# Local Heat and Energy Efficiency Strategy

Glasgow
CITY COUNCIL

# FOREWORD

As the City Convenor for  Climate, Glasgow Green Deal, Transport and City Centre Recovery, it is a great pleasure to present this strategy. The creation of a Local Heat and Energy Efficiency Strategy is an important milestone on our journey to reaching our target of being Net Zero Carbon by 2030 and becoming a more sustainable and resilient city. In global terms, cities are responsible for around 75% of energy consumption and 80% of greenhouse gas emissions. Therefore, cities are the fulcrums against which climate action can be levered and amplified to the point of making meaningful and transformational progress in combatting the very present reality that is the climate and ecological emergency. Our vision is for Glasgow to maintain its position as a global leader and influencer in climate action and, particularly through this strategy, a forerunner in a just and equitable energy transition.

We aspire to be a world class city with a thriving and inclusive economy where everyone can flourish and benefit from the city's success. The sustainable and low carbon agenda goes hand in hand with this vision. Social justice is at the heart of this approach.  We manage the most extensive programme of domestic energy efficiency support in the country in order to tackle fuel poverty and help to provide affordable warmth for its most vulnerable citizens.  Further plans by the City Government for the deployment of heat networks and other renewable or low carbon heating systems will contribute to this important agenda.

Glasgow must ensure a just transition to net-zero. Communities are already experiencing the impacts of climate change across the city and reaching net-zero must be achieved in a manner that ensures communities can benefit. Now more than ever, we need to ensure solutions are co-created with communities and are delivered with communities at the heart of them. Our city has worked hard to meet and exceed a carbon emissions reduction target of 30% by 2020 from a 2006 baseline, achieving a 42% reduction in 2021. We need to continue this hard work to ensure emissions continue to decrease. Resting on the back of our achievements to date is not an option if we are to continue our transformation to a truly sustainable city.

This strategy follows on from our  Energy and Carbon Masterplan, incorporating new obligations put upon Scottish Local Authorities by both the Local Heat and Energy Efficiency Strategies (Scotland) Order 2022 and the Heat Networks (Scotland) Act. It aligns with our recently released Local Housing Strategy and drives progress towards our vision. By working collaboratively with the city's multiple stakeholders  to deliver this strategy, we will take a significant step towards realising our own city's ambition of becoming a Net Zero Carbon city by 2030.

The Scottish Energy Strategy, the Scottish Energy Efficiency Programme and the Heat in Buildings Strategy have provided strategic frameworks for Scotland to decarbonise its heat and tackle fuel poverty. Glasgow's LHEES will underpin these national efforts by placing local planning at the heart of the push for net zero. With programmes such as the Glasgow City Region City Deal delivering major infrastructural investments to unlock development and stimulate economic growth, the city is more resilient than ever. We must now ensure that future investment and development activity is based on the low carbon and energy efficient principles set out in this strategy.

We have some fantastic examples of innovative renewable energy projects already in our city. Amongst these include the Glasgow Recycling and Renewable Energy Centre, a state-of-the-art recycling and sustainable waste management facility that produces enough energy to power the equivalent of 22,000 households, heat the equivalent of some 8,000 homes and save 90,000 tonnes of $CO_2$ every year. The city is already home to over eight active district heating schemes. We have renewable energy production within the city with the Cathkin Wind Turbine and a wealth of innovative social enterprises helping to support more resilient and low carbon communities. Additionally, several transformational regeneration initiatives have been delivered in Glasgow such as the Sighthill housing development and the Dalmarnock Village (previously the Athlete's Village). These provide world-class exemplars for energy efficient design and sustainable development.

Glasgow also continues its successful delivery of the Energy Efficient Scotland: Area Based Schemes (EES:ABS) programme. Between 2013-22, the EES:ABS scheme has delivered energy efficiency improvements to over 10,600 properties across 79 project areas with an overall spend of £96.4m (of which £35.6m was ABS funded). This work has ensured that Glasgow is delivering for our most vulnerable citizens. This strategy sets out zones in the city suitable for the delivery of a range of measures aimed at decarbonising heat supply and reducing heat demand, including the deployment of heat networks. I am excited at the prospect of working with the communities, businesses and industry in these areas to deliver pioneering projects that will help the city to deliver its energy transition and meet fuel poverty and decarbonisation targets.

I invite you to take the time to read through this strategy and provide any thoughts or suggestions you might have that can help us on this journey. Glasgow City Council welcomes all comments, and looks forward to engaging with feedback as we develop this strategy further.

Councillor Angus Millar

# EXECUTIVE SUMMARY

## 1. Introduction

In the wake of the 21st century, humanity finds itself grappling with one of the most pressing challenges of our time: climate change. As the Earth's climate system undergoes unprecedented shifts, the consequences of human actions on our environment have become glaringly evident. From soaring temperatures and extreme weather events to rising sea levels and the loss of biodiversity, the impacts of climate change are far-reaching and affecting all corners of the globe.

For Glasgow, which has come a long way in reducing its emissions by 42% from a 2006 baseline year, much of the overall progress towards our 2030 net zero target is attributable to a reduction in emissions associated with electricity consumption. Efforts to reduce emissions from heating, particularly through gas use (and indeed transport) have struggled to see the same success. In this respect, Glasgow has reached a point in its low carbon journey where a strategy focused on reducing heating-based emissions is required. In addition, responding to the climate emergency must also act as a springboard for tackling wider socio-economic issues that persist across the city.

Fuel poverty persists at rate of 25% of residents in Glasgow. However, whilst already unacceptably high, this figure in reality is likely much higher due to the cumulative recent impacts of the cost-of living crisis, the COVID-19 pandemic, and the current conflict in Ukraine. All of these events have contributed to volatility in core sectors for Glasgow and the rest of Scotland such as energy and food.

Reducing emissions associated with how we heat our buildings presents an opportunity to create an environment where Glasgow can also benefit from affordable and reliable heating in the long-term, ensuring a just transition to net zero that is equitable for all.

## 2. National Developments

To support the decarbonisation of heat at national level, a range of legislative and policy instruments have been developed in recent years.

### 2.1 Local Heat and Energy Efficiency Strategies (Order) Scotland 2022

In May 2022, the Scottish Government placed a duty on all local authorities to complete and publish a Local Heat and Energy Efficiency Strategy (LHEES). The Local Heat and Energy Efficiency Strategies (Order) Scotland 2022 required all local authorities to publish their LHEES before 31st of December 2023 and then to update the document at intervals of no more than five years.

The Order defines an LHEES as 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.

## 2.2 Heat Networks (Scotland) Act 2021

The Heat Networks (Scotland) Act 2021 introduced powers to regulate the heat networks market in Scotland for the first time. The provisions of the Act play a vital role in Glasgow's LHEES which has identified heat networks as a key strategic technology to enable the heat transition. As such, the regulations surrounding the Heat Networks Act have played a critical role in framing the LHEES Delivery Plan. Key provisions of the Act include:

- **Building Assessment Reports (BARs).** A requirement for public sector organisations to review their non-domestic building stock to assess suitability to connect into a heat network. This is likely to extend to all non-domestic buildings, including the private sector, in time. Delivery of the LHEES will include completion of this requirement. This provision of the Act has now come into force and more information can be accessed here.
- **Heat Network Zones.** Local authorities need to identify, consult on, and designate Heat Network Zones in their areas. Scottish Ministers also have powers to designate zones, should they choose to do so. The purpose of zoning is to attract investment from heat network developers. This provision of the Act has now come into force and more information can be accessed here.
- **Licensing.** All heat network companies (including existing operators) will need a licence to operate in Scotland. This will help to drive up standards, improving user trust and providing greater certainty to investors.
- **Consenting.** A consent system will be introduced for heat network developments. Companies will need consent for each individual network they operate. This will help to make sure that networks are developed in places where they will have the most benefit, and that communities get a say in plans for their areas. The consenting authority is yet to be determined but the Heat networks Act lists Scottish Ministers as the default consenting authority. Scottish Ministers also have the authority to designate a local authority as the consent authority for their area where the local authority makes a written request to do so.
- **Permitting.** Permits are an additional regulatory instrument required to build and/or operate a heat network in a heat network zone. Thus, in addition to a licence and a consent, heat network operators will need to apply for a permit to build and operate a network in a designated zone. (NB no permit is required for any heat network not within a zone). One permit may be issued per zone for a specified number of years. This will help to encourage investment, by potentially providing operators with exclusive access to high opportunity areas. The exact scope of this is yet to be clarified.

## 2.3 Heat in Buildings Strategy

The Heat in Buildings Strategy sets out Scotland's vision for the future of heat in buildings, and the actions being taken in the buildings sector to deliver on climate change commitments, maximise economic opportunities, and ensure a just transition, including helping to address fuel poverty. In this context, the LHEES is a tool to underpin the Heat in Buildings Strategy with a tailored, area-based approach to heat and energy efficiency planning and delivery.

## 2.4 Related Targets

There are several national targets that contextualise this LHEES, determining both our focus and pace. These are outlined in table 1 below:

| YEAR | TARGET |
|---|---|
| 2027 | 2.6 TWh of heat supplied by heat networks (3% of national demand) |
| 2028 | Private Rented Domestic Sector to meet EPC C |
| 2030 | 6 TWh of heat supplied by heat networks (8% of national demand) 50% of Scotland's heat, transport, and electricity to be supplied by renewables 75% emissions reduction (from 1990 baseline) |
| 2032 | Social Housing Sector to meet EPC B |
| 2033 | Owner Occupied Domestic Sector to meet EPC C |
| 2040 | 90% emissions reduction (from 1990 baseline) No more than 5% and 1% of households to be in fuel poverty and extreme fuel poverty respectively |
| 2045 | Scotland to be net zero emissions |

*Table 1 - Key LHEES Targets*

# 3. Glasgow's LHEES

Alongside the policy context, the scope of Glasgow's LHEES has been determined by the characteristics of the city's built environment and the current focus of related delivery. Assessment under these criteria has led to the identification of four key areas of focus summarised below:

## 3.1 Heat Networks

Heat networks have been identified as a low-regret decarbonisation technology through the Heat in Buildings Strategy. Glasgow is a significantly heat dense urban area of Scotland and as such, the deployment of heat networks will be a key mechanism in delivering net zero carbon and therefore is a priority focus for this first iteration of the LHEES.

Glasgow's LHEES has undertaken an extensive spatial analysis exercise to identify where in the city heat networks could be the most viable.

This mapping has primarily sought to match heat demand with heat supply, identifying areas where there is sufficient demand density alongside potential low carbon or renewable heat supply opportunities. Figure 1 below highlights the outputs of this work at city level.

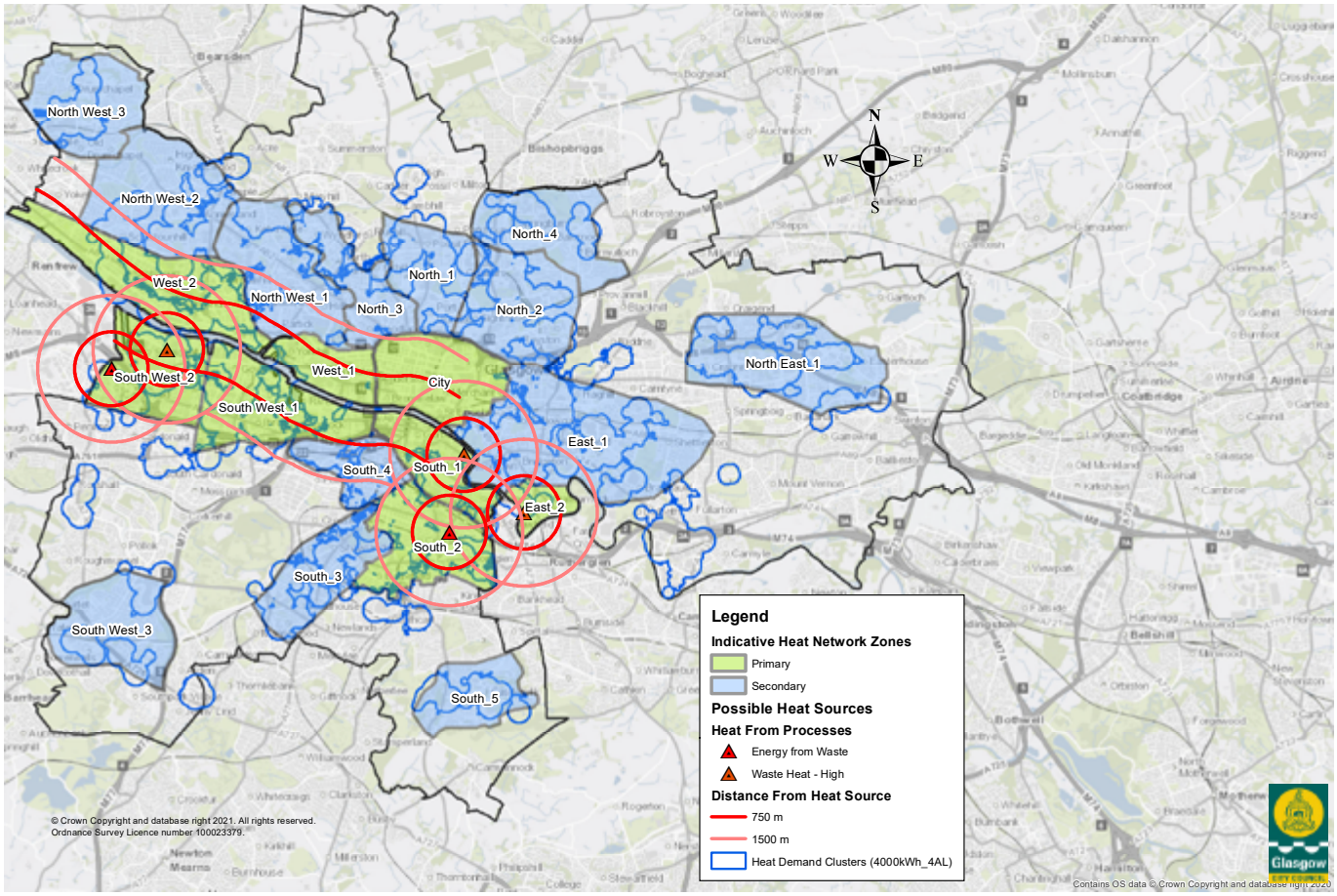


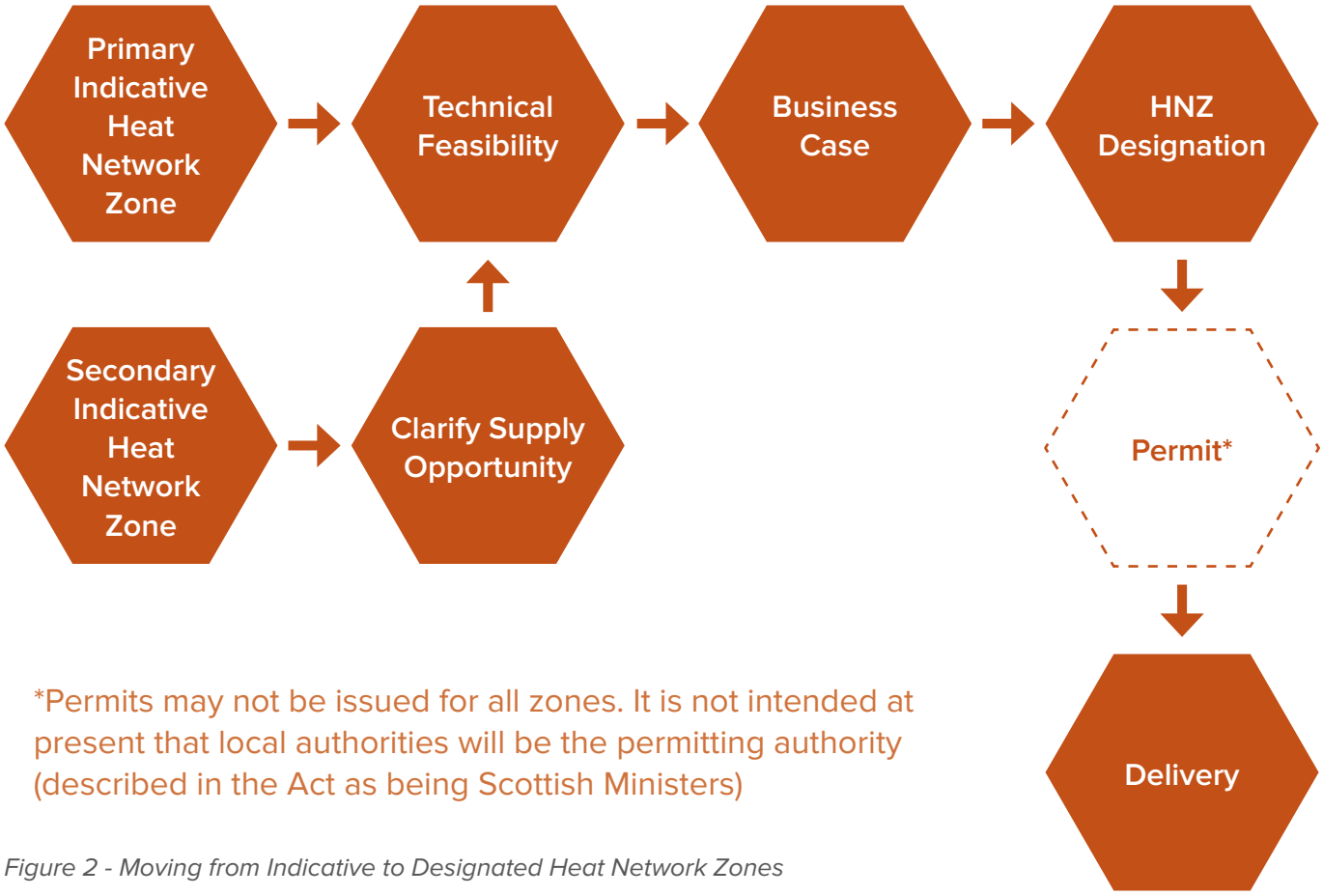

*Figure 1 - Indicative Heat Network Zones*

The work completed for this LHEES forms an important first step to the eventual legal designation of Heat Network Zones as set out in the Heat Networks Act and is a defining point for Glasgow as the city accelerates strategic planning for the heat transition.

Building on the work done to identify these Zones, the LHEES Delivery Plan will work to move these zones from a current position of indicative into a position where they can confidently be designated as legal Heat Network Zones to accelerate delivery.

The heat dense landscape of Glasgow presents challenges in this process (for example, sizing and locating zones) and there is yet to be clarity on the scope and function of a Heat Network Zone (specifically around the permitting element). This first iteration of the LHEES has been developed in cognisance of this.

Figure 2 below provides a high-level oversight on how zones will become commercialised and formally designated in order to bring the level of private finance required to fund deployment.




