate could act as the potential heat source within Penicuik to connect schools and existing council owned housing. This can be seen visually in figure 23.

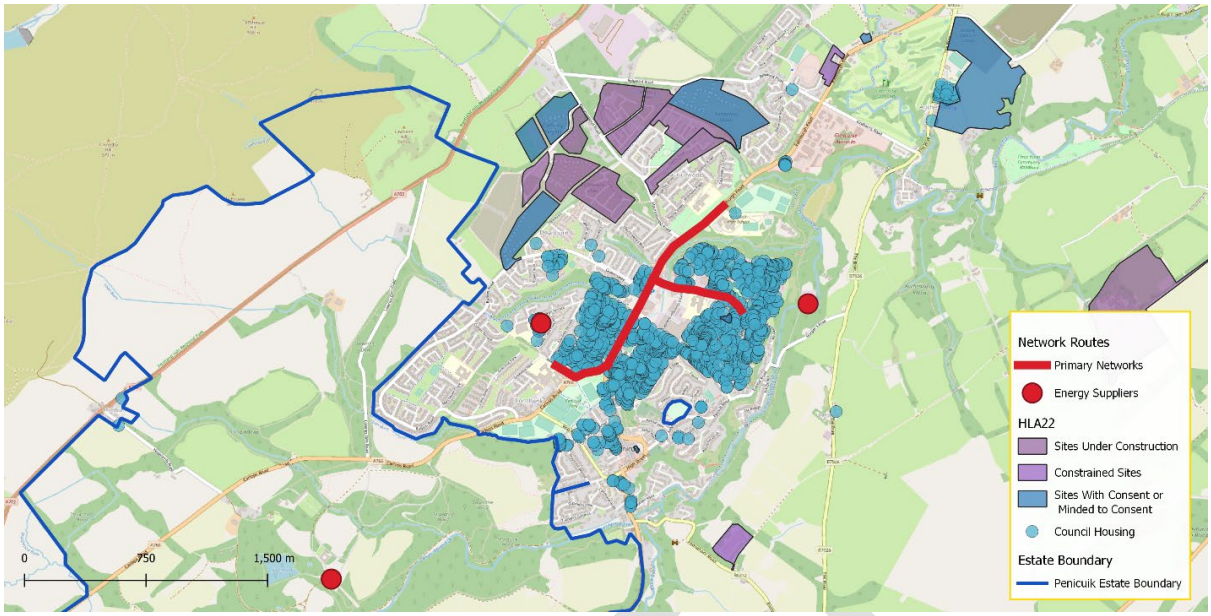


Figure 23: Area of Penicuik District Heat Network Investment (Vattenfall, 2023)

9 Cross Boundary Opportunities

9.1 Millerhill EfW

In October 2022 Buro Happold completed a study to assess the heat network opportunities across the Midlothian, East Lothian and Edinburgh local authority areas. The case study provided a summary of a project to investigate cross-boundary heat network opportunities using the analytical approaches set out in the LHEES methodology. The analytical approaches outlined in the LHEES methodology were modified here to consider potential heat network zones from a large heat supply source perspective, and also to better include consideration of new developments.

The opportunity presented in this case study is based around the Millerhill EfW plant in Midlothian. This site is in Midlothian but is close to both East Lothian and the City of Edinburgh. Figure 24 details the location of Millerhill in the context of nearby local authority boundaries. As previously discussed, MEL is currently using heat from this facility to heat new development at Shawfair, however the magnitude and relatively low cost of heat available from Millerhill presents an opportunity to expand to supply other local demands, potentially crossing local authority boundaries in future phases of development.

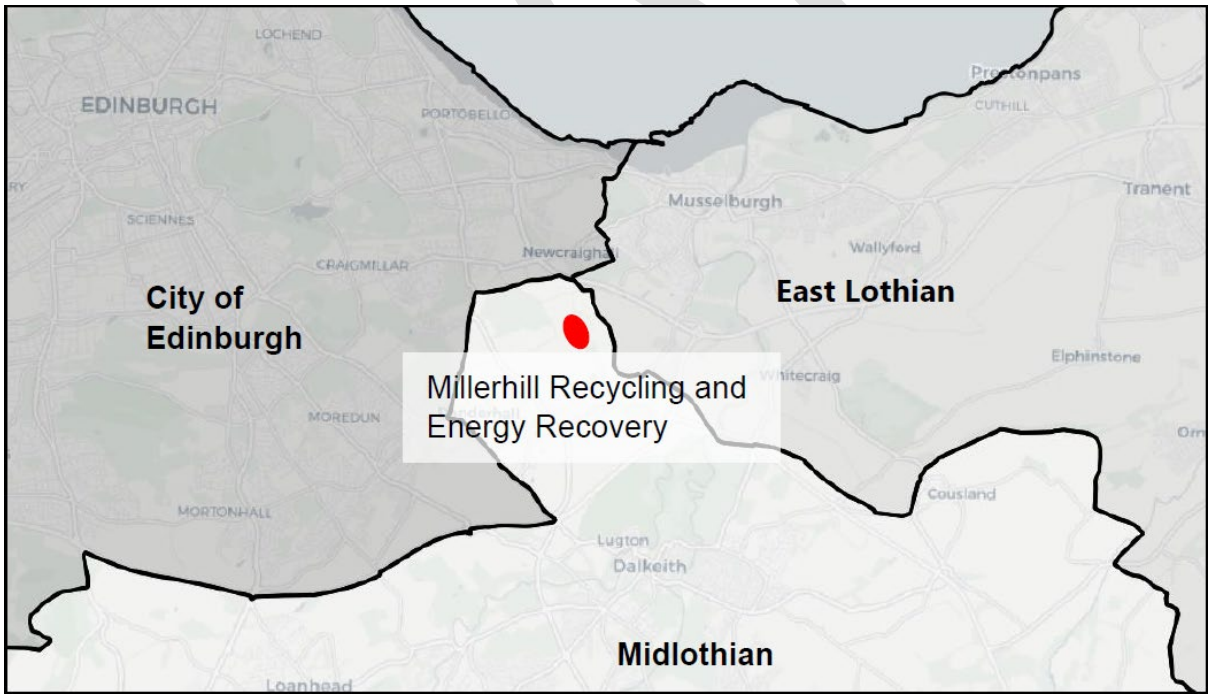


Figure 24: Millerhill EfW in context to Local Authority boundaries (Buro Happold, 2022)

