



“Improve the energy efficiency of buildings and ensure a just transition to decarbonised heat sources across Angus to reduce Fuel Poverty and contribute towards achieving Net Zero emissions”.

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Executive Summary

The Local Heat and Energy Efficiency Strategies (Scotland) Order 2022 places a duty on Local Authorities to prepare a Local Heat and Energy Efficiency Strategy (LHEES) and Delivery Plan. It also requires that the LHEES is updated at intervals of no more than every five years.

LHEES is primarily driven by Scotland's statutory targets:

- Net Zero emissions by 2045; and
- By 2040, as far as reasonably possible, no household in Scotland is in fuel poverty.

The LHEES is at the heart of a place based, locally led and tailored approach to the zero-emissions heat transition. The aim of the LHEES is to:

“Improve the energy efficiency of buildings and ensure a just transition to decarbonised heat sources across Angus to reduce Fuel Poverty and contribute towards achieving Net Zero emissions”.

The LHEES seeks to understand which energy efficiency measures and heat decarbonisation options are suitable for different building types within Angus. Following this, the LHEES identifies Strategic Zones to explore potential pathways to decarbonise buildings at a strategic level. This will allow the Council to track progress, allocate funding, identify stakeholders and engage with them to progress the LHEES delivery.

Analysis of the Baseline Domestic and Non-Domestic Analytics data found that:



Angus has **58,818** homes, of which:



64% are owner occupied.



45% of homes have no wall insulation.



9% of homes have low levels of loft insulation.



28% are off-gas grid, higher than the Scottish average of 18%.



60% of homes have poor Energy Performance Certificate ratings.



22% of households in Angus are in Fuel Poverty and 10% are in Extreme Fuel Poverty.



Almost **30,500** homes are classified as LHEES Category 1, meaning they are highly suitable for a heat pump.



There is a link between poor energy efficiency as a driver for fuel poverty and the building being listed and/or located in a conservation area.



Poor energy efficiency is most prevalent in rural areas and town centres.



Angus's non-domestic stock comprises of **6,489 buildings**, with the most common types being retail and light manufacturing/industry/workshops.



Electricity is the most common heating system fuel type for non-domestic buildings.



Around **13% of non-domestic heat demand** is attributed to Council owned buildings.

As a result, the energy efficiency of homes in Angus is poor and there is less than 10 years to improve the efficiency of them to meet the National targets¹. An area-wide approach is needed to address the poor energy efficiency of buildings via a 'fabric-first' approach to reduce energy demand, to in turn, enable the transition to zero-emissions heating systems. However, the impacts on Fuel Poverty must also be considered. Although heat decarbonisation is essential to address the climate emergency, it is essential that any measures to be applied promote both decarbonisation and lower fuel costs, as well as, ensuring that the installation of zero-emissions heating systems do not have detrimental effect on fuel poverty. A 'fabric first' approach to increase the energy efficiency of the building may be required in the first instance to help those in fuel poverty to manage their running costs before a zero-emissions heating system is considered.

The baseline analysis highlighted the current energy efficiency and heat decarbonisation potential of the building stock throughout Angus. From this analysis the LHEES priorities have been identified as:

- Improve the energy efficiency of domestic and non-domestic buildings.
- Just transition to decarbonised heat sources.
- Reduce Fuel Poverty.
- Contribute towards achieving Net Zero emissions.

The outputs of the baseline analysis were collated to identify 'Data Zones' to explore potential pathways to decarbonise buildings at a strategic level, in line with the aim of the LHEES. The Strategic Zone analysis identified where 'hard to treat'² domestic buildings are located, and where poor energy efficiency is acting as a driver for fuel poverty. These areas have been identified as Strategic Zones which may require extra support and tailored approaches to the installation of energy efficient solutions and zero-emissions heating systems. The analysis also identified that almost 30,500 domestic buildings are deemed suitable for heat pump retrofit offering a significant opportunity to decarbonise heat across Angus. These areas of opportunity have been identified as Strategic Zones and will be used to inform area-based energy efficiency and heat decarbonisation projects within the LHEES Delivery Plan. Five potential Heat Network Zones have also been identified in Angus which will be explored further.

The LHEES Delivery Plan is an accompanying document setting out how the Council proposes to support implementation of its LHEES Strategy. The LHEES Delivery Plan will transform buildings and heating systems to those that are efficient, affordable, and zero-emissions. It will also provide long-term co-benefits and opportunities within Angus such as contributing towards a healthier population due to warmer homes and unlock additional economic growth opportunities linked with energy efficiency and heat infrastructure.

¹ Heat in Buildings Strategy: achieving Net Zero Emissions in Scotland's Buildings (Oct 2021) - by 2033 all homes have the equivalent of EPC C where technically and legally feasible and cost effective.

² Hard to treat building are difficult to make energy efficient through conventional improvements, such as cavity insulation, loft insulation or zero-emissions heating solutions, like heat pumps.

1. Introduction

1.1 What is a LHEES?

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

LHEES should be primarily driven by Scotland's statutory targets for greenhouse gas emissions reduction and fuel poverty:

- Net Zero emissions by 2045; and
- In 2040, as far as reasonably possible, no household in Scotland is in fuel poverty.

For each Local Authority area, the Strategies should:

- 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.

Accompanying the Strategy will be a Delivery Plan, which will be developed in partnership with key stakeholders, and provide a strong basis for action for local communities, government, investors, developers and wider stakeholders, pinpointing areas for targeted intervention and early, low-regrets measures³.

³ low-regrets measures are relatively low-cost measures that provide relatively large benefit under predicted future climates.

1.2 Council Status

Climate Change mitigation and adaptation has been part of the Council's activities for over 15 years:

- In February 2007, the Council signed Scotland's Climate Change Declaration.
- In September 2019, the Council declared a Climate Emergency.
- In March 2020, the Council committed to an area-wide Net Zero carbon status by the year 2045, aligned to the Angus Sustainable Energy and Climate Action Plan (SECAP).

From the base year of 2012/13 to the end of the financial year 2022/23, the Council reduced its operational carbon emissions by 58%⁴. The Council aims to take its experience to help Angus area-wide reduce its emissions via energy efficiency measures and work together with householders, communities, landlords, tenants, business & industry, and the wider public sector to decarbonise heat in domestic and non-domestic buildings.

The Council is fully committed to the National targets to reduce fuel poverty by 2040 so that as far as reasonably possible, no household in Scotland is in fuel poverty and in any event:

- No more than 5% of households are in fuel poverty (when a household is required to spend more than 10% of its income in order to maintain a satisfactory heating regime)
- No more than 1% of households are in extreme fuel poverty (when a household is required to spend more than 20% of its income in order to maintain a satisfactory heating regime)
- The median fuel poverty gap is no more than £250 (adjusted to 2015 fuel prices)

Reaching these levels will require significant effort, especially due to the recent increases in fuel poverty rates due to the wider financial situation and increase in fuel costs. Prior to the pandemic in 2020, the start of the conflict in Ukraine in 2022, and the cost of crisis from 2021 to 2024, the Scottish House Condition Survey (SHCS 2017-19) reported that 22% of households in Angus were in Fuel Poverty and 10% in were in Extreme Fuel Poverty. Due to the knock-on effects of these recent events, it would be prudent to assume that fuel poverty rates are much higher, as will be the fuel poverty gap.

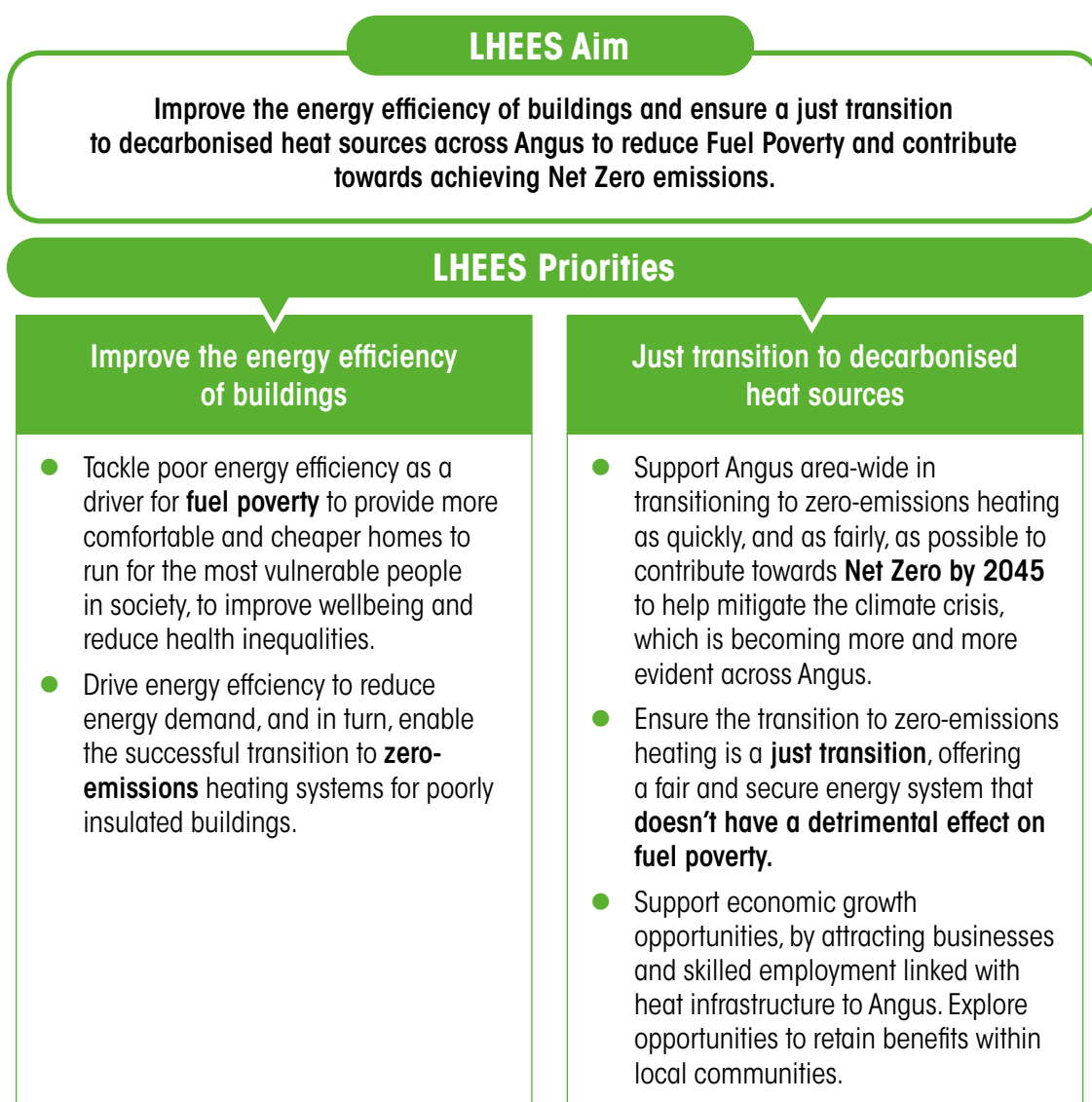
To help reduce fuel poverty efforts must focus on maximising the energy efficiency of the housing stock to help those in fuel poverty manage their running costs before a zero-emissions heating system is installed. Although heat decarbonisation is essential to address the climate emergency, the installation of zero-emissions heating systems must seek to lower fuel costs to assist fuel poor households to maximise their incomes.

⁴ Angus Council Transition to Net Zero Action Plan: 2022 to 2030

1.3 LHEES Aim & Priorities

The creation of the LHEES sets out a long-term plan for decarbonising heat and improving the energy efficiency of buildings across the Council area; this ties in with the Council's policies and local priorities. Going forward, the LHEES will enable the Council to further progress towards meeting the Local and National targets and help mitigate climate change area-wide within Angus.

The LHEES aim and priorities are:



2. Policy Summary

The LHEES considerations focus on energy efficiency, fuel poverty and heat decarbonisation and these are informed by a range of local, regional, and national policies, which contain a variety of different priorities and targets to help direct the LHEES.

The primary drivers are the Heat in Buildings Strategy (2021), Heat Network (Scotland) Act 2021 and the Fuel Poverty (Scotland) Act 2019. These strategies are ultimately pushing towards the Climate Change (Scotland) Act 2009 (as amended) target of net zero by 2045. This LHEES is therefore primarily driven by Scotland's statutory targets for greenhouse gas emissions reduction and fuel poverty.

2.1 National Policy Summary

The main national policies that drive this LHEES strategy can be found below:

Climate Change Scotland Act 2009, (as amended)

The Climate Change (Scotland) Act 2009 set out the initial legal framework for climate action and targets for the reduction of greenhouse gases in Scotland. The Act was updated in 2019; ambitious new targets were set for the reduction of greenhouse gases in Scotland with the aim of reaching Net Zero emissions by 2045.

Angus' energy consumption is 37%⁵ of the total area-wide emissions; the majority of homes and businesses are currently heated and powered by fossil fuels. The purpose of LHEES is to improve the energy efficiency of buildings and reduce greenhouse gas emissions resulting from the heating of buildings; this will assist in the delivery of the Net Zero target.

Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019

The Act sets targets relating to the eradication of fuel poverty in Scotland. The Act shares the same objective as LHEES; they both seek to remove low levels of energy efficiency as a driver of fuel poverty.

By 2040 the Act requires:

- 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
- The median fuel poverty gap of households in Scotland in fuel poverty is no more than £250.

⁵ UK local authority and regional greenhouse gas emissions national statistics: 2021

Alongside the national statutory targets to reduce fuel poverty, the Act also established a new two-part definition whereby a household is considered fuel poor if:

- after housing costs have been deducted, more than 10% (20% for extreme fuel poverty) of their net income is required to pay for their reasonable fuel needs; and
- after further adjustments are made to deduct childcare costs and any benefits received for a disability or care need, their remaining income is insufficient to maintain an acceptable standard of living, defined as being at least 90% of the UK Minimum Income Standard.

Heat In Buildings Strategy: Achieving Net Zero Emissions in Scotland's Buildings (October 2021). LHEES should reflect the following objectives to the pathway for Net Zero, as set out in the Heat in Buildings Strategy, which are as follows:

- By 2028 all private rented sector homes to reach a minimum standard equivalent to EPC C, where technically feasible and cost-effective.
- By 2030 the large majority of buildings shall achieve a good standard of energy efficiency:
 - Emissions from buildings must be 68% lower than 2020 levels.
 - Zero-emissions heating in 170,000 off-gas fossil fuel heated home, and at least 1 million on-gas homes.
 - Zero-emissions heating in the equivalent of 50,000 non-domestic buildings.
- By 2032, the social rented housing sector should achieve an EPC rating B in all buildings (The Scottish Government closed its consultation on the new Social Housing Net Zero Standard (SHNZS) in March 2024. This will replace the Energy Efficiency Standard for Social Housing 2 and will align any new standard with Net Zero targets).
- By 2033, all homes have the equivalent of an Energy Performance Certificate (EPC) rating of C where technically and legally feasible and cost effective.
- By 2040, fuel poor homes to achieve an EPC rating B.
- By 2045, homes and buildings no longer contributing to climate change.

In November 2023, the Scottish Government published a consultation on a Heat in Buildings Bill with proposals on new laws around the energy efficiency of homes and buildings and the way they are heated. The main points are:

- Reconfirm that the use of polluting heating systems will be prohibited after 2045.
- Introduce new laws that will require people and businesses to end their use of polluting heating when a heat network becomes available.
- Introduce a new law that will require homeowners to make sure that their homes meet a reasonable minimum energy efficiency standard by 2033.
- Private landlords will be required to meet minimum energy efficiency standards by 2028.

The Housing to 2040 national strategy was published in 2020. Scotland's first ever national housing strategy provides the vision for housing, what housing should look like and how it will be provided. There are four key themes:

- More homes at the heart of great places.
- Affordability and choice.
- Affordable warmth and zero emissions.
- Improving the quality of all homes.

It confirms the Scottish Government's commitment to achieve climate change targets and ensure that new and existing homes are fit for the future with zero-emissions heating systems. Included in the vision will be:

- Zero-emissions heating for new buildings consented from 2024.
- Aim for all new homes delivered by social landlords to be zero emission homes by 2026.
- Adapt existing homes to improve energy efficiency and decarbonise heating.
- Continued investment in energy efficiency support, extending support for fuel poor, rural and off-grid communities.
- Significant investment in decarbonised heat from 2025 onward.
- New regulations to set standards for zero-emission heating and energy efficiency (due 2023-25).
- Regulation in the private sector (both rented and owner-occupied) for minimum EPC standards.

The fourth National Planning Framework (NPF4) was approved by the Scottish Parliament in 2023 and illustrates the vision for Scotland to 2045. It will set out national planning policies and a new spatial plan for future developments. The framework will focus on delivery of four key outcomes:

- Net Zero emissions.
- A wellbeing economy.
- Resilient communities.
- Better, greener places.

It explores the concepts and challenges related to new housing delivery, place-making, decarbonising homes and improving energy efficiency, and maximising and sustaining the existing built environment.

The NPF4 policies 11 (energy) and 19 (heating and cooling) have direct links to LHEES; policy 11 supports renewable energy development and Policy 19 helps to decarbonise heat. Policy 19 states that Local Development Plans should take into account the areas of heat network potential and any designated Heat Network Zones identified via the LHEES process.

Other Scottish Government national policies that drive this LHEES strategy are:

- Energy Efficient Scotland (2020)
- Climate Change Plan (2018)
- Heat Networks Delivery Plan (2021)
- The Energy Efficiency (Domestic Private Rented Property) (Scotland) Regulations (2020)
- Energy Strategy and Just Transition Plan (2023)
- Owner-Occupier Energy Efficiency Standard (2019)
- Energy Efficiency Standard for Social Housing 1 & 2 (2014 & 2019)

2.2 Local Plans, Policy and Strategies

This LHEES strategy has been informed by a range of local policy that is alignment with the broader national policy context. The main local strategies that support this LHEES strategy can be found below:

Council Plan 2023 to 2028 (2024 update)

The Council Plan sets out the Council's vision, priorities and overarching strategic policy framework for the next five years. The Council's vision is for Angus to be 'a great place to live, work and visit'.

The priorities of the Council Plan relate to the LHEES in the following areas:

- Take action to mitigate against climate change by delivering the Council's Transition to Net Zero Action Plan: 2022 to 2030 and leading on the delivery of a Sustainable Energy Climate Action Plan (SECAP) for Angus to reduce area wide emissions.
- Reduce the Council's energy use through a reduction in the property estate coupled with good management to reduce wasting energy.
- Ensure that the Council's housing estate is well maintained and invest in improvements.

Community Plan 2022 to 2030

The Community Plan outlines the Community Planning Partners focus and commitment to work more closely and effectively together to realise the ambitions for Angus, delivering positive change and securing the best possible future for communities. The priorities of the Community Planning Partners insofar as it relates to LHEES, are as follows:

- 'Caring for our economy': support Angus to achieve inclusive and sustainable economic growth.
- 'Caring for our people': reduce inequalities in all communities.
- 'Caring for our place': protect and enhance the natural and built environment.

Local Housing Strategy 2023 to 2028

The overarching vision of the Local Housing Strategy 2023-28 is to ensure that "everyone in Angus has a good quality, safe, secure and warm home that they can afford". To achieve this, it recognises that there must be the ambitions to reduce emissions and make better

use of the Council's housing stock. To overcome the challenges and achieve the vision, a number of priorities were identified that complement the LHEES ambition:

- Making best use of the Council's existing housing stock – by reducing empty buildings and improving the condition of existing homes.
- Enabling and supporting a generous supply of good quality new homes to meet people's needs.
- Supporting thriving communities, with focus on increasing rural homes and supporting place-based regeneration.
- Tackling fuel poverty by improving access to fuel poverty support

These priorities will be targeted by a range of activities that set out short, medium and long-term goals, helping monitor progress and align the Local Housing Strategy (LHS) objectives with other strategic objectives. The activities are outlined in the LHS Delivery Plan that has been developed with a level of flexibility and will evolve as the evidence base develops.

Tay Cities Deal and the Mercury Programme

The Tay Cities Region Deal brings together public, private and voluntary organisations in the council areas of Angus, Dundee, Fife and Perth & Kinross to deliver a smarter and fairer region. The Tay Cities Deal identifies a £26.5 million capital investment fund for projects in Angus, the Angus Fund. The Angus Fund will be used to stimulate The Mercury Programme, which is Angus Council's visionary £1 billion partnership programme between government, public, private and community sectors.

The purpose of the Mercury Programme is to increase productivity through clean growth, protecting places for future generations to live, work and visit. The Mercury Programme has three interlinking components of investment; Clean Growth, Low Carbon, and Agri Tech. The LHEES will assist in the development of low carbon and renewable solutions for energy across Angus and the wider Tay Cities region which will significantly reduce greenhouse gas emissions and contribute towards the National Net Zero target.