*Permits may not be issued for all zones. It is not intended at present that local authorities will be the permitting authority (described in the Act as being Scottish Ministers)

*Figure 2 - Moving from Indicative to Designated Heat Network Zones*

## 3.2 Addressing Poor Energy Efficiency as a Driver of Fuel Poverty

It is understood that the poor energy efficiency of some domestic buildings is contributing to unacceptably high levels of fuel poverty across the city. Glasgow's LHEES has undertaken spatial analysis to identify areas in the city where retrofit interventions may have the greatest positive impact on local fuel poverty rates.

Scotland is at the early stages of determining the regulatory and funding framework that will drive the large-scale rollout of retrofit required to reach statutory carbon emissions and fuel poverty targets. This iteration of the LHEES has therefore intentionally kept mapping for this aspect broad to not exclude any potential funding or technical routes to retrofit.

Delivery will be focused on embedding the LHEES into existing programmes of work such as **Area Based Schemes** which provides funding to retrofit households classed as fuel poor or unlocking the full potential of **ECO funding** which could leverage higher proportion of funding from energy companies to drive retrofit interventions across the city. It is likely that future iterations of the LHEES will be able to define projects to a higher granularity as key decisions are made by the Scottish Government in relation to deadlines for EPC targets and the use of mains gas. In this respect, the current iteration of the LHEES forms an evidence base for future project development and acts as a live tool to be updated in line with local and national developments.

## 3.3 Identifying Opportunities for Individual or Communal Heat Pumps

Where larger-scale district heat networks do not present a viable decarbonisation pathway, the deployment of heat pumps at either individual scale or as part of smaller community heat networks may be the most appropriate intervention. Glasgow's LHEES has undertaken mapping work to identify concentrations of domestic properties that present as particularly suitable for the installation of a heat pump. This has considered building thermal efficiency alongside potential planning restrictions that may impede delivery (such as listed buildings or conservation areas).

Figure 3 on the next page identifies discrete zones where projects to deploy individual or communal heat pumps are the most feasible. As with the retrofit agenda, the national policy landscape around the rollout of heat pumps is evolving. As such, this iteration of the LHEES provides an evidence base for future project identification and will be used as a live tool to be updated in line with local progress and national developments.

Delivery will therefore focus on engagement with residents in these areas to better understand the appetite for low-carbon heating and refining identified areas into potential projects. For this reason, mapping work at this stage has been kept broad. It is anticipated that future iterations of the LHEES will identify projects to a higher degree of granularity as the national landscape becomes clearer.

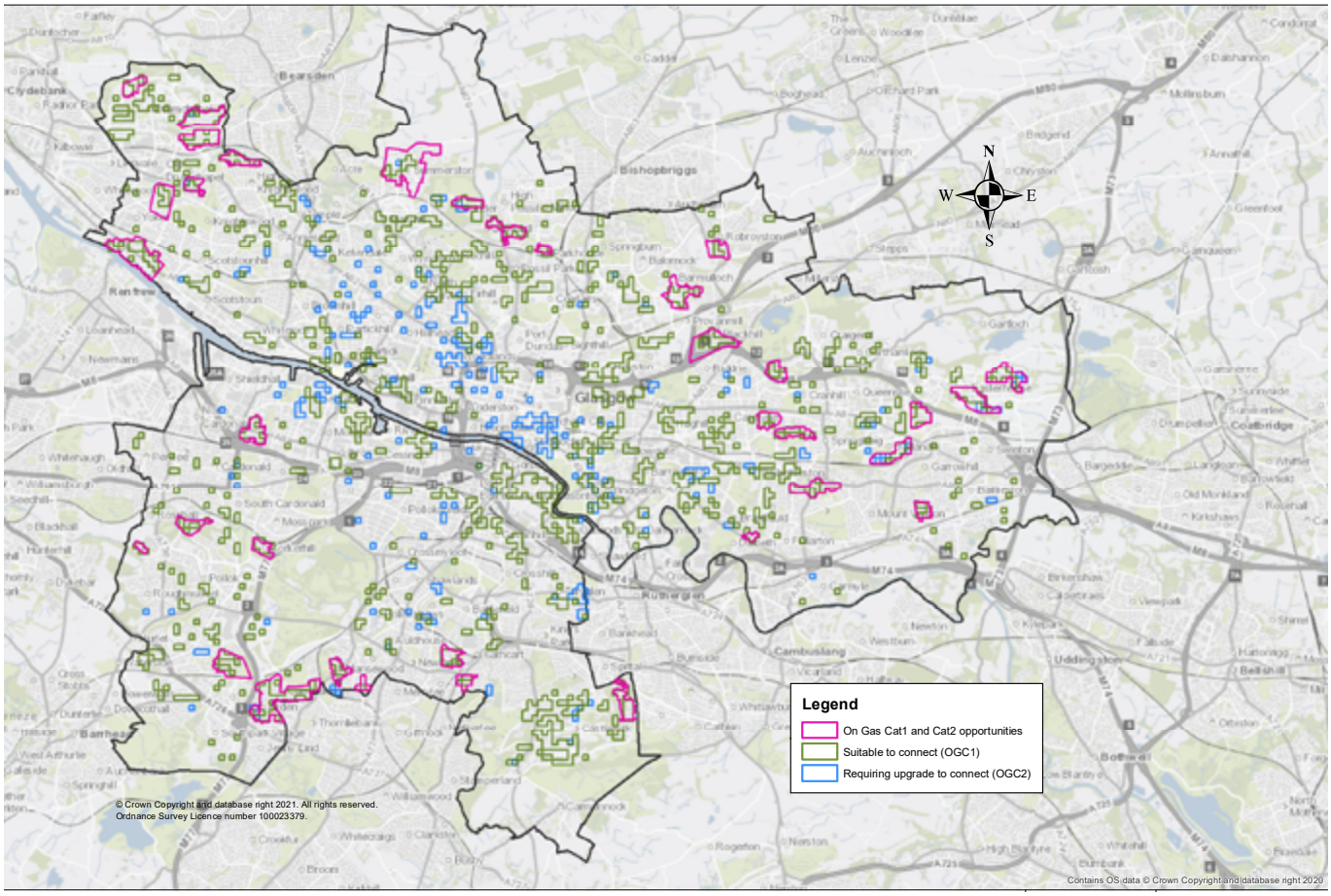



*Figure 3 - On Gas Grid Delivery Areas*

## 3.4 Developing Solutions for Pre-1919 Tenements

Traditional pre-1919 tenemental housing is an iconic element of Glasgow's cityscape. Whilst these dwellings are an iconic part of the cityscape and popular choice for residents, they are also big carbon emitters primarily due to heat loss through sandstone walls, sash windows, roofs, and floors. As a result, they can be expensive to heat due to their poor energy efficiency, contributing to fuel poverty and unhealthy living conditions in unheated homes, which are often cold and have higher incidences of damp and mould.

Pre-1919 properties are classed as "hard to treat" in retrofit terms because standard approaches to improve energy efficiency, such as increasing the insulation, airtightness, and ventilation to achieve the building fabric thermal performance required to install low or zero carbon heating systems, are not easily achievable and can be expensive to do.

Glasgow's LHEES has identified concentrations of pre-1919 domestic properties in the city to support project identification. This evidence base will be used in the development of the upcoming Retrofit Strategy, which will have a focus on pre-1919 tenemental properties. Determining solutions for pre-1919 properties will therefore be taken forward by the Retrofit Strategy in cognisance of the work completed through the LHEES.

# 4. Delivering the LHEES – An Energy Partnership for Glasgow

As part of the LHEES Delivery Plan, Glasgow City Council has confirmed the evaluation of a possible energy partnership to unlock delivery of, though potentially not limited to, heat networks.

An energy partnership would be a legally defined, collaborative arrangement between Glasgow City Council and an external organisation to bring capital investment and delivery capability into large energy-related projects. The projects taken forward by the energy partnership could deliver on local priorities relating to carbon reduction, fuel poverty, and energy resilience. Glasgow City Council considers that an energy partnership could be the leading body responsible for the delivery of heat networks in Glasgow. The Council is also considering the scope of any partnership proposed and will assess the potential for an energy partnership to be the leading body in the delivery of the wider net zero agenda for Glasgow rather than focused solely on heat networks.

Development of this is a key action in the LHEES Delivery Plan and all options relating to governance structures, control v. risk arrangements and co-investment will be explored.

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# 1

# SETTING THE SCENE

## 1.1 An Unprecedented Challenge

The existential threat posed by climate change is no longer a debatable theory, it is an ever-present risk to the future of life on our planet, with increasingly observable impacts being witnessed across the world and on our own doorstep. It is an issue that requires unprecedented coordination and endeavour at both global and local scale.

In 2018, the Intergovernmental Panel on Climate Change (IPCC)[1] produced a report that outlined that the world had 12 years to significantly ramp down carbon emissions and keep global warming under 1.5°C if catastrophic environmental breakdown is to be avoided. This target, the report highlighted, was feasible but lay at the ambitious end of the target set out in the Paris Climate Agreement (which compelled nations to keep their temperature rises to between 1.5-2°C).

While there will still be serious climate impacts at 1.5°C, this is the level scientists have identified as the ceiling under which less devastating, but still significantly impactful impacts of climate change can be maintained. Every fraction of additional warming beyond 1.5°C will bring worsening impacts, threatening lives, livelihoods and economies.

The IPCC report concluded that keeping global temperatures under 1.5°C would require rapid, far-reaching, and unprecedented changes in all aspects of society. The gravity of the situation cannot be overstated, and drastic action is required if the worst impacts of climate degradation are to be mitigated.

The widely used image below in Figure 4[2] visually demonstrates the dramatic changes and acceleration in annual temperatures. It indicates annual temperatures found in Scotland between 1884 and 2022 on a scale from blue to red (with red indicating higher temperatures).

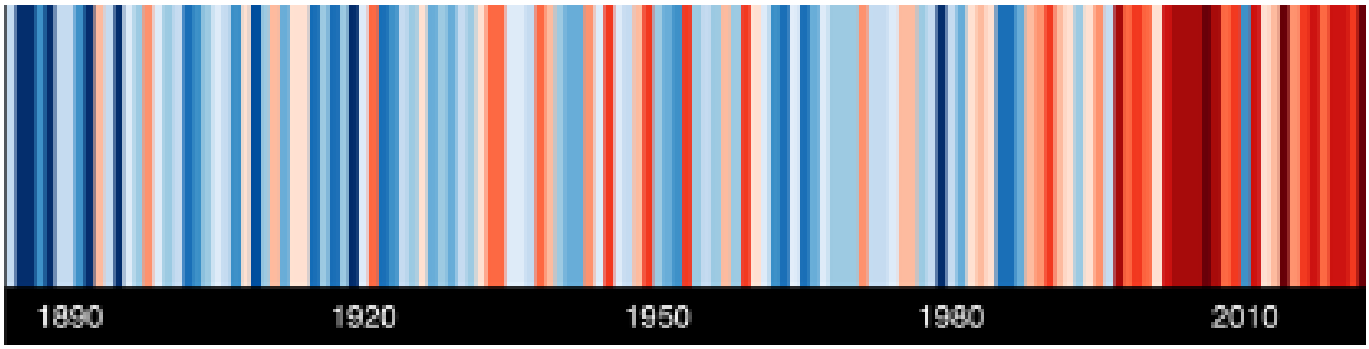



*Figure 4 - Average Annual Temperature for Scotland. 1884 to 2022*

Climate change is not an isolated challenge, and Glasgow must work to ensure that our transition to net zero is achieved in a manner that tackles wider social issues that persist in the city: increasing citizen and community resilience in tandem with delivering on an improved quality of life.

*[1] The IPCC is the United Nation's intergovernmental body aimed at providing objective research and recommendations relating to climate change.*
*[2] Source University of Reading. https://showyourstripes.info/l/europe/unitedkingdom/scotland*

Glasgow must progress a just transition[3] and adherence to this principle will ensure that net zero carbon is achieved to the benefit of all in the city. Working toward this, a cross-party Just Transition Working Group was established, and a recommendation report is expected to be published in 2023. Additionally, a Just Transition Skills Action Plan is currently in production with publication also expected in 2023.

Challenges persist in relation to low-income households, deprivation that is comparatively higher than the national average, and extensive non-traditional and solid-wall construction types. This amounts to an unacceptable prevalence of fuel poverty across the city as residents struggle to pay for heat that is then lost due to the poorly insulated building stock that typifies much of the city. Improving the thermal efficiency of all segments of our built environment, in particular domestic properties, therefore holds compounded benefits.

The importance of tackling fuel poverty has increased in the last three years. The impacts of the decision to leave the European Union, the COVID-19 pandemic and the Russian invasion of Ukraine have contributed to rising fuel costs for citizens with corresponding increases in fuel poverty rates. The current cost-of-living crisis, an umbrella term for the compounded impacts of these events, means that it is now imperative that Glasgow works to provide long term energy security.

## 1.2 Dear Green Place

Whilst we all, as a species, across borders and demographics, have a part to play to help mitigate and adapt to the impacts of climate change, cities have a particularly important role to play in the net zero transition. Seventy-five percent of Europe's population currently live in cities and urban areas[4] and this is expected to rise to 84% by 2050[5]. As cities bear a disproportionate amount of culpability in our rising temperatures, in tandem with increased percentage of population, they hold a greater responsibility to act.

In 2019, Glasgow City Council declared a state of Climate and Ecological Emergency in response to the findings of the 2018 IPCC report. This was an acknowledgement that as a local authority, the City Council has a key role to play in leading on climate action and enabling the city, its citizens, its institutions, and businesses to address the global climate and ecological emergency.

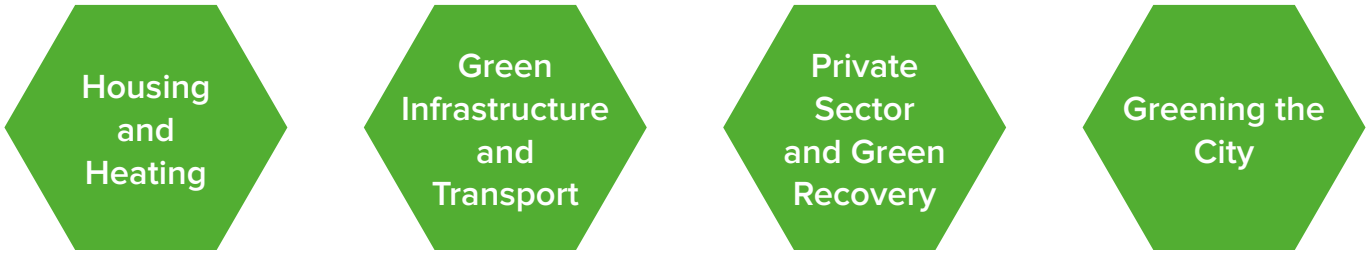
Additionally, the declaration provides a mechanism to accelerate improvements to other aspects of the city also, enabling safer streets, producing cleaner air, creating warmer homes and providing more locally produced nutritious food for everyone.

*[3] A just transition aims to ensure that the benefits of reaching net zero carbon are shared widely whilst supporting those who stand to lose the most from any proposed transition.*
*[4] https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=EU*
*[5] https://knowledge4policy.ec.europa.eu/foresight/topic/continuing-urbanisation/developments-and-forecasts-on-continuing-urbanisation_en#:~:text=Europe's%20level%20of%20urbanisation%20is,a%20smooth%20and%20constant%20increase*

With the declaration of a climate and ecological emergency, the city also set a target of becoming **net zero carbon by 2030**[6] in September of the same year, bringing the original local target date forward by seven years and placing the city 15 years ahead of the national target and 20 years ahead of the UK target.

The declaration of an emergency and the accompanying net zero carbon target reaffirmed Glasgow's aspirations to become a truly sustainable and net zero carbon city which is now further crystallised in the Council's Strategic Plan 2022-2027[7] which outlines a grand challenge for Glasgow to fight the climate emergency in a just transition.

The Sustainable Glasgow Partnership, freshly relaunched in March 2020, further refocuses the momentum on citywide climate action. The Partnership's diverse board includes members from housing, communities, business, universities, enterprise and education working together to create a sustainable and low carbon city. This partnership consolidates city partners in a combined effort for the benefit of all in the city.[8] The Partnership has four thematic hubs each with differing scope:




Following this, the City Council published its Glasgow Climate Plan in 2021. The Plan set out 59 actions that will lead the city towards achieving its net zero carbon by 2030 target, whilst ensuring that the quality of life for citizens improves and the economy of the city transitions to a green economy. The Climate Plan is discussed in more detail in Appendix A, section 1.2.

## 1.3 Fuel Poverty in Glasgow

Despite significant investment in energy efficiency measures in Glasgow properties over the last few decades[9], fuel poverty has not decreased. In fact, it has increased. For Glasgow, the most recent official measure of fuel poverty (in the Scottish House Condition Survey 2019) estimated 25% of all households (around 73,000) were in fuel poverty.

Since then, the city has been significantly impacted by the effects of the COVID-19 pandemic alongside rising energy prices and inflationary pressures. In cognisance of these developments, it is justifiable to assume that fuel poverty rates for households in Glasgow is significantly higher than 25%.

*[6] At present, Glasgow's net zero carbon target refers to Scope 1 and 2 emissions. Work is ongoing to understand how we can quantify, and work to lower, our scope 3 emissions. For information on emissions categorisation, see* **here**.

*[7] https://www.glasgow.gov.uk/strategicplan*

*[8] https://www.glasgow.gov.uk/sustainableglasgow*

*[9] Between 2013 and 2022, the ABS programme delivered 79 project areas to circa 10,600 properties with overall spend of £96.4m of which £35.6m was ABS funding. Additionally, in the last 10-15 years, Registered Social Landlords (RSLs) in Glasgow have invested over £1bn in maintaining and improving homes to meet the requirements of the Scottish Housing Quality Standard (SHQS) and Energy Efficiency Standard for Social Housing (EESSH).*

Poor energy efficiency is a significant contributor to fuel poverty rates across the city. Our transition to a net zero carbon city must also act as a springboard to address socio-economic issues such as fuel poverty and energy resilience.

The LHEES therefore takes a holistic approach to heating our built environment, one that seeks to reduce demand for heat in conjunction with decarbonising the city's heat supply as a means of ensuring Glasgow can benefit from affordable, secure and green heating.

## 1.4 Reflecting on Success

The Council's declaration of a climate and ecological emergency focused minds and created a shared acceptance that the connotations of the word 'emergency' denoted the need to act meaningfully, holistically, and most importantly – at pace. However, this was not the beginning of work to redress the impacts of climate change.