Three distinct potential zones, shown in figure 25, within the vicinity of Millerhill were identified to take forward for further consideration as “cross-boundary” opportunities in relation to heat networks. These combine existing demands with anticipated demands from new development.

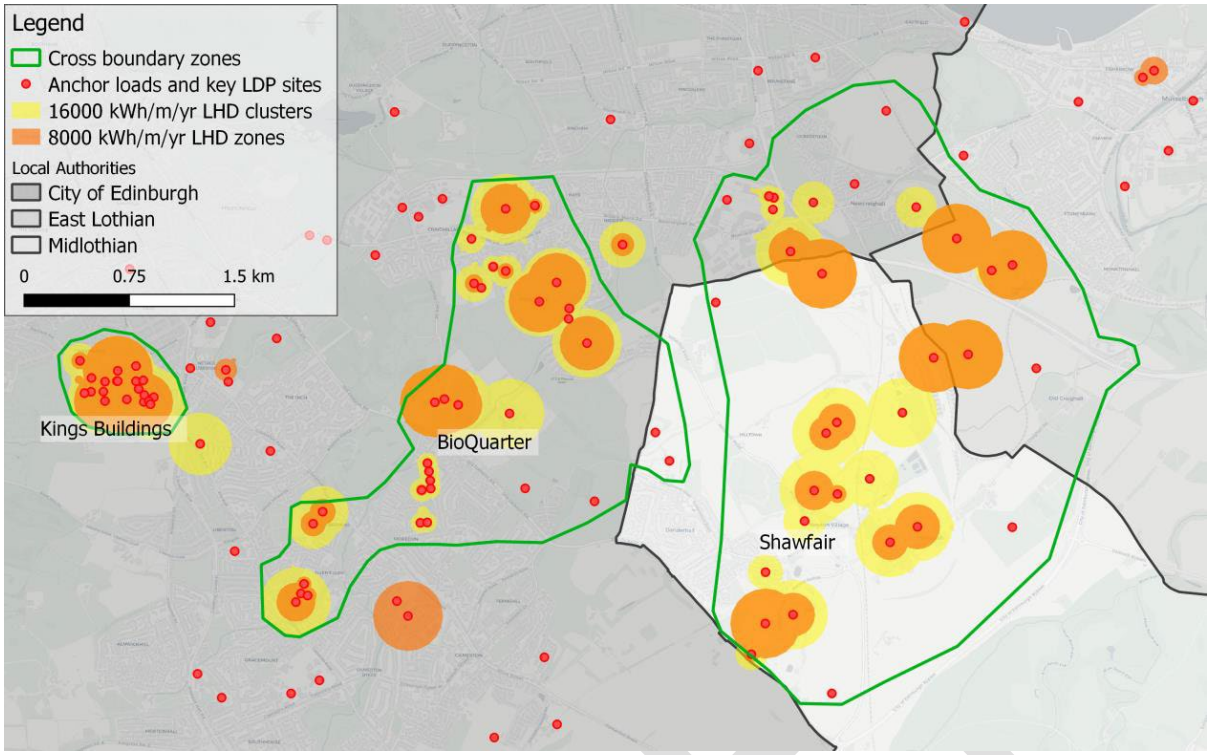


Figure 25: Potential Heat Zones across Midlothian and Edinburgh (Buro Happold, 2022)

9.2 East Lothian

East Lothian's LHEES has signified potential major infrastructure opportunities which would bring heat into Midlothian and vice versa.

These opportunities include Cockenzie Power Station. The coastal location could provide access to sea water for a sea source heat pump. The site development provides an opportunity to align major heat network pipe routes with roadways, before they are constructed. There is a pipe already in the ground underneath the A1 nearby Millerhill EfW which could potentially connect Midlothian with East Lothian.

An EfW plant owned by Viridor began operation in 2019 and is situated in the town of Dunbar. They have a commitment to make up to 10 MW of heat available for local use. To date this has not been accessed. There is potential to capture significantly more waste heat. In a presentation given to East Lothian Council in late 2021 Viridor indicated that the plant could satisfy the heating needs of 71,000 homes.

In line with Scottish Government policies to promote active travel, East Lothian Council is preparing plans for an Active Travel Corridor, a combined cycle path and walkway along the route of the A199 (old A1) from Dunbar to Tranent, a distance of around 24km. With significant surplus heat in Dunbar as explained above, this provides an opportunity to bring this heat towards centre of demand via a pipeline beneath or alongside the proposed cycle path.

10 Net Zero Solutions

This report has outlined the main DHN zones; **Shawfair/Danderhall, Dalkeith and surrounding areas, Penicuik and Easterbush.** Many existing properties within these zones will also require energy efficiency improvements to reduce heat loss alongside the DHN connection. These are areas that have both a substantial heat demand alongside a potential source of waste heat. Areas out with these zones will have to find an alternative source of heat. Individual heat pumps are expected to be the main route to deliver net zero heat for a significant proportion of properties that currently use fossil fuels and are unable to connect to a district heat network. This may be due to their rural location or distance from neighbouring properties. For heat pumps to be effective, the property is required to insulated to a high standard and have a suitable outside area to place the heat pump itself. As discussed in the baseline analysis, a low percentage of properties are eligible for a heat pump depending if they are on or off gas.