Other local strategies that support this LHEES strategy are:

- Angus Local Development Plan (2016)
- Interim Regional Spatial Strategy (Tayside) (2021)
- Strategic Housing Investment Plan (2022/23 to 2027/28)
- Sustainable Energy & Climate Action Plan (SECAP)
- Angus Council Transition to Net Zero Action Plan: 2022 to 2030
- Angus Economic Strategy (2013)
- Angus Economic Development Land & Property Strategy 2021 to 2030
- Tay Cities Regional Economic Strategy 2019 to 2039

3 LHEES Approach

3.1 LHEES Structure

As established in the Local Heat and Energy Efficiency Strategies (Scotland) Order 2022, LHEES should have a two-part structure:

A **Local Heat and Energy Efficiency 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

A **Local Heat and Energy Efficiency Delivery Plan** is a document setting out how a Local Authority proposes to support implementation of its local heat and energy efficiency strategy.

Both documents are available via the **Councils website**.

The Council must publish an updated Local Heat and Energy Efficiency Strategy and Delivery Plan at intervals of no more than five years after the date of publication of the previous strategy.

3.2 LHEES Process

The Scottish Government produced LHEES Methodology and Guidance to assist local Authorities on how to produce an LHEES in accordance with the requirements set out in the LHEES Order and Guidance. The LHEES Methodology is split into eight proposed stages:

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

The purpose of the LHEES Methodology is to enable the Council to complete LHEES Stages one to six. The completion of these Stages will provide the Council with the data analysis and evidence base to enable the Council to complete its LHEES Strategy and Delivery Plan documentation. The Council received Scottish Government funding to assist with the LHEES development. ChangeWorks consultants were appointed to carry out stages one to six, and to support with stages seven and eight.

More in depth information on LHEES Methodology and Guidance can be found on the [Scottish Governments website](#).

3.3 LHEES Considerations

The LHEES Considerations are a list of technologies, building typologies and policy priorities used to identify and target interventions. As set out in table one, they include:

	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	Mixed-tenure, mixed-use and historic buildings	Mixed-tenure, mixed-use buildings, listed buildings, and buildings in conservation areas

Table one: Summary of LHEES considerations

Off-Gas grid heat decarbonisation

In order to meet the climate targets and ensure long-term delivery of the Net Zero objectives, by 2030 the vast majority of the 170,000 off-gas homes in Scotland that currently use high emissions oil, LPG, and solid fuels must convert to zero-emissions heating. LHEES should identify low regrets off-gas heat decarbonisation pathways and opportunities at a strategic level and at a delivery level.

On-Gas grid heat decarbonisation

To meet Scotland’s statutory targets for emissions reduction, the use of natural gas must significantly reduce and eventually phased out entirely. By 2030 at least 1 million homes will need to switch to zero-emissions heat, away from high carbon heating such as gas. LHEES should identify potential on-gas heat decarbonisation pathways and opportunities at a strategic and delivery level.

Heat networks

LHEES should highlight zones within the Council boundary where heat networks present a potential decarbonisation option. The Council is required to consider heat demand density, the proximity of large heat demands that could form the basis of a network, and any opportunities or constraints relating to development potential e.g., proximity of identified zones to existing heat networks. Zoning that takes place within LHEES will serve as an initial analysis that will inform the designation of heat network zones.

Poor building energy efficiency

LHEES should identify possible locations at a strategic and delivery level where poor building energy efficiency exists across the local authority. This could be low levels of wall insulation, loft insulation or glazing – or a combination of these measures.

Poor building energy efficiency as a driver of fuel poverty

Poor building energy efficiency is a recognised factor that can contribute to fuel poverty. LHEES should identify possible locations at a strategic and delivery level where poor building energy efficiency acts as a driver for fuel poverty. Within areas of high fuel poverty, this could be where low levels of wall insulation, loft insulation or glazing exist, potentially in combination. This should help to ensure that area-based energy efficiency and heat decarbonisation projects will be effective in reducing fuel poverty, as well as highlighting where extreme fuel poverty is prevalent and further measures and support may be needed.

Mixed-tenure, mixed-use and historic buildings

For mixed-tenure and mixed-use (including the non-domestic sector), building level intervention is likely to be the most effective way to reduce emissions caused by heating. For historic buildings (including those in listed buildings and conservation areas), it is likely that they may require tailored approaches to the installation of zero-emissions heat and energy efficiency solutions, or where specific advice and support might be available. Identifying such areas will enable the Council to coordinate or regulate to achieve this outcome. LHEES should identify at a strategic and delivery level where there are buildings of mixed-tenure or mixed-use and also where there are historic buildings.

3.4 Governance

3.4.1 LHEES Working Group

A LHEES Working Group consisting of Council Officers from Housing (Strategy and Technical), Building Standards, Planning, Property Assets, Capital Projects, Economic Develop, GIS and Strategic Policy & Planning Services was formed to provide specialist input, as well as oversight of the LHEES as it was developed.

3.4.2 Stakeholders

During stage one of the LHEES process, an initial stakeholder identification exercise was carried out using the LHEES Policy and Strategy Review Template. A summary of key internal (Council) and area-wide stakeholders was drafted and shared with the LHEES

Working Group for comment. A diagram containing an area-wide stakeholder interest/influence matrix, which can be found in appendix 8.1. This will be kept under continuous review and updated as and when required.

Internal stakeholders are predominantly members of the Council's LHEES Working Group. A number of LHEES workshops have been held and group/individual meetings taken place during the LHEES process.

Area-wide stakeholder engagement has centred around Social Housing providers to date. A meeting was held on the 20th of March 2024 to introduce LHEES and discuss their priorities, challenges and opportunities surrounding energy efficiency, heat decarbonisation and fuel poverty. The LHEES Delivery Plan contains actions to carry out more extensive stakeholder engagement in the upcoming years. Once this has taken place the Delivery Plan will be updated with more detailed actions and projects.

3.5 Consultation

3.5.1 LHEES Working Group

The draft LHEES Strategy and Delivery Plan were made available on a shared platform for members of the working group to review and comment.

3.5.2 Elected Members Consultation

Elected Members were kept informed throughout the development of the LHEES via briefing sessions on the 5th of February 2024 and the 27th of March 2024. A briefing session on the draft LHEES Strategy and Delivery Plan took place on the 18th of June 2024.

3.5.3 Public Consultation

Public Consultation on the draft LHEES Strategy and Delivery Plan commenced on the 20th of June 2024 for six weeks, it concluded on the 2nd of August 2024.

3.5.4 Strategic Environmental Assessment (SEA)

Section 8 (1) of the Environmental Assessment (Scotland) Act 2005 requires Local Authorities to determine if a plan is likely to have significant environmental effects. Through the SEA process, the Council submitted a Screening Report to the Consultation Authorities: Scottish Environment Protection Agency (SEPA), Historic Environment Scotland (HES) and NatureScot, and considered the criteria set out in the Environmental Assessment (Scotland) Act 2005.

The outcome as detailed in the Consultation Authorities Letter of the 7th of September 2023 was that the LHEES and Delivery Plan is unlikely to have any significant environmental effects as the strategy aims to identify pathways to enable buildings within Angus to decarbonise heat and improve energy efficiency of the building stock. Those actions which have environmental implications are already known as they relate to existing commitments in national strategies which have previously been subject to SEA.

Any future revisions to the LHEES and its Delivery Plan will require to the Council to re-assess any likely significant environmental impacts again in line with the requirements of the Environmental Assessment (Scotland) Act 2005.

3.6 Formalities

Following the consultations and document review from the Scottish Government, the LHEES Strategy and Delivery Plan was submitted to Full Council Committee for approval. The documents were subsequently submitted to the Scottish Government and made publicly available on the **Council's website**.

4. Baseline

The baseline analysis allows the Council to understand the current energy efficiency status and heat decarbonisation potential of the building stock at a Council wide level. It has involved baseline data analysis of the domestic housing and non-domestic building stock against the LHEES Considerations, Targets, and Indicators.

4.1 Domestic Building Stock

The Energy Saving Trust's Home Analytics domestic dataset was used as the main source of data (Domestic Baseline Tool version 4.0 - August 2022). This dataset uses data obtained from local authorities, Registered Social Landlords and Energy Performance Certificates, and is calibrated where possible to verify published sources of data such as the UK Census and national housing surveys. It uses advanced statistical and geo-spatial models to develop a profile of the housing stock at the individual address level. The data is not 100% accurate and the characteristics of some buildings are based on extrapolated data, but the dataset is of sufficient quality to allow detailed analysis and conclusions.

Based on information within the Home Analytics dataset, Angus has 58,818 domestic buildings within the local authority boundary, with an average energy demand of 25,645 kWh per year. This is 10% more than the Scottish average of 23,005 kWh per year. The landscape and infrastructure within Angus are both pivotal in how residents heat their homes. With many rural areas in exposed areas high above sea level, coupled with coastal towns and settlements which bear the brunt of harsh North Sea weather fronts, maintaining a comfortable living environment can be costly.

Appendix 8.2 of this document contains a summary table of the housing stock within Angus split into construction types and compared against various categories. It gives a visual representation of the housing stocks characteristics within Angus.

4.1.1 Building Construction

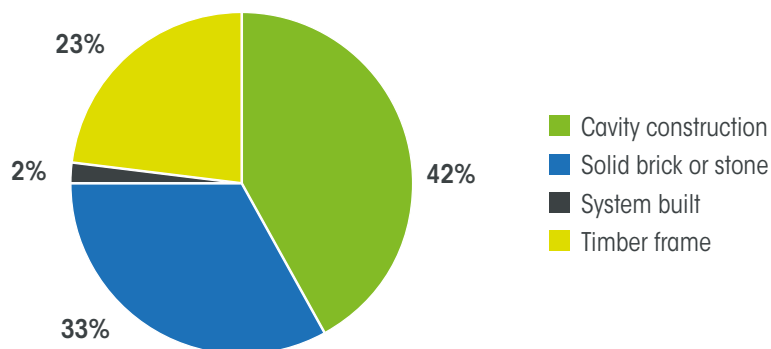


Figure one: Pie chart showing the percentage breakdown of domestic construction types within Angus.

Solid Brick & Stone Construction

As shown in figure one, a third of domestic buildings in Angus are constructed from solid brick or stone, with 74% of the buildings constructed prior to 1919. The data shows that domestic buildings constructed from solid brick or stone are highly likely to have uninsulated walls along with higher levels of uninsulated lofts and partial or full single glazed windows. Solid brick or stone buildings are often considered 'hard to treat'⁶ due to the invasive nature of some efficiency measures and the cost. These buildings are likely to be situated in and around town centres, and in rural areas which are likely to be off the gas grid. They are also more likely to be situated in Conservation Areas and/or have Listed Building status. Any improvements, alterations, changes to Listed Buildings and buildings within Conservation Areas (Listed and non-listed buildings) will require to comply with the appropriate Legislative requirements and planning policy as set out in the Development Plan (which in Angus comprises of National Planning Framework 4 and the Angus Local Development Plan (2016)). As a result, improvements to buildings to improve energy efficiency and decarbonise heat within these designations might require going through a statutory process.

Solid brick or stone domestic buildings also have the highest number of private rentals, which mainly consist of buildings in and around town centres (mixed-use, above commercial premises, for example) and rural buildings.

Cavity Wall Construction

42% of domestic buildings in Angus are of cavity wall construction. Broadly speaking, cavity construction was most popular from the 1950's into the 1980's, with buildings likely to originally contain no wall insulation, single glazed windows, and thin layer of loft insulation (less than 99mm). Cavity wall constructed buildings built from 1992 onwards contain wall insulation, higher levels of loft insulation and double glazing as standard. From 1919 to 1991, 69% of cavity wall constructed buildings have likely had cavity wall insulation retrofitted and 95% have likely had their loft insulation topped up to levels greater than 100mm, showing a desire from all tenure types to increase the efficiency of their buildings. It would also suggest

⁶ hard to treat building are difficult to make energy efficient through conventional improvements, such as cavity insulation, loft insulation or zero-emissions heating solutions, like heat pumps.

that its 'technically easier' and more cost effective to install energy efficiency measures to this construction type. However, there is still work to do with 28% of cavity walls remaining uninsulated, mainly in the owner occupier and private rental tenure types.

Cavity wall constructed domestic buildings have the highest percentage of social housing owned buildings and the highest levels of fuel poverty. This is not due to poorly insulated buildings, in fact it's the opposite. 94% of cavity wall constructed Social Housing buildings have wall insulation, loft insulation >100mm and double glazing, making them the most efficient tenure type due to the Energy Efficiency Standards for Social Housing (EESH). Fuel Poverty is likely due to personal circumstances rather than poor energy efficiency. The data purely highlights the correlation between construction type, Social Housing tenure type and areas of fuel poverty in Angus.

Timber Frame Construction

Timber frame construction accounts for 23% of domestic buildings in Angus. Timber frame construction started to become more common in the 1950's but increased significantly from the 1990's onwards due to an increase in energy efficiency requirements in the Building Regulations. Due to this, these buildings are generally the most efficient construction type in Angus with 73% of buildings achieving an EPC band A to C.

Buildings from the period 1950 to 1991 didn't necessarily require wall insulation due to the Building Regulations at the time, due to this, 82% of timber frame walls from this period still require to be insulated, if feasible. Buildings from this period were likely to be originally constructed with less than 99mm of loft insulation and may have contained single glazing, pre-1970's. Owners have likely increased their levels of loft insulation and installed double glazing as only 6% of lofts have less than 99mm of insulation and only 1% still contain single glazed windows. Again, this shows a desire from all tenure types to increase the efficiency of their buildings. It would also suggest that upgrading loft insulation and double-glazed windows are 'technically easy' measures to install and are cost effective. Retrofitting wall insulation may be too invasive and/or not feasible for this construction type.

Due to the higher levels of energy efficiency associated with this construction type and good accessibility to the gas grid, lower levels of fuel poverty are present.

4.1.2 Tenure

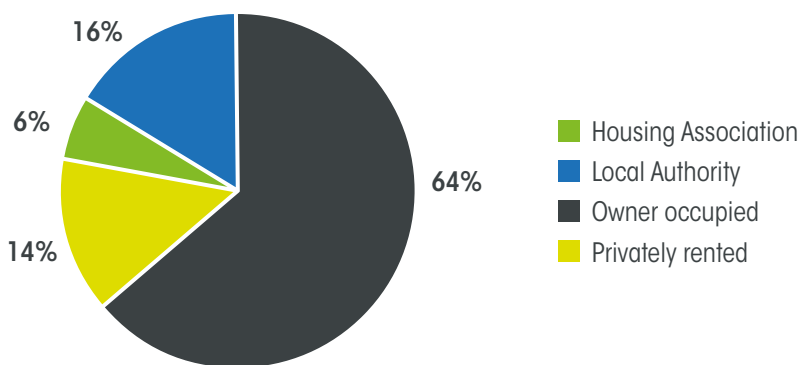


Figure two: Pie chart showing the percentage breakdown of domestic tenure types within Angus. 12% of homes are located in mixed-tenure buildings.

As shown in figure two, Social Housing buildings make up 22% of the housing stock in Angus; 16% are Council owned buildings; and 6% are Social Housing owned buildings. Social Housing providers and the Council have obligations to meet Energy Efficiency Standard for Social Housing (ESSH) and the Council has considerable experience within its Housing teams of delivering large scale energy efficiency improvements to meet the ESSH targets. This is explained more in section 5.4.4. below.

The Private Rental sector makes up 14% of housing stock in Angus. Engagement with both landlords and tenants are vital to understand their challenges and prepare a successful LHEES that takes all relevant perspectives into account, including short term lets.

Owner Occupiers make up 64% of housing stock in Angus and support and action from owner occupiers is vital for the success of improving energy efficiency and decarbonising heat in Angus. For instance, 45% of homes in Angus have uninsulated walls with 32% of these homes being owner occupied. If the Council can gain buy-in from Owner Occupiers, then significant improvements in energy efficiency and heat decarbonisation across Angus could be achieved.

4.1.3 Mixed-Tenure, Mixed-Use and Historic Buildings

Mixed-tenure buildings combine a range of tenure options, which can include owner-occupier housing, shared ownership housing and rental buildings (private and social), for example, a block of flats. Mixed-use buildings are defined as a building that has both residential and non-residential elements, for example, a shop with a flat above it. In Angus, mixed-tenure homes make up 12% of the housing stock and buildings with more than 1 dwelling in the building accounts for 28% of domestic buildings within Angus.

Historic buildings are buildings that are considered to have particular historical or architectural significance. Within Angus 7% (3,956) of domestic buildings are situated in Conservation Areas, with 3% of domestic buildings have been designated as either Category A, B or C Listed Buildings. Domestic buildings with listed status and/or are situated in Conservation Areas tend to have poor energy efficiency with an average of 79% of domestic buildings containing uninsulated walls, 27% containing low levels of loft insulation and 32% containing single glazed windows. They are typically pre-1919 constructed buildings located in and around town centres, accessible rural areas (e.g., Auchmithie, Edzell, Glamis, Tannadice, etc.) and remote rural areas (e.g., Angus Glens).

4.1.4 On-Gas Grid/Off-Gas Grid



72% homes in Angus are **on-gas** v Scottish average of 82%

28% homes in Angus are **off-gas** v Scottish average of 18%

Angus is predominantly a rural Council, hence the percentage of on-gas grid domestic buildings being less than the Scottish average, and the percentage of off-gas grid domestic buildings being higher than the Scottish average. Off-gas heating sources used across the domestic buildings within Angus are electricity which accounts for 15% of homes, Oil 10%, liquid petroleum gas (LPG) 2% and Biomass/Solid Fuel 1%. Figure three highlights the areas where there are high percentages of off-gas grid domestic buildings in Angus:

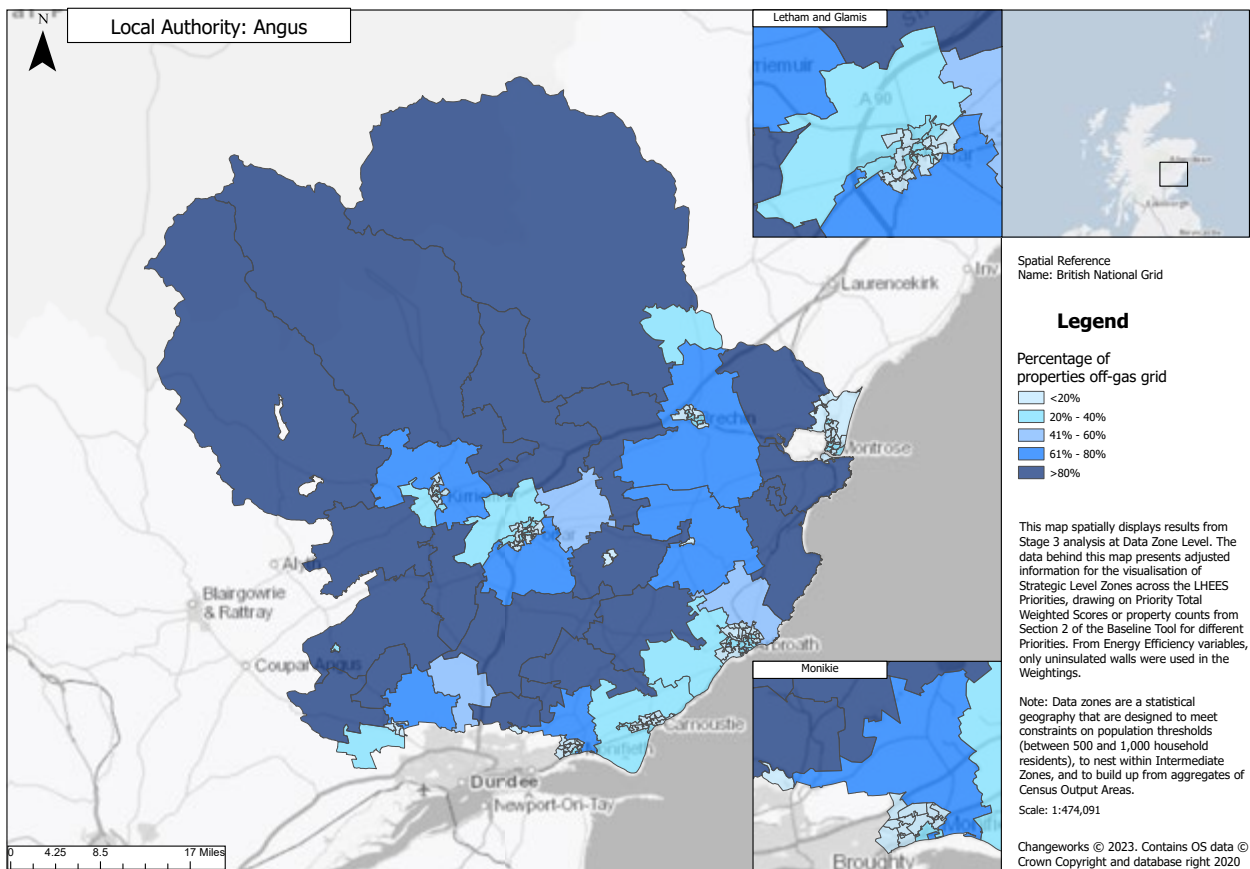


Figure three: The percentage of off-gas grid domestic buildings across Angus. The darker the colour of blue, the greater the number percentage of buildings off-gas grid.