Glasgow City Council's Energy and Carbon Masterplan (ECMP), published in 2015[10], laid out a roadmap to meet a carbon reduction target of 30% by 2020 (based on a 2006 baseline). The ECMP followed from the launch of the Sustainable Glasgow Partnership in 2010 and builds on the Sustainable Glasgow Report published in the same year. As illustrated in Figure 5 below, the city hit this target five years ahead of schedule and continued to build on this success with recent 2021 data showing a 42% reduction in carbon emissions (from a 2006 baseline):

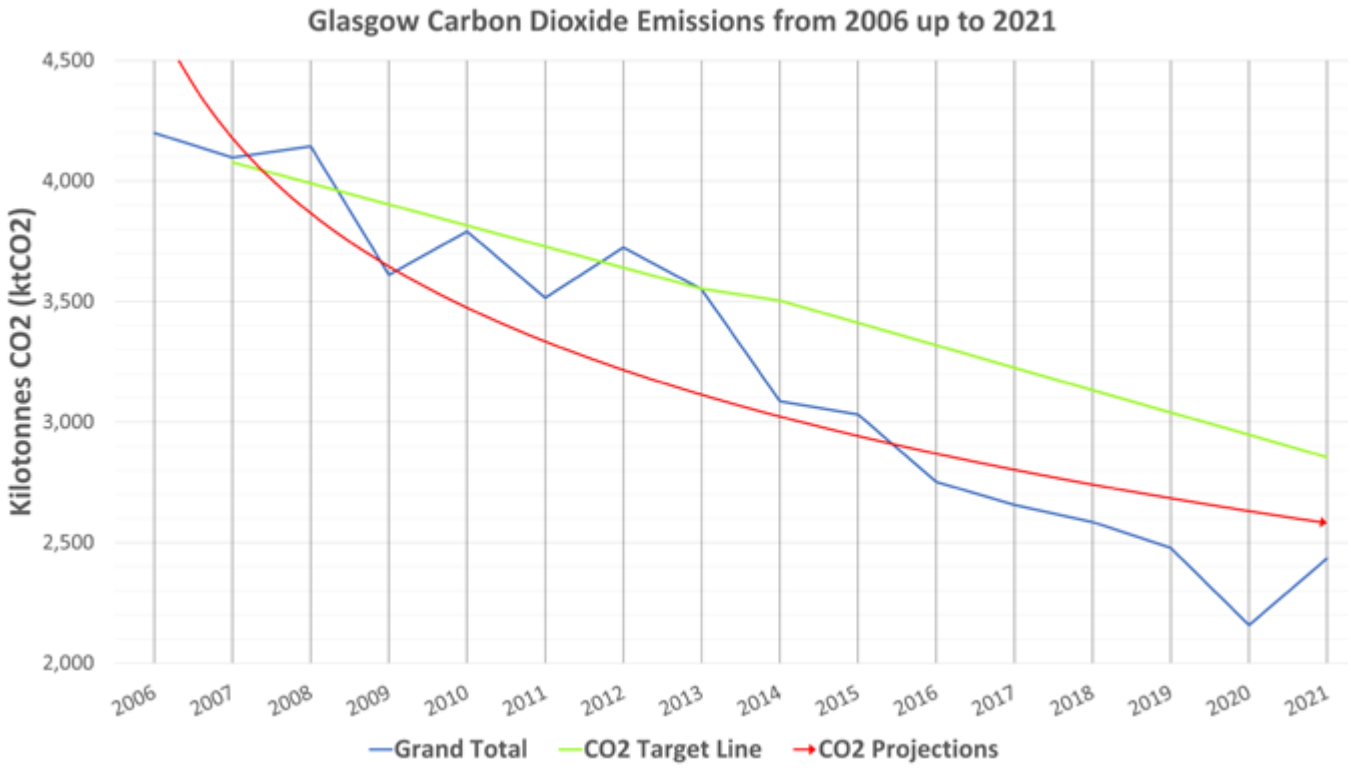



*Figure 5 - Carbon Emissions Reductions 2006-2021*

[10] https://www.glasgow.gov.uk/CHttpHandler.ashx?id=32441&p=0

**Key points include:**

- In 2016: The $CO_2$ emissions in Glasgow totalled 2,752 kilo-tonnes which represents a 35% reduction from 2006 baseline levels, hitting our target four years early.
- In 2021: The $CO_2$ emissions in Glasgow totalled 2,435 kilo-tonnes which represents a 42% reduction from 2006 baseline levels.

## Glasgow has reduced its carbon emissions by 1,765 kilo-tonnes $CO_2$ in the period 2006-2021

The data for 2020 showed that Glasgow hit a milestone figure of reducing its emissions by 50% from baseline. This was a significant achievement but one that came with strong caveats due to the impacts of the COVID-19 pandemic[11]. The recovery from the pandemic and lessening of related restrictions has resulted in emissions increasing in 2021 and the overall reduction from baseline falling to 42%. This post-covid emissions bounce back is a trend that has been seen across similar cities in the UK.

*[11] On the 23rd of March 2020, the nation entered the first in a string of lockdowns on normal activity to tackle the spread of the COVID-19 virus. This amounted to a complete overhaul of ordinary life for most individuals. Millions of people began working from home or were furloughed as businesses closed to prevent the spread of the virus. Transport networks were severely disrupted, with busses and trains running with extremely low passenger numbers and roads absent of vehicles as people followed the Government's 'stay at home' message. There was an almost complete halt on large swathes of commercial and industrial activity across the country as businesses deemed 'non-essential' were instructed to close.*

# 2

# GLASGOW'S LHEES VISION

**Our LHEES vision for the future of heating in Glasgow is to create the conditions for the city to benefit from affordable, reliable and sustainable heat in the long-term. This will be achieved by delivering an LHEES which reduces the demand for heat, decarbonises the supply of heat, and decentralises heating systems.**

## 2.1 Contributing to a Net Zero Transition for Everyone

Glasgow's LHEES aligns with the citywide target of net zero carbon by 2030. Alongside other Council strategies contributing towards this target, the LHEES will form an important part of the response to the climate and ecological emergency: establishing a clear framework for decarbonised and decentralised heating systems in the City whilst reducing heat demand through fabric improvements, fostering energy resilience, and reducing fuel poverty.

## Glasgow's LHEES Aligns with the City Target of Net Zero Carbon by 2030

Figure 6 shows our emissions reduction progress to date split by source. It shows large reductions on emissions from electricity but shows a much smaller reductions in gas and transport related emissions.[12] Where electricity sector emissions have reduced by 73% since 2006, gas sector emissions have reduced by 15%, underscoring the necessity for a strategy focused on gas related emissions.

The development of this LHEES has allowed us to reflect and refocus efforts to reduce carbon emissions across the built environment following the successful completion of the Energy and Carbon Masterplan in 2020. It takes a blended approach to the built environment by inclusion of the housing sector and those key issues that need addressed with regards to fuel poverty, building design and retrofit across the city alongside delivering low carbon heating and energy for the residents of Glasgow.

*[12] Reductions in the carbon emissions from electricity consumption have been achieved nationally in Scotland due to the significant deployment of onshore and offshore wind generation. At local level, Glasgow has continued its programme of solar PV install on GCC owned assets alongside opening the Polmadie energy from waste plant (the GRREC) and installing the 3MW wind turbine at Cathkin Braes. Through examples of projects such as these, Glasgow continues to contribute to the decarbonisation of the national electricity grid in Scotland.*

Alongside Glasgow's net zero target, the LHEES is driven by Scotland's statutory targets for greenhouse gas emissions reduction and fuel poverty:

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

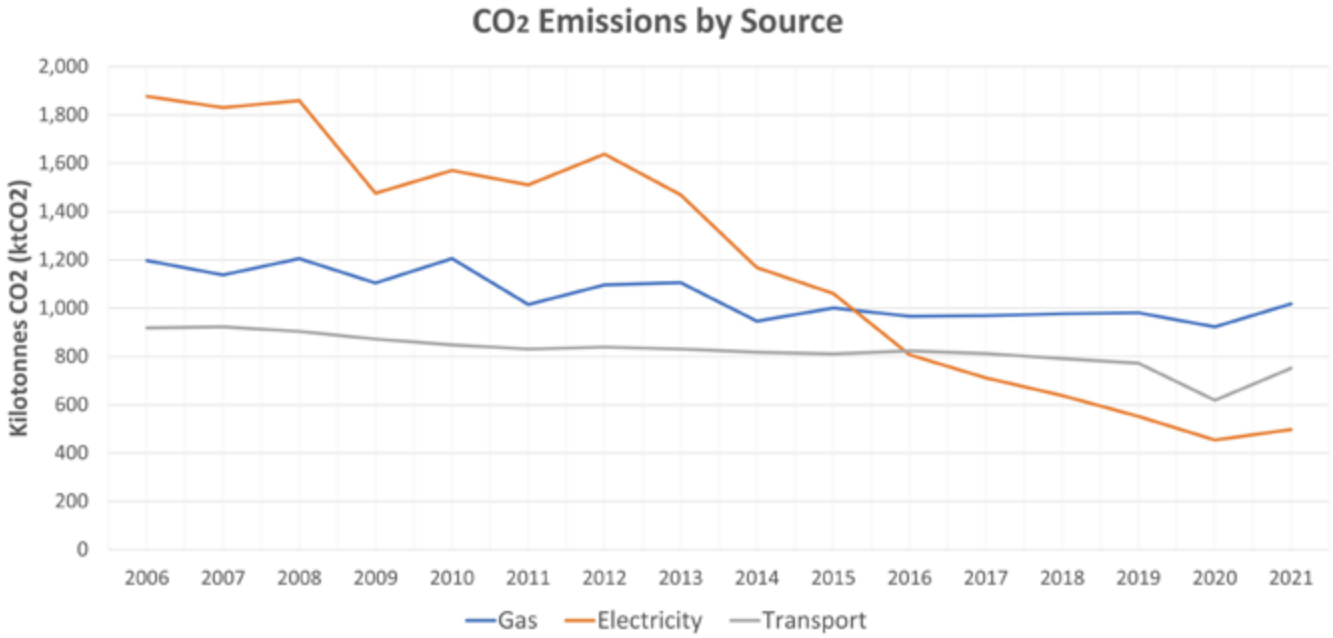



*Figure 6 - Glasgow Emissions by Source (2005-2021)*

## 2.2 Glasgow's LHEES Journey

Glasgow City Council participated in Phase I of the LHEES pilot (funded by the Scottish Government) in 2018. At this time a city-wide approach to LHEES was explored.

The LHEES pilot commenced a period of significant engagement with relevant city stakeholders both internal and external to the Council. This pilot allowed the city to generate significant momentum amongst stakeholders; prompting discourse on how to address the significant challenges as well as harness the opportunities presented by decarbonisation of our built environment.

There have been significant developments in the policy and legislative environment around heat and buildings in Scotland since 2018. This has the establishment of the Heat Networks (Scotland) Act 2021 alongside the statutory requirement for local authorities to produce an LHEES.

## 2.3 The Local Heat and Energy Efficiency Strategies (Scotland) Order 2022[13]

Following consultation and engagement which involved all 32 Scottish local authorities, the Scottish Government made it a statutory duty for all local authorities to produce an LHEES and to update their LHEES at intervals of no more than five years.

[13] https://www.legislation.gov.uk/sdsi/2022/9780111053935

Guidance on how to develop an LHEES accompanied the Order was included, alongside a suggested methodology for meeting the requirements of the guidance. Local authorities are expected to have their LHEES published by the end of 2023.

The Local Heat and Energy Efficiency Strategies (Scotland) Order 2022

- Came into force on the 21st May 2022.
- Requires Local Authorities to publish their first LHEES and associated delivery plan on or before 31st December 2023.
- Requires Local Authorities to publish an updated LHEES and associated delivery plan at intervals of no more than 5 years after the date of publication of the previous strategy.

## 2.4 LHEES Guidance

The LHEES Guidance provides local authorities with a standardised approach to developing and delivering LHEES. There are requirements as to what an LHEES should achieve which include -

- Setting out how each segment of the building stock needs to change to meet national objectives, including achieving zero greenhouse gas emissions in the building sector, and the removal of poor energy efficiency as a driver of fuel poverty.
- Identifying indicative Heat Network Zones.
- Prioritising areas for delivery, against national and local priorities, setting out the principal measures for reducing emissions from buildings within each zone.

## 2.5 LHEES Considerations

The LHEES Guidance outlines that the function and scope of local authorities LHEES should be framed around six ‘LHEES Considerations’, outlined in Figure 7. For each Consideration, spatial zones are to be generated to visualise potential pathways to decarbonise the building stock at local authority level (Strategic Zones) and then at delivery level (Delivery Areas). This is used to guide the design of policy levers, such as advice, funding programmes and regulation, which will give further direction and clarity to delivery routes and timescales. The identification of indicative Heat Network Zones has followed a separate process to the other Considerations.

Local authorities are not required to address all the LHEES Considerations and the emphasis on any Considerations should in part be informed by the priorities and profile of the local authority area. Additionally, depending on the focus for delivery, the LHEES Considerations should not be taken into account in isolation, and it may be more suitable to combine analysis for multiple Considerations at a time.

| | 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 |

*Figure 7 LHEES Considerations*

## 2.6 Prioritising LHEES Considerations in a Local Context

Decision making on how to prioritise Considerations in Glasgow's first LHEES has been informed largely through identification of local priorities alongside analysis of the characteristics of Glasgow's built environment. Table 2 below discusses each of the Considerations briefly in a local context. To prioritise within our LHEES, we:

- **Analysed the profile of the city's built environment.** Identification of where the main challenges are. Glasgow has a mixed profile of domestic and non-domestic buildings which require prioritisation. For example, there are a high proportion of hard-to-treat pre-1919 buildings in the city.
- **Reviewed the local policy context.** The LHEES cuts across a broad range of policies for the city and alignment with these has influenced prioritisation within LHEES.
- **Engaged with stakeholders.** Stakeholder engagement (both internal and external to the Council) has allowed for a targeted approach to delivering on low-regret measures[14] and developing solutions to longer term challenges in the city.

[14] *https://www.gov.scot/publications/energy-performance-certificates-introduction/*

| LHEES Consideration | Description | Glasgow Context |
|---|---|---|
| **Heat Networks** | Highlighting zones within a local authority where heat networks present a potential decarbonisation option. | Glasgow is highly suitable for heat networks from a heat demand perspective. This Consideration is a priority focus for the LHEES[15]. |
| **Poor Building Energy Efficiency as a Driver of Fuel Poverty** | Identifying possible locations at a strategic and delivery level where poor building energy efficiency acts as a driver for fuel poverty. | Glasgow's LHEES has focused on this Consideration as a mechanism of reducing fuel poverty. |
| **On-Gas Grid Buildings** | Identifying potential on-gas heat decarbonisation pathways and opportunities at a strategic and delivery level. | Glasgow's LHEES has focused on this Consideration to better understand connection viability for heat networks and to identify decarbonisation pathways for areas not suitable for heat networks. |
| **Mixed Tenure, Mixed-Use and Historic Buildings** | Identifying where there are buildings of mixed-tenure or mixed-use and also where there are historic buildings. | Glasgow's LHEES has focused on this Consideration, specifically on the challenges around pre-1919 tenemental properties which are prevalent in the city[16]. |
| **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 has been incorporated into delivery of the heat networks Consideration which will need to consider domestic energy efficiency interventions in indicative Heat Network Zones. |
| **Off-Gas Grid Buildings** | Identifying low regrets off-gas heat decarbonisation pathways and opportunities at a strategic level and at a delivery level. | 82% of Glasgow's domestic properties are on the gas-grid. This Consideration therefore has not been prioritised for the current LHEES. |

*Table 2 - LHEES Considerations and Relevance to Glasgow*

*[15] It is important to note the distinction between communal heat networks and district heat networks. Communal networks typically exist within one building or between a few whereas district heating applies to larger scale networks that connect multiple buildings.*

*[16] There are around 77,000 traditional tenemental buildings (a quarter of the city's housing supply) consisting of 61,300 flats (within 7,700 traditional tenement buildings), 6,800 flats which have been created through the conversion of around 2,200 townhouses and terraced properties, 9,100 villas/terraced properties which remain in their original form, and around 5,900 commercial units (mostly ground floor shops) within traditional tenement buildings with a further 900 commercial units within townhouses/terraces.*

## 2.7 Stakeholder Engagement

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

- Initial internal workshops to determine the scope of Glasgow's LHEES upon development of the 2018 pilot.
- Ongoing internal engagement with Housing and Planning officers.
- Ongoing engagement with strategic partners such as Scottish Futures Trust, Energy Saving Trust, and Zero Waste Scotland.
- Engagement with other local authorities producing LHEES through the Local Authority LHEES Forum. Engagement with the Scottish Government on the development of the LHEES Guidance and the regulations around the Heat Networks Act.
- A stakeholder engagement event targeted at internal partners, strategic partners, and city stakeholders such as social housing providers.
- Further targeted engagement with city stakeholders through the consultation process for the LHEES.
- A full public consultation was undertaken for an initial draft of the LHEES. Where appropriate and feasible, the LHEES was updated according to consultation feedback.

# 3

# OUR NET ZERO JOURNEY

**There are several key targets to which our LHEES will contribute to. In addition to the key targets, the LHEES is considered in the context of local and national policy on climate change, fuel poverty, energy efficiency and planning. Understanding how the city is currently performing in relation to our targets and the characteristics of our built environment are also critical in framing our low carbon journey.**

## 3.1 Key Targets

The LHEES aligns itself to targets set both locally and nationally relating to carbon reduction, energy efficiency improvements, heat networks and fuel poverty. The key targets are outlined in Table 3.

| Year | Target | National/Local |
|---|---|---|
| **2027** | 2.6 TWh of heat supplied by heat networks (3% of national demand) | National |
| **2028** | Private Rented Domestic Sector to meet EPC C | National and local |
| **2030** | Net Zero Carbon for Glasgow | Local |
| | 6 TWh of heat supplied by heat networks (8% of national demand) | National |
| | 50% of Scotland's heat, transport and electricity to be supplied by renewables | National |
| | 75% emissions reduction (from 1990 baseline) | National |
| **2032** | Social Housing Sector to meet EPC B | National and local |
| **2033** | Owner Occupied Domestic Sector to meet EPC C | National and local |
| **2040** | 90% emissions reduction (from 1990 baseline) | National |
| | No more than 5% and 1% of households to be in fuel poverty and extreme fuel poverty respectively | National and local |
| **2045** | Scotland to be net zero emissions | National |

*Table 3 - Key LHEES targets*

### 3.1.1 Carbon Emissions Targets

Both Glasgow and Scotland have set ambitious emissions reductions targets. By 2030, Glasgow aims to be net zero carbon (from a 2006 baseline). Additionally, by 2030, there is a national target of achieving a 75% reduction in carbon emissions (from a 1990 baseline year) alongside a target of having renewables supply 50% of Scotland's energy demand for transport, electricity and heating. By 2045, Scotland should achieve net zero for all emissions. As a local authority, Glasgow is not required to meet its pro-rata share of the emissions reduction targets set nationally but will play an instrumental role in contributing to their achievement.

### 3.1.2 Heat Networks Targets

The Heat Networks (Scotland) Act 2021, discussed in Appendix A, section 2.3, has set statutory targets for Scottish Ministers to ensure that the combined supply of thermal energy by heat networks in Scotland reaches 2.6TWh in 2027 and 6TWh by 2030 (3% and 8% of total demand respectively).

### 3.1.3 Fuel Poverty Targets

The Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act, passed in 2019, set new statutory targets for fuel poverty alongside a new definition of fuel poverty that aligns more closely with relative income poverty. The new target aims to have no more than 5% of households being in fuel poverty and 1% in extreme fuel poverty by 2040.