The top Data Zones where energy efficiency is likely to be a driver for fuel poverty are **Dalkeith, Mayfield and Newtongrange.** In these areas a fabric first approach could be taken to ensure that no method of low carbon heat installation will further increase fuel poverty within the household. This approach will also mean that no heat is wasted.

A study undertaken by Cambridge University summarises the pathway that every decision maker for every property needs to follow to reach a net zero solution. The decisions they need to make may not be clear-cut, may involve complex analysis and could involve significant expense or investment, however benefits include warmer winters, improved health and lower and less volatile energy bills alongside the benefit of a reduced your carbon footprint. It is therefore critical that the 'decision maker' for each property is aware of their options.

A key aspect of Midlothian's Delivery Plan will be to identify the individuals linked with each property who will likely have to make a decision on the future heating for their property. Properties are either domestic or non-domestic and we expect the decision makers fall into the following categories:

- Domestic – Homeowner, Midlothian Council, RSL's or private landlord
- Non-Domestic – Midlothian Council, Businesses owner, private landlord or other public sector landowner (NHS)

Once these individuals have been identified then it will be important to engage effectively. For each decision maker a retrofitting guide could be provided with information on how to make their homes more energy efficient and lower carbon. The guide could set out a whole-house approach to retrofitting the most common types of property in the particular zone. The guidance particularly focuses on reducing carbon emissions from homes, as this will make a key contribution to our net zero targets. Without the community taking action, it will not be possible for Midlothian to reach net zero by 2023.

Officers recognise that decision makers will have different budgets and needs, particularly at a time when the cost of living is increasing rapidly and there is such economic uncertainty. Ideally the guide would outline the steps that would be needed to retrofit the property to a net zero carbon standard. It would take a phased approach, so that individuals can start with the budget available to them. Staring with no cost steps (such as reducing your thermostat, heating only the rooms that you are using) to more expensive steps such as insulation measures.

There are varying levels of engagement for decision makers regarding needs and urgency to decarbonise their heating. Those responsible for multiple properties are considerably more engaged with the need for action on heating. For the majority of decision makers any urgency is linked with reducing overall energy costs rather than a motivation to reduce their carbon footprint. The perceived costs and uncertainty over the technology involved and the possibility of future grants schemes are a very significant barrier to making progress on decarbonising heat.

The main responsibility for raising awareness will lie with the Scottish Government via the Net Zero Nation Public Engagement Strategy. However, this will need to be enhanced at a local level, with considerable reliance on community-led activities coordinated by Midlothian Council in partnership with the Midlothian Climate Action Hub.

11 Next Steps

Ongoing monitoring will be critical for the success of this strategy and delivery plan. This will ensure key outcomes are achieved and allow for continuous improvements to meet changing requirements and incorporate new information and data. The accompanying Delivery Plan in section 13, will outline our 5-year plan for delivering our key outcomes. Some examples of priority areas for development area:

Complete Portfolio Energy Assessment Tool (PEAT) analysis: The output from PEAT includes a package of recommended measures for each property, the SAP rating improvement as a result of those measures being installed, as well as the total cost of the measure and associated fuel and emissions savings. This will assist us in improving energy efficiency and alleviating fuel poverty in our highlighted areas.

Conduct Non-Domestic analysis: There have been some studies done across Midlothian to assess the non- domestic stock. The next steps will be reviewing these studies and carrying out data analysis using the LHEES methodology and guidance, including completion of the non-domestic baseline tool, to assess the non-domestic stock.

Community Engagement: After the initial community engagement exercise planned for early 2024. Officers will work to identify the key 'decision makers' across Midlothian and target energy efficiency engagement in line with the 'Cambridge approach'.

The Local Heat and Energy Efficiency Strategy is seen as a live document and will be regularly updated in line with changes to policies, targets, and actions, as well as any new information and data. Every 5 years the strategy will be reviewed, and delivery plan updated, to meet the requirements of the Local Heat and Energy Efficiency Strategies (Scotland) Order 2022.

12 Funding & Investment

MEL will bring significant investment opportunities along with technical support to assist with the progress of MLC's heat network development. However, additional funding will be needed for proposed decarbonisation work as the council will likely not have the capital or revenue capacity to delivered on this scale.

12.1 Scottish Government Funding

Table 5 indicates the funding that is available to the Council and our stakeholders. Noting that this my change alongside alterations to legislation and policy landscape.

Table 5: Funding Summary

Name of Fund	Summary	Recipient
Energy Efficiency Scotland: Area Based Schemes (EESABS)	Scottish Government awarded funding to local authorities to develop and deliver energy efficiency programmes in areas with high levels of fuel poverty. This funding is blended with owners contributions and funding from RSL's who may choose to insulate their homes at the same time.	Local Authorities, RSL's.
Heat Network Fund	Funded by Scottish Government to support and develop heat networks. Can offer 100% funding for feasibility studies and up to 50% of Outline Business Cases.	Local Authorities
Public Sector Heat Decarbonisation Fund	Funded by Scottish Government via Salix. Total of £20m to help public sector decarbonise their heating systems by replacing them with zero direct emissions systems, as well as for retrofit energy efficiency measures to buildings.	Local Authorities
Heat Network Support Unit	Funded by Scottish Government to support and develop heat networks. Can offer 100% funding for feasibility studies and up to 50% of Outline Business Cases.	Local Authorities
Social Housing Net Zero Heat Fund	Funded by Scottish Government and also open to other social landlords. For low carbon heat and fabric first approach.	Local Authorities and RSL's
Energy Redress Scheme	The Energy Saving Trust manages the Energy Redress Scheme that redistributes the fines implemented on energy suppliers. Not for profit organisations such as Housing	RSL's and non profit organisations