One of the drivers of fuel poverty is the types of fuel used by householders. In many instances access to mains gas supply is a barrier, particularly for rural households. The alternative heating systems tend to be more expensive, with biomass/solid fuel, oil, liquid petroleum gas (LPG) and electricity the more common fuel systems. The findings from the Scottish House Condition Survey 2019⁷ show that fuel poverty rates for homes with electricity as their primary heating fuel is 43% compared to 22% for gas.

⁷ www.gov.scot/publications/scottish-house-condition-survey-2019-key-findings/documents

4.1.5 Energy Efficiency

Energy Performance Certificates (EPCs) tell you how energy efficient a building is and gives it a rating from A (very efficient) to G (inefficient). The Scottish Government requirements are that all private rented sector homes require to reach a minimum standard equivalent to EPC C, where technically feasible and cost-effective, by 2028. The Energy Efficient Standard for Social Housing 2 (ESSH2), or equivalent⁸, aims to maximise the number of social rented homes achieving EPC B by 2032, subject to some exemptions. For all other owner occupiers, an EPC C rating is to be reached by 2033 (where technically and legally feasible and cost-effective). The proposals are intended to reduce bills and stop leaky homes adding to emissions.

60% of domestic buildings within Angus have an EPC rating of D-G, this means that approximately 35,000 homes across Angus will need upgraded with energy efficiency measures and/or low or zero-emission heating systems in less than 10 years.

As shown in table two, Angus has significantly more buildings in the lower efficiency bands E to G than the Scottish National average, this highlights the poor energy efficiency of domestic buildings in Angus.

Energy Performance Certificate Ratings	Owner Occupied		Private Rental		Social Housing	
	Angus Council	Scotland	Angus Council	Scotland	Angus Council	Scotland
A (92-100)	0%	0%	0%	0%	1%	0%
B (81-91)	6%	4%	4%	7%	8%	6%
C (69-80)	30%	43%	22%	43%	61%	59%
D (55-68)	38%	38%	33%	35%	26%	28%
E (39-54)	18%	11%	25%	9%	3%	6%
F (21-38)	6%	3%	12%	5%	1%	1%
G (1-20)	2%	1%	3%	1%	0%	0%

Table two: The percentage of EPC ratings in Angus, split by tenure type and compared against the Scottish National average.

As previously stated, households in Angus are estimated to use more domestic fuel than the national average and thus average local fuel spend is considerably higher. There are a range of influencing factors but none more so than the fabric of the building, with many households estimated to have inadequate wall and/or loft insulation. Approximately 26,600 dwellings within Angus do not have wall insulation (45%), and around 5,311 dwellings (9%) do not have loft insulation (less than 100mm). Of course, the caveats being that not all buildings would be suitable for wall insulation, nor may it be technically feasible, and not all buildings do in fact have a loft.

⁸ The Scottish Government closed its consultation on the new Social Housing Net Zero Standard (SHNZS) in March 2024. This will replace the Energy Efficiency Standard for Social Housing 2 and will align any new standard with Net Zero targets.

The data does however paint a stark picture that the housing stock in this regard requires substantial investment to help drive up energy efficiency ratings. It is also worth noting that the data also estimates that around 93% of households within Angus have at least double glazing installed. This suggests that householders do have an awareness of energy efficiency issues and large investments have been made.

4.1.6 Fuel Poverty

Fuel poverty occurs when a household is required to spend more than 10% of its income in order to maintain a satisfactory heating regime. Extreme fuel poverty occurs when a household is required to spend more than 20% of its income in order to maintain a satisfactory heating regime. Prior to the pandemic in 2020, the start of the conflict in Ukraine in 2022, and the cost of crisis from 2021 to 2024, the Scottish House Condition Survey (SHCS 2017-19) reported that 22% of households in Angus were in Fuel Poverty and 10% in were in Extreme Fuel Poverty. Due to the knock-on effects of these recent events, it would be prudent to assume that fuel poverty rates are much higher, as will be the fuel poverty gap.

The Council has used the Scottish Index for Multiple Deprivation (SIMD) to assess fuel poverty within the local authority. SIMD is a standard tool for identifying areas with high levels of deprivation and was published in 2020. The SIMD:

- shows where Scotland’s most deprived areas are, so organisations know where their work can have the biggest impact.
- is a relative measure of deprivation across small areas in Scotland.
- looks at multiple deprivation.

‘Deprived’ does not just mean ‘poor’ or ‘low income’. It can also mean people have fewer resources and opportunities, for example in health and education. Communities can use SIMD to identify the things that matter to them such as access to services.

The SIMD data can be used to:

- Compare overall deprivation of small areas.
- Compare the seven domains of deprivation.
- Compare the proportion of small areas in a council that are very deprived.
- Find areas where many people experience multiple deprivation.
- Find areas of greater need for support and intervention

SIMD data is split into ten deciles covering the whole population, where one is most deprived and ten is least on the scale.

Housing Association	Local Authority	Owner Occupied	Privately Rented	Total
642	1,767	1,482	439	4330

Table three: SIMD statistics covering deciles one and two (extreme fuel poverty) within Angus, split by tenure type.

In a national context, out of the 32 Local Authorities in Scotland, Angus is the 22nd most deprived area based on the SIMD analysis carried out. As shown in table three, a total of 4,330 buildings within Angus fall within SIMD deciles one and two, which can indicate extreme fuel poverty. Just under half of the total domestic buildings owned by the Council fall into this category; this illustrates a link between the social housing tenure type and areas with high SIMD scores.

The poor energy efficiency of a domestic building can be a driver fuel poverty. There is clear evidence for this when looking at the top five areas within Angus where poor energy efficiency is likely to be acting as a driver fuel poverty:

- Uninsulated walls are prevalent in 64% to 76% of domestic buildings.
- Single glazed windows are prevalent in 10% to 43% of domestic buildings.
- Loft insulation of less than 100mm is prevalent in 13% to 22% of domestic buildings.

There is also a clear link between poor energy efficiency acting as a driver for fuel poverty and the building being listed and/or located in a Conservation Area. Nine of the top twelve Data Zones where poor energy efficiency is acting as a driver for fuel poverty have a high number of buildings located within Conservation Areas and with Listed Building status. The Data Zones are: Kirriemuir 04, Montrose South 02, Lunan 03, Arbroath Harbour 04, Brechin West 01, Montrose South 01, Montrose South 03, Arbroath Harbour 03 and Montrose South 06.

SIMD is an area-based measure of relative deprivation. It uses small geographical areas called Data Zones to measure deprivation. Angus has been split into 155 Data Zones where the extent to which each Data Zone is deprived is assessed across seven domains: income, employment, education, health, access to services, crime, and housing. Not every person in a highly deprived area will themselves be experiencing high levels of deprivation, and Data Zones in rural areas tend to cover a large land area and reflect a more mixed picture of people experiencing different levels of deprivation. More information on Data Zones can be found in **section 5** of this document.

4.2 Non-Domestic Buildings

There are approximately 220,000 non-domestic buildings in Scotland, they vary significantly in floor area and energy use, and include around 23,000 buildings in public ownership. Non-domestic buildings account for 12% percent of Scotland's final energy consumption (17 TWh) and for 7% of Scotland's total greenhouse gas emissions. Over half of Scotland's non-domestic buildings are already heated using low or zero emissions sources. Some of the largest non-domestic buildings are more likely to have gas heating systems, and for other non-domestic buildings not using gas heating, electric heating (either direct or through Heating Ventilation and Air Conditioning (HVAC) systems) and oil are common alternatives.

The Energy Saving Trust's Non-Domestic Analytics dataset (Non-Domestic Baseline Tool version 4.0 - September 2022) was used as the main source of data to analyse the non-domestic building stock within Angus. The dataset uses publicly available EPC data and statistically modelled values, to model baseline heat demand (space heating and hot water heating). Typologies were estimated using Ordnance Survey classification

descriptions, land use categories, and EPC building types where available. The dataset is still being developed; around 87% of the non-domestic building data within Angus contains extrapolated data which gives low confidence levels. The Scottish Government and its delivery partners are aware of this issue and are carrying out exploratory work to develop a national dataset for non-domestic buildings that has potential to be integrated into the LHEES methodology in future.

Based on the data within the 'Non-Domestic Analytics', there are a total of 6,489 non-domestic buildings located within Angus, with a total floor area of 3.4 million m2. The most common types of non-domestic buildings are retail (25%) and light manufacturing/industry/workshops (15%); they also account for the highest heat demand within Angus, as shown in figure four.

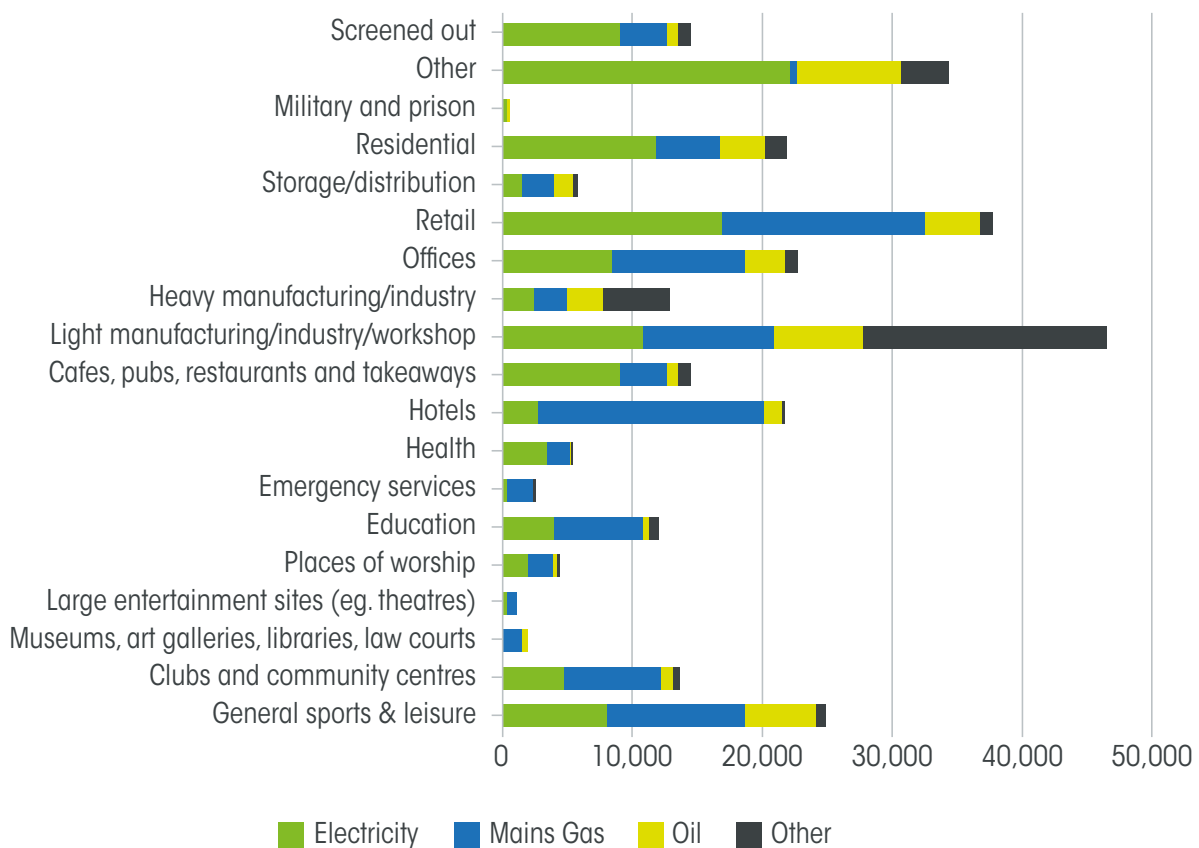


Figure four: Heat demand (MWh/yr.) for non-domestic buildings in Angus split by fuel type and typology.

The total heat demand of non-domestic buildings within Angus is calculated to be 292,834 MWh per year. Council owned buildings such as offices, schools, libraries, museums, sports centres, etc. are included within these figures and contribute to approximately 13% of the non-domestic heat demand per year.

Figure five, shows that electricity is the most common heating system fuel type, used by 3,663 non-domestic buildings in Angus (57%), and accounts for 38% of the heat demand

for non-domestic buildings in Angus. In the 'Heat in Buildings Strategy' zero-emissions heating systems are defined as "systems that have zero direct greenhouse gas emissions, such as individual electric heat pumps and connection to heat networks, or electric systems such as storage heaters". This means that approx. 3,663 of non-domestic buildings and approx. 38% of heat demand for non-domestic buildings in Angus are already from a zero-emissions heating source.

Mains gas is used by 1,245 non-domestic buildings in Angus (19%) and accounts for 37% of the heat demand for non-domestic buildings in Angus. Oil is used by 1,171 non-domestic buildings in Angus (18%) and accounts for 14% of the heat demand for non-domestic buildings in Angus. 'Other fuels' are used by 410 non-domestic buildings in Angus. Between gas and oil, half of the heat demand in non-domestic buildings in Angus is from high carbon sources.

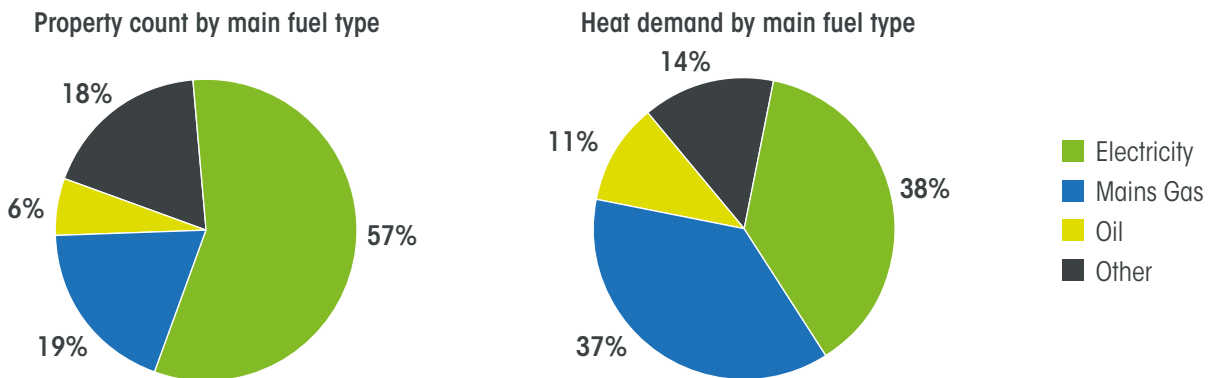


Figure five: Non-domestic buildings in Angus fuel type split by count and heat demand (MWh/yr.)

Figure six, shows that the highest number of non-domestic buildings in Angus are retail (25%) and light manufacturing / industry / workshops (15%), and the majority of non-domestic buildings in Angus were built pre-1919 (46%) and post-1983 (43%). Like pre-1919 domestic buildings, pre-1919 non-domestic buildings are more likely to have poor energy efficiency and will be more challenging to retrofit due to high proportions of solid brick/ stone wall construction. They are also more likely to be Listed Buildings or situated in Conservation Areas. Retail buildings in Angus account for approximately 72% of pre-1919 non-domestic buildings and are likely to be situated in Victorian era High Streets. 59% of non-domestic buildings in Angus are located in urban areas and small towns with the remainder split between rural and remote/very remote areas.

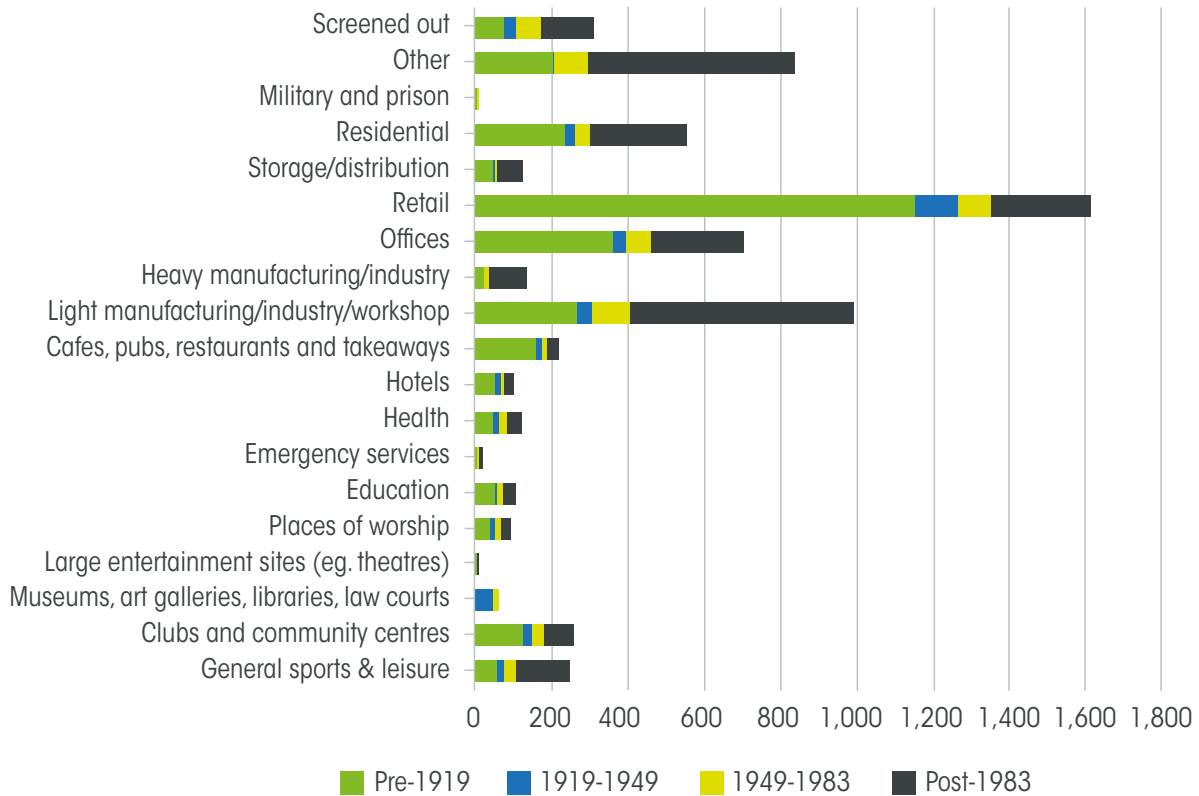


Figure six: Angus non-domestic property count by typology, split by age.

4.2.1 Angus Council Non-Domestic Buildings

Since 2012/13 (Public Bodies Climate Change Duties nominated base year) the Council has reduced the carbon emissions of its buildings by 55% through a variety of measures such as: LED lighting upgrades with controls, installation of Building Management Systems, insulation, draughtproofing, installation of variable speed drives, domestic hot water rationalisation and controls, and the installation of biomass boilers, solar thermal and solar photovoltaics. The majority of these energy efficiency and renewable energy projects have been funded by the Council and via external funding. Going forward the Council are commissioning a 'Road to Net Zero' Study to enable best value decisions on how Council owned non-domestic buildings can contribute to the overall Net Zero emissions target, together with the level of investment required in future years.

Since 2009, the Council has designed new buildings that incorporate a host of sustainability measures which go beyond Buildings Standards, to make them energy efficient and low carbon. In 2010, the Council designed and built Seaview Primary School, which won the national Carbon Trust Low Carbon Building Award. Similar design standards were incorporated into the new Isla Primary School in Lintrathen, Montrose Sports Centre and Kinloch House in Carnoustie. Currently, the Council are constructing the new Monifieth Learning Campus; the Campus has been designed to Passivhaus Standards, which will deliver an energy efficient building with a high level of user comfort.

Design work is to be undertaken in 2024/25 for a pilot scheme to retrofit Air Source Heat Pumps to provide low carbon heating to Rosemount Primary School in Hillside, Montrose. Once a suitable design is in place, funding will be sought progress with the works. The outcome of this scheme will help to inform the Council's future Net Zero heating emissions strategy.

4.3 Existing Heat Networks

The Council operates ten small heat networks in the form of communal heating systems. They consist of one biomass system with gas boiler back up and the remaining nine are served by gas boilers. They serve seven Council sheltered housing complexes located in Arbroath, Carnoustie, Kirriemuir, Letham and Montrose, Arbroath Business Centre which contains multiple business units, Arbroath Harbour Visitor Centre which contains multiple business units, and the Academy Court Council housing development in Forfar. Appendix 8.3 contains a map showing the location of these communal heating systems across Angus.

5. Strategic Zones

Now the current energy efficiency and heat decarbonisation potential of the building stock Angus wide is understood, 'Data Zones' can be identified to explore potential pathways to decarbonise buildings at a strategic level, in line with the LHEES aim to *"improve the energy efficiency of buildings and ensure a just transition to decarbonised heat sources across Angus to reduce Fuel Poverty and contribute towards achieving Net Zero emissions"*.