Fuel poverty targets are to be met in relation to households within each local authority area and therefore are directly applicable to Glasgow.

#### Definition of Fuel Poverty -

**According to the Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019, a household is in fuel poverty if the fuel costs necessary for the home to meet a reasonable condition of heat are more than 10% of the households adjusted net income. Extreme fuel poverty applies when meeting these conditions requires more than 20% of households adjusted net income.**

### 3.1.4 Minimum Energy Efficiency Standard

Targets for improving the energy efficiency of Scotland's domestic stock have been established through the Scottish Government's Heat in Buildings Strategy and regulations remain to be established to enforce these targets. These targets are measured using the SAP scoring system which establishes predicted Energy Performance Certificate (EPC) ratings[17]. The targets are split by tenure type and include -

- All private rented sector properties to reach a minimum standard equivalent to EPC Band C, where technically feasible and cost effective, at change of tenancy, with a backstop of 2028 for all remaining existing properties.
- All owner-occupied properties to reach a minimum standard equivalent to EPC Band C, where technically feasible and cost effective, at change of tenancy, with a backstop of 2033.
- Social housing targets. Targets relating to social housing are set through the Energy Efficiency Standard for Social Housing (EESSH). EESSH2 was confirmed in 2019 and set out a target for all social housing to meet, or can be treated as meeting, EPC B or is as energy efficient as practically possible, by 2032 and within the limits of cost, technology and necessary consent. In addition, no social housing below EPC band D is to be relet from December 2025 subject to temporary specified exemptions.

## 3.2 Policy and Strategy Context

The LHEES is not an isolated strategy and is integrated across a broader environmental, social and economic landscape. It takes influence from a range of different policies, strategies and targets at local and national level.

A full review of the policy and strategy context relevant to the LHEES is included in Appendix A with a summary of key policies and strategies provided below.

### 3.2.1 Local Policy Context

- Glasgow Strategic Plan 2022-2027. Sets out priority themes and commitments to be delivered in the period of 2022-2027 by the Council and wider Council family.
- The Climate Plan. The Climate Plan provides a framework for Glasgow to deliver net zero carbon by 2030.
- City Development Plan (CDP). The CDP2 is currently under development and sets out the Council's vision and strategy for land use alongside providing the basis for assessing planning applications.
- Glasgow Local Housing Strategy 2023-2028 (LHS). The purpose of the LHS is to provide an evidence-based policy framework, housing needs assessment and investment platform (the related Strategic Housing Investment Platform, or SHIP) to guide stakeholders in decisions around new development and continually raised maintenance and management standards.

*[17] These 19 typologies are primarily defined to align to those in the Building Energy Efficiency Survey (BEES). BEES is a BEIS produced document and although it is based on English and Welsh data it is currently one of the best sources for examining potential opportunities for energy efficiency and heating system improvements in the UK's non-domestic building stock.*

- City Centre Living Strategy. The vision of the City Centre Living Strategy is to enable a sustainable, inclusive and diverse city centre population with a key ambition to double the population of the city centre to around 40,000 by 2035.
- Glasgow Economic Strategy. The Glasgow Economic Strategy sets out the clearly defined actions the city will take to deliver an inclusive, sustainable and more productive economy for our city.
- The Open Space Strategy. The OSS is a corporate strategy that will align the work of various council services to deliver a variety of benefits for people and nature in Glasgow by unlocking the city's open spaces.
- Carbon Management Plan. The next iteration of the Carbon Management Plan (CMP3) is currently under development and will set out how the Council intends to utilise its estate, assets and resources to catalyse the net zero transition for Glasgow.
- Glasgow Adaptation Plan. The Glasgow Adaptation Plan 2022-2030 focuses on the local impacts of global temperature increases, what they mean for the city and how, with other partners, we plan to respond to them now and in the future. The Plan considers climate hazards, exposure levels and our local vulnerability to them.

### 3.2.2 National Policy Context

- Climate Change Plan 2018–2032 - Update. Provides update to Scotland's 2018-2032 Climate Change Plan sets out the Scottish Government's pathway to achieving the targets set by the Climate Change Act 2019 and is a key strategic document for delivering a green recovery from COVID-19.
- Heat in Buildings Strategy (2021). Sets Scotland's vision for the future of heat in buildings, and the actions being taken in the buildings sector to deliver on climate change commitments, maximise economic opportunities, and ensure a just transition, including helping to address fuel poverty.
- Heat Networks Act (2021) and associated Heat Networks Delivery Plan. Provides a regulatory framework by which to stimulate investment in heat networks across Scotland alongside setting statutory targets for heat networks. The Heat Networks Delivery Plan outlines how the Scottish Government will use the provisions of the Act to accelerate the deployment of heat networks. (A summary of the Act is provided in Appendix A)
- Scottish Energy Strategy & Just Transition Plan. Sets out how Scotland will meet the challenge of reducing demand within main energy-using sectors such as heat in buildings, transport, industry and agriculture whilst using energy more efficiently, and becoming largely decarbonised by 2030.
- Housing to 2040. Sets out a vision for housing in Scotland to 2040 and a route map to get there.
- National Planning Framework (NPF4). Identifies where development and infrastructure are required to assist Scotland in meeting its goals.

- New Build Heat Standard. From the 1st of April 2024, new buildings in Scotland applying for a building warrant will be required to use zero direct emissions heating systems (ZDEH) to meet their space and hot water heating and cooling demands.
- Hydrogen Policy Statement (2020). Sets out vision for Scotland to become a leading hydrogen nation in the production of reliable, competitive, sustainable hydrogen
- Tenements (Scotland) Act 2004. Regulates tenemental properties in Scotland and makes provisions relating to common repairs and shared ownership.
- Historic Environment Policy for Scotland (May 2019). A policy statement directing decision-making that affects the historic environment.
- The Planning (Listed Building Consent and Conservation Area Consent Procedure) (Scotland) Regulations 2015. Provides provisions on applications for listed building consent and applications for conservation area consent.
- Review of Electricity Market Arrangements (REMA) (UK Government). Proposals under the scope of REMA include the exploration of fundamental changes to the electricity market to disable volatile gas prices from setting the wholesale cost of electricity, allowing consumers to benefit from lower cost renewable energy.

## 3.3 Baselining Glasgow's Performance

This section provides information on Glasgow's progress in regard to carbon reduction to date and current conditions of the city's built environment to give a concise view of our progress towards net zero, domestic and non-domestic building performance and heat networks currently active in the city.

### 3.3.1 Domestic Building Stock

To provide an overview of Glasgow's baseline for domestic buildings, the Energy Saving Trust's 'Home Analytics' dataset was utilised. Home Analytics is actively used across local authorities to support climate emergency and carbon reduction plans and is a key dataset for the LHEES.

Glasgow has just under 330,000 domestic properties, some key statistics on domestic stock performance are noted below -

- Mains gas is the main fuel type for 82% of properties.
- Fuel poverty is estimated at 25% whilst extreme fuel poverty is estimated at 13%.
- Heat demand per dwelling is modelled at 9,634 kWh/year.
- 21% of residents live within Council Tax Bands A-C.
- 38% of homes fall within EPC Rating D-G.
- Out of the three key indicators of poor energy efficiency[18], 41% of domestic properties in Glasgow are without wall insulation. Low loft insulation and single glazing rate comparatively lower at 8% and 11% respectively.

[18] *Single Glazing Windows, Loft Insulation <100mm, Wall Insulation. Source – Home Analytics*

#### 3.3.1.1 Building Form

Figures 8-10 below highlight the stock characteristics for Glasgow from a spatial perspective, including EPC rating, property age and property type. Key points to consider:

- **Figure 8:** 51% of domestic buildings in Glasgow are rated as EPC C. A large proportion are rated EPC D (27%) and only 11% are rated between EPC E-G.
- **Figure 9:** There is variance in the types of properties across the city, but with 73% being within flatted properties.
- **Figure 10:** Property ages are mixed. However, properties built before 1919 (pre-1919) and between 1950-1983 are the most prevalent in Glasgow (25% and 30% respectively).

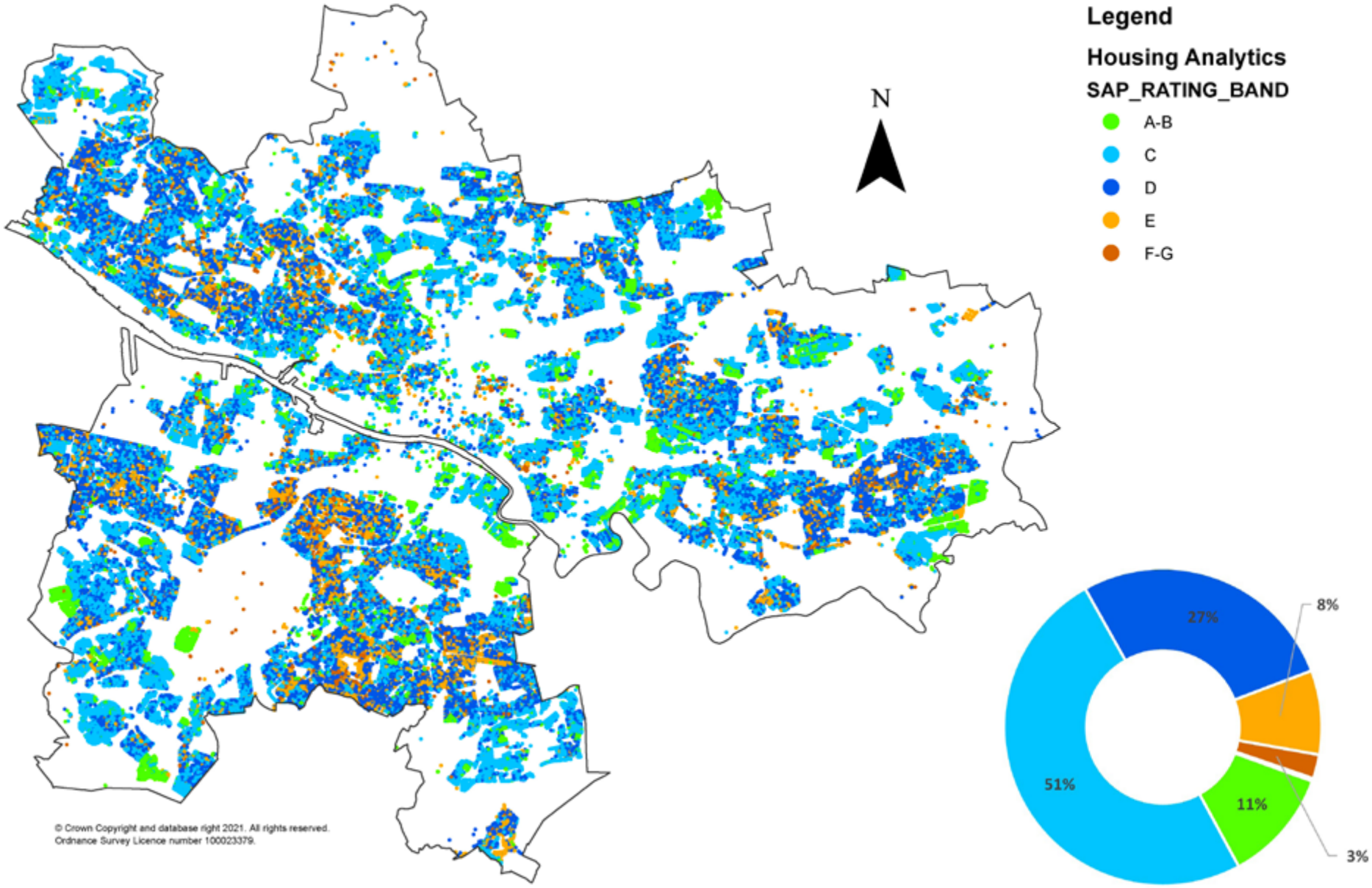



*Figure 8 - EPC Ratings of Domestic Properties*

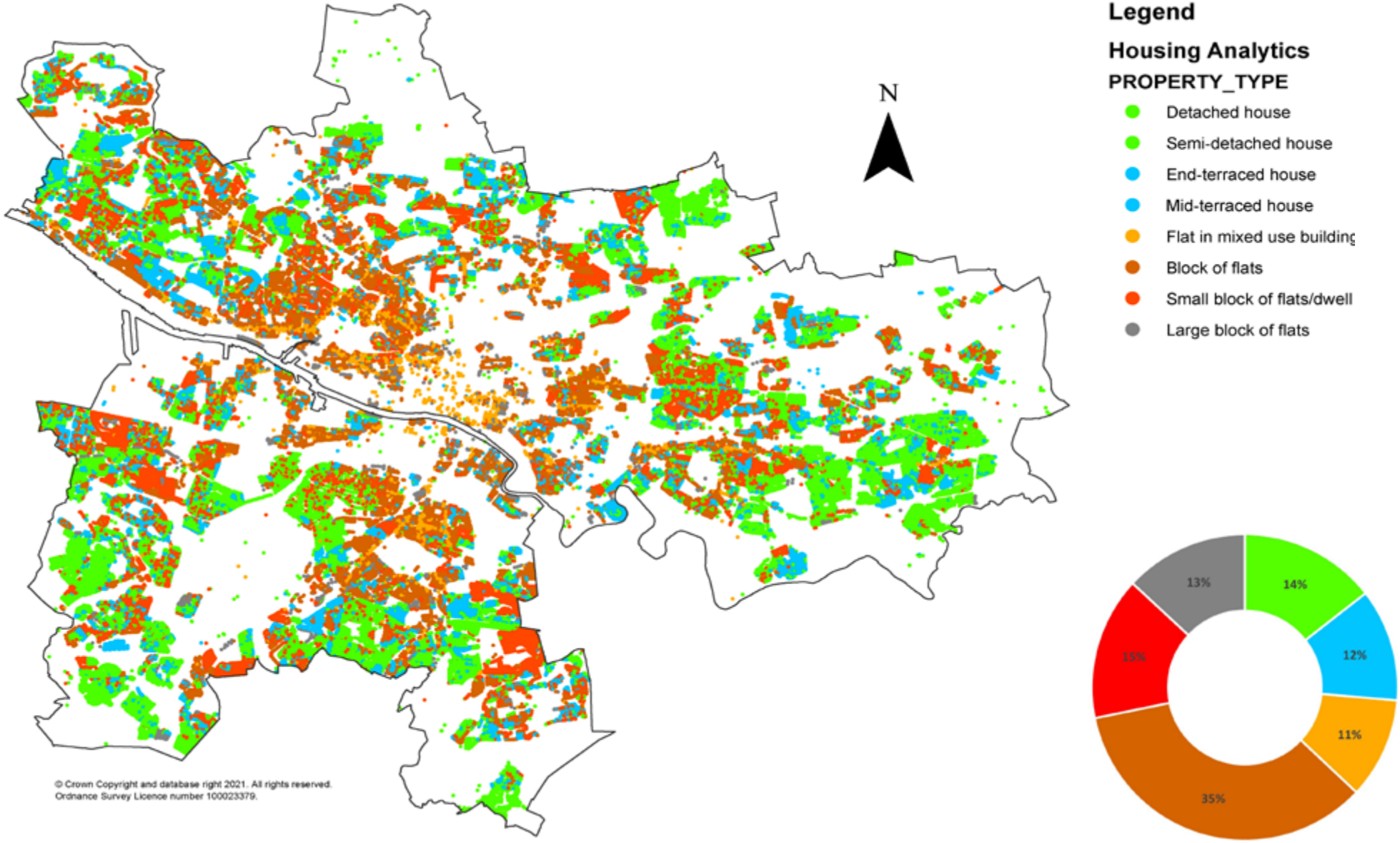



*Figure 9 - Property Type by Building Type*

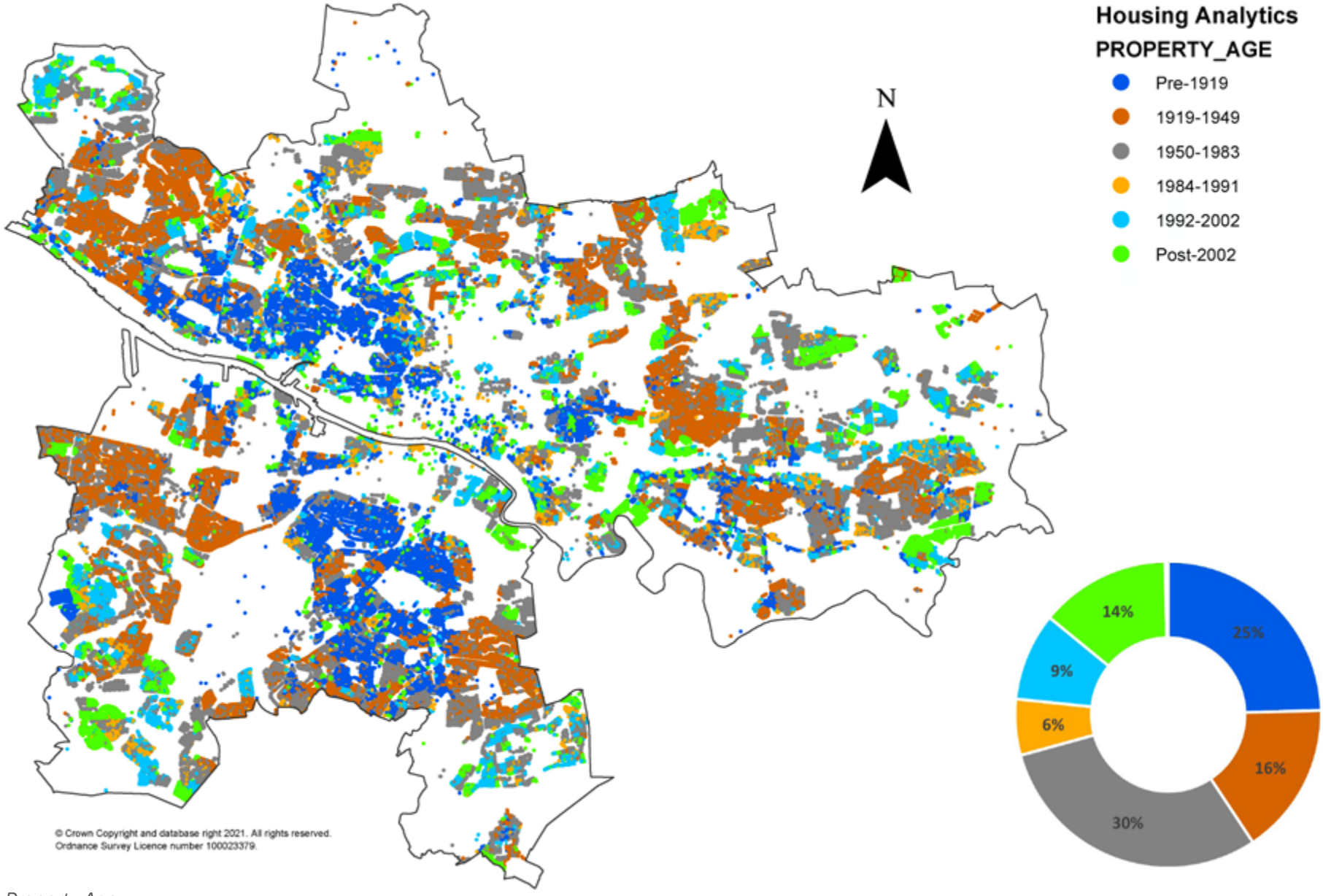



*Figure 10 - Property Age*

### 3.3.1.2 Tenure Type

Figure 11, mixed tenure in Glasgow, indicates that nearly half of the housing stock in Glasgow (46%) is of mixed tenure blocks with multiple owners.