	Associations are eligible to apply for fabric, low-carbon heating and solar measures with the percentage of funding variable depending on the project.	
Energy Company Obligation (ECO4)	This scheme provides match funding with support for lower income and vulnerable-to-cold domestic owner-occupiers, private sector tenants and social tenants, depending on eligibility criteria.	Home owners, private tenants and social tenants.
District heating Loan fund	This fund targets support for local authorities, registered social landlords, businesses, Energy Services Companies (ESCOs), and legally constituted community groups. It offers capital funding support for heat networks/district heating generated by renewables fuel through unsecured loans of up to £1 million towards capital measures for heat network projects. Large stand-alone anchor load buildings can also be supported. The interest rate is typically 3.5% and repayable over 10-15 years.	Midlothian Council, RSL's, businesses, ESCOs and community groups
Private Rented Sector Landlord Loan	Scottish Government funded loan that helps landlords improve the energy efficiency of their properties and meet minimum standards	Private Landlords
Home Energy Scotland Grant and Loan	Funding from the Scottish government, administered by Home Energy Scotland to provide grants and interest free loans for energy efficiency improvement and renewable technology	Private homeowners, private tenants.
Warmer Homes Scotland	Funding from the Scottish government, administered by Warmworks. Fully funded measures for energy efficiency improvements and heating. This is means tested.	Homeowners, private tenants.

12.2 Alternative funding options

Comfort as a service is a potential alternative funding model for MLC and MEL. With this model the capital costs from installed measures are covered over time through 'comfort' or heat payment from the tenants to the social housing provider. In some cases, the social housing provider can partner with a billing contractor to remain at arms-length and not be drawn into becoming an 'energy supplier'. The concept is based on the investor, the property owner, paying the capital costs for fabric and low-carbon heating measures through the heating bill savings that the tenants would

be making in the property now that it is more energy efficient. This means that tenants do not benefit from a reduction in running costs but from the increased comfort levels in the improved properties. In addition, the tenant benefits from security of supply as the fluctuation of external energy costs has less influence on a property that has been fully insulated. The ‘comfort’ costs can also remain static as they are based on initial capital costs and not as influenced by energy costs.

This is a concept that will be considered by MLC and MEL to help fund proposed projects.

13 Delivery Plan

Action	Stakeholders	How we will get there	Timescale	Progress	Funding	Benefit
Turn heat on at Millerhill Energy Centre to take heat to Shawfair	MEL, Vattenfall, FCC	Ensure low carbon heat is available for the heat network and continue to work towards taking heat from the EfW plant (expected 2025).	By Summer 2024	Heat Network taking heat to connected homes	Scottish Government's Low Carbon Infrastructure Transformation Project (LCITP).	This initial phase of the network is expected to save over 2,500 tonnes of CO2 per year, the equivalent of taking 1,200 cars off the road.
Assessment of Non-domestic stock	MLC, Aether	Use the Energy Saving Trust's 'Non-Domestic Analytics' (NDA) to provide a strategic overview of the non-domestic estate in Midlothian. LHEES Officer will also recognise non-domestic work undertaken via Aether (CC Consultants).	Completion within 6 months of LHEES adoption	Assessment of all non-domestic stock completed.	NA	This supports understanding of the breakdown of building typologies and by other criteria, such as fuel type, property age, or floor area. The approach developed is intended to support the characterisation of the non-domestic building stock.
Run all Delivery Areas identified in the LHEES through Energy	MLC, Changeworks, EST	Run all identified Delivery Areas through PEAT analysis to better	Completion within 6 months of LHEES adoption	Completion of PEAT analysis for all LHEES Delivery Areas	NA	The output from PEAT includes a package of recommended

Saving Trust's Portfolio Energy Asset Tool (PEAT)		quantify those areas that present the highest opportunity.				measures for each property, the SAP rating improvement as a result of those measures being installed, as well as the total cost of the measure and associated fuel and emissions savings. This will assist us in improving energy efficiency and alleviating fuel poverty in our highlighted areas.
Complete Building Assessment Reports (BARs) for required MLC owned buildings	MLC	Complete Building Assessment Reports for required MLC owned buildings, prioritising those that are of a high suitability for heat network connection and are located within indicative HNZs. Facilitate and support other public sector organisations in	Completion within 1 year of LHEES adoption	Count of number of BARs completed.	NA	Improved 'confidence per MWh' level within indicative HNZs

		Midlothian to complete these				
Commencement of a business case for expansion of the Shawfair project to connect Council housing ownerships in Danderhall	MLC, Vattenfall, MEL, Changeworks	Engage MLC colleagues and relevant not for profit organisation Changeworks for collaboration. Project development and procurement for delivery undertaken via MEL.	Commencement within 6 months of LHEES adoption.	Work on business case is underway alongside a customer journey.	TBC	By successfully implementing replacement low carbon heating to Council owned houses at Danderhall MLC can replicate this within other areas of the Council.
Develop and connect Shawfair Town expansion to Newton Wellington Farm	MLC, MEL, Vattenfall	MEL has concluded a plot connection agreement with Cala Homes (East of Scotland) as the first additional heat load, the Newton and Wellington Farms development, and the first heat main extension off of the Shawfair main spine.	Completion within 5 years of LHEES adoption	New homes connected to the heat network as per the plot connection agreement.	Self funded.	This being the first heat main extension off of the Shawfair main spine.
Commencement of business case for a DHN in the heat zone of Dalkeith and	MLC, MEL, Vattenfall	Conduct assessments to determine where waste heat can be sources to provide	Within 1 year of LHEES adoption.	Commencement of business case for a DHN at Dalkeith and	TBC	Dalkeith has the largest heat demand within Midlothian and is also an area with