What are Data Zones?

In Scotland, there are a number of geographic areas that are used to understand statistics about the population. Intermediate zones fit within Council boundaries and typically contain between 2,500 and 6,000 residents. Data zones are smaller than intermediate zones and contain between 500 and 1,000 residents. Angus contains 155 Data Zones and they are named after the intermediate zone they are within. For example, Forfar West 01 is a data zone within the Forfar West Intermediate zone. Data zones are intended to be small enough to represent communities, such as social characteristics and geographical constraints, but large enough to protect confidentiality.

5.1 Heat Decarbonisation Targets

In order to meet National climate targets and ensure long-term delivery of the Net Zero objectives, by 2030 the vast majority of the 170,000 off- gas homes in Scotland that currently use high emissions oil, LPG, and solid fuels must convert to zero- emissions heating. The use of natural gas must significantly reduce and eventually be phased out entirely. By 2030 at least 1 million homes will need to switch to zero- emissions heat, away from high carbon heating such as gas. By 2030, the equivalent of 50,000 of Scotland's non-domestic buildings need to convert to zero-emissions heat.

The National Targets for decarbonising heat in domestic and non-domestic buildings are:

- By 2045, at the latest, all buildings will have zero-emissions heating systems, and
- By 2038, Publicly owned buildings are to meet zero emission heating requirements.

The Interim National Targets for decarbonising heat in domestic and non-domestic buildings are:

- Principal Emissions Reduction Target: 68% reduction in emissions from buildings by 2030 against a 2020 baseline as set out in the Climate Change Plan Update.

- Heat Networks Target: the combined supply of thermal energy by heat networks to reach 2.6 TWh of output by 2027 and 6 TWh of output by 2030.
- Renewable Heat Target (provisional): at least 22% of heat in buildings to be directly supplied from renewable sources by 2030.

LHEES should identify low-regrets⁹ off-gas heat decarbonisation pathways and opportunities, and potential on-gas heat decarbonisation pathways at a strategic level and at a delivery level.

Research commissioned by the Scottish Government¹⁰ found that there are various low and zero emissions heating options available for all domestic dwellings, with the deployment of heat pumps and development of low and zero emissions heat networks identified as the 'low-regrets strategic technologies' to focus on. Heat pumps and heat networks are deemed as a 'tried and tested primary heating technologies'; the costs of installation and running costs for consumers are already understood, meaning cost uncertainty is low. The research also found no evidence to suggest that heat pumps could not operate effectively in Scotland.

5.2 Heat Decarbonisation - Building Level

For the Off-Gas and On-Gas LHEES Considerations, indicators and criteria are used to assess the most appropriate pathway for each building. The categories, shown in table four, aims to give an initial indication of where heat pump installation may be more straightforward, and where there are likely to be more significant challenges in upgrading buildings to be heat pump ready.

Category	Description
0	Those buildings that already have a low or zero-emissions heating system and those that are connected to a heat network
1	Those considered highly suited for heat pump retrofit (i.e., well insulated buildings with a wet heating system (typically a boiler distributing hot water to radiators), excluding any consideration of electricity network impacts or costs of any network upgrades)
2	Those with secondary potential for heat pump retrofit (i.e., buildings in need of moderate fabric upgrade and/or heat distribution system upgrades to be heat pump ready). Moderate fabric upgrades are generally considered to be insulating cavity walls and topping up loft insulation.
3	Those with tertiary potential for heat pump retrofit (i.e., buildings in need of significant fabric upgrade/heat distribution system upgrades 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. Significant fabric upgrades are generally considered to be insulating the walls of solid brick and stone and timber constructed buildings, topping up loft insulation and installing double/triple glazed windows.

Table four: Descriptions of buildings and decarbonisation pathways in Categories 0 to 3.

⁹ low-regrets measures are relatively low-cost measures that provide relatively large benefit under predicted future climates.

¹⁰ www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/documents/ - pages 17 to 19.

What are Heat Pumps?

Heat pumps run on electricity instead of gas. As the UK increases its generation of electricity from renewable sources, such as wind turbines, the electricity grid will become 'greener' making electricity a zero-emissions energy source.

Heat pumps warm buildings by absorbing heat from the air, ground, or water. In a heat pump the amount of heat produced for every unit of electricity used is known as the Coefficient of Performance (CoP). So, if a heat pump has a CoP of 3.0, it has the potential to produce up to three units of heat for every unit of electricity it uses. In comparison, electric boilers, storage heaters and panel heaters produce 1 unit of heat for every unit of electricity used. Heat pumps are one of many technologies that can be utilised as zero-emissions heating system. Individual building appraisals will determine what technology best suits the building type and building user needs.

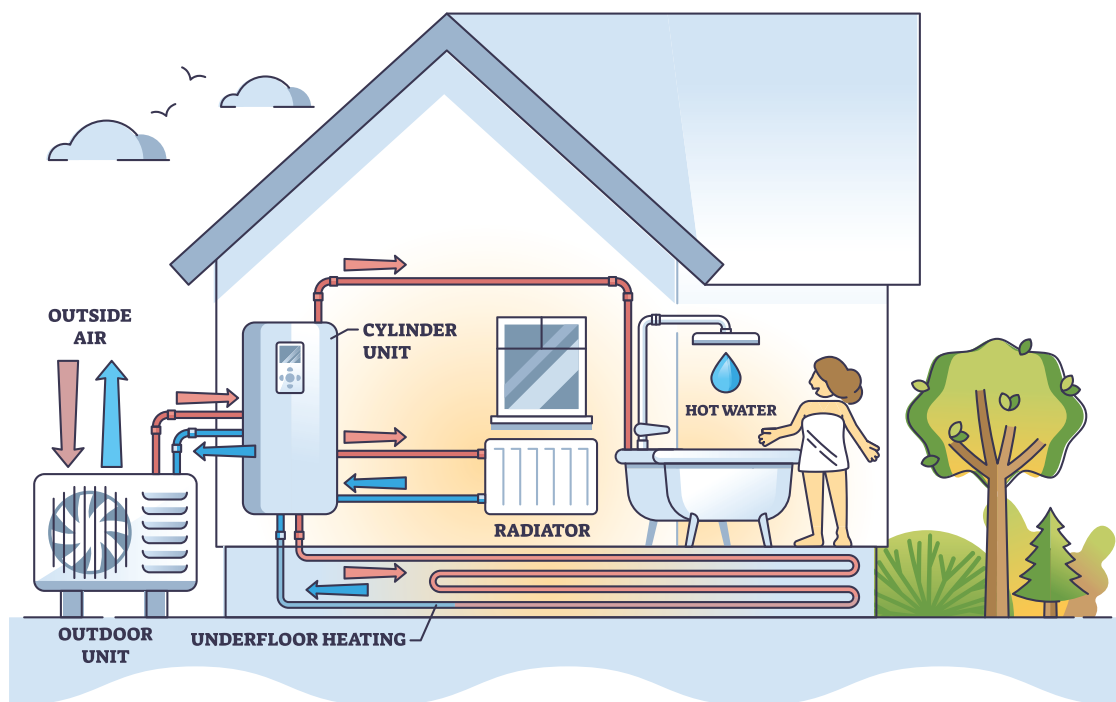


Figure seven: Basic visual explanation of how a heat pump works. Actual installations will differ, this diagram shows the basic principles of how heat pumps work.

Air-source pumps, for example, suck in outdoor air and pass it over tubes containing refrigerant fluids to produce heat. The basic explanation in figure seven shows a box of about 1m x 1m x 0.4m outside the building. Space is also required inside for a heat pump unit and hot water cylinder. The unit will be about the size of a gas boiler, while the cylinder depends on the size of the home. The type and size of the equipment, remedial works required, and costs will vary from building to building. It is critical that the specification and sizing of heat pumps and heat emitters (e.g. radiators) is correct to ensure optimum heat pump performance¹¹.

¹¹ www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/documents/ - page 19.

5.2.1 Off Gas - domestic buildings

There are approximately 16,669 off gas grid buildings within Angus, which equates to 28% off all domestic buildings, which is greater than the national average of 18%. Within Angus 60% of off-gas domestic buildings are located in rural areas and 40% are located in towns and villages.

Appendix 8.4 of this document contains a summary of the statistics for domestic buildings which are off-gas grid, based on Home Analytics data. Buildings have been categorised based on their suitability for heat pump retrofit.

Off-Gas Category 0

Around 489 off-gas grid domestic buildings within Angus already have zero or low emissions heating, the majority are owner-occupied buildings with heat pumps.

Off-Gas Category 1

There are around 6,850 off-gas domestic buildings within Angus which are highly suited for heat pump retrofit as they are well insulated with a wet heating system (typically a boiler distributing hot water to radiators).

Figure eight, shows the distribution of Off-Gas Grid Category 1 domestic buildings across Angus.

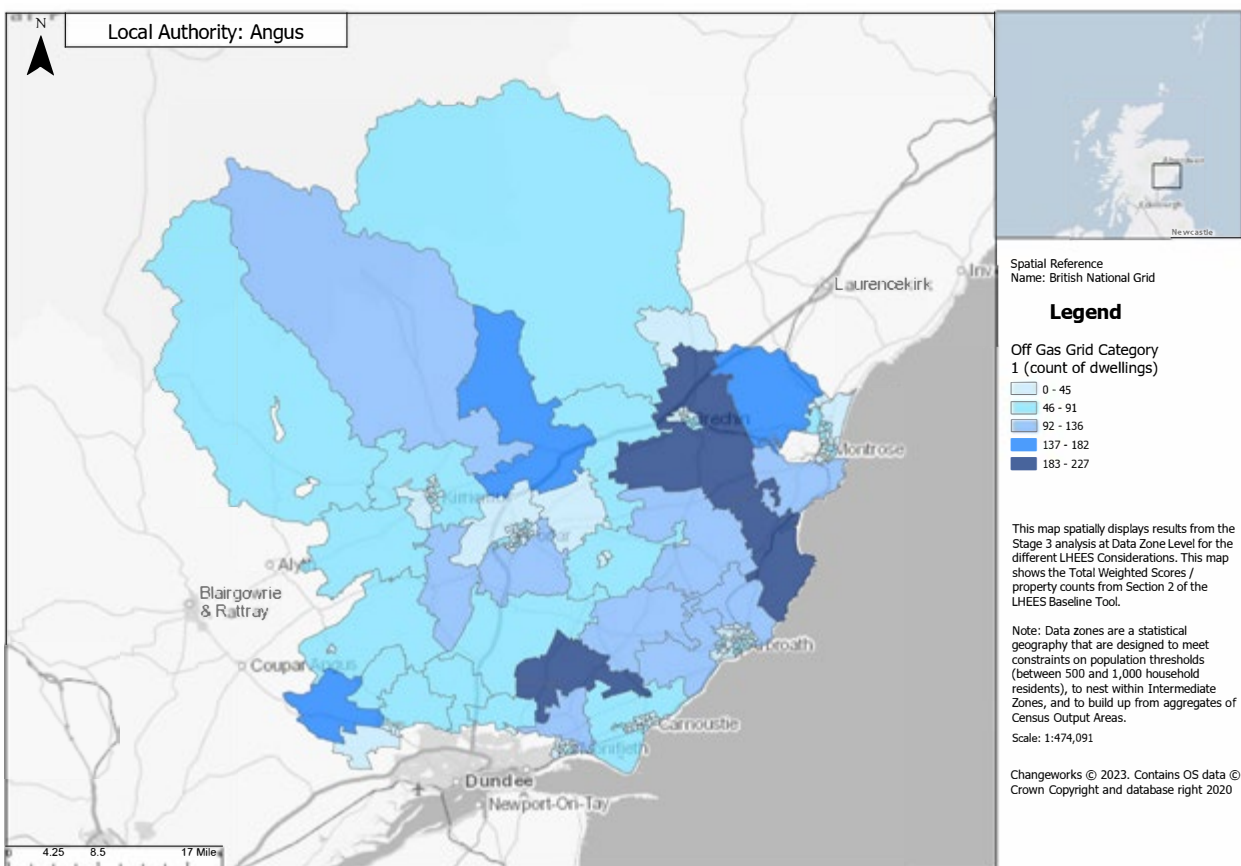


Figure eight: Count of Off-Gas Grid Category 1 domestic buildings within each Data Zone. The darker the colour of blue, the greater the number of buildings categorised as Off-Gas Grid Category 1.

The Data Zones with the highest number of Off-Gas Grid Category 1 buildings within Angus are shown in table five; these zones have the highest potential for building-level heat decarbonisation.

Ranking	Data Zones	Number of buildings which are Category 1
1	Monikie - 04	227
2	Friockheim - 04	205
3	Lunan - 01	204
4	Monikie - 03	183
5	Hillside - 05	169
6	Angus Glens - 03	142
7	South Angus - 08	142
8	Arbroath Landward - 01	131
9	Arbroath Landward - 03	124
10	Arbroath Harbour - 03	117
11	Letham and Glamis - 08	116
12	Arbroath Kirkton - 05	115

Table five: Off-Gas Data Zones with highest building counts based on Category 1 selection – highly suitable for heat pump retrofit.

The Data Zones in table five have the following attributes that make them highly suitable for heat pump retrofit:

- Insulated walls are present for all construction types (cavity wall, solid brick & stone, and timber frame).
- Timber frame is most common construction type for category 1 as it is generally the most well-insulated construction type due the increase in insulation levels set by the Building Regulations.
- 88% of the domestic buildings have loft insulation of >100mm.
- 98% of the domestic buildings have double/triple glazing.
- No domestic buildings are listed or are located in conservation areas.
- There are low numbers of mixed-tenure/mixed-use domestic buildings which reduces the number of stakeholders to engage with to coordinate works and the potential occurrence of conflict between stakeholders.

Ten of the twelve Data Zones in table five are located in rural areas, with Arbroath Harbour 03 and Arbroath Kirkton 05 Data Zones located in the town. The rural areas have SIMD ratings of six to eight, which suggests lower levels of fuel poverty. The Arbroath Harbour

03 Data Zone has an average SIMD rating of one and the Arbroath Kirkton 05 Data Zone has an average SIMD rating of three; these low SIMD ratings suggest that fuel poverty and extreme fuel are prevalent in these areas. Considerations will need to be taken to ensure that heat pump retrofit is the best option to ensure fuel poverty levels aren't exacerbated.

Off-Gas Category 2

There are around 1,839 off-gas domestic buildings within Angus with a secondary potential for heat pump retrofit. These buildings will require moderate fabric upgrades and/or heat distribution system upgrades to be ready pump ready.

Figure nine, shows the distribution of Off-Gas Grid Category 2 domestic buildings across Angus:

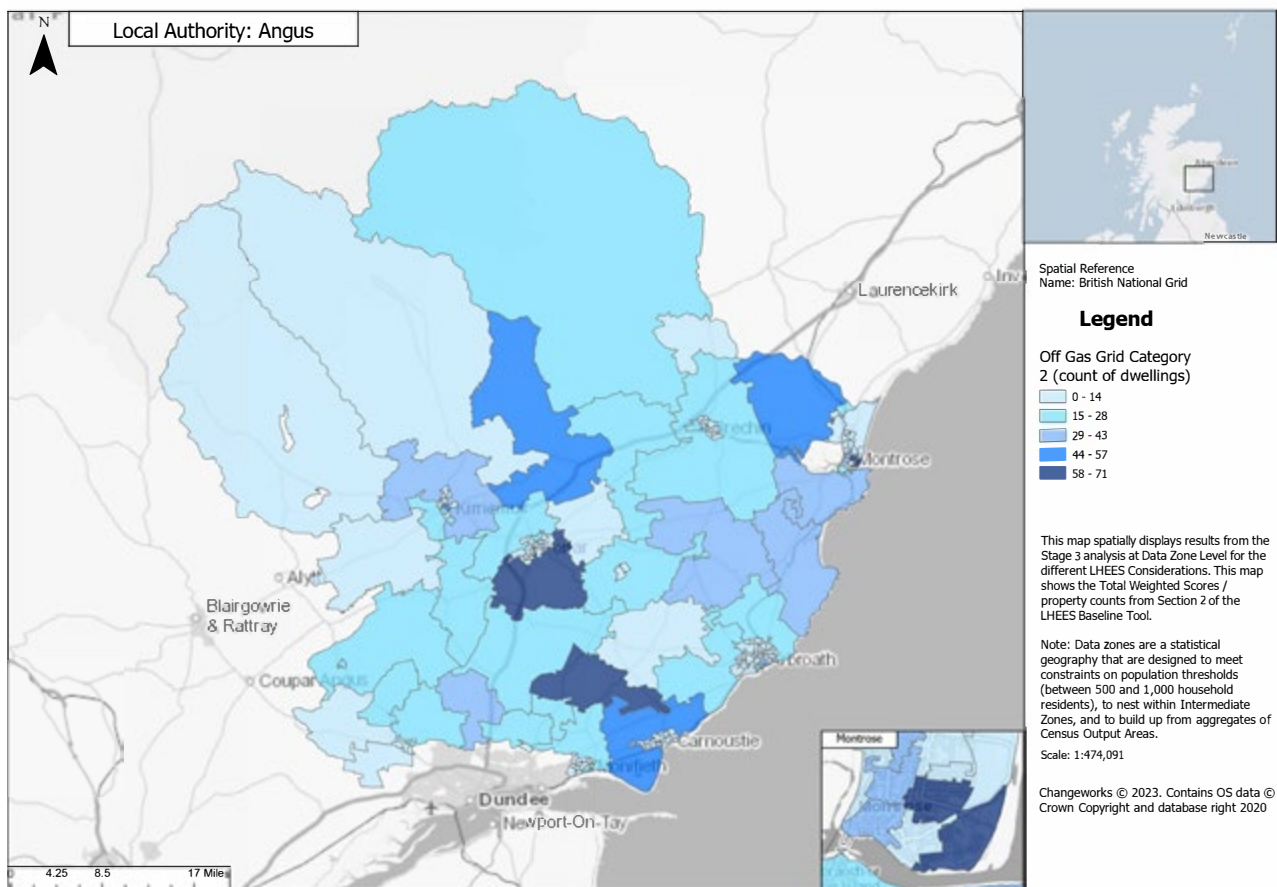


Figure nine: Count of Off-Gas Grid Category 2 domestic buildings within each Data Zone. The darker the colour of blue, the greater the number of buildings categorised as Off-Gas Grid Category 2.

The Data Zones with the highest number of Off-Gas Grid Category 2 buildings are shown in table six as follows:

Ranking	Data Zones	Number of buildings which are Category 2
1	Montrose South - 04	71
2	Letham and Glamis - 05	63
3	Monikie - 04	62
4	Angus Glens - 03	56
5	Arbroath Harbour - 05	49
6	Kirriemuir - 04	49
7	Monikie - 08	47
8	Hillside - 05	47
9	Friockheim - 01	42
10	Lunan - 02	42
11	South Angus - 06	42
12	Kirriemuir Landward - 05	38

Table six: Off-Gas Data Zones with highest building counts based on Category 2 selection – moderate fabric upgrades and/or the or addition of a wet distribution system prior to heat pump retrofit.

The Data Zones in table six have the following attributes that considers them suitable for secondary potential heat pump retrofit:

- Insulated walls are present in solid brick and stone, and timber frame construction types.
- Uninsulated cavity wall is most common construction type for the category 2 consideration.
- 80% of the domestic buildings have loft insulation of >100mm.
- 95% of the domestic buildings have double/triple glazing.
- 14% of the domestic buildings are listed and 25% are located in conservation areas. Any improvements, alterations, changes to Listed Buildings and buildings within Conservation Areas (Listed and non-listed buildings) will require to comply with the appropriate Legislative requirements and planning policy
- There are low numbers of mixed-tenure/mixed-use domestic buildings which reduces the number of stakeholders to engage with to coordinate works and the potential occurrence of conflict between stakeholders.
- 66% of the domestic buildings have a boiler, which suggests they will have a wet heating system (typically pipes and radiators).

From the above analysis, the moderate fabric upgrades required to become heat pump ready are generally considered to be insulating cavity walls and topping up loft insulation. 66% of the domestic buildings have a boiler which suggests that wet heat distribution

systems (typically pipes and radiators) will need to be installed in the remaining 34%. Other means of delivering heat such as air ducting pipes and wall mounted blowers could be considered to deliver warm air to rooms instead of installing a wet heat distribution system.