Figure 12, tenure type in Glasgow, indicates that 49% of properties are owner occupied, 35% are owned by Housing Associations and 16% are privately rented[19].

Tenure type is a key influence in determining appropriate engagement and will be impacted in different ways through upcoming regulations on tenure specific EPC targets.

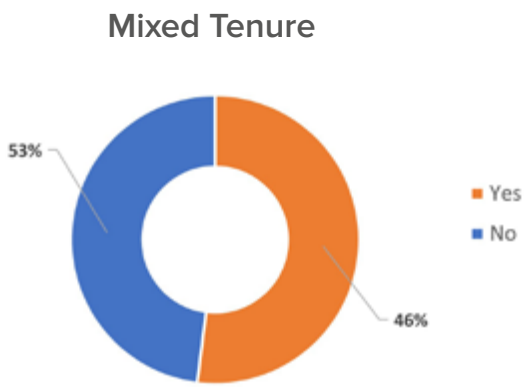



*Figure 11 - Mixed Tenure Split*

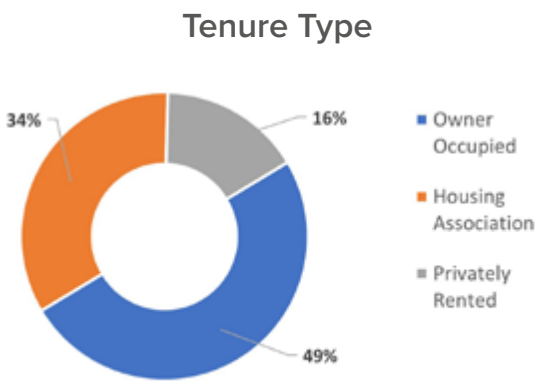



*Figure 12 - Tenure Type*

### 3.3.1.3 National Comparison

A comparison of the domestic stock profile of Glasgow against the national figures is shown in Table 4. This highlights that Glasgow's stock is slightly more energy efficient, with 14% more stock rated between EPC A-C than the comparative national figures. The figures also show that Glasgow has a significantly higher percentage of flatted properties at 74% compared to 40% nationally. Scotland has a higher prevalence of owner-occupied properties (62%) compared to Glasgow at 50%.

*[19] These figures are taken from Energy Saving Trust's Home Analytics dataset. Figures from the Scottish Government indicate Glasgow has a higher percentage of privately rented properties (20%) with only 44% owner occupied properties. These figures should therefore be treated as dynamic. The difference in tenure data may impact on engagement approaches but does not impact on the challenges of retrofit from a technical perspective. Overall, the implications in the difference in tenure data are not thought to hold significant impact on analysis at this stage.*

| | | Scotland | Glasgow |
|---|---|---|---|
| **EPC Rating** | A-B | 9% | 11% |
| | C | 39% | 51% |
| | D | 35% | 27% |
| | E | 12% | 8% |
| | F - G | 5% | 3% |
| **Property Type** | Detached/Semi Detached | 39% | 14% |
| | Mid/End Terraced House | 20% | 12% |
| | Flat in Mixed Use Building | 5% | 11% |
| | Block of Flats | 15% | 35% |
| | Small Block of Flats/Converted Flats | 14% | 15% |
| | Large Block of Flats | 6% | 13% |
| | Unknown | 1% | 0% |
| **Tenure Type** | Owner Occupied | 62% | 49% |
| | Housing Association | 11% | 35% |
| | Privately Rented | 14% | 16% |
| | Local Authority | 12% | 0% |
| | Unknown | 1% | 0% |

*Table 4 - National Stock Comparison*

## 3.3.2 Non-Domestic Building Stock

### 3.3.2.1 Non-Domestic Analytics Dataset

For the analysis of non-domestic building stock, the Energy Saving Trust's 'Non-Domestic Analytics' (NDA) tool can be used to provide a strategic overview of the non-domestic estate in Glasgow. This supports better understanding of the breakdown of building typologies and by other criteria, such as fuel type, property age, or floor area. The approach developed is intended to support the characterisation of the non-domestic building stock.

NDA is built from non-domestic EPC records and other datasets, with statistical and geo-spatial modelling employed to develop a profile of the non-domestic stock at property level. In Scotland there is a lack of high-resolution measured data to inform the Non-Domestic Analytics model.

This means overall confidence in the model and the information it can provide is not of as a high a quality as the domestic sector. NDA has a lack of information relating to some key information fields for consideration of heat decarbonisation interventions, such as construction type, insulation and tenure

| Main Typology | Property Count | Property count (%) | Heat Demand (MWh/yr) | Heat Demand (%) |
|---|---|---|---|---|
| General sports & leisure | 263 | 1.0 | 32,676 | 2.6 |
| Clubs and community centres | 553 | 2.1 | 27,700 | 2.2 |
| Museums, art galleries, libraries, law courts | 52 | 0.2 | 5,012 | 0.4 |
| Large entertainment sites (e.g., theatres, cinemas, conference centres) | 39 | 0.2 | 6,085 | 0.5 |
| Places of worship | 38 | 0.1 | 2,761 | 0.2 |
| Education | 634 | 2.5 | 61,772 | 5.0 |
| Emergency services | 38 | 0.1 | 8,748 | 0.7 |
| Health | 661 | 2.6 | 122,250 | 9.8 |
| Hotels | 241 | 0.9 | 81,329 | 6.5 |
| Cafes, pubs, restaurants and takeaways | 1410 | 5.5 | 57,440 | 4.6 |
| Light manufacturing / industry / workshop | 1723 | 6.7 | 86,959 | 7.0 |
| Heavy manufacturing / industry | 147 | 0.6 | 19,661 | 1.6 |
| Offices | 7144 | 27.6 | 325,657 | 26.2 |
| Retail | 10,398 | 40.2 | 225,159 | 18.1 |
| Storage / distribution | 798 | 3.1 | 73,526 | 5.9 |
| Residential | 859 | 3.3 | 30,631 | 2.5 |
| Military and prison | 4 | 0.0 | 265 | 0.0 |
| Other | 38 | 0.1 | 4,966 | 0.4 |
| Screened out | 823 | 3.2 | 72,223 | 5.8 |
| TOTAL | 25,863 | | 1,244,819 | |

*Table 5 - Non-Domestic Stock Type in Glasgow*

### 3.3.2.2 Typology

Table 5 on previous page disaggregates Glasgow's non-domestic building stock by typology[20]. There are often commonalities across typologies that could suggest common decarbonisation options might be suitable thus potentially revealing economies of scale. Retail premises and offices make up most non-domestic building types in Glasgow at 40.2% and 27.6% respectively. Light manufacturing/Industry/Workshops account for 6.7% of properties and cafes, pubs restaurants and takeaway account for 5.5%.

Property count is useful to understand the profile of the non-domestic stock, but it is important to consider the heat demand. For example, a single large hotel is likely to have a higher heat demand than ten small cafes. Offices make up just over a quarter (26.2%) of total non-domestic heat demand followed by retail at 18.1%. Properties classed as 'health' constitute 9.8% of total demand with hotels registering 6.5%.

### 3.3.2.3 Fuel Type

Identifying the main fuel type assists in determining the most appropriate approach for a property. Properties using mains gas are more likely to be suitable for heat network connection as they predominantly will have wet heating systems (boilers) and therefore retrofit for heat network connection will likely be less complex and less costly than retrofitting electrically heated properties.

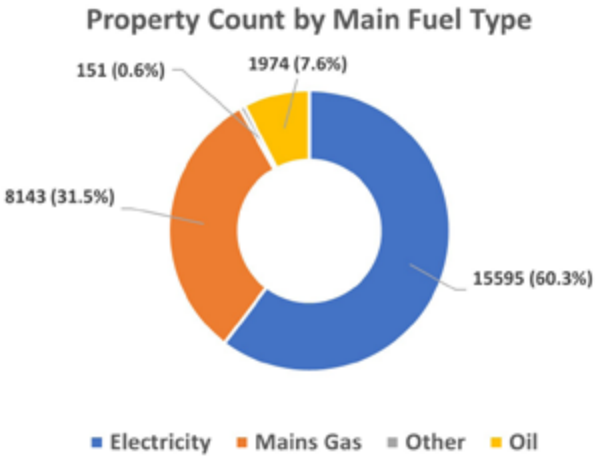



*Figure 13 Property Count by Fuel Type*

Energy efficiency and demand-management measures for those buildings using electricity as their main fuel source may be a more appropriate approach. This is particularly important in direct electric heating systems where fuel costs are high, so any energy efficiency improvements have a greater impact on savings. The incentives for property owners to switch must also be considered. Whilst retrofitting electrically heated buildings over to a wet system can be expensive, there may still be incentive to switch from property owners as their current heating system will be costly.

*[20] These 19 typologies are primarily defined to align to those in the Building Energy Efficiency Survey (BEES). BEES is a BEIS produced document and although it is based on English and Welsh data it is currently one of the best sources for examining potential opportunities for energy efficiency and heating system improvements in the UK's non-domestic building stock.*

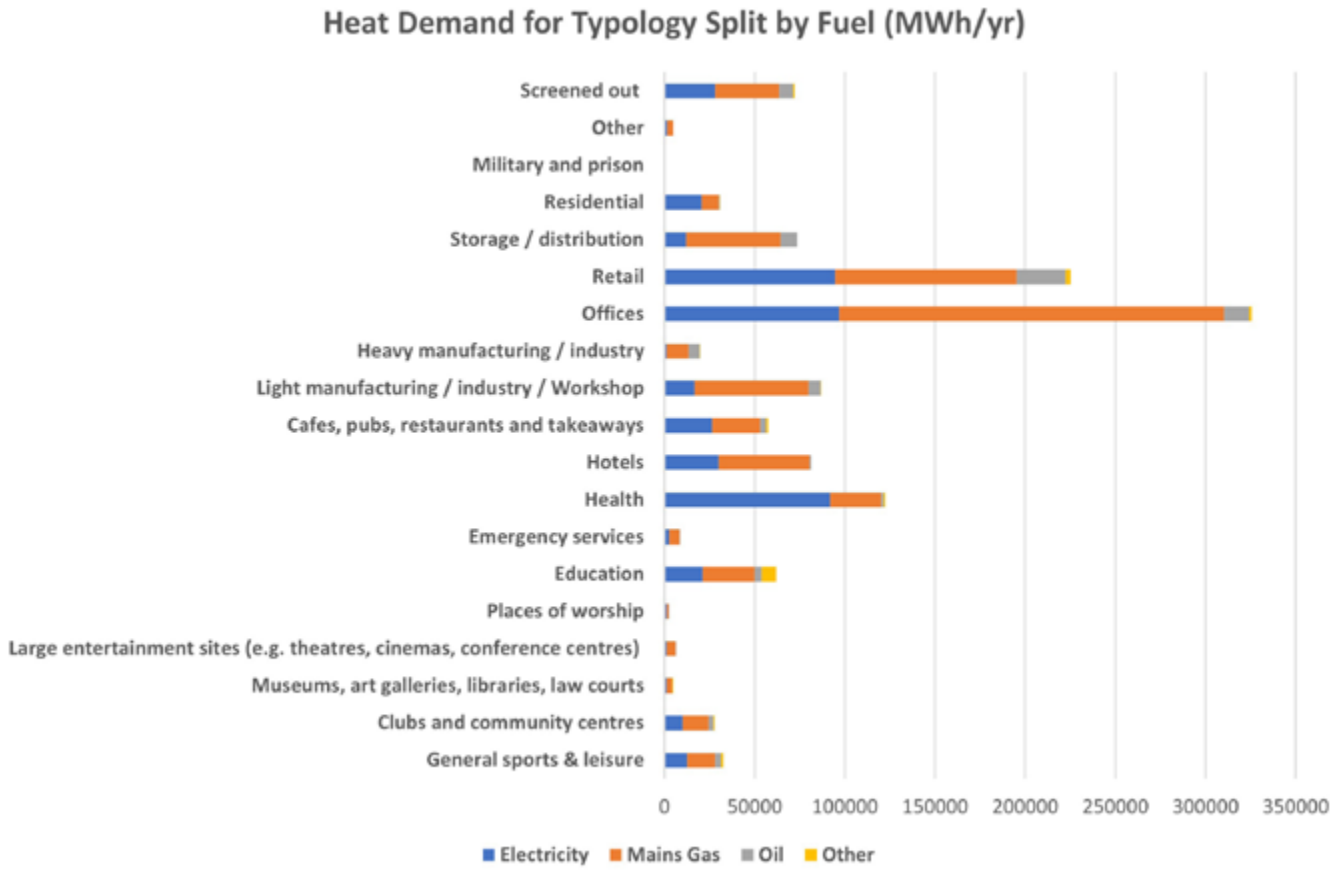



*Figure 14 - Heat Demand by Building Use*

53.8% of the heat demand from non-domestic properties in Glasgow is met using mains gas, with electricity being the main fuel type for 37.8% of the total heat demand. By contrast, Figure 13 highlights that by property count, 60.3% of properties use electricity as their main fuel type, indicating that a lot of the electrically heated buildings are of smaller size with a correspondingly lower heat demand. Offices, which make up 26% of total non-domestic heat demand are largely met by mains gas which accounts for 65% of their total heat demand.

The main fuel type used in retail premises, which have the second highest proportion of total heat demand (18.1%), is mixed with neither gas nor electricity making up a majority. Main gas covers 44.7% of total heat demand for retail buildings whilst electricity is used for 42%.

### 3.3.2.4 Floor Area

Identifying properties by floor area, Figure 15, provides useful indicators in assessing suitability to connect into a heat network or to use individual heat pumps. Buildings with large floor spaces can often have high heat demand but register a low heat density[21]. These properties are typically harder to heat with heat pumps and may not be feasible connections for low temperature heat networks.[22]

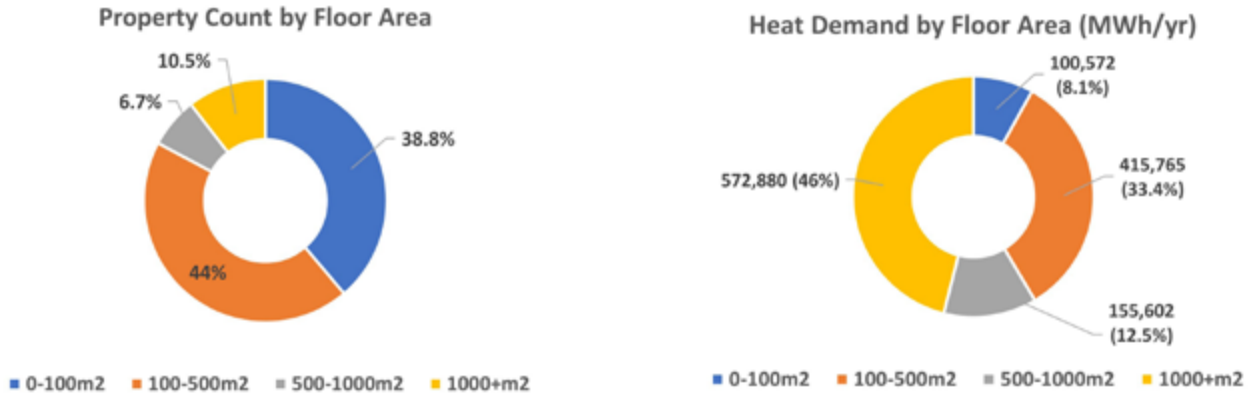



*Figure 15 - Property Count and Heat Demand by Floor Area*

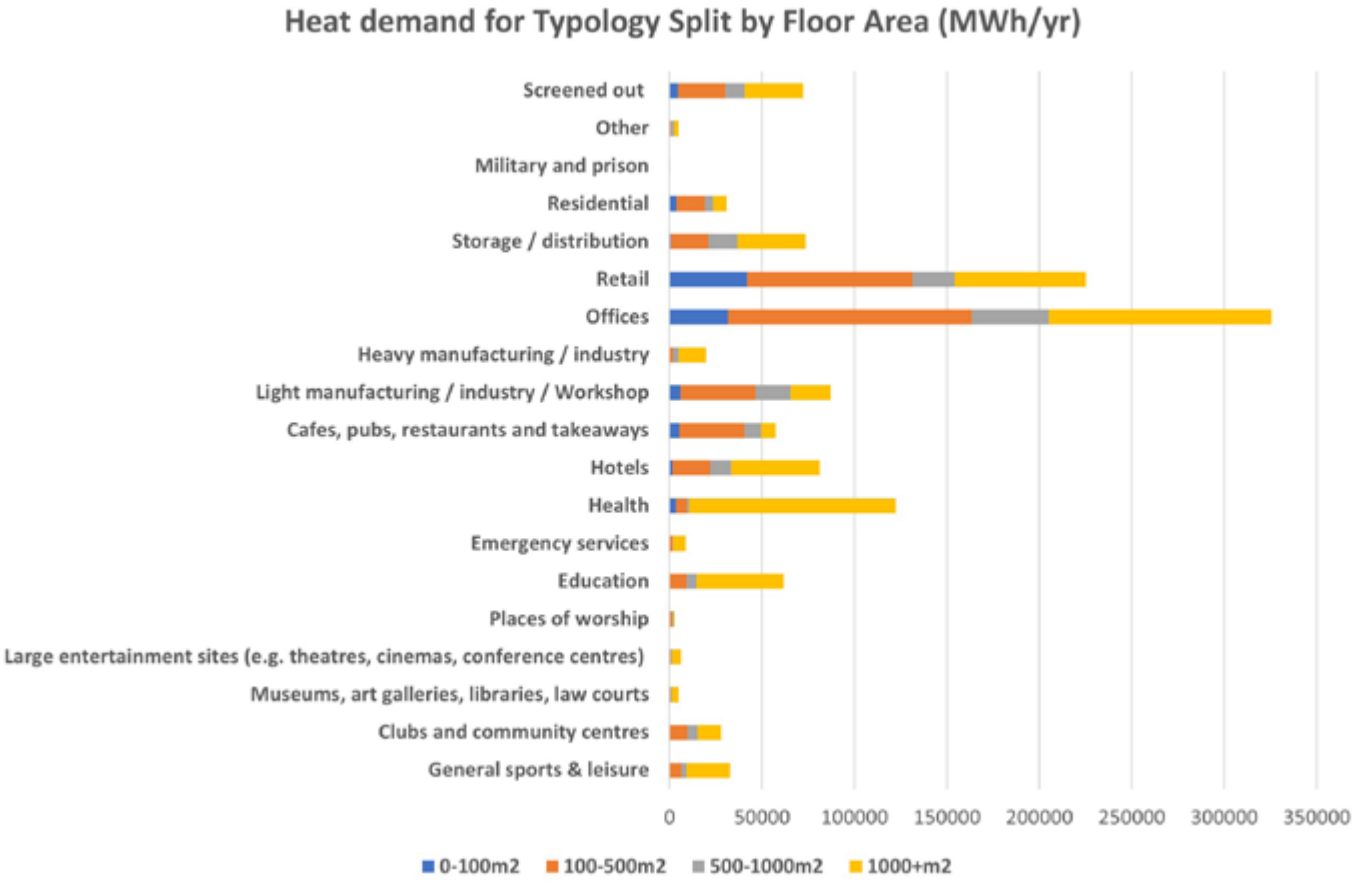



*Figure 16 Heat Demand/Floor Area by Building Use*

*[21] A low density of heat is a measure of heat demand across an area. The smaller the area, the higher the heat density.*

*[22] Heat networks supplied via heat pumps should be designed to be low temperature as far as reasonably possible. This ensures a higher coefficient of performance (CoP). However, higher temperature networks fed via geothermal or EfW heat should not be precluded as they may enable connection of buildings not typically suited to heat pumps. CoP is the ratio of heat energy produced compared to electrical energy consumption. This can be expressed as: CoP x electrical energy consumed = heat energy to network.*

Whilst 82.8% of properties have floor areas of between 0-500m$^2$, 46% of heat demand comes from properties with >1000m$^2$ floor area. For offices, which have the highest heat demand across typologies, 40% have a floor space between 100-500m$^2$ and 37% have large floor spaces of >1000m2. Health premises have floor spaces predominantly over 1000m$^2$ (91%) as do educational premises (76%). See Figure 16.