surrounding settlements.		heat to Dalkeith (inclusive of council owned buildings). This will be followed by the development of an official business case.		surrounding areas.		high levels of fuel poverty, therefore this area and it's surrounding settlements are a priority for a DHN.
Commencement of business case for expansion of UoE Easter Bush Campus to connect new build developments and Council housing ownerships in Loanhead	MLC, MEL, Vattenfall, UofE	Create proposition for shared value between MEL and UoE to gain access to UoE energy sources. Ensure connection to old and new Midlothian Council buildings and demonstrate housing retrofit proposition in Danderhall. Finally, consider business case for DHN expansion to Loanhead.	Commencement within 3 years of LHEES adoption.	Commencement of a business case for a DHN at Easterbush	TBC	Opportunity coordination with existing DHN that creates opportunity for growth and asset decarbonisation for Midlothian
Build a business case for connecting renewable energy from Penicuik Estate to Penicuik Town	MLC, MEL, Vattenfall, Penicuik Estate	MEL will support the Penicuik Estate development to identify appropriate energy integration to lever in power generation which can connect	Commencement within 5 years of LHEES adoption.	Determine whether the site is ready for a DHN connection	TBC	Opportunity for coordination a private entity to create opportunity for growth and asset decarbonisation for Midlothian's

		Penicuik estate to Penicuik Town, inclusive of any new development, while using Council infrastructure as anchor loads.				new and existing buildings.
Undertake in depth PEAT study for Midlothian Council owned Social Housing	MLC, Changeworks	Run all Council Owned Social housing properties through PEAT analysis to better quantify those areas that present the highest opportunity.	Completion within 6 months of LHEES adoption.	Completion of PEAT analysis for all Council Owned Social Housing.	NA	The output from PEAT includes a package of recommended measures for each property, the SAP rating improvement as a result of those measures being installed, as well as the total cost.
Create a working group for cross boundary DHN potential across, Midlothian, Edinburgh and East Lothian	MLC, MEL, Vattenfall, Edinburgh Council, East Lothian Council	Engage with nominated stakeholders to discuss DHN plans across the district to determine cross boundary potential.	Ongoing	Identification of LHEES related opportunities and MEL principles that exist across local authority boundaries	TBC	Working across boundaries enables individuals, organisations and other entities to work together and learn from each other. DHNs don't adhere to local government boundaries and focus should be on geographical boundaries.

Identify the key 'decision makers' across Midlothian and target energy efficiency engagement	MLC, Changeworks, MVA	Identify the key 'decision makers' across Midlothian and then create a pathway that every decision maker for every property needs to follow to reach a net zero solution.	Completion within 1 year of LHEES adoption.	A comprehensive engagement plan for Midlothian will be developed.	TBC	Officers recognise that decision makers will have different budgets and needs, particularly at a time when the cost of living is increasing rapidly and there is such economic uncertainty. Ideally our engagement will outline steps needed to retrofit said property to a net zero carbon standard
Ensure the LHEES is embedded into the development and delivery of Council policy on energy, housing, planning, and development.	MLC	Work with MLC partners to ensure LHEES is embedded into the delivery of the - Local Housing Strategy - Local Development Plan - Single Midlothian Plan - Midlothian's Climate Change Strategy	Ongoing	Publication of strategies relevant to the LHEES with the ambitions of the LHEES embedded within them.	NA	Consideration of the relevant local and national policy and strategies that are relevant to the LHEES, making sure that LHEES runs in line with these strategies and adheres to any key targets

Direct funding and advice for retrofit through EES:ABS and wider funding sources into Delivery Areas identified within the LHEES.	MLC, Changeworks	Ensure that the EES:ABS programme and other funding/programme opportunities are maximised and continue in areas identified for the Poor Energy Efficiency as a Driver of Fuel Poverty consideration in the LHEES.	Ongoing	Amount of EES:ABS funding spent. Number of properties successfully treated.	EES:ABS funding secured annually.	Positive impact on fuel poverty in targeted properties.

Appendix 1 – Stakeholder Engagement

Internal Engagement

One to one meetings have been held with relevant internal Council stakeholders. These discussions involved an overview of the LHEES context and outputs, outlining whether the officer's area of work would have relevant inputs to LHEES, or subsequently be impacted by LHEES. Stakeholders were then ranked by 'power' and 'interest', in relation to the strategy content, allowing a detailed stakeholder map to be produced. This stakeholder map found, in Figure 1, highlights internal stakeholders in orange. This is a working map and stakeholders will move depending on their influence and interest at each stage of the strategy.