Nine of the twelve Data Zones in table six have an average SIMD rating of six, which suggests they are less likely to be experiencing fuel poverty. The remaining three Data Zones (Arbroath Harbour 05, Montrose South 04 & Kirriemuir 04) have an average SIMD rating of three, which suggests that fuel poverty is prevalent in these areas. Kirriemuir 04 has been ranked number one for Data Zones with highest Total Weighted Score, where poor energy efficiency is likely to be acting as a driver for fuel poverty. Careful consideration will need to be taken with the decarbonisation of the heating systems in these Data Zones to ensure the levels of fuel poverty aren't exacerbated

Off-Gas Category 3

3,738 domestic buildings within Angus need significant fabric upgrades to be heat pump ready and 3,753 are less suited to heat pump technology; they are considered to be 'hard to treat'. Hard to treat buildings are difficult to make energy efficient through conventional improvements, such as cavity insulation, loft insulation or zero-emissions heating solutions, like heat pumps. Figure ten, shows the distribution of Off-Gas Grid Category 3 domestic buildings across Angus:

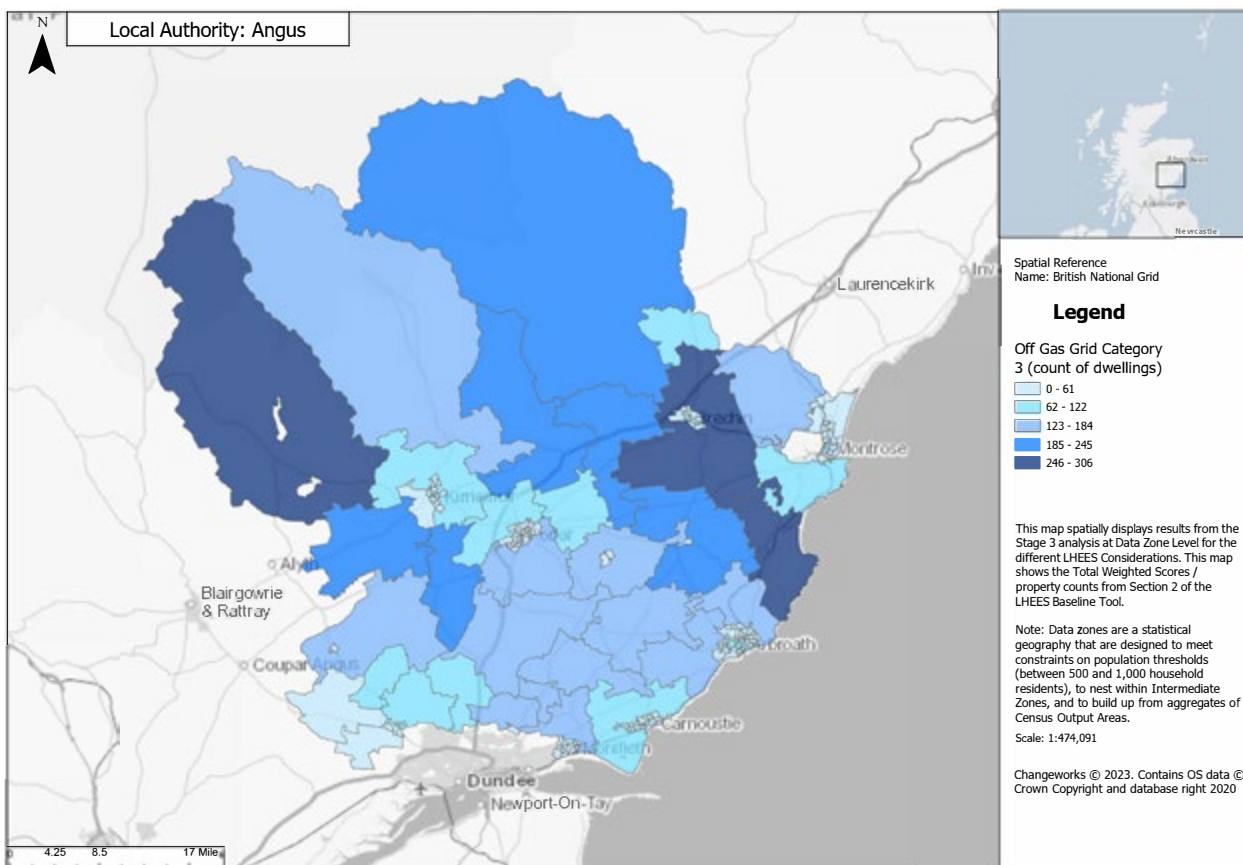


Figure ten: Count of Off-Gas Grid Category 3 domestic buildings within each Data Zone. The darker the colour of blue, the greater the number of buildings categorised as Off-Gas Grid Category 3.

The Data Zones with the highest number of Off-Gas Grid Category 3 buildings are shown in table seven:

Ranking	Data Zones	Number of buildings which are Category 3
1	Friockheim - 04	306
2	Lunan - 01	259
3	Angus Glens - 01	247
4	Angus Glens - 03	213
5	Angus Glens - 04	212
6	Kirriemuir Landward - 03	198
7	Friockheim - 01	191
8	Friockheim - 03	191
9	Letham and Glamis - 08	190
10	Monikie - 04	183
11	Hillside - 05	177
12	Angus Glens - 02	171

Table seven: Off-Gas Data Zones with highest building counts based on Category 3 selection – significant fabric upgrades required to be heat pump ready or are less suited to heat pump technology.

The Data Zones in table seven have the following attributes that considers them suitable for tertiary potential heat pump retrofit or attributes that considers them less suited to heat pump technology:

- Uninsulated walls are present in all construction types.
- Uninsulated solid brick and stone is most common construction type for the category 3 consideration.
- 85% of the domestic buildings have loft insulation of >100mm.
- 79% of the domestic buildings have double/triple glazing.
- 8% of the domestic buildings are listed and 5% are located in conservation areas. Any improvements, alterations, changes to Listed Buildings and buildings within Conservation Areas (Listed and non-listed buildings) will require to comply with the appropriate Legislative requirements and planning policy
- There are low numbers of mixed-tenure/mixed-use domestic buildings which reduces the number of stakeholders to engage with to coordinate works and the potential occurrence of conflict between stakeholders.
- 74% of the domestic buildings have an oil or LPG heating system.

From the above analysis, the significant fabric upgrades required to become heat pump ready are generally considered to be insulating all wall types, but solid brick and stone in particular, topping up loft insulation and installing double/triple glazing.

Heat pumps are generally recommended for Category 3 domestic buildings with oil and LPG heating systems as wet heat distribution systems (typically pipes and radiators) are already present. For domestic properties less suited to heat pump technology electrification (either storage or direct) or biomass are likely to be the most suitable technologies for the decarbonisation pathway for the remaining domestic buildings.

Within the Home Analytics Domestic Baseline Tool there are Category 3 non-heat pump weightings to determine whether electricity or biomass is the most suitable decarbonisation pathway for domestic buildings less suited to heat pump technology. The biomass weighting categories are if the domestic buildings are detached, semi-detached and of solid brick and stone construction. The electricity weighting categories are if the domestic buildings are a flat, located in an urban area, have insulated walls and double/triple glazing. The highest calculated weighting determines if biomass or electricity is the most suitable decarbonisation pathway.

The average SIMD rating for the Data Zones in table seven is six, which suggests lower levels of Fuel Poverty, despite the Off-Gas Category 3 domestic buildings being poorly insulated and considered hard to treat. In general, the poor energy efficiency of the Off-Gas Category 3 domestic buildings doesn't seem to be acting as a driver for fuel poverty.

5.2.2 On Gas – domestic buildings

Mains gas is concentrated in and around the main towns and settlements within Angus. There are approximately 42,000 on-gas grid buildings within Angus, which equates to 72% off all domestic buildings, which is less than the national average of 82%.

Appendix 8.5 of this Strategy contains a summary of the statistics for domestic buildings which are on-gas grid, based on Home Analytics data. Buildings have been categorised based on their suitability for heat pump retrofit.

On-Gas Category 0

Around 587 on-gas grid domestic buildings are located within Angus and already have zero or low emissions heating. The vast majority of these buildings are Council and Housing Association domestic buildings with heat pumps and communal heating systems.

On-Gas Category 1

There are around 23,575 on-gas domestic buildings within Angus, which are highly suited for heat pump retrofit as they are well insulated with a wet heating system (typically a boiler distributing hot water to radiators).

Figure eleven, shows the distribution of On-Gas Grid Category 1 domestic buildings across Angus:

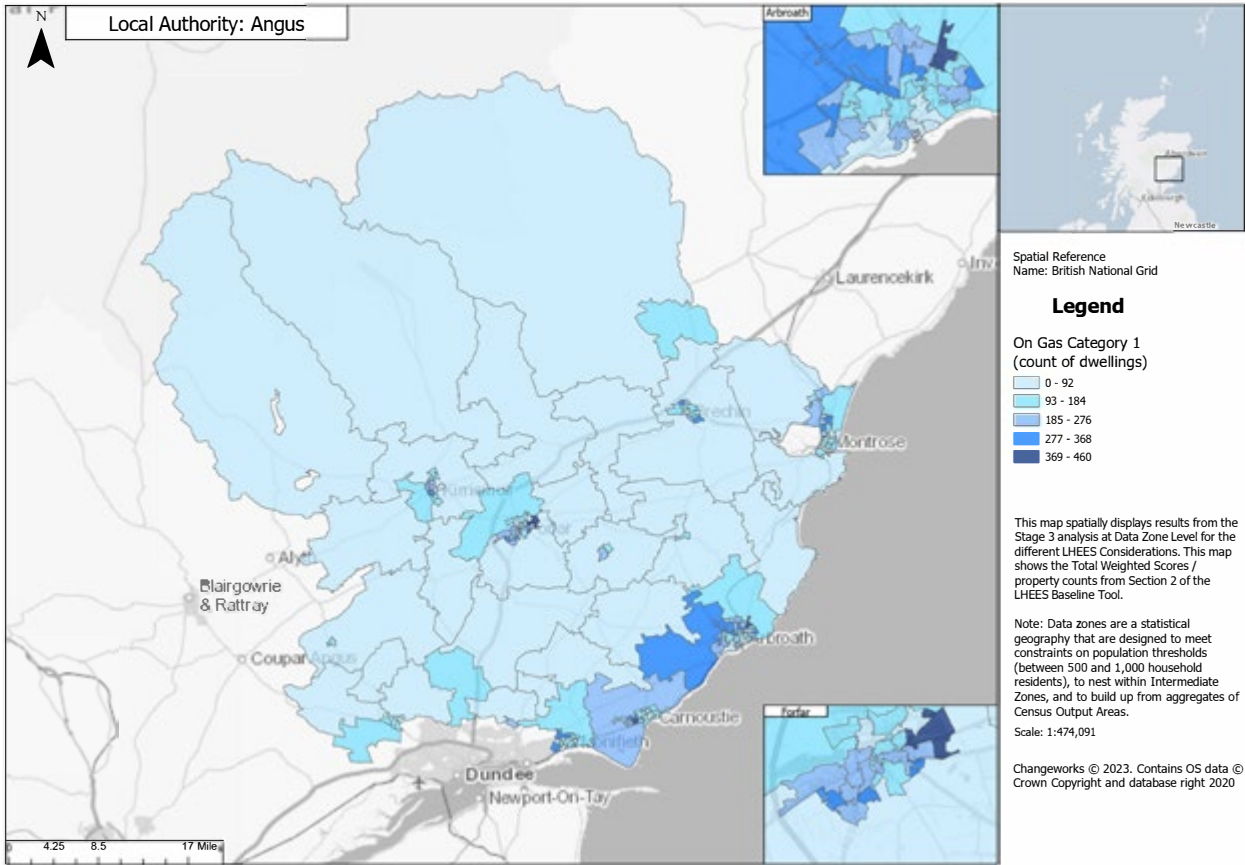


Figure eleven: Count of On-Gas Grid Category 1 domestic buildings within each Data Zone. The darker the colour of blue, the greater the number of buildings categorised as On-Gas Grid Category 1.

The Data Zones with the highest number of On-Gas Grid Category 1 buildings are shown in table eight. These zones have the highest potential for building-level heat decarbonisation.

Ranking	Data Zones	Number of buildings which are Category 1
1	Forfar East - 06	460
2	Arbroath Cliffburn - 03	450
3	Carnoustie West - 04	416
4	Arbroath Kirkton - 06	362
5	Monikie - 06	354
6	Montrose North - 03	346
7	Forfar Central - 02	334
8	Forfar West - 04	318
9	Forfar West - 01	317
10	Montrose North - 05	313
11	Carnoustie West - 05	311
12	Arbroath Kirkton - 02	310

Table eight: On-Gas Data Zones with highest building counts based on Category 1 selection – highly suitable for heat pump retrofit.

The Data Zones in table eight have the following attributes that make them highly suitable for heat pump retrofit:

- Insulated walls are present for all construction types (cavity wall, solid brick & stone, and timber frame).
- 77% of the domestic buildings have loft insulation of >100mm.
- 98% of the domestic buildings have double/triple glazing.
- No domestic buildings are listed or are located in conservation areas.
- There are low numbers of mixed-tenure/mixed-use domestic buildings which reduces the number of stakeholders to engage with to coordinate works and the potential occurrence of conflict between stakeholders.

Ten of the twelve Data Zones in table eight contain higher numbers of Local Authority domestic buildings. They have an average SIMD rating of three which suggests that fuel poverty is prevalent in these areas; this is despite the domestic buildings being well insulated. This could be down to other factors, such as, the cost of living and affordability which are contributing towards fuel poverty, not poor energy efficiency. Careful consideration will need to be taken with the decarbonisation of the heating systems to ensure the levels of fuel poverty aren't exacerbated. The remaining two Data Zones (Forfar East 06 and Monikie 06) are mainly of owner occupier tenure and have a SIMD rating of eight, meaning they are less likely to be experiencing fuel poverty.

On-Gas Category 2

There are around 5,176 on-gas domestic buildings within Angus with a secondary potential for heat pump retrofit. These buildings will require moderate fabric upgrades and/or heat distribution system upgrades to be ready pump ready.

Figure twelve, shows the distribution of Off-Gas Grid Category 2 domestic buildings across Angus:

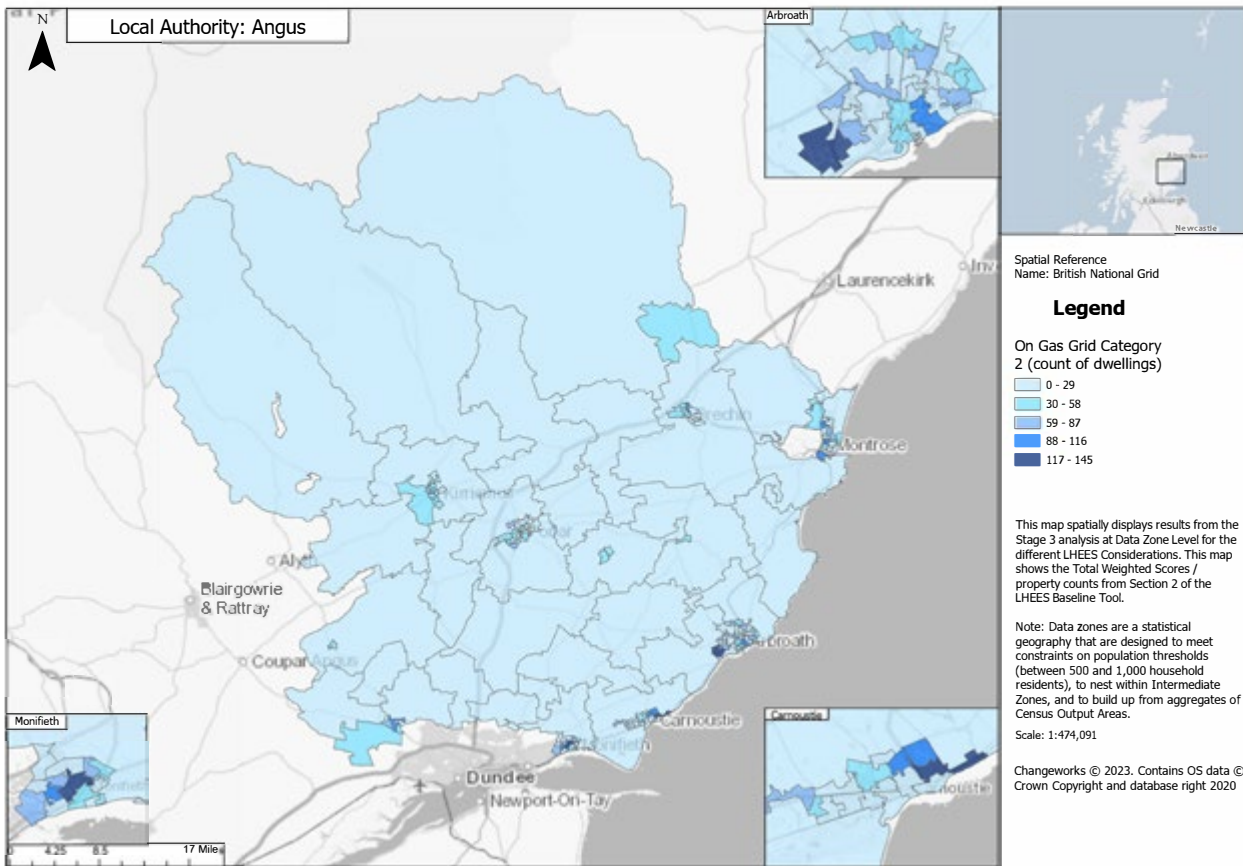


Figure twelve: Count of On-Gas Grid Category 2 domestic buildings within each Data Zone. The darker the colour of blue, the greater the number of buildings categorised as On-Gas Grid Category 2.

The Data Zones with the highest number of On-Gas Grid Category 2 buildings are shown in table nine, as follows:

Ranking	Data Zones	Number of buildings which are Category 2
1	Monifieth East - 02	145
2	Arbroath Kirkton - 07	141
3	Carnoustie East - 05	132
4	South Angus - 03	115
5	Arbroath Harbour - 05	114
6	Brechin West - 03	113
7	Monifieth West - 03	110
8	Lunan - 04	106
9	Montrose South - 02	94
10	Arbroath Harbour - 04	93
11	Carnoustie East - 06	93
12	Montrose North - 04	92

Table nine: On-Gas Data Zones with highest building counts based on Category 2 selection – moderate fabric upgrades and/or the or addition of a wet distribution system prior to heat pump retrofit.

The Data Zones in table nine have the following attributes that considers them suitable for secondary potential heat pump retrofit:

- Insulated walls are present in solid brick and stone, and timber frame construction types.
- Uninsulated cavity wall is most common construction type for the category 2 consideration.
- 79% of the domestic buildings have loft insulation of >100mm.
- 96% of the domestic buildings have double/triple glazing.
- 3% of the domestic buildings are listed and 18% are located in conservation areas. Any improvements, alterations, changes to Listed Buildings and buildings within Conservation Areas (Listed and non-listed buildings) will require to comply with the appropriate Legislative requirements and planning policy
- There are low numbers of mixed-tenure/mixed-use domestic buildings which reduces the number of stakeholders to engage with to coordinate works and the potential occurrence of conflict between stakeholders.
- 77% of the domestic buildings have a boiler, which suggests they will have a wet heating system (typically pipes and radiators).

From the above analysis, the moderate fabric upgrades required to become heat pump ready are generally considered to be insulating cavity walls and topping up loft insulation. 77% of the domestic buildings have a boiler which suggests that wet heat distribution

systems (typically pipes and radiators) will need to be installed in the remaining 23%. Other means of delivering heat such as air ducting pipes and wall mounted blowers could be considered to deliver warm air to rooms instead of installing a wet heat distribution system.