### 3.3.2.5 Property Age

The age of a property can be used as a proxy for fabric efficiency and ease of improvement. Post-1983 buildings should generally be of higher thermal efficiency, buildings constructed between 1949-1983 will have a high share of cavity walls (which, if uninsulated, are relatively inexpensive to insulate), earlier properties will have a mix of construction type with pre 1919 properties having a high portion of solid brick or stone – which are more expensive to improve. Proportion of these are shown in Figure 17.

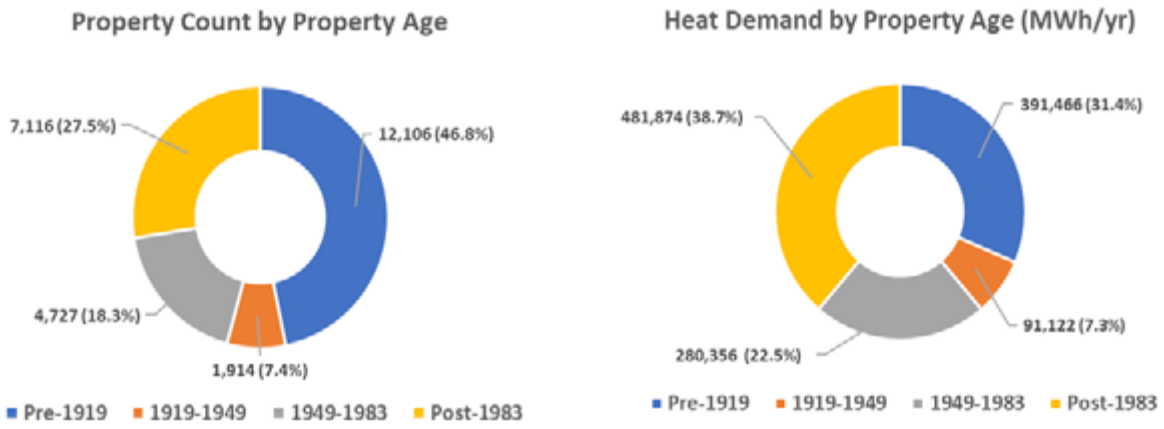



*Figure 17 Property Count/Heat Demand by Property Age*

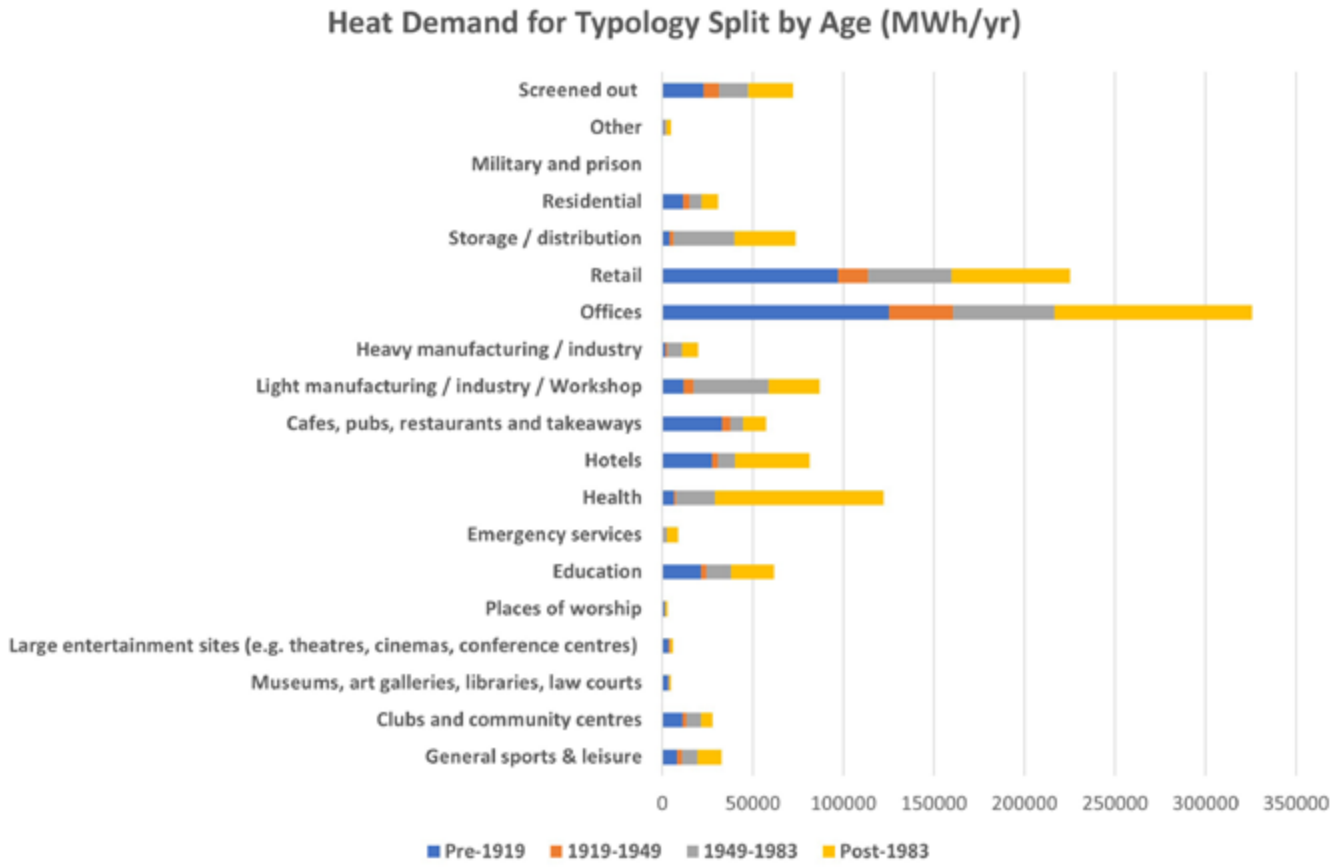



*Figure 18 Property Age by Building Use*

Pre-1919 non-domestic properties constitute 46.8% of the total count and post-1983 buildings are the second most prevalent at 27.5%. However, heat demand from post-1983 properties is higher than pre-1919 at 38.7% compared to pre-1919 buildings at 31.4%.

Offices, which have the highest heat demand across all typologies, are mixed in their age category when split by heat demand. 38.4% of heat demand for offices comes from pre-1919 buildings, 33.5% from post-1983, 17.2% from 1949-1983, and 10.9% from buildings aged between 1919-1949. Post-1983 properties account for a significant proportion of the total heat demand from hospitals in the city (76.1%). Proportion of these are shown in Figure 18.

### 3.3.2.6 Key Conclusions for the Non-Domestic Sector

Some key conclusions for Glasgow's non-domestic building stock are summarised below -

- Offices and retail premises account for 67.8% of all non-domestic properties in Glasgow and 44.3% of total non-domestic heat demand.
- Whilst health premises only account for 2.6% of non-domestic properties, they account for 9.8% of total heat demand.
- Most of the heat demand is from properties that use mains gas as their primary fuel type (53.8%) with electrically heated properties accounting for 37.8% of total heat demand.
- Properties with a floor space of >1000m$^2$ only account for 10.5% of properties but have the highest heat demand (46%). Properties with a floor space of 100-500m$^2$ have the second highest heat demand at 33.4%.
- Pre-1919 and post-1983 properties are prevalent in Glasgow, making up 74.3% of the total property count and 70.1% of the total heat demand.

## 3.3.3 Heat Networks

Glasgow already has several active heat networks which provide an opportunity to learn from these implemented schemes in terms of understanding how they progressed; and some of the challenges experienced, such as customer engagement and operational efficiency.

The Scotland Heat Map lists the schemes operating in Glasgow though many may just be a shared heating system within a smaller building. These active networks are shown in Figure 19 with some of the larger, more notable schemes including -

- **Dalmarnock Village (Formerly the Commonwealth Games Athlete's Village)** - The Athlete's Village was opened 2014 for the Commonwealth Games. It is owned by Glasgow City Council with Vital Energy responsible for the design, construction, and maintenance of the network. A 1.68 MW gas CHP energy centre connects to a 28km district heating network and supplies heat and hot water to 704 homes, Emirates Arena, Sir Chris Hoy Velodrome, a community centre, nursery school, and a 120-bed care home.
- **Clyde Gateway** - Community Energy. The Clyde Gateway Community Energy Project is a £6.2 million project, developed in partnership with Scottish Water Horizons, which has delivered an energy centre and district heating network to the Central Dalmarnock area. The combined heat & power (CHP) generator supplies electricity to the Dalmarnock Waste Water Treatment Works with the waste heat used to provide an instant supply of heat and hot water to local residents and businesses. The project has enabled the first phase of infrastructure, designed to be considerably more efficient than conventional heating and should significantly reduce energy bills in the near future.

The network went live in 2023 with connections to the Keepmoat Homes site and Eastworks building in Dalmarnock with plans to connect over 300 homes and commercial businesses over the coming years. It is a further phase in an investment programme which will eventually see the entire development area of South Dalmarnock and Shawfield area served by district heating from renewable sources.

- **Wyndford Estate –** The Wyndford Estate communal heating network was completed in 2012. It is owned by Cube Housing Association and was delivered in partnership with Vital Energy, SSE and Scottish Gas. A 1.2 MW CHP engine provides hot water and heating to 1,900 tenants of Cube Housing Association at the Wyndford Estate in the Maryhill area of Glasgow.
- **Hillpark Drive –** The Hillpark Drive communal heating system opened in 2018 for residents. It is owned by Wheatley Group and was delivered in partnership with Star Renewables and WSP Parsons Brinckerhoff. A 400 kW air source heat pump delivers low-cost heat and hot water to around 350 residents.
- **University of Glasgow –** The district heating scheme at the University of Glasgow was completed in 2016. A 3.25 MW gas CHP engine supplies heat to around 53 of the University's buildings through a 5.5km pipe network.
- **University of Strathclyde –** The district heating scheme at the University of Strathclyde was completed in 2018. A 3.3 MW gas CHP engine provides heat to the 18 of the University's buildings through a 3 km pipe network.
- **NG Homes Springburn –** The communal heating network was opened in 2021. Air Source Heat Pumps were placed on the roofs of six tower blocks under ownership by NG Homes to provide low-carbon, low-cost heating and hot water to residents. This project brought all flats located in the tower blocks into EESSH2 compliance and has reduced fuel poverty rates for residents.
- **Ibroxholm Oval –** Ibroxholm Oval is a housing estate owned by GHA in the south of the City. The area contains two high-rise blocks of flats which were heated by electrical heating. In partnership with Scottish Power Energy Networks (SPEN) and Integrated Energy Utilities (IEU), GHA designed and built a district heating solution for one of the blocks, containing 98 homes.
- **New Gorbals District Heating –** The New Gorbals district heating network was opened in 2018 and provides heating and hot water to around 300 residents in four high rise blocks. The heat network has replaced resident's costly electric storage heaters.

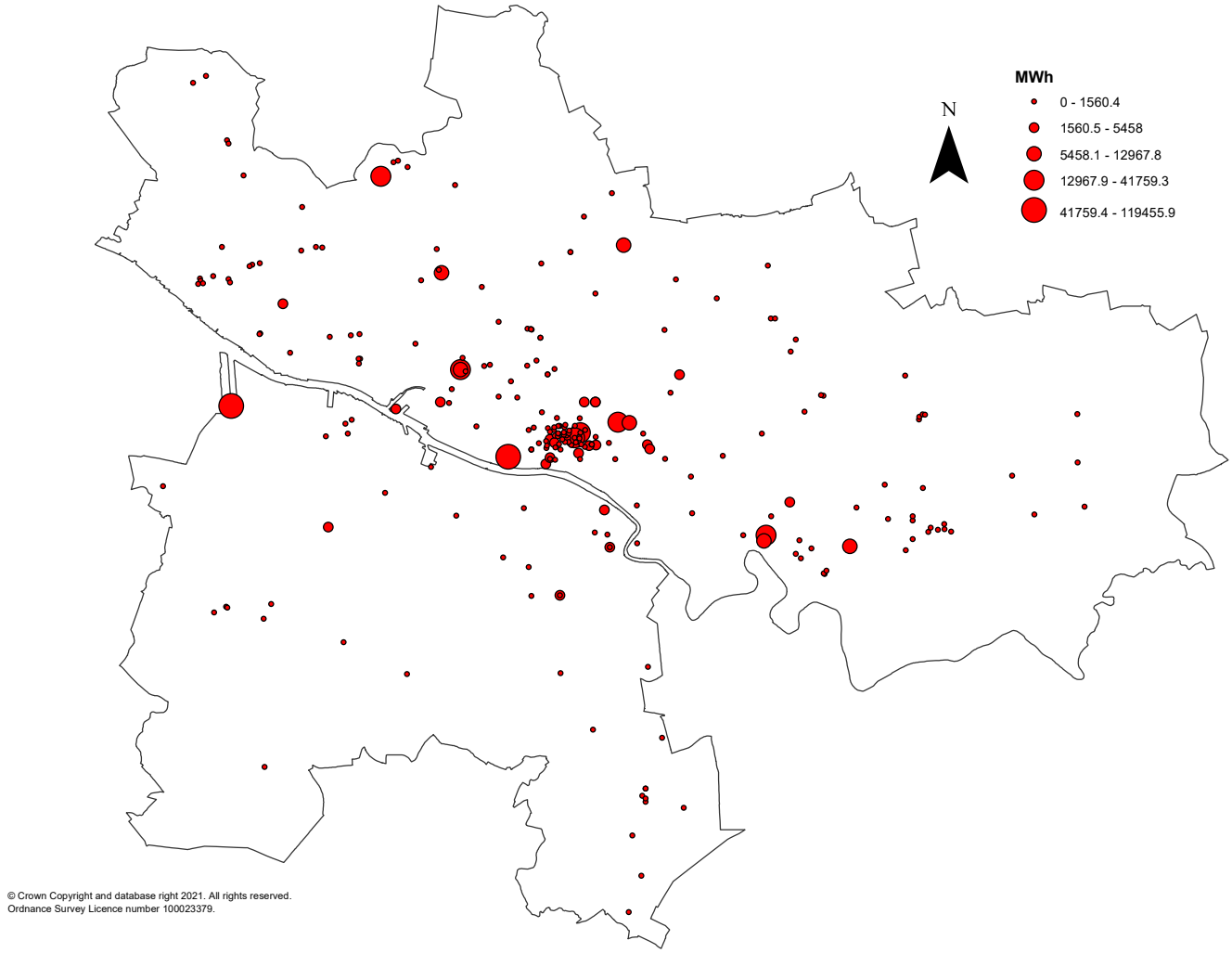



*Figure 19 -Existing Communal Heating and Heat Networks*

# 4

# KEY OPPORTUNITIES

## 4.1 Renewable or Low Carbon Heat Supply Opportunities for Glasgow

A summary of the potential sources of renewable or low carbon heat applicable to Glasgow's LHEES is included below. Where data has been available, Figure 20 highlights these opportunities from a spatial perspective.