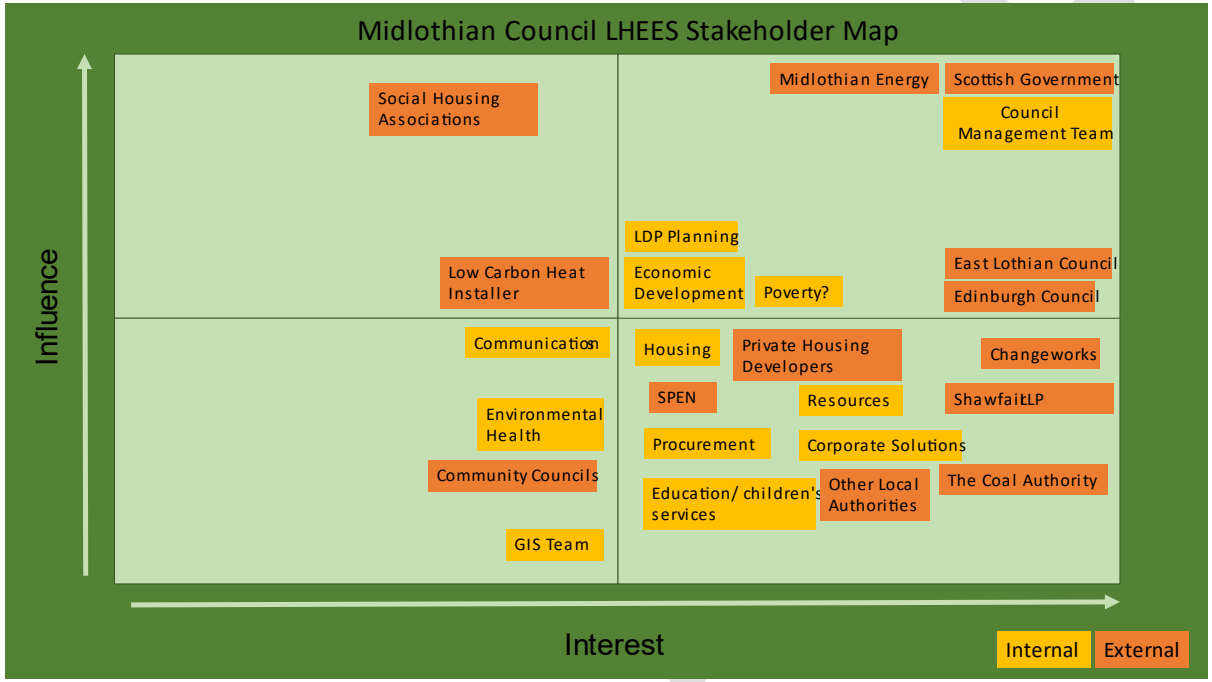


Figure 26: Stakeholder Map

An LHEES working group has been developed, compromising of Midlothian Council employees (LHEES, Estates and Social Housing Officers as these roles impact directly on work relating to heat and energy efficiency), MEL, Vattenfall and Changeworks representatives. Midlothian Officers are eager to work in conjunction with stakeholders to ensure that work is being done efficiently. A tenant having one point of contact for fabric improvements and low carbon heat modifications will make the process easier for the tenant. A focus of this working group has been Danderhall Town.

External Engagement

Due to time constraints, one to one meetings were not possible for external engagement. This was due to the quantity of individuals and groups that we wanted to engage with. Our LHEES Officer has engaged with Midlothian Climate Emergency Group, who compromise of a range of key primary Midlothian community stakeholders including, Community Council representatives, Midlothian Voluntary Action, Skills Development, Nature Scot, MEL and MLC. Initial engagement has included presenting LHEES stage 1-4 findings and informing the group on heat decarbonisation and energy efficiency measures. Engagement with this group will continue and is seen as a key means of identifying issues and accessing further key local and community partners to develop and strengthen ‘grass rots’ external engagement.

1.1.1 Registered Social Landlord Consultation

Table 6, below shows that there are 10 RSLs who own housing in Midlothian. Midlothian Council (6,912 homes), Melville Housing Association (1,959 homes) and Castle Rock Edinvar Housing Association (1009 homes) all have a significant supply of housing in the local area whereas the other providers have a smaller number of units, and are often providers of specialist housing, such as retirement housing.

Table 6: RSL Stock Profile

Type of provision	Total No. Units	Percentage of Total %
Ark Housing Association	6	0.05
Bield Housing Association	116	1.00
Blackwood Housing Association	23	0.20
Castle Rock Edinvar Housing Association	1009	9.00
Dunedin Canmore Housing Association	98	1.00
Link Housing Association	20	0.10
Melville Housing Association	1959	19.0
Midlothian Council	6912	68.0
Trust Housing Association	35	0.30
Viewpoint Housing Association	34	0.30
Total	**10,212**	**100.00%**

RSL's in Midlothian tend to have older properties and have concerns about energy efficiency and decarbonisation. A consultation has been shared with RSL's to raise awareness of LHEES and it's priorities, and to gain an understanding of how RSL's are planning to decarbonise their stock.

1.1.2 Business Engagement

Midlothian Council has an active Business Support team and there is a lot of work going on to assist and educate businesses about means of reducing their carbon footprint and adopting more energy efficient practices and transition to low carbon heat. This work is summarised in table 7.

Table 7: Midlothian Business Engagement Summary

Action	Aim
Midlothian Business Green Pledge	Business Gateway Midlothian are offering local businesses the opportunity to sign up to their 'Green Pledge', a concept to encourage businesses to become more carbon friendly. If businesses sign up then they can use the 'Green pledge' logo on their website as long as they agree to the following: • Switch to a 100% renewable energy supplier at contract renewal or earlier • Review and reduce your energy use such as switching off IT at the end of the day, using energy efficient LED light bulbs, switching your heating down a degree. • Encourage your employees to use active transport such as walking or cycling to work • Review your work practices – encourage work from home where possible • Switch to green products – paper instead of plastic wherever possible • Re-use and recycle equipment, waste and products 68 businesses have signed up to the pledge so far.
The Energy Training Academy	The Energy Training Academy is a community interest company specialising in providing high-quality training and education in the gas and renewables industry. A team of experienced and certified instructors are dedicated to ensuring that all students receive the knowledge and hands-on training they need to succeed in their careers. This is situated in Midlothian and is in place to train individuals in renewables and energy efficiency to assist them in finding local employment. Vattenfall will have a suite in this facility, opening in spring 2024 where they will educate individuals on DHNs.
The Green Transition Fund	The Green Transition Fund is designed to support businesses that were implementing a process or business improvement that would reduce carbon emissions. The maximum grant value is £20K. This is funded by

	Local Authority Covid Economic Recovery fund. Currently the full amount of the fund has been spent with over subscription, showing a clear appetite for the SME base in Midlothian to generate emission and costs savings through green projects. 20 applications have been received with 11 grants awarded.