Nine of the twelve Data Zones in table nine have an average SIMD rating of nine, which suggests they are less likely to be experiencing fuel poverty. The remaining three Data Zones (Arbroath Harbour 05, Montrose South 02 & Arbroath Harbour 04) have an average SIMD rating of four, which suggests that fuel poverty is prevalent in these areas. Montrose South 02 & Arbroath Harbour 04 are also ranked second and fourth for Data Zones with highest Total Weighted Score, where poor energy efficiency is likely to be acting as a driver for fuel poverty. Careful consideration will need to be taken with the decarbonisation of the heating systems in these Data Zones to ensure the levels of fuel poverty aren't exacerbated

On-Gas Category 3

12,901 domestic buildings within Angus need significant fabric upgrade to be heat pump ready or are less suited to heat pump technology; they are considered 'hard to treat'. Hard to treat buildings are difficult to make energy efficient through conventional improvements, such as cavity insulation, loft insulation or zero-emissions heating solutions, like heat pumps. Figure thirteen, shows the distribution of On-Gas Grid Category 3 domestic buildings across Angus:

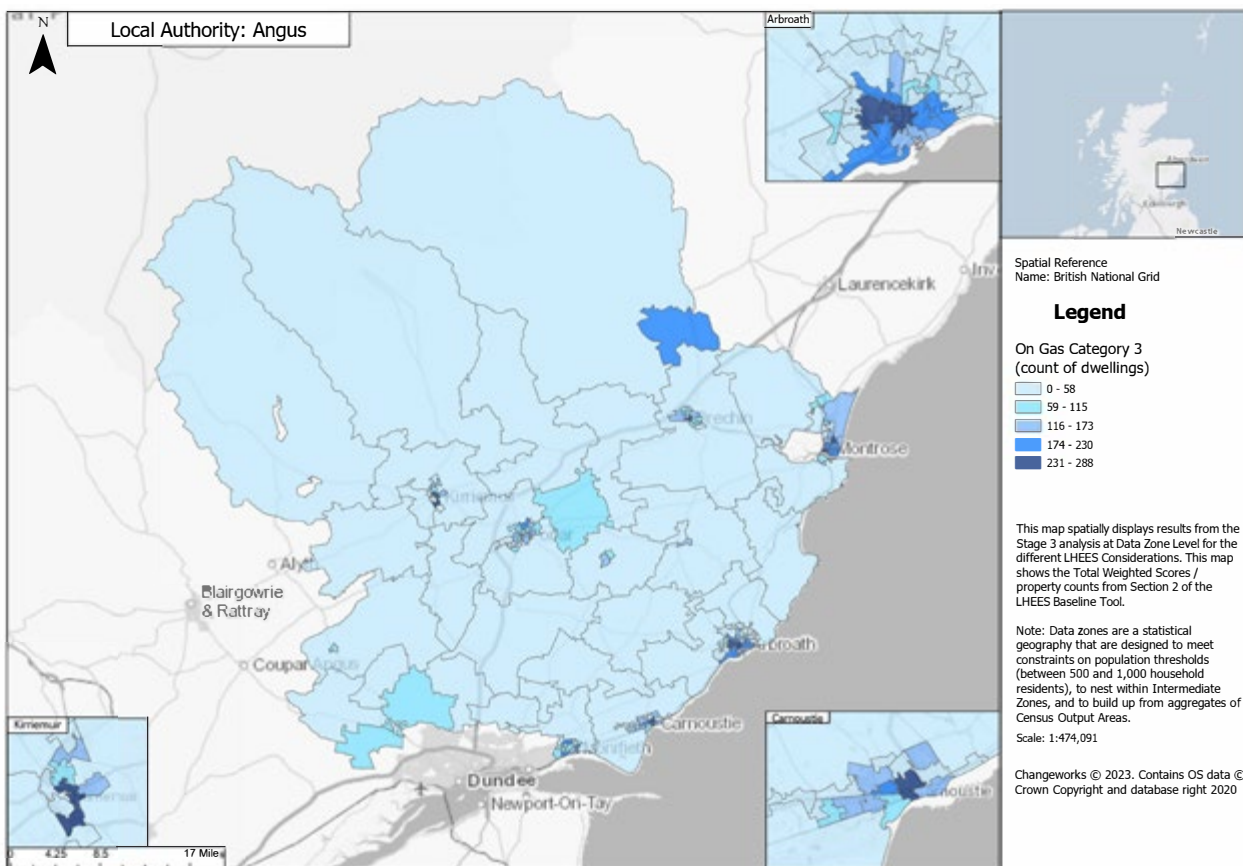


Figure thirteen: Count of On-Gas Grid Category 3 domestic buildings within each Data Zone. The darker the colour of blue, the greater the number of buildings categorised as On-Gas Grid Category 3.

The Data Zones with the highest number of On-Gas Grid Category 3 buildings are shown in table ten:

Ranking	Data Zones	Number of buildings which are Category 3
1	Arbroath Harbour – 01 *	288
2	Kirriemuir – 01 *	268
3	Carnoustie East – 03 *	265
4	Arbroath Keptie - 03	256
5	Kirriemuir – 04 *	255
6	Montrose South – 01 *	246
7	Montrose South – 06 *	245
8	Brechin West – 01 *	231
9	Arbroath Harbour – 06 *	226
10	Arbroath Keptie - 04	226
11	Arbroath Harbour – 04 *	217
12	Carnoustie East - 02	213

Table ten: On-Gas Data Zones with highest building counts based on Category 3 selection – significant fabric upgrades required to be heat pump ready or are less suited to heat pump technology.

The Data Zones in table ten have the following attributes that considers them suitable for tertiary potential heat pump retrofit or attributes that considers them less suited to heat pump technology:

- Uninsulated walls are present in all construction types.
- Uninsulated solid brick and stone is most common construction type for the category 3 consideration.
- 47% of the domestic buildings have loft insulation of >100mm.
- 84% of the domestic buildings have double/triple glazing.
- 8% of the domestic buildings are listed and 25% are located in conservation areas. Any improvements, alterations, changes to Listed Buildings and buildings within Conservation Areas (Listed and non-listed buildings) will require to comply with the appropriate Legislative requirements and planning policy
- 9% of the domestic buildings are mixed-tenure/mixed-use which means a number of stakeholders will have to be engage with to coordinate works and there is the potential occurrence of conflicts of interest between stakeholders.
- 94% of the domestic buildings have a boiler, which suggests they will have a wet heating system (typically pipes and radiators).

From the above analysis, the significant fabric upgrades required to become heat pump ready are generally considered to be insulating all wall types, but solid brick and stone in particular, topping up loft insulation and installing double/triple glazing. 94% of the domestic buildings have a boiler which suggests that wet heat distribution systems (typically pipes and radiators) are already installed but they will need significant upgrades, for example: new pipework, larger radiators and/or a new hot water cylinder.

In table 10, nine of the twelve Data Zones are marked with an Asterisk to highlight Data Zones with highest Total Weighted Score and zone ranking for poor energy efficiency, and Data Zones with highest Total Weighted Score, where poor energy efficiency is likely to be acting as a driver for fuel poverty. Again, careful consideration will need to be taken with the decarbonisation of the heating systems to ensure the levels of fuel poverty aren't exacerbated.

5.2.3 Building Level Heat Decarbonisation Summary: Off-Gas and On-Gas

The requirement for the fabric upgrade of approximately 9,300 (56%) of off-gas and approximately 18,000 (43%) of on-gas domestic building stock in Angus prior to heat decarbonisation demonstrates the scale of the challenge. Poor energy efficiency requires a 'fabric-first' approach, which means prioritising insulation measures, and focussing on improving building energy efficiency prior to the installation of zero- emissions heating systems; it's crucial to get the balance right between projects to reduce Fuel Poverty and decarbonise heat, fuel poverty must not be exacerbated.

However, on a positive note, there are 30,425 off-gas and on-gas buildings deemed highly suitable for heat pump retrofit offering a significant opportunity for the decarbonisation of heat in domestic buildings in Angus.

5.2.4 Building Level Heat Decarbonisation Challenges

Despite the benefits of heat pumps, there are challenges surrounding their installation:

- Category 1 domestic buildings may be classed as 'heat pump ready' but internal pipework may need to be replaced and/or adapted and radiators may need to be replaced and/or resized which will increase costs and lead to more intrusive works than initially anticipated.
- Finding a suitable location on the outside of flats, for example, or installing hot water cylinders in buildings without cylinders could be problematic.
- Constraints on the electricity grid within Angus could present barriers in priority delivery areas. Transitioning a large number of buildings to heat pumps will substantially increase the demand on the electricity system. Engagement with SSEN will be taken forward as an action in the LHEES Delivery Plan.

5.3 Heat Decarbonisation - Heat Networks

Heat Networks supply heat to homes and buildings from a central source, avoiding the need for individual gas boilers. They can offer an efficient, environmentally friendly way to heat homes and businesses. Heat networks are a key strategic technology for reducing emissions from heating homes and buildings, and will play a key role in achieving climate

change targets. They can also lead to fuel savings, helping to reduce fuel poverty; the Competition and Markets Authority found that up to 90% of heat network customers enjoy similar, or lower, bills than those with standard gas boilers¹². Currently around 1.5% of Scotland's heat is supplied from heat networks and an estimated 34,000 homes are connected to heat networks. LHEES identifies where the clearest Heat Network opportunities are in different local areas.

The generation of Heat Network opportunities uses the Scottish Heat Map data. The Heat Map shows heat demand estimates across Scotland and shows where there are existing and planned heat networks, existing and potential energy supply sources. It has good coverage for heat demand for the non-domestic sector, albeit with a range of confidence levels. Confidence levels are set to improve with the introduction of Building Assessment Reports (BAR's).

As defined in Part five of the Heat Networks (Scotland) Act 2021, the role of a Building Assessment Report (BAR) is to help assess the suitability of a non-domestic building for connecting to a heat network enabling more informed decision making regarding the review of heat network opportunities and the designation of Heat Network Zones. Currently the scope of the BAR duty is non-domestic public-sector owned buildings, but the intention is to expand the BAR duty to commercial/privately owned non-domestic buildings in due course.

The LHEES Heat Network methodology sets out criteria for defining a heat networks:

- **Anchor loads with a heat demand > 500 MWh/yr.**

Anchor loads are high heat demand buildings and key connections within a heat network, they are typically non-domestic buildings.

As a standard threshold, as per LHEES methodology, any building with a heat demand greater than 500 MWh/yr. (500,000 kWh) is classed as an anchor load.

- **Heat density radii clusters**

This next step involves identifying buffered area regions for each anchor load point, this it to display the "indicative connection potential" radius from each point. This is done by using a linear heat density threshold; 4000 kWh/yr./m

The LHD of a heat network is the total annual heat demand, divided by the total length of the network. The higher the linear heat density, the better the financial viability of the heat network tends to be. Where overlapping buffers occur, these are blended to define a single cluster.

- **>2 Anchor loads per cluster**

This final step applies filter criteria from the outputs from step two to prioritise Potential Zones for heat networks. A minimum of two anchor loads per cluster must be identified to prioritise a cluster as a heat network.

¹² https://assets.publishing.service.gov.uk/media/5b55965740f0b6338218d6a4/heat_networks_final_report.pdf

Using the previous criteria, the following potential heat network zones have been identified:

- **Arbroath High School and D&A College, and surrounding area**
- **Elliot Industrial Estate Arbroath and surrounding area**
- **Orchardbank Industrial Estate Forfar and surrounding area**
- **West High Street Forfar and surrounding area**
- **South Montrose and surrounding area**

Maps and opportunity summaries for each heat network zone can be found in Appendix 8.6 to 8.11 of this Strategy.

The LHEES Heat Network methodology identifies Heat Network Zones with the highest potential to initially focus on; by adjusting the above criteria, more potential Heat Networks Zones within Angus could be identified for further investigation.

The Heat Networks (Scotland) Act 2021 places a duty on the Council to conduct a review of areas likely to be particularly suitable for heat networks within its area. The LHEES methodology supports the activity related to formal zone designation, and the LHEES Delivery Plan has actions around further investigation of the potential heat network zones.

5.3.1 Heat Network Challenges

Despite the benefits of Heat Networks there are challenges surrounding their development:

- The initial analysis of Heat Network opportunities within Angus has shown that Heat Networks might only play a minor and very localised role in decarbonising heat across Angus.
- Major infrastructure will need to be installed with high up-front costs, low and long-term returns.
- There are consumer concerns around the connection costs, running costs, not being able to switch supplier, performance, and reliability as well as potential disruption.

5.4 Energy Efficiency

5.4.1 Energy Efficiency Targets

It is essential that homes and buildings achieve a good standard of energy efficiency prior to the roll out of zero-emissions heating systems to reduce overall energy demand and to ensure that poor energy efficiency is removed as a driver of fuel poverty.

Where technically and legally feasible and cost-effective, domestic buildings must achieve a good level of energy efficiency. The National Targets for improving energy efficiency in domestic buildings are:

- All owner-occupier homes reach a minimum standard equivalent to EPC C by 2033.
- All private-rented homes reach a minimum standard equivalent to EPC C by 2028.
- All social rented homes to meet or be treated as meeting EPC B by 2032 (as per the second EESSH2 milestone – this currently under review with the new Social Housing Net Zero Standard due to be announced next year).

LHEES should identify building energy efficiency improvement pathways and opportunities at a strategic level and at a delivery level.

5.4.2 Poor Energy Efficiency

The Domestic Home Analytics data contains information on the construction of each domestic building in Angus and their suitability for a range of energy efficiency measures. The core indicators relating to energy efficiency include loft insulation, window glazing and wall insulation. In order to identify areas where insulation measures have the potential to reduce heat demands and improve energy efficiency, the following weightings to the core indicators were applied:

Building Energy Efficiency Weightings	
Loft Insulation prediction, <100mm	33
Single glazed windows	33
Uninsulated wall prediction, all construction types	34
Total	100

Table eleven: Building energy efficiency weightings applied to the energy efficiency core indicators.

The score for each data zone was calculated using version 4.0 of the LHEES Baseline Tool adapted to provide outputs at Delivery Area resolution. The outcome shows a large number of Data Zones, covering a large geographical area of Angus, with higher scores indicating poorer energy efficiency (Figure fourteen).

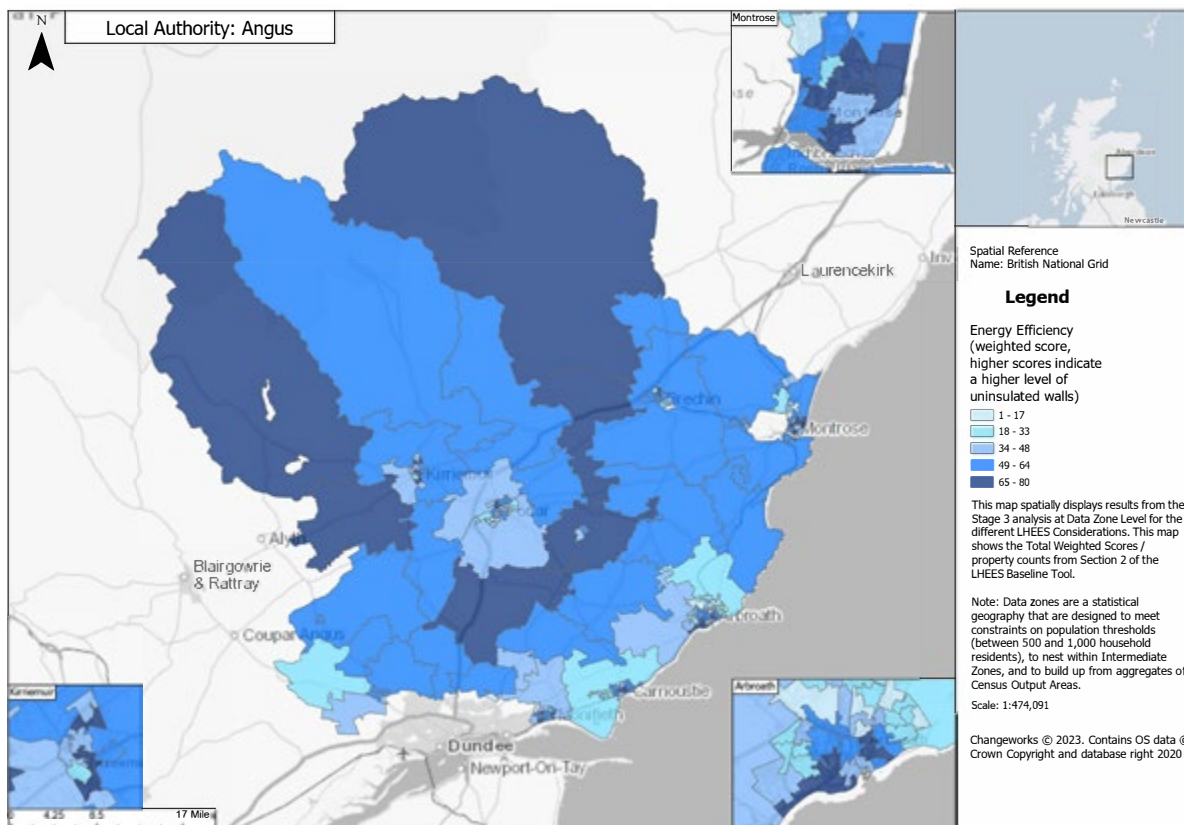


Figure fourteen: Weighted score for energy efficiency for each Data Zone. The darker the colour of blue, the higher the total weighted score indicating poor energy efficiency.

Fabric upgrades (wall insulation, loft insulation and glazing) are required for approximately 60% of the domestic building stock in Angus, which accounts for just over 35,000 buildings.

As highlighted in table twelve, the Data Zones with poor energy efficiency tend to be situated in rural areas and in and around town centres. They are also more likely to be of solid brick and stone construction and be situated in Conservation Areas and/or have Listed Building status; these characteristics consider a building 'hard to treat' as energy efficiency improvements through conventional measures, such as cavity insulation, loft insulation or zero-emissions heating solutions, like heat pumps are difficult.

Ranking	Data Zones	Number of interventions identified
1	Montrose South - 02	636
2	Carnoustie East - 03	442
3	Montrose South - 06	495
4	Angus Glens - 04	336
5	Angus Glens - 02	334
6	Kirriemuir - 04	549
7	Monifieth East - 07	336
8	Arbroath Keptie - 02	347
9	Kirriemuir - 01	498
10	Lunan - 03	246
11	Angus Glens - 01	341
12	Brechin West - 01	521

Table twelve: Total Weighted Score and Data Zone ranking for the poor energy efficiency Consideration.

5.4.3 Poor Energy Efficiency and Fuel Poverty

Poor energy efficiency can be considered as a driver for fuel poverty. Poor energy efficiency can lead to high energy costs which can push households into fuel poverty. A fabric first approach continues to be the basis of all fuel poverty interventions with loft insulation, window glazing, and wall insulation being used as core measures and indicators. As already described above in section 5.4.2, above, the same methodology has taken place with the addition of the 'probability of fuel poverty' being added to the weightings to assess the likeliness of poor energy efficiency acting as driver for fuel poverty:

Poor Building Energy Efficiency likely to be acting as a driver for Fuel Poverty Weightings

Loft Insulation prediction, <100mm	17
Single glazed windows	16
Uninsulated wall prediction, all construction types	17
Probability of fuel poverty (Fuel bill >10% of income after housing)	50
Total	100

Table thirteen: Poor building energy efficiency likely to be acting as a driver for Fuel Poverty weightings applied to the energy efficiency core indicators.

The outcome in figure fifteen, shows a higher prevalence of poor energy efficiency which is likely acting as a driver for fuel poverty in Data Zones within each of the seven main towns in Angus and in rural areas.

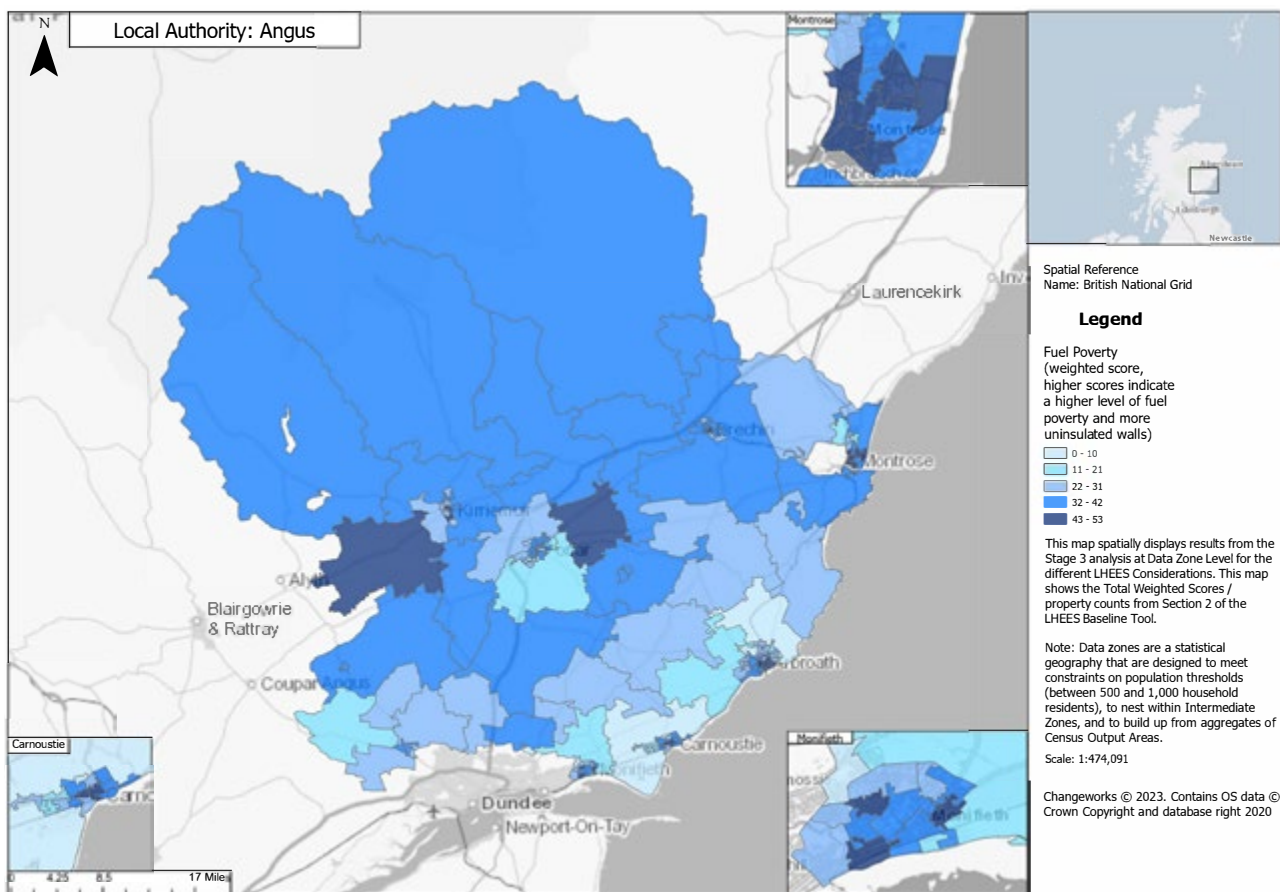


Figure fifteen: Weighted score for energy efficiency acting as a driver for fuel poverty for each Data Zone. The darker the colour of blue, the higher the total weighted score.