### Heat Networks – Low Carbon or Renewable Heat Supply Opportunities

| Supply | Description |
|---|---|
| **The River Clyde** | Heat can be extracted from watercourses and waterbodies through use of a water-source heat pump. The River Clyde has significant potential for offtake of heat into a heat network, particularly in the tidal section of the river. The heat offtake potential is so high that the limiting factors are the amount limits to temperature variation alongside the need for space to locate the energy centre and heat pumps. |
| **Energy from Waste (EfW)** | Glasgow has one operational energy from waste plant, the Glasgow Recycling and Renewable Energy Centre (GRREC), and one planned, the South Clyde Energy Centre. There is demonstrable opportunity to offtake surplus heat generated at the EfW plants for supply into a heat network. |
| **Deep Geothermal** | Pre-feasibility works have indicated that Glasgow has the right geological conditions to enable deep geothermal energy extraction. A 6km deep geothermal well could produce ~200°C steam. This project has transformational potential for the heating landscape in Glasgow and could provide low-carbon heat to thousands of homes and properties, spearheading investment into both renewable energy projects and district heating. |
| **Wastewater** | Heat can be sustainably extracted from the wastewater network. There are currently two wastewater treatment plants active in Glasgow: Shieldhall and Dalmarnock. The latter is already in use as a supply for a heat network through Clyde Gateway's D2 grids project. Additionally, there is opportunity to extract heat from the wastewater pipe network. |
| **Mine Workings** | Water contained within flooded ex-mines is heated by geological processes, typically ranging between 12-20°C with little seasonal variation. Abstracting heat from water in disused mine workings therefore presents a potential renewable heat supply opportunity, particularly given the landscape in Glasgow. Further research is required into the viability of this option given the relative shallow depth of much of Glasgow's mines. |
| **Other Sources of Waste Heat** | Waste heat sources offer a relatively untapped source of energy that could potentially provide a useful means of low-carbon heat for heat networks. The opportunity presented by waste heat has not yet been fully quantified, but opportunities have been assessed in the LHEES relating to –<br>• Distilleries<br>• Supermarkets<br>• Data Centres<br>• Laundrettes<br>• Bakeries |

*Table 6 - Renewable or Low Carbon Supply Opportunities*

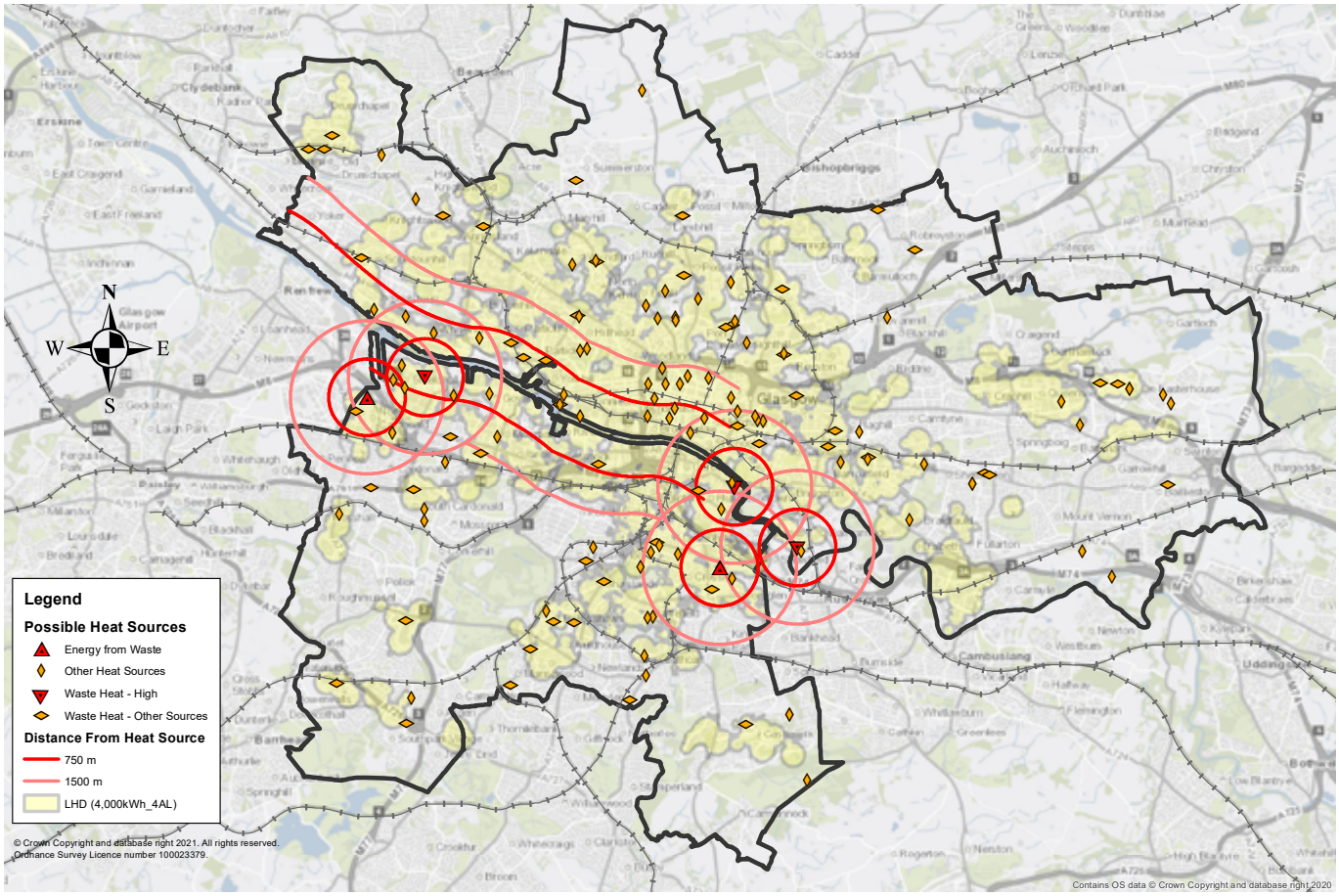



*Figure 20 - Renewable or Low Carbon Supply Opportunities Map*

## 4.2 Existing/Planned Works

There are multiple examples of heat network schemes in Glasgow either in operation or planned. Some of the key development opportunities from a larger-scale perspective are outlined below -

- **GRREC[23] Feasibility.** Glasgow City Council is currently undertaking techno-economic feasibility works with the help of consultants to better understand the potential to harness surplus heat from the GRREC to supply a heat network in the area.
- **Climate Neutral Innovation District.** The University of Strathclyde is leading a project to establish the current innovation district as a climate neutral area. Key to this is the aspiration to establish a heat network in the district supplied with heat pumps installed in the River Clyde.
- **South Clyde Energy Centre.** A new energy from waste plant is under construction in the Shieldhall area of Glasgow. The South Clyde Energy Centre (SCEC) will enter commercial operations in 2025 and will provide low carbon electricity into the grid alongside the potential for future heat offtake as part of a district heating network in the surrounding area.

*[23] Glasgow Recycling and Renewable Energy Centre. An energy from waste plant in the Polmadie area of the city. See section 4.1 above*

- **Glasgow Waters Peel Development.** Plans are in place, funded through Low Carbon Infrastructure Transition Programme (LCITP)[24], to develop a district heating scheme in the Yorkhill Quay area of the city to service a new water park development alongside leisure facilities and offices.
- **Clyde Gateway D2 Grids.** Clyde Gateway is currently progressing the development of a 5th generation district heating scheme in the east end of the city. This innovative project allows for the use of low temperature water to be circulated around the network which is then upgraded at building level to required temperatures.

*[24] LCITP is no longer active and has largely been replaced by the Scottish Government's Heat Network Fund.*

# 5

# KEY RISKS AND CHALLENGES

**Key risks and challenges for LHEES delivery are listed below. These have been framed around the identification of local priorities and corresponding LHEES Considerations in regard to: heat networks, energy efficiency & fuel poverty, and individual or communal heat pump schemes.**

## 5.1 Heat Networks

- **Demand Assurance.** Sufficient demand assurance is critical for the economic viability of any heat network project. However, for heat networks, creating sufficient demand assurance is challenging. Often, projects are faced with a situation where a potential customer indicates that it would be willing to connect to the network when it is operational but cannot or will not legally commit in advance of the network being built. Without these advance commitments, heat network developers find it harder to commit to high levels of investment. This is further exacerbated when commitments are required from multiple potential customers.

  Without certainty of a return on investment, large-scale district heating projects can have a risk-profile that is unpalatable to many investors. High project uncertainty then impacts on the cost of capital, which is critical given the large upfront costs required to construct a network. This can then negatively impact on the tariff that can be offered to customers, creating a reluctance to connect and reinforcing the challenges posed by low demand assurance as highlighted in Figure 21.

  The Scottish and UK Governments will consult on the option of mandatory connection (particularly for large heat consumers and public sector buildings) in 2023. Legislation to mandate connection is supported by Glasgow City Council although this must be accompanied by robust engagement with building owners that could be subject to such legislation.

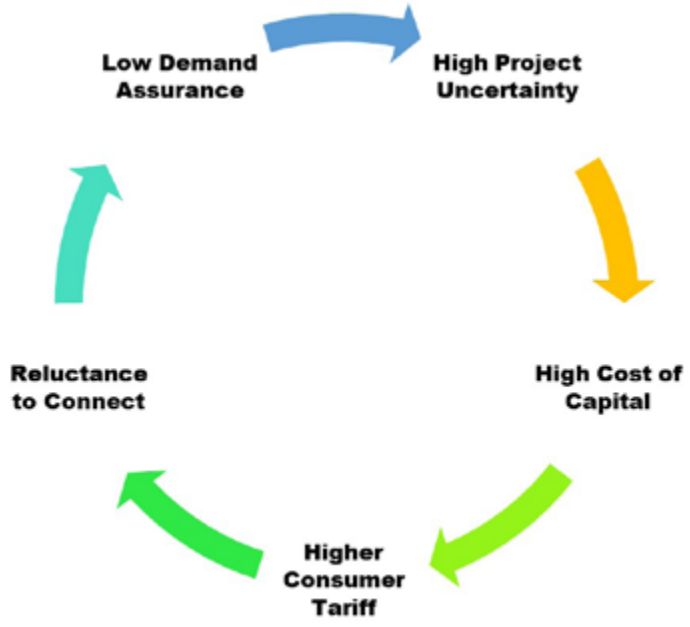



*Figure 21 - Impacts of Low Demand Assurance*

- **High Upfront Capital Costs.** Heat network schemes typically have high up-front capital costs alongside a longer-term return on investment. This causes challenges in business case development and at present, nearly all schemes require Government subsidy to make them deliverable. For Glasgow, where large-scale district heating presents a key strategic heat decarbonisation opportunity, the approach to develop large multi-phased projects will require initial investment in oversized assets meaning that schemes may run at a loss in their initial phase.

  In high density urban environments, trenching and digging to install the pipe network contributes a significant proportion of initial capital costs. **The Heat Vision 2030** project, which looked at the implementation of a heat network in the city centre of Glasgow and became the basis upon which the Climate Neutral Innovation District project was developed, attributed 82% of capital costs to the civils elements of the project.

  High upfront costs compounded with an already uncertain investment landscape can act as a barrier to unlocking lower cost capital which is critical to business case development.

- **Consumer Confidence.** Heat networks have been identified as a low-decarbonisation option by the Scottish Government from a technical perspective. However, the sector remains relatively immature in the UK and carries with it relatively low levels of consumer confidence. This is either attributable to a general lack of awareness or pre-existing poor perceptions of the technology due to issues borne in some previous projects.

  A key concern for consumers relates to being 'locked in' to a heat network with high prices and with no option to go to the open market for a better price in response. Concerns around being locked into high prices are then compounded by concerns around the reliability of a heat network to meet consumers minimum service requirements. Particularly for domestic homeowners, this can feed into a general concern around the impact on their property value.

  The regulations brought forward by the Heat Networks Act alongside the UK's Energy Bill both aim to alleviate consumer concerns by providing price caps, pricing powers of Ofgem, and a certain degree of quality assurance, but concerns persist and continue to act as a barrier in creating the demand assurance that is critical for any project to stack up.

- **Procurement.** The connection of public buildings is a key consideration for strategic heat network planning. Public buildings frequently have a high level of local government involvement (either directly owned and operated or as landlords) which can make them a relatively accessible typology to engage early for decarbonisation options as they have a higher likelihood to connect. A cluster of public sector loads can often provide a useful core for development of a heat network.

  However, coordinating connection at scale for public buildings can be difficult as they first must evidence that heat supply from a heat network demonstrates best value, which in most cases requires some form of procurement exercise. This can be challenging to plan and coordinate. This has previously served as a barrier to development with projects often stalling at (or being delayed by) the procurement phase. Lack of funding for local authorities to scope and carry out the procurement processes associated with building (or procuring connections to) heat networks has been identified as a common hurdle for the successful delivery of heat network projects. Furthermore, skills gaps among local authorities carrying out this type of procurement exercise also presents a challenge due to the unfamiliar contracting policy (i.e. long term 25 year plus energy services contract in comparison to typical 1-2 year gas supply contract). Navigating the public procurement routing is identified as one of the most significant barriers that projects must overcome.

- **Negative Subsidy: Non-Domestic Rates. Non-Domestic Rates.** (NDRs) are valued differently for heat networks compared to conventional utilities infrastructure such as gas and electricity. For heat networks, the rateable value is set by the construction costs of the network and elements of the energy centre (which are typically very high) whereas for conventional utilities, the rateable value is set by the unit cost of the product being sold. Until non-domestic rates are reassessed on a long-term basis for heat networks, they will struggle to compete against conventional utilities.

  The Scottish Government introduced a 50% rates relief for district heating installations in 2017 until 2032. The Scottish Government then introduced a 90% relief on NDRs for new district heating networks powered by renewables from 2021. This relief will be available until 31st March 2024. The extension of this relief is currently under review by the Scottish Government. However, to date a permanent solution has not been established, contributing further to investment uncertainty and correspondingly high costs of capital borrowing that is atypical of heat network projects. Glasgow City Council is supportive of a permanent solution to the current challenges posted by non-domestic rates.

- **Counterfactual: Operating Costs.** The cost of electricity remains high in comparison to the price of gas. This is in part related to the current structure of the UK energy market that ties the price of electricity to the price of gas. The UK Government is currently consulting on the possibility of decoupling electricity prices from gas prices to bring electricity cost closer to the average cost of generation[25] (generation costs are lower for renewables, which take up an increasingly larger portion of overall generation, than fossil fuels).

  There is currently no statutory deadline for buildings in Scotland to have a decarbonised heating solution in place and until this is set, the counterfactual against which heat networks will be compared against from a consumer cost perspective remains as gas. Evidencing a clearly demonstrable rationale for consumers to connect to a heat network away from main gas is therefore challenging in the absence of clear policy direction around decarbonised heat for existing buildings.

  For some organisations which have made commitments in relation to net zero heat in existing buildings and new-build, the counterfactual for district heating will be individual heat pumps. Heat networks projects must be able to demonstrate they can offer a cheaper alternative to individual heat pumps (which they will if deployed in areas of high heat density due to their higher efficiency). However, for the majority of buildings, challenges persist for incentivising a switch from gas.

  The Scottish Government's upcoming Heat in Buildings consultation may provide clarity on an expected date for buildings to disconnect form the gas network and until this date is set, the counterfactual comparison to mains gas rather than individual heat pumps remains a barrier to development.

- **Designing Efficient Networks for the Future.** Planning for delivery a multi-phase heat network represents a significant design challenge. The presence of multiple different overlapping variables (such as projected v actual heat offtake and guarantees on the timing of connections) creates difficulties in the design stage. Oversized networks, which assist in future-proofing development, may run at a loss as they operate initially at part-load and are more difficult to fund at the outset.

  Connection dialogue with heat offtakers is prone to stalling, which impacts of the planned build phasing and therefore the investment case. Alternatively, whilst undersized networks may provide a more positive initial business case due to being reliant on fewer variables, they can then run into difficulties when looking to expand. Expansion may be inhibited due to undersized pipes or the requirement to add additional supply capacity. Ensuring that heat networks can operate at maximum operational efficiency is a key challenge directly relatable to challenges around the initial sizing of the network alongside build phase plans.

[25] *Review of Energy Market Arrangement (REMA).*

There are mitigating tools that can help to improve operational efficiencies for heat networks and these can range from digitalisation of systems (the use of smart software systems that enable connected buildings to communicate with each other and optimise the system in real time, addressing inefficiencies created by networks typically running at 'coldest day conditions') to the concept of modular networks that have separate energy centres but are constructed to be interoperable with each other, circumventing some of the challenges around getting the build phase correct in the design stage. All available mitigating tools should be considered when developing heat network projects for Glasgow.

- **Fabric First: Aligning Priorities.** In the context of Glasgow's 2030 net zero carbon target, the principle of addressing fabric first[26] presents a risk. Achieving this target will require the city to simultaneously improve energy efficiency (EE), as a means of reducing demand, and decarbonise heat supply, rather than successively. It is important to consider the interaction of these policy priorities to ensure both are complementary rather than inhibitive to each other. A greater understanding of what energy efficiency improvements to our buildings are possible alongside an effective programme of retrofit to deliver these improvements will assist in the convergence of these strategic priorities.

- **Supply Chain and Skills Capacity.** Scotland has set ambitious targets relating to heat networks and climate change. There is at present a gap between the targets set and the capacity of our supply chains and skills to deliver them. This presents a key risk to the deliverability of heat networks in Scotland and the wider LHEES agenda.

- **Data Confidence.** Much of the data landscape surrounding heat networks is yet to be quantified to a sufficient degree of reliability. The Scottish Heat Map assigns confidence levels to each heat demand point and the majority of these are classed as the lowest level of confidence (C1), see Figure 22. There can often be a reluctance from commercial organisations to submit accurate demand data due to perceptions around commercial sensitivity. To design investable heat network projects, the average confidence level of demand data must improve. Similarly, supply data remains largely unquantified. Where feasibility works have been completed, a specific supply opportunity may have been quantified but at present there is not a uniform data source for this in Scotland. The upcoming Building Assessment Reports (BARs) duty under the Heat Networks Act will help to improve confidence in the data landscape for public sector buildings and this may, in time, extend to all non-domestic buildings.

*[26] 'Fabric first' refers to the approach in building design that seeks first to maximise the output of the existing components of the building before considering measures to decarbonise the energy supply.*

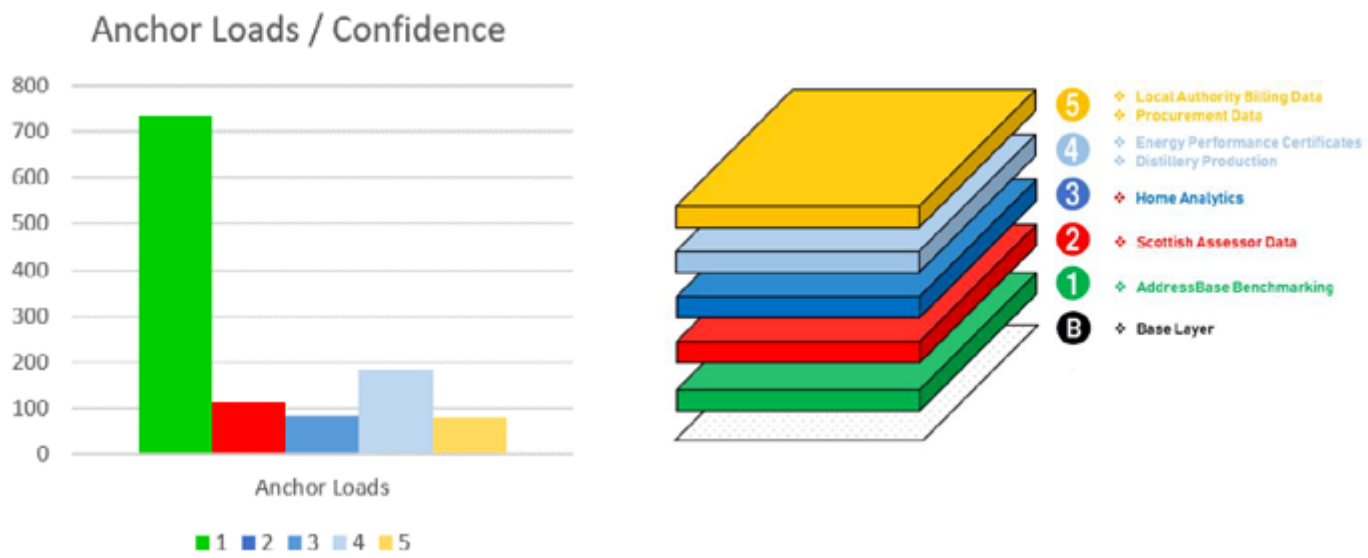



*Figure 22 Heat Demand Data Confidence*

## 5.2 Poor Energy Efficiency and Fuel Poverty

- **Pre-1919 Tenemental Buildings.** Traditional pre-1919 tenemental housing is an iconic element of Glasgow's cityscape. These buildings typically consist of three or four stories and are built from red or blonde sandstone. Often located in areas of high demand and characterised by mixed-tenure arrangement within individual blocks. Whilst these dwellings are an iconic part of the cityscape and popular choice for residents, they are also big carbon emitters with heat loss through sandstone walls, sash windows, roofs and floors. As a result, they can be expensive to heat due to their poor energy efficiency, contributing to fuel poverty and unhealthy living conditions in unheated homes, which are often cold and have higher incidences of damp and mould.