Midlothian business survey, circulated in September 2023, asked businesses a range of questions regarding Net Zero commitments. 18 businesses (6.5%) in Midlothian responded, a summary of the results can be found in table 8 below:

Table 8: Business Consultation Results

Question	Answer Options	Response in Percentage % (No.)
How would you describe your understanding of Government targets relating to Net Zero?	A – Clear Understanding of how this will impact my business B – Reasonable understanding but would like more information on the specific impact on my business C – Limited/no understanding on how my business will be impacted	A- 27.78 (5) B- 33.33 (6) C- 38.89 (7)
Have you made any changes to your business in regard to Net Zero?	A - Yes, have installed zero/low carbon heating system B - Yes, other action to reduce carbon emissions C - No D – Other (specify)	A- 00.00 (0) B- 27.78 (5) C- 50.00 (9) D- 16.67 (3) Other: Reusable packaging and EV's.
Have you engaged with any government support initiatives with regards to the transition to net zero?	A – Yes, Business Energy Scotland B – Yes, Zero Waste Scotland C – No D – Other (Specify)	A- 00.00 (0) B- 05.56 (1) C- 70.78 (14) D- 16.67 (3) Other: Business gateway
Have you signed the Midlothian Business Green Pledge?	A – Yes B – No	A- 27.78 (5) B- 72.22 (13)

Do you feel enough support is available to you with regard to the impact the transition to Net Zero will have on your business?	A - Yes, and I don't need any more information/support B – Yes, but I would like access to ongoing information/support C – No	A- 44.44 (8) B- 11.11 (2) C- 44.44 (8)

Although a small proportion of businesses responded to the consultation, we can still see trends within the results. 0% of respondents had installed a low carbon heating system and only 50% had introduced any carbon saving measures, this highlights the need for funding and support for these businesses to make improvements. This is highlighted in the results as 70% of respondents had received no support from governing bodies. LHEES will focus business engagement on support and awareness to assist businesses on the path to Net Zero.

1.1.3 Community Engagement

Community engagement is important for the successful delivery of LHEES. The community has been consulted on Net Zero issues in relation to the Local Development Plan (LDP) work. A full LHEES consultation will be completed early 2024. The LHEES Lead Officer has engages with council tenants to raise awareness of the consultation to come. Section 8, outlining potential delivery zones, will allow council officers to focus their engagement on targeted areas relevant to decarbonisation projects.

1.1.4 Private Landlords

Table 5 shows the number of private lets advertised in Midlothian from 2019-2020. Noting that lets within the private rented sector were heavily impacted by the Covid pandemic in 2020 and continued to be so into 2021/22. The LHEES lead has engaged with private sector landlords to raise awareness of LHEES and the support available to landlords, alongside raising awareness of when the final strategy would be published.

Table 9: Number of private sector lets in Midlothian 2019-2020

Year	2019	2020
No. of lets	270	131

1.1.5 Community Action Hub

The Midlothian Climate Action Network have been given funding from the Scottish Government for a staffed Climate Action Hub. The Hub will support a collaborative effort focused on community-led climate action and adaptation within the region. Early actions by the Hub will include opening the first round of a seed funding grant programme and delivery of four energy efficiency roadshow events across the county region. These workstreams will increase awareness and understanding of climate change while providing sharing and learning opportunities to promote positive community efforts.

This facility will provide a location for engagement surrounding LHEES priorities.

Appendix 2 - LHEES Considerations

2.1 District Heat Networks (DHN)

A heat network, often called district heating, is a distribution system of insulated pipes, taking heat from a central source and delivering it to a number of domestic or non-domestic buildings. DHN's can cover a large area such as a town or sometimes cities, however often they are local and supply a small cluster of buildings. District heating has a number of advantages compared to individual heating systems. They are more energy efficient, as typically they produce both heat and electricity in a combined heat and power plant, this has an added benefit of reducing greenhouse gas emissions. Due to these systems using less fuel to heat a greater quantity of buildings compared with individual boilers, they are more cost effective and building owners can see an average 25% decrease in their heating bills (Heat Network Support, 2023).

The Heat Networks (Scotland) Act 2021 (the Act) was passed in February 2021. The Act aims to accelerate the deployment of heat networks in Scotland setting ambitious targets for the amount of heat to be supplied by heat networks (2.6 Terawatt hours (TWh) of output by 2027 and 6 TWh of output by 2030 – 3% and 8% respectively of current heat supply). A large focus of LHEES will be focused on our work with Vattenfall, assessing the suitability for heat networks (Scottish Government, 2021).

2.2 Off-gas grid buildings

Off-gas grid buildings are those that do not have a gas connection installed. Therefore, the main heat source is often via electricity or oil, or in some cases ASHP or Biomass technologies are used. Rural areas are more likely to be off of the gas grid and often find higher levels of fuel poverty compared to those connected to gas due to the high cost of electricity.

The approach used to identify potential off-gas heat decarbonisation opportunities involves grouping properties into 4 categories, primarily from the perspective of heat pump suitability. Category 0 identifies properties that currently have a low or zero emissions heating system. Categories 1 to 3 outline potential pathways for heat decarbonisation for all other properties.

Category 1: Those considered highly suited for heat pump retrofit (i.e. well insulated properties with a wet heating system, excluding any consideration of electricity network impacts or costs of any network upgrades)

Category 2: Those with secondary potential for heat pump retrofit (i.e. properties in need of moderate fabric upgrade and / or addition of wet distribution system to be heat pump ready).