But, when it comes to ranking the Data Zones using the weighted LHEES methodology, the top twelve Data Zones where poor energy efficiency is likely to be acting as a driver

for fuel poverty are located in small towns (Kirriemuir and Brechin) and other urban areas such as Arbroath and Montrose; there are no rural Data Zones present in the top twelve ranking. These areas are more densely populated so therefore have a larger building count which increases their ranking, see table fourteen:

Ranking	Data Zones
1	Kirriemuir - 04*
2	Montrose South - 02*
3	Lunan - 03*
4	Arbroath Harbour - 04*
5	Brechin West - 01*
6	Montrose South - 01*
7	Montrose South - 03*
8	Arbroath Harbour - 06
9	Arbroath Harbour - 03*
10	Arbroath Harbour - 01
11	Monifieth East - 07
12	Montrose South - 06*

Table fourteen: Total Weighted Score and Data Zone ranking for the poor energy efficiency acting as a driver for fuel poverty Consideration. The Data Zones marked with an Asterisk indicates that they are listed and/or located in conservation areas.

These Data Zones where poor energy efficiency is likely acting as a driver for fuel poverty are mainly of Solid Brick & Stone construction; have high numbers of mixed-use/ mixed-tenure; and have a high number of buildings that are listed and/or located in Conservation Areas. The ownership of the buildings is more mixed within these Data Zones, with high levels of Council and Housing Association buildings. As previously stated, there is a high correlation between social housing tenure types and fuel poverty (areas with high SIMD scores).

Despite being located in small towns (Kirriemuir and Brechin) and other urban areas, such as Arbroath and Montrose, where the gas grid is present, there are areas within the Data Zones that don't have access to the gas grid. They are classed as off-gas as their main heating systems are electric room heaters or electric storage heating. As highlighted in the Scottish House Condition Survey 2019, fuel poverty rates for homes with electricity as their primary heating fuel are almost double that of gas as the primary heating fuel¹³.

Although heat decarbonisation is essential to address the climate emergency, it is essential that measures both promote decarbonisation and lower fuel costs. Moreover,

¹³ The fuel poverty rate for homes with electricity as their primary heating fuel is 43% compared to 22% for gas <https://www.gov.scot/publications/scottish-house-condition-survey-2019-key-findings/documents/>

the installation of a zero-emissions heating system must not have detrimental effect on fuel poverty. A 'fabric first' approach to increase the energy efficiency of the building may be required in the first instance to help those in fuel poverty to manage their running costs before a zero-emissions heating system is installed.

5.4.4 Angus Council & the Energy Efficiency Standard for Social Housing (EESH 1 & 2)

The EESH was introduced in March 2014 with an aim to encourage landlords to improve the energy efficiency of social housing in Scotland by installing reasonable measures, to in turn reduce energy consumption, fuel poverty and carbon emissions. It set a target of EPC C or D to be met by 31 December 2020, dependent on dwelling type and fuel type.

The second milestone (EESH2) was confirmed in June 2019, and it set a target of all social housing to meet, or be treated as meeting EPC band B, or be as energy efficient as practically possible, by the end of December 2032 and within the limits of cost, technology, and necessary consent.

EESH2 is currently on hold. The Scottish Government closed its consultation on the new Social Housing Net Zero Standard (SHNZS) in March 2024. This will replace the Energy Efficiency Standard for Social Housing 2 and will align any new standard with Net Zero targets.

The Council has delivered a comprehensive programme of improvements to existing homes over the last five years with a significant focus on meeting EESH. Until the details of the new Social Housing Net Zero Standard are announced, social landlords are encouraged to continue investment in energy efficiency measures to help reduce running costs. The Council has funded these works so far from the Council's Housing Revenue Account Capital Plan, installing measures such as;

- Cavity Wall Insulation (Extract and Refill).
- External Wall Insulation.
- Internal Wall Insulation.
- Loft Insulation.
- Underfloor Insulation.
- Window Replacements.

The Council have been able to secure funding through the Social Housing Net Zero Heat Fund for installation of Solar PV and battery storage, alongside quantum electric heating in some of the Council's sheltered housing properties, which is performing well and helping to reduce energy bills for these tenants.

5.4.5 Improving Private Sector Domestic Buildings

The Eco Flex 4 (Energy Company Obligation) and GBIS Flex (Great British Insulation Scheme Flex) provide funding for private domestic properties towards energy efficiency upgrades for householders in fuel poverty, on low income and vulnerable to the cold. The scheme aims to target eligible properties with the lowest energy efficiency ratings, usually EPC band D or below. The scheme has been operating in Angus since 2023 and is anticipated to last until 2026. To date, around £1.8m of Eco funding has been leveraged into Angus installing measures such as:

- Air Source Heat Pumps.
- Solar Photovoltaic.
- Internal Wall Insulation.
- Smart Heating Controls.
- Loft Insulation.
- Cavity Wall Insulation.
- Room-In-Roof Insulation.

As shown in table fifteen, the Eco Flex 4 scheme has helped improve energy efficiency ratings and reduce carbon emissions and fuel spend, with each household receiving around £21,000 of grant funded measures.

Year	No. of Installations	Eco Flex 4 Funding	Carbon Savings (tonnes CO ² e)	Annual Energy Bill Savings
2023/24	57	£1.169m	404	£73,000
2024/25 *	28	£604,000	109	£47,000

Table fifteen: Eco Flex 4 installations to May 2024.

The Council aims to see a year-on-year increase in the number of successful energy efficiency installations, maximising funding for Angus private sector households. More information on Eco Flex 4 funding can be found on the Angus Council Housing website.

The Home Energy Efficiency Programme for Scotland (HEEPS) is an area-based scheme run throughout each Council area in Scotland, targeting homes with poor energy efficiency and aiming to reduce fuel poverty. Through a funding program of around £6.7m, around 1,150 properties within Angus have benefited since 2017, with external wall insulation installed at little or no cost to the homeowner.

The area-based schemes have been located in Arbroath, Brechin, Forfar, and Montrose, with other locations also benefiting having linked to the funding through other Council capital programmes.

The Scottish Government’s Energy Efficient Scotland: Area Based Schemes 2020 is a successor to HEEPs with the Council continuing to bid for funding for private owners and providing areas of focus, linking in with the Councils current EESSH2 external wall insulation contracts, for example.

There are other funding streams available; each property and household circumstances can be different, therefore the amount of grant funding and/or customer contribution can vary. By applying through the central Home Energy Scotland Hub¹⁴, people can find out exactly what funding they can obtain.

¹⁴ www.homeenergyscotland.org/find-funding

5.5 Other Outcomes

5.5.1 Mixed-Tenure and Mixed-Use

Mixed-tenure buildings combine a range of tenure options, which can include owner-occupier housing, shared ownership housing and rental buildings (private and social), for example, a block of flats. Mixed-use buildings are defined as a building that has both residential and non-residential elements, for example, a shop with a flat above it. In Angus, mixed-tenure homes make up 12% of the housing stock and buildings with more than one dwelling in the building accounts for 28% of domestic buildings.

For mixed-tenure and mixed-use considerations, building counts are used to identify instances where there are multiple buildings in a building. Typically, mixed-tenure and mixed-use buildings are located in and around the main seven towns in Angus.

Table sixteen, shows the Data Zones highest count of mixed-tenure and mixed-use buildings across Angus:

Ranking	Data Zones	Number of buildings with mixed tenure	Data Zones	Number of buildings with dwellings > 1
1	Montrose South - 01	332	Montrose South - 01	555
2	Montrose South - 07	235	Arbroath Harbour - 04	435
3	Arbroath Harbour - 04	225	Arbroath Harbour - 01	400
4	Montrose South - 02	216	Arbroath Harbour - 02	374
5	Arbroath Harbour - 02	191	Montrose South - 02	366
6	Arbroath Harbour - 01	177	Montrose South - 07	358
7	Montrose South - 04	166	Monifieth East - 06	346
8	Brechin East - 03	164	Montrose South - 04	345
9	Montrose South - 03	147	Brechin West - 01	320
10	Forfar East - 03	146	Montrose South - 03	294
11	Arbroath Harbour - 06	143	Arbroath Harbour - 03	291
12	Brechin West - 01	141	Arbroath Harbour - 06	281

Table sixteen: Highest counts of mixed-tenure and mixed-use buildings in Angus.

Mixed-tenure and mixed-use buildings have unique challenges for the implementation of energy efficiency measures and heat decarbonisation solutions as they have multiple stakeholders to engage with that may have conflicting interests. For example, all owners in a block of flats may not agree to external wall insulation which would make it difficult or impossible to proceed with. Regulations may need to be brought in to apply energy efficiency and heat standards to whole buildings rather than to individual buildings or units to facilitate common works.

5.5.2 Conservation Areas and Listed Buildings

Conservation Areas are legally defined by the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 as places of “special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance”. In Angus, there are nineteen designated Conservation Areas, which include parts of small villages and the historic core of many of the burghs. More information can be found on the Angus Council website.

‘Listing’ a building is a way of protecting buildings of special historic or architectural interest. Listing applies to the whole building or structure and its curtilage. This includes the interior, exterior and any object or structure fixed to it. Buildings are put into one of three listing categories – category A, B or C. More information can be found on the Angus Council website and Historic Environment Scotland’s website.

Historic buildings are buildings that are considered to have particular historical or architectural significance. Historic building counts are used to identify instances where there are domestic Listed Buildings and buildings in Conservation Areas. 7% (3,956) of domestic buildings are situated in Conservation Areas within Angus, with 3% of domestic buildings listed as Category A, B or C Listed Buildings. Table seventeen, shows the highest number of domestic buildings with listed status and the number of domestic buildings located in within Conservation Areas across Angus:

Ranking	Data Zones	Number of buildings with an A-C listed status	Data Zones	Number of buildings within a conservation area
1	Montrose South - 02*	217	Montrose South - 02*	460
2	Montrose South - 01*	103	Arbroath Harbour - 05	390
3	Brechin West - 01*	91	Montrose South - 01*	300
4	Kirriemuir - 04*	90	Arbroath Harbour - 04*	269
5	Hillside - 03	74	Kirriemuir - 04*	265
6	Letham and Glamis - 08	67	Brechin West - 01*	218
7	Arbroath Harbour - 04*	65	Montrose South - 06*	189
8	Montrose South - 03*	52	Arbroath Harbour - 03*	173
9	Forfar Central - 03	52	Montrose South - 04	138
10	Montrose North - 01	51	Montrose South - 03*	126
11	Arbroath Harbour - 03*	51	Lunan - 03*	121
12	Forfar West - 06	50	Montrose South - 07	121

Table seventeen: Highest counts of buildings with listed status and buildings located with conservation areas in Angus.

Listed buildings and buildings within Conservation Areas in Angus are, energy efficiency wise, generally a poorly performing group of domestic buildings; they have the highest percentage of uninsulated walls, contain low levels of loft insulation and have the highest percentage of single glazed windows. The Domestic Home Analytics Baseline Tool analysis shows there are clear links between poor energy efficiency acting as a driver for fuel poverty and domestic buildings being listed and/or located in conservation areas. In table seventeen, the Data Zones marked with an Asterix highlight Data Zones with the highest Total Weighted Score, where poor energy efficiency is likely to be acting as a driver for fuel poverty.

The installation of energy efficiency measures and zero-emissions heating systems in historic buildings can be more challenging and more costly than other building types, as specialist contractors may need to be involved and bespoke solutions may be required¹⁵. The recent UK government publication 'Adapting historic homes for energy efficiency: a review of the barriers' highlighted the disproportionate costs faced by owners of historic homes. The stakeholders involved in the review of the publication called for further action and intervention from the Government to rebalance and negate the additional costs of energy efficiency retrofit, especially where the occupants could be considered vulnerable or low income.

Any improvements, alterations, changes to Listed Buildings and buildings within Conservation Areas (Listed and non-listed buildings) will require to comply with the appropriate Legislative requirements and planning policy as set out in the Development Plan (which in Angus comprises of National Planning Framework 4 and the Angus Local Development Plan (2016)). As a result, improvements to buildings to improve energy efficiency and decarbonise heat within these designations might require going through a statutory process.

The Scottish Government are working with Historic Environment Scotland to develop approaches and solutions to transition Scotland's historic buildings to low and zero-emissions heating while respecting and preserving the special characteristics of the buildings.

Historic Environment Scotland published a technical document in November 2021 called a 'Guide to Energy Retrofit of Traditional Buildings'¹⁶. The guide describes retrofit measures which can be used to improve the energy efficiency of traditional buildings, whilst maintaining as much of their historic fabric and creating healthy indoor environments. These measures are backed up by research and showcased in various case studies, as trialled by Historic Environment Scotland.

¹⁵ www.gov.uk/government/publications/adapting-historic-homes-for-energy-efficiency-a-review-of-the-barriers/adapting-historic-homes-for-energy-efficiency-a-review-of-the-barriers

¹⁶ <https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationid=47c9f2eb-1ade-4a76-a775-add0008972f3>

6. Challenges

The LHEES is a positive mechanism to drive energy efficiency improvements and the decarbonisation of heat within Angus. However, there are challenges that need to be highlighted. The Council will seek to limit the impact of any barriers by working with the Scottish Government and other stakeholders.

Public Awareness and Buy-in

- The majority of households and many businesses in Angus won't have heard of LHEES and the terms heat decarbonisation and zero-emissions heat. A National communication campaign should be developed first to raise awareness possibly via the Scottish Governments Net Zero Nation Public Engagement Strategy. The Council and its partners should develop local communications to promote the Angus LHEES to make people aware of the Strategy and Delivery Plan, and how they are involved.
- To gain buy-in to the LHEES, households and businesses need to have confidence in the measures and technologies that are proposed. Recent TV programmes, for example, haven't helped consumer confidence in heat pumps.
- Householders and businesses must have positive experiences when installing energy efficiency measures and zero-emissions heating to gather and maintain support for LHEES. It is essential contractors have the correct knowledge, skills and experience to firstly recommend the correct type of energy efficiency measures and zero-emissions heating systems, and secondly install them correctly. Poorly completed works could result in higher energy costs and building related issues such as cold bridging causing condensation, damp and mould. Negative experiences will affect the delivery of LHEES.

Skills and Supply Chain

- The number of homes to be retrofitted and connected to heat networks each year is significant to enable Angus meet its targets. A substantial skilled workforce will be required to keep pace with the work. Industry bodies have highlighted a lack availability of skilled staff to meet existing levels of demand before any increased demand arising from the heat in buildings transition is taken into account.
- With the recently experienced materials shortages and increased prices across the construction sector, it is essential the supply chain is equipped to deliver high quality services to consumers, from the initial installation to ongoing maintenance.

Funding and Delivery

- The Scottish Government document 'Towards an Industry for Green Heat: heat in buildings supply chains delivery plan' estimates the total cost of decarbonising Scotland's buildings to be in the region of £33 billion between now and 2045. Large scale and wide scale funding is required to help homeowners, landlords, businesses, public bodies, etc. to improve the energy efficiency of their buildings and enable the transition to zero-emissions heat. It is estimated that the average cost of upgrading an average home in Angus to the required energy efficiency standard is £20,000; this cost is out of reach for the average person in Angus.
- For non-domestic buildings, the upgrade costs will be significantly higher. 'Money' is the key factor in how successful the LHEES delivery will be. The Scottish Government must develop accessible funds, with a quick and simple application process, for a wide range of circumstances to encourage the people of Angus (domestic and non-domestic) to buy-in to LHEES and enable the rapid and large-scale changes required to achieve Net Zero in buildings.
- Legislation uncertainty is affecting the delivery of Social Housing improvement works - EESSH2 is currently on temporary on hold, pending review due to the 2032 milestone not being in line with Net Zero targets for heating. A consultation has been held by the Scottish Government to invite views on proposals for a new Social Housing Net Zero Standard to replace EESSH2.
- LHEES Strategies have been tasked to 'set out the long-term plans for decarbonising heat in buildings and improving their energy efficiency across an entire local authority area'. Therefore, long-term resources are required within local authorities to allow the successful delivery of LHEES.

7. Summary

The LHEES has been developed by the Council, but it needs to be supported and delivered by everyone in Angus. The LHEES has highlighted which options are likely to be available for most buildings and which buildings are going to be harder to treat. It will be for individual homeowners, businesses, and landlords to decide what is best for them and their buildings. The installation of energy efficiency measures and the transition to zero-emissions heating systems will be costly for building owners, support from the Scottish Government will be required to ensure funding isn't a barrier for LHEES delivery.

The Baseline Analysis showed that domestic buildings across Angus have an energy demand 10% higher than the Scottish average and 60% (approx. 35,000) of Angus homes have poor energy efficiency ratings. Broadly speaking, the energy efficiency of homes in Angus is poor and there is less than 10 years to improve the efficiency of them to meet National targets¹⁷.

In terms of decarbonising heat, the poor energy efficiency of domestic buildings needs to be addressed via a 'fabric-first' approach to reduce energy demand, to enable the transition to zero-emissions heating systems. However, the impacts on Fuel Poverty must also be considered. Although heat decarbonisation is essential to address the climate emergency, it is essential that measures both promote decarbonisation and lower fuel costs and that the installation of a zero-emissions heating system must not have detrimental effect on fuel poverty. A 'fabric first' approach to increase the energy efficiency of the building may be required in the first instance to help those in fuel poverty to manage their running costs before a zero-emissions heating system is considered.

As part of the Strategic Zone analysis, 'hard to treat'¹⁸ domestic buildings and domestic buildings where poor energy efficiency is acting as a driver for fuel poverty were located. These areas have been identified as Strategic Zones, as it is acknowledged they may require extra support and tailored approaches to the installation of energy efficiency solutions and zero-emissions heat.

¹⁷ Heat in Buildings Strategy: achieving Net Zero Emissions in Scotland's Buildings (Oct 2021) - by 2033 all homes have the equivalent of EPC C where technically and legally feasible and cost effective.

¹⁸ Hard to treat building are difficult to make energy efficient through conventional improvements, such as cavity insulation, loft insulation or zero-emissions heating solutions, like heat pumps.

Despite the challenges, there are huge opportunities for Angus. There are over 30,000 domestic buildings deemed highly suitable for heat pump retrofit offering a significant opportunity to decarbonise heat across Angus. These areas of opportunity have been identified as Strategic Zones and will be used to inform area-based energy efficiency and heat decarbonisation projects within the LHEES Delivery Plan. Five potential Heat Network Zones have also been identified in Angus which will be further explored.

The LHEES is essentially a mechanism to assist the Council and Angus as an area to meet the Scottish Governments target of buildings achieving Net Zero emissions by 2045 (or before), but the LHEES has many other co-benefits such as:

- Healthier population: better homes are crucial for public health. Cold, damp homes create a lot of pressure on NHS and social care services. Improved public health and wellbeing through better houses would avoid huge personal and financial costs.
- Helping the most vulnerable in society: it is hoped the LHEES will deliver more comfortable and cheaper homes to run, which will in turn reduce fuel poverty.
- Wider economic impacts: LHEES has the potential to unlock additional economic growth opportunities, helping attract businesses and skilled employment linked with energy efficiency and heat infrastructure to Angus.
- Community Wealth Building: currently households and businesses within Angus pay millions of pounds each year to gas suppliers for heating. The establishment and long-term operation of Heat Networks across Angus creates an opportunity to retain benefits within local communities.

Angus must transition as quickly, and as fairly, as possible to zero-emissions heating to help achieve Net Zero emissions by 2045 in Angus and to help mitigate the climate crisis, which is becoming more and more evident across Angus. The LHEES aim to “improve the energy efficiency of buildings and ensure a just transition to decarbonised heat sources across Angus to reduce Fuel Poverty and contribute towards achieving Net Zero emissions” will be challenging but will also provide long-term benefits and opportunities for Angus.

It is hoped in years to come Angus will have a zero-emissions, fair and secure energy system to allow the people of Angus to live, work and play in comfort knowing that they won't face high levels fuel poverty and they're homes and buildings aren't contributing to climate change.

8. Appendices

8.1 Stakeholder Interest/Influence Matrix

The matrix contains the assessed levels of interest and influence of area-wide stakeholders within Angus. This will be kept under continuous review and updated as required.

<p>Tier 1</p>	<p>Key player, engage closely</p>	<p>Households Landlords Communities Business & Industry Abbeyfield Angus HA Ark HA Bield HA Blackwood Homes and Care Cairn HA Calendonia HA Hillcrest HA Sanctuary Scotland Trust HA NHS Tayside Scottish Ambulance Service Police Scotland Scottish Fire & Rescue SSEN Changeworks Home Energy Scotland Warmworks Zero Waste Scotland</p>
<p>Tier 2</p>	<p>Keep satisfied, meet needs</p>	<p>Community Council's D&A College Forestry and Land Scotland Historic Environment Scotland Invest in Angus NatureScot Scottish Water SEPA Skills Development Scotland</p>
<p>Tier 3</p>	<p>Keep informed, show consideration</p>	<p>Charitable Trusts Citizens Advice Bureau Community Planning and Development Crown Estate Scotland Scottish Historic Buildings Trust</p>
<p>Tier 4</p>	<p>Least important, minimal effort</p>	

8.2 Angus Housing Stock Summary Table

The summary table of the housing stock in Angus split into construction types and compared against various categories. It gives visual representation of the Angus housing stock characteristics. The approximate number of buildings is shown, along with a percentage to highlight the prevalence of uninsulated walls within a construction type or the prevalence of fuel poverty within a construction type, for example.

		Cavity Wall		Timber Frame		Solid Brick or Stone	
Age	Pre-1919	228	1%	303	2%	14,395	74%
	1919 to 1949	3,039	12%	59	0%	1,222	6%
	1950 to 1983	17,990	72%	2,709	20%	2,193	11%
	1984 to 1991	1,449	6%	1,517	11%	328	2%
	1992 to 2002	1,365	5%	3,193	24%	491	3%
	Post-2002	849	3%	5,648	42%	740	4%
Energy Efficiency	Uninsulated Walls	7,037	28%	3,772	28%	15,266	79%
	Loft Insulation <100mm	1,279	5%	759	6%	3,185	16%
	Single Glazed Windows	962	4%	175	1%	2,864	15%
	EPC rating A to C	9,527	40%	9,585	73%	4,365	22%
	EPC rating D to G	14,048	60%	3,521	27%	15,248	78%
Tenure	Owner Occupier	15,070	60%	9,205	69%	13,039	67%
	Local Authority	6,422	26%	1,529	11%	1,077	6%
	Housing Association	1,410	6%	1,412	11%	718	4%
	Private Rental	2,018	8%	1,283	10%	4,535	23%
Location	Town	20,915	84%	8,555	64%	12,442	64%
	Rural	4,005	16%	4,874	36%	6,927	36%
	Off-gas grid	5,078	20%	3,163	24%	7,615	39%
Historic Buildings	Conservation Area	382	2%	306	2%	3,253	17%
	Listed Building (A, B or C)	70	0%	102	1%	1,747	9%
Fuel Poverty SIMD ratings	1 & 2	2,753	11%	623	5%	882	5%
	3, 4 & 5	9,931	40%	3,423	25%	8,066	42%

8.3 Locations of Communal Heating Systems (small Heat Networks) within Angus



N.B. The blue circles indicate the location of the Communal Heating Systems.

8.4 Off-Gas Grid Summary

The below table contains a summary of the statistics for domestic buildings which are off-gas grid, based on Home Analytics data. Buildings have been categorised based on their suitability for heat pump retrofit. The percentage of buildings is against the whole Local Authority area - 58,818 domestic buildings in Angus.

	Count in Category	Tenure Types				Category 0 breakdown	
		Housing Assoc.	Local Authority	Owner Occupied	Privately Rented	Heat Pump	Communal
Category 0							
No. of domestic buildings	489	64	116	255	54	368	121

Category 1							
No. of domestic buildings	6,850	712	1,205	3,945	988		
% of buildings	12%	1%	2%	7%	2%		

Category 2							
No. of domestic buildings	1,839	130	137	1,166	406		
% of buildings	3%	0%	0%	2%	1%		

	Count in Category	Tenure Types				Category 3 breakdown		
		Housing Assoc.	Local Authority	Owner Occupied	Privately Rented	Heat pump	Biomass	Electric
Category 3								
No. of domestic buildings	7,491	136	389	4,600	2,366	3,735	488	3,265
% of buildings	13%	0%	1%	8%	4%	6%	1%	6%

8.5 On-Gas Grid Summary Table

The below table contains a summary of the statistics for domestic buildings which are on-gas grid, based on Home Analytics data. Buildings have been categorised based on their suitability for heat pump retrofit. The percentage of buildings is against the whole Local Authority area - 58,818 domestic buildings in Angus.

	Tenure Types				
	Count in Category	Housing Assoc.	Local Authority	Owner Occupied	Privately Rented
Category 0					
No. of domestic buildings	587	225	294	56	12
Category 1					
No. of domestic buildings	23,575	1,589	6,340	13,974	1,672
% of buildings	40%	3%	11%	24%	3%
Category 2					
No of domestic buildings	5,176	217	251	4,160	548
% of buildings	9%	0%	0%	7%	1%
Category 3					
No. of domestic buildings	12,901	302	892	9,801	1,906
% of buildings	22%	1%	2%	17%	3%

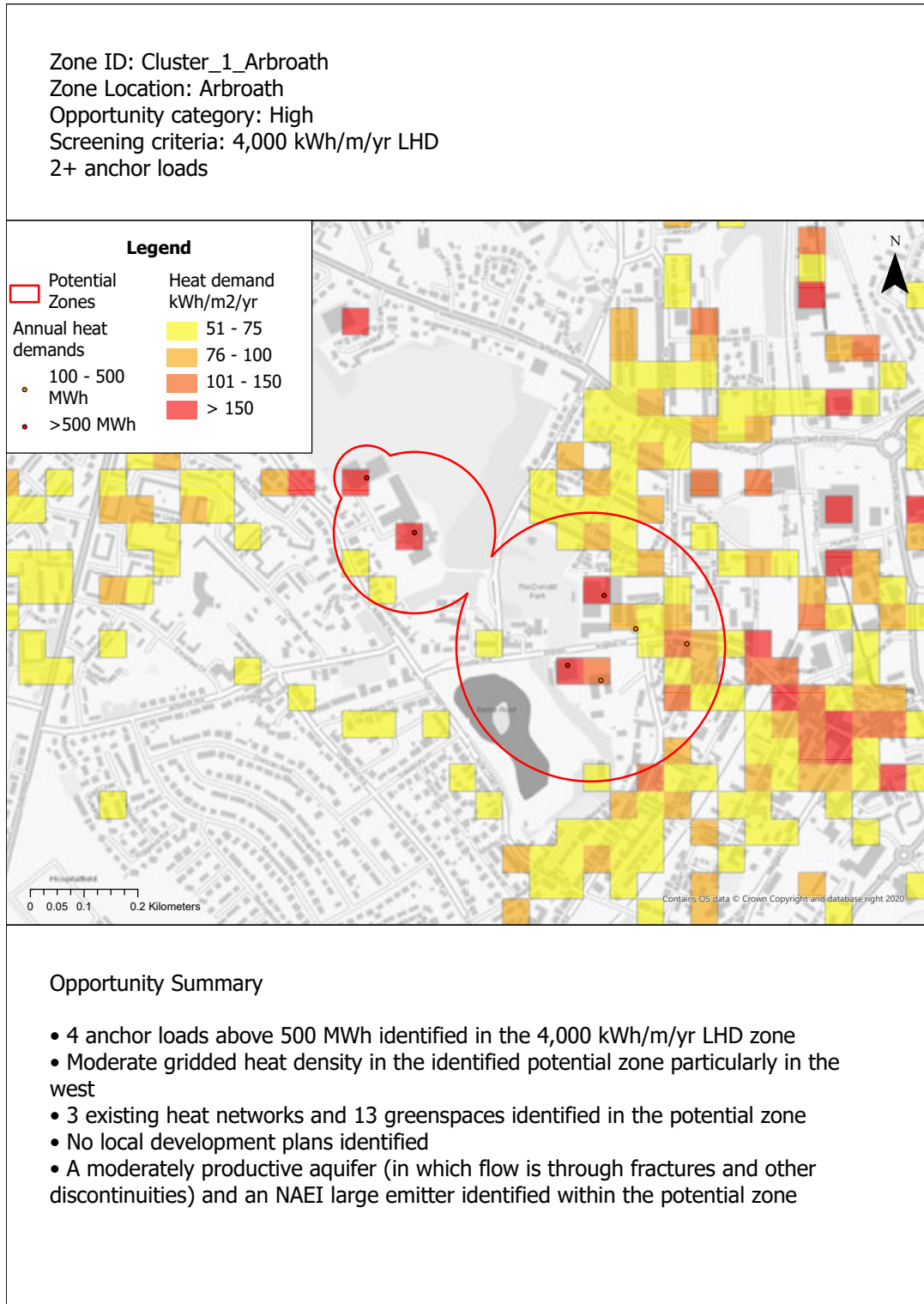
8.6 Locations of Identified Heat Network Zones in Angus



N.B. The blue circles indicate the location of the Identified Heat Network Zones, the size of the circle isn't the area the Zone covers.

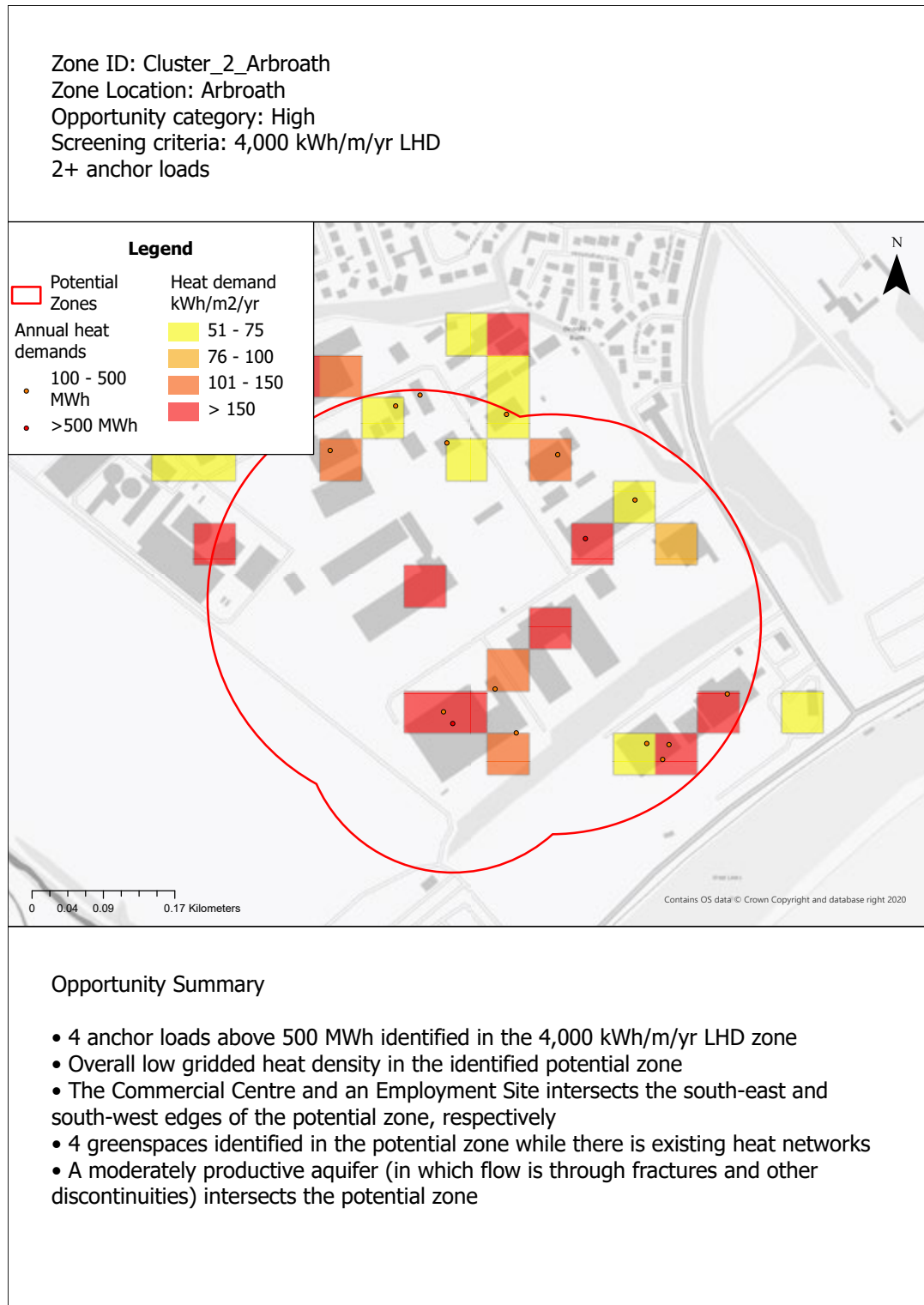
Identified Heat Network Zones:

8.7 Arbroath High School and D&A College & surrounding area



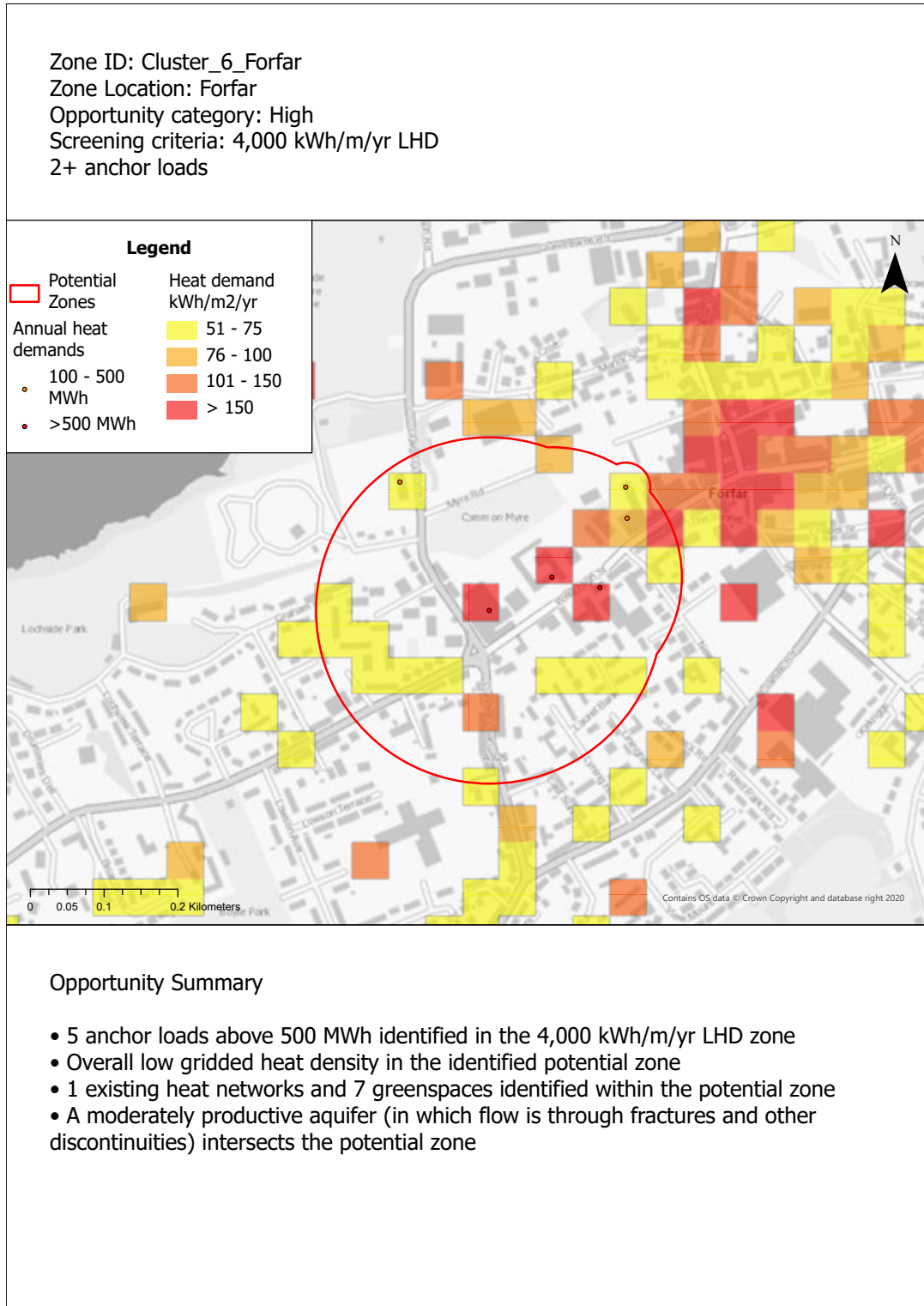
N.B. The surrounding area includes buildings within the red 'potential zone' circles

8.8 Elliot Industrial Estate Arbroath and surrounding area



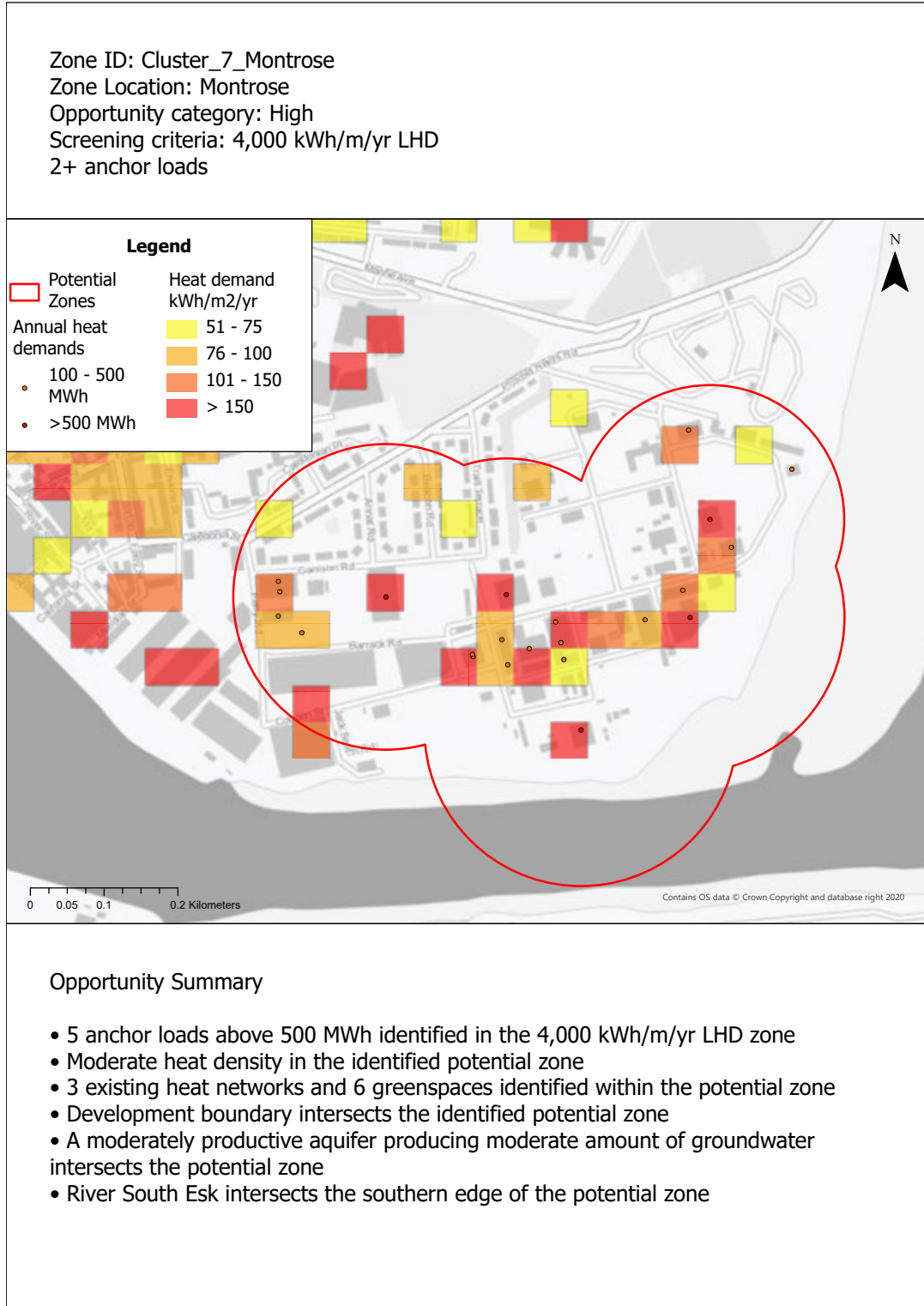
N.B. The surrounding area includes buildings within the red 'potential zone' circles

8.10 West High Street Forfar and surrounding area



N.B. The surrounding area includes buildings within the red 'potential zone' circles

8.11 South Montrose and surrounding area



N.B. The surrounding area includes buildings within the red 'potential zone' circles