Category 3: Those with tertiary potential for heat pump retrofit (i.e. properties in need of significant fabric upgrade to be heat pump ready) or those less suited to heat pump technology, with electric (storage or direct) or biomass likely to be the most viable decarbonisation technology.

The Categories used here are suggested groupings only, proving an approach to identify subsets of properties that share similar characteristics and may require similar retrofit action. The Categories do not imply prioritisation of one group over another.

2.3 On-Gas Grid Buildings

On-gas grid buildings are those that have a gas connection installed and gas is often used for heating and cooking. Similar to the off-gas grid analysis, the approach used to identify potential off-gas heat decarbonisation opportunities involves grouping properties into 4 categories. Category 0 identifies properties that currently have a low or zero emissions heating system. Categories 1 to 3 group all other properties in terms of heat pump suitability.

Category 1: Those considered highly suited for heat pump retrofit (i.e. well insulated properties with a wet heating system, excluding any consideration of electricity network impacts or costs of any network upgrades),

Category 2: Those with secondary potential for heat pump retrofit (i.e. properties in need of moderate fabric upgrade and / or addition of wet distribution system to be heat pump ready),

Category 3: Those with tertiary potential for heat pump retrofit (i.e. properties in need of significant fabric upgrade to be heat pump ready). There is no sub-categorisation of Category 3 properties for On-Gas Grid as the

It is important to assess for potential retrofit of on-gas areas to comply with decarbonisation targets.

2.4 Poor building energy efficiency

Energy efficient is a term used to explain using less energy to perform the same task. For example, using energy efficient light bulbs will use less energy than a normal bulb when ran for the same length of time. There are several benefits from becoming energy efficient, including reducing greenhouse gas emissions, reducing energy demand and lowering costs (IEA, 2023). Ensuring that individuals in a household or building are carrying out energy efficient practices is important to ensure energy is not being wasted.

Building energy efficiency refers to the fabric of the property. This includes the insulation (wall, floor and loft) and glazing type. The better the level of building efficiency, the less energy is required to heat the home.

2.5 Poor building energy efficiency as a driver for fuel poverty

Fuel poverty is the condition by which a household is unable to afford to heat their home to a comfortable temperature. It is caused by low income, high fuel prices, poor energy efficiency and unaffordable housing prices. The Fuel Poverty Act was passed in 2019 and sets statutory targets for reducing fuel poverty, introduced a new definition which aligned fuel poverty more closely with relative income poverty and required Scottish ministers to produce a comprehensive strategy to show how they intend to meet the targets. Fuel poverty is now defined by the Scottish Government as any household spending more than 10% (20% for extreme fuel poverty) of their income on energy, after housing costs have been deducted. New figures published by the Scottish Government show that in 2018 a quarter of households in Scotland were in fuel poverty at around 619,000 while one in ten were in extreme fuel poverty at 279,000 *(Scottish government, 2021).*

Fuel poverty can be alleviated by improving household income and their ability to comfortably pay bills, reduce fuel costs, and most importantly reducing energy consumption by improving energy efficiency. Energy efficiency is a key driver for fuel poverty. By improving energy efficiency in the home, the householder will be able to utilise their energy more efficiently, reducing energy wastage and overall energy costs.

2.6 Mixed-tenure, mixed-use and historic buildings

Mixed-tenure and mixed-use buildings could include a mixture of owner occupied, private rented and social housing, and also non-domestic uses, or simply multiple ownership within the same tenure. Historic buildings include the buildings that are within conservation areas or those that are listed buildings. These categories may require established alternative approaches and regulation for the installation of low carbon heat and energy efficiency solutions as there could be more than one owner/stakeholder involved.

2.7 Low Carbon Technologies

Before low carbon heat technology is considered, a fabric first approach is important. This involves insulating a property to make it more energy efficient before introducing new heat technology. Figure 3 highlights where a property will lose its heat, indicating the importance of sound insulation. Often low carbon heat technology requires a property to be well insulation, otherwise the property will not be heated adequately. Required insulation includes, loft, underfloor and wall. While improved glazing and draft proofing is also important.

Figure 27: Home Heat Loss (Scottish Energy Grants, 2018)

Once a property is adequately insulated, consideration can be given to low carbon heat technology. A heat pump captures heat from outside and moves it into the property. It uses electricity to do this, but the heat energy delivered to the property is much more than the electrical energy used to power the system. As a heat pump captures heat that is already present in the environment, the system itself does not burn any fuel and therefore emits no carbon dioxide. There are two main types of heat pump, ground and air, and both pumps can deliver both heat and hot water to a building. Heat pumps are more efficient than other heating systems because the amount of heat they produce is more than the amount of electricity they use.

Biomass boilers are also an option for low carbon heating. Biomass is a renewable energy source, generated from burning wood, plants and other organic matter, such as manure or household waste. It releases carbon dioxide when burned, but considerably less than fossil fuels. Biomass heating systems burn wood pellets, chips or logs to provide warmth in a single room or to power central heating and hot water boilers. It is important that the fuel sources is locally sourced, to ensure that the system is as environmentally sustainable as possible.

Hydrogen could be a potential frontrunner for heating homes in the future. It is suggested that hydrogen will be used in areas less suited to electrification or unsuitable for heat pumps. The main role for hydrogen currently only appears to be in areas like shipping and hard-to-decarbonise parts of industry. Currently, there is no blueprint for a conversion of the gas grid to hydrogen anywhere in the world. Therefore, hydrogen could be a low carbon option in the future but not something that is ready to be rolled out nationally, and therefore won't be considered within the LHEES.