  Pre-1919 dwellings are built using traditional construction methods. This means they have solid stone masonry walls, are built from natural materials such as slate, timber, stone and lime that allow moisture transfer, and have a design that provides passive ventilation. They are classed as "hard to treat" in retrofit terms because standard approaches to improve energy efficiency, such as increasing the insulation, airtightness and ventilation to achieve the building fabric thermal performance required to install low or zero carbon heating systems, are generally not easily replicable and can be expensive to do.

  Additionally, many of Glasgow's pre-1919 buildings are either listed, are situated in conservation areas, or both. This creates a challenging environment to undertake retrofit interventions that for solid-stone buildings would typically involve installation of external wall insulation.

- **Mixed Tenure.** Around 74% of Glasgow's homes are flats, often with multiple ownership and tenures within individual blocks. This can result in underinvestment where repair is needed for common areas if the respective owners cannot agree on or collectively pay for the maintenance required. Whilst factoring should be present, it is often ineffective. This is particularly challenging in developing models to retrofit existing properties at scale for the city, which require, as a prerequisite, the building to be in good repair and the property owners to have the financial ability and willingness to partake in the improvements. Multi-tenure occupancy can cause difficulties in maximising uptake in Area Based Scheme (ABS)[27] projects also with some properties often unable to proceed due differing funding criteria . This is equally challenging for the installation of low-carbon heating systems such as air source heat pumps where viability improves if there is investment at block level. For Glasgow to reduce and decarbonise its heat, solutions must be designed to function for mixed-tenure occupancy and alleviate rather than exacerbate efforts to tackle fuel poverty.

- **Owner Occupied Dwellings.** Owner occupied properties make up half of Glasgow's domestic properties, rising to 63% when those properties rated EPC A-C are removed. Whilst properties with an EPC rating of D and below area-focus for retrofit targeting, many properties with EPC rating between A-C (compliant with EPC targets for owner occupiers) still utilise gas boilers and will need heat supply solutions in order to fully decarbonise.

  Developing policy around retrofitting owner-occupied properties is a complex task. Financial savings for homeowners having their property retrofitted have often been found to be smaller than predicted which makes one of the key incentives, cost saving, tenuous. Carbon savings can be an insufficient motivator in isolation for many owner-occupiers, and many would rather spend money on improvements that have a stronger visual impact. Where there is a more clarified pathway for delivering energy efficiency improvements for social housing and, to an extent, the private rented sector, owner occupiers need comprehensive framework of incentivisation and/or regulation to retrofit their home. Achieving national EPC targets will require a targeted long-term approach to owner-occupied properties and policy must focus on engaging with owner occupiers to develop a better understanding of the motivators to retrofit at individual level alongside the establishment of robust funding mechanisms at the national level designed to support homeowners to make the right choice.

*[27] See Appendix C for discussion on the EES:ABS funding criteria*

- **Private Rented Dwellings.** Privately rented homes account for 16% of housing in the city. There are higher concentrations found in the "harder to treat" pre-1919 properties, over a quarter of traditional tenements are privately rented. Private landlords, particularly commercial landlords with large portfolios, are often less able to access grant funding for energy efficiency measures or full retrofit to provide low or zero carbon heating systems.

  Affordability will be a key factor affecting the response of landlords to the decarbonisation agenda. Lack of funds may inhibit or prevent retrofit delivery and in mixed tenure blocks stymie whole building approaches. As with other tenures, a careful mix of incentivisation and legislation will be required to compel action.

- **Non-Domestic Properties.** For Glasgow, which has just under 25,900 non-domestic properties, understanding how to sequence the transition of non-domestic properties to a higher degree of energy efficiency and low-carbon heating is essential.

  Non-domestic properties pose unique challenges due to their diverse character and often underreported energy efficiency ratings. Around three in four non-domestic buildings across Scotland are EPC E or lower and 5% EPC B and above which outlines the scale of the challenge.[28] However, rather than indicating that non-domestic buildings are energy inefficient, these statistics are indicators that non-domestic properties are simply high heat consumers.

## 5.3 Individual and Communal Heat Pumps

- **Connection Suitability.** Individual and smaller communal heat pump schemes remain technically challenging due to the typically poor energy efficiency of a large proportion of Glasgow domestic and non-domestic building stock. Where density is insufficient for a heat network to be feasible, property or communal level solutions to decarbonisation will likely be a more appropriate pathway.

  Whilst heat pumps use energy more efficiently than gas boilers or electric heating (typically 3 times more efficiently) this is caveated by the fact that electricity is more expensive than gas and that the efficiency of a heat pump is a function of the energy efficiency of the property in which the heat pump is installed. The presence of these factors can often amount to heat pumps being of a similar cost to run for consumers than conventional heating methods.

[28] *Non-domestic EPCs are rated differently from domestic EPCs which makes comparison challenging.*

As a result, whilst any property can likely be renovated for a heat pump, the cost of retrofit alongside the higher cost of electricity typically means that those properties with better energy efficiency are more suited to heat pumps. This is however only a static view of heat pumps. It is likely that as the cost of electricity reduces as well of the cost of retrofitting, the average suitability of heat pumps across all archetypes from a technical and financial perspective will improve. Targetting those properties that present as most suitable will aid in overcoming these obstacles by supporting market expansion of heat pumps.

- **Funding.** There is yet to be a defined funding pathway for domestic properties to install individual heat pumps. Until there is a clarified funding approach, action relating to individual and communal heat pump schemes for Glasgow remains high-level and speculative.

- **Cost of Electricity.** The cost of electricity remains vulnerable to volatile gas markets (see section 5.1). This presents challenges in incentivising individuals to switch from gas boilers to heat pumps and can make project development at community level difficult. Until a deadline is established to stipulate disconnection from mains gas, gas will remain the counterfactual against electricity with the latter typically more expensive.

# 6

# A STRATEGIC APPROACH FOR HEAT NETWORK DEVELOPMENT

## 6.1 Strategic Objectives

For heat networks to succeed in Glasgow, the sector's investability must improve. This will require a comprehensive mix of policies at local and national level designed to ensure that there is minimum additional cost compared to gas and to maximise the incentive to switch. The cost of heat compared to conventional fuels like gas is a key driver of this, but heat networks must also be shown as the most cost-effective decarbonisation option for buildings within indicative Heat Network Zones. Glasgow's LHEES Delivery Plan includes action to lower the risk attached to investment and connection. The Council and city stakeholders must work to build the case for heat networks within Heat Network Zones as the Zones move from indicative to designated.

The Council will work to produce feasibility studies for each indicative zone, focusing on improving demand confidence, clarifying supply options, and engaging with potential anchor load connections. This must be done in conjunction with communication at city level on the potential benefits presented by heat networks.[29] Delivering heat networks in Glasgow will be informed by the provisions of the Heat Networks (Scotland) Act 2021 alongside a locally led focus which is framed around three strategic objectives.

| Strategic Objectives for Heat Networks Delivery | Description |
|---|---|
| **1: Build the Case for Heat Networks in Glasgow** | The City Council and partners must work to build the case for heat networks as a mechanism for stimulating connection dialogue whilst ensuring that the city is prepared for change. In the absence of a mandate to connect into a network, delivery of this objective is tied to delivery of the second strategic objective. This work will help to strengthen investor confidence that there is a market for heat network development in Glasgow. |
| **2: Catalyse Private Finance to Unlock Delivery** | Significant private finance will be required to enable the delivery of large-scale district heating projects in Glasgow. In the short term, LHEES delivery will focus on reducing uncertainty and creating an attractive landscape for heat network investment. |
| **3: Alignment with City Goals** | Glasgow must ensure that heat networks are deployed in a manner that contributes to strategic goals around carbon reduction and fuel poverty and do not solely serve a commercial purpose. |

*Table 7 - Strategic Objective for Heat Network Delivery*

[29] *These benefits are framed using the Energy Trilemma which looks to balance affordability, reliability and sustainability in the development of energy systems.*

## 6.2 A Phased Approach

The delivery of the LHEES must take a long-term vision to enable Glasgow's heat transition alongside targeted short-term action to ensure that Glasgow maintains its pace. The development of a phased approach allows for the City to characterise its vision in the long term and sets a broad plan on how to get there. Future iterations of the LHEES will help to populate the later Phase III whilst this current LHEES (LHEES1) will primarily address Phases I and II.


| Phase | Overview | Timescales |
|---|---|---|
| **Phase I: Creating an Investable Landscape** | Phase I will consist of pre-capital and engagement works to scope deliverable heat network projects within designated Heat Network Zones. This will also involve the development of a delivery model to deploy heat networks in Glasgow, including the possibility of establishing an Energy Partnership. | **2024-2029 (LHEES1)** |
| **Phase II: Initial Project Delivery** | Phase II will see the first heat networks delivered in Glasgow through the LHEES Delivery Plan. This will be focused on coordinating delivery towards those areas that are the most suitable from a technical, economic and strategic perspective in a balanced manner to create an initial footprint for larger heat networks in Glasgow. | **2024-2029 (LHEES1)** |
| **Phase III: Expansion** | Phase III will focus on growing the heat networks sector in Glasgow, focusing on expansion of the networks delivered during Phase II and pushing development into areas of the city that will become 'unlocked' due to Phase II works. This phase will seek to increasingly embed strategic goals around fuel poverty and carbon reduction into expansion plans as the commercial case for investment improves due to Phase I and II activities. Plans for Phase III will be further clarified upon development of the second LHEES. By this time, less feasible sources of waste heat may now have become viable for use and less commercially attractive properties may now have a pathway to connect. | **2029-2034 (LHEES2)** |

*Table 8 - Phased Approach to Heat Network Development*

# 7

# DEVELOPING LHEES ZONES

# 7. Developing LHEES Zones

The LHEES provides a framework for delivery alongside a spatial evidence base for where in Glasgow interventions targeting carbon reduction and/or fuel poverty may prove the most successful. This is provided at both strategic and delivery level where appropriate. Therefore, Glasgow's LHEES identifies areas in the city that have the most potential to deliver on the following:

- **Deployment of Heat Networks.** Whilst heat networks are recognised as a low-regret approach to decarbonisation, the sector remains relatively immature in the UK. Identifying where heat networks have the best chance of success from a commercial perspective and balancing this against strategic priorities for the city on fuel poverty and carbon reduction has framed the zoning process that Glasgow has undertaken.
- **Tackling Poor Energy Efficiency as a Driver of Extreme Fuel Poverty.** Glasgow is working to eliminate fuel poverty at pace and in line with statutory targets. The LHEES has identified areas in Glasgow where energy efficiency interventions may have the greatest impact on the alleviation of fuel poverty for our most vulnerable citizens. This work has considered key indicators of poor energy efficiency in conjunction with local fuel poverty rates.
- **Individual/Community Scale Heat Pumps**. • Whilst a significant proportion of Glasgow has a density of heat that indicates viability of district heating, it is unlikely that district heating will provide 100% of the heating solution for the whole of every Indicative Heat Network Zone. Additionally, there are areas of the city where analysis has indicated insufficient density to support a network. The LHEES has identified areas with concentrations of domestic properties that may be suitable for the deployment of individual heat pumps or smaller communal heat network schemes. This work has included an assessment of building thermal efficiency and consideration of any planning restrictions that may impede delivery. This work has assessed areas within Indicative Heat Network Zones also.
- **Targeting Pre-1919 Domestic Properties.** Glasgow has a large stock of hard to treat pre-1919 buildings. Reducing the carbon footprint of this property type will likely require a targeted and custom approach. The LHEES has identified areas in the city with high concentrations of pre-1919 properties as an evidence base to direct related projects towards.

## 7.1 Strategic Mapping – a Citywide Approach

Strategic mapping was completed to provide an initial assessment of the city and identify where interventions are required or most suitable. The analysis acts as a starting point to support the generation and prioritisation of more granular delivery areas. **Strategic zones were generated to assess at city level based on: heat demand/density, where poor energy efficiency is driving fuel poverty, individual/communal heat pump suitability,[30] and concentrations of pre-1919 properties.**

[30] *Domestic properties that are either suitable for heat pump connection or in need of fabric improvements that will enable heat pump connection.*

### 7.1.1 Heat Demand/Density

Initial analysis of Glasgow's heat demand using the Scotland Heat Map, indicated a **total heat demand of 6.27 TWh/yr.** For comparison, the City of Edinburgh has a total heat demand of 5.4 TWh/yr. Much of Glasgow's heat demand is concentrated into smaller areas of the city, providing areas of high density of heat that presents a significant opportunity for the deployment of large-scale district heating systems.

To provide a strategic guide of Glasgow's heat dense areas, Figure 23 was plotted to display heat demand aggregated to intermediate zones in Glasgow[31]. The figure below illustrates that the city centre, much of the west end, parts of the southside, sections of the Gorbals and the Linthouse area are the most heat dense areas of the city. To contextualise this, the total heat demands in these areas are likely influenced by the presence of large anchor loads[32], for example: the Scottish Events Campus, all the city's universities, the Strathclyde Distillery, the city's hospitals (Queen Elizabeth University Hospital is a key contributor to the total heat demand in the Linthouse area) and industrial activity along the river. Additionally, sitting beneath the large anchor loads, high heat demand in the west end and the southside is likely also a result of low levels of thermal efficiency within domestic and non-domestic properties.

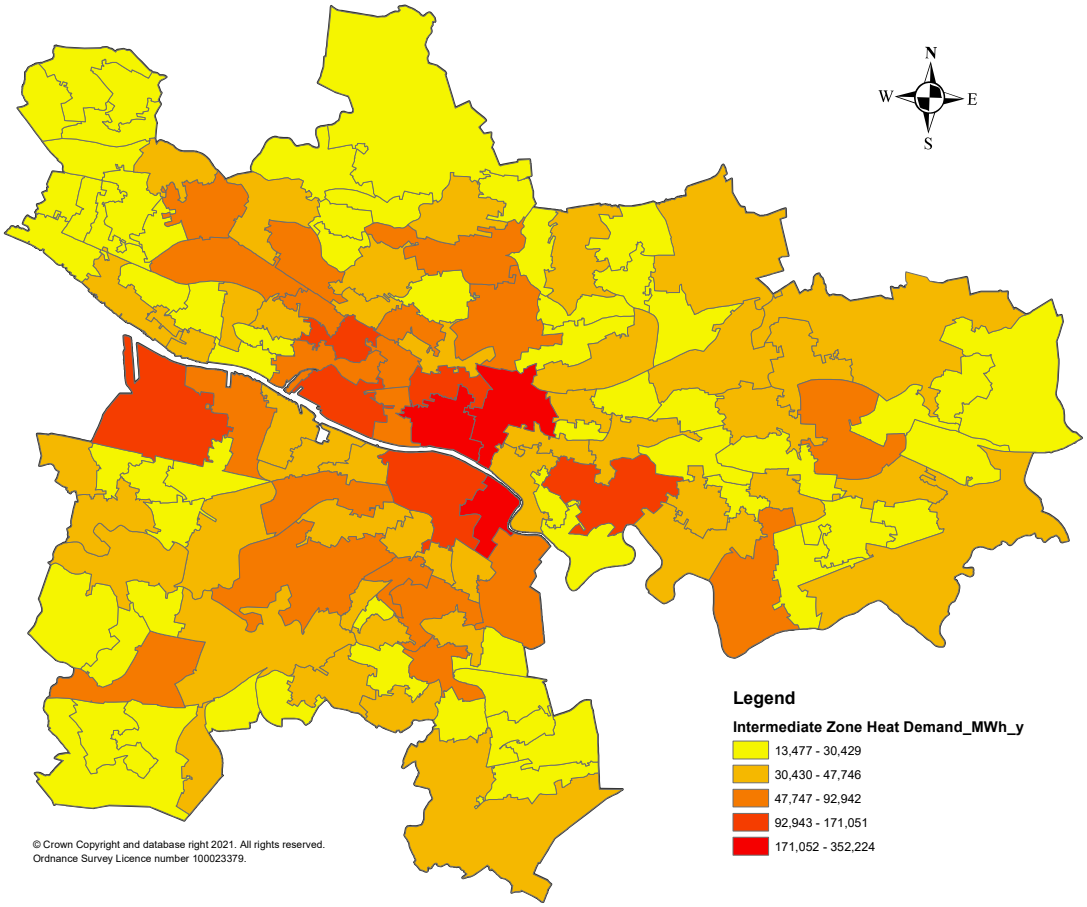



*Figure 23 - Heat Demand by Intermediate Zone*

[31] https://www.data.gov.uk/dataset/133d4983-c57d-4ded-bc59-390c962ea280/intermediate-zone-boundaries-2011

[32] *Buildings with a high heat demand and a stable heat use pattern. These buildings, assumed as connecting into a network, are typically critical in proving the initial economic case for any heat network project. Typical examples include leisure centres with swimming pools and hospitals*

The majority of pre-1919 tenemental buildings which typically have poor thermal efficiency exist in these areas of the city. This serves to raise the total heat demand of these areas. Fuel poverty may also be supressing heat demands in more deprived areas of the city causing them to register at lower levels.

### 7.1.2 Poor Energy Efficiency as a Driver of Fuel Poverty

To assess at a strategic level where poor energy efficiency is believed to be driving fuel poverty, the Home Analytics database produced by the Energy Saving Trust was used alongside tools developed for the LHEES by Zero Waste Scotland on behalf of the Scottish Government. The approach can consider four different building fabric criteria with specific weightings, as shown in Table 9, to produce a total weighted score.

| Indicator | Default Weighting | Glasgow Weighting |
|---|---|---|
| **Fuel poverty probability** | 50% | 0% |
| **Extreme fuel poverty probability** | 0% | 50% |
| **Single Glazing Windows** | 16% | 0% |
| **Loft Insulation (<100mm)** | 16% | 0% |
| **Wall Insulation** | 17% | 50% |
| **Total** | **100%** | **100%** |

*Table 9 – Weighting Criteria for Energy Efficiency/Fuel Poverty Strategic Mapping*

The weightings applied to each of these can be adjusted to suit local circumstances and retrofit actions. Engagement with GCC NRS Housing Services provided guidance to weight the poor energy efficiency indicators fully to the wall insulation indicator. Around 42% of Glasgow's domestic properties are without wall insulation and therefore the

The initial analysis undertaken used all those estimated to be in Extreme Fuel Poverty (approximately 14% of Glasgow population)[33] and those with a >70% chance of having no wall insulation.

[33] *This figure is thought to be substantially higher in reality due to the compounded impacts of the cost-of-living crisis*

This is plotted in Figure 24 which identified areas dominated with pre 1919 architecture, potentially correlating the lack of wall insulation in individual dwellings and extreme fuel poverty in certain areas of the west end and southside areas of the city. From this, the highest scoring 10 data zones have been highlighted in Figure 25. Due to the difficulty in retrofit in the indicated areas, these properties may benefit from supply decarbonisation measures, such as connection to a heat network or an individual heat pump, rather than demand reduction measures as a mechanism of lowering or stabilising energy costs to tackle fuel poverty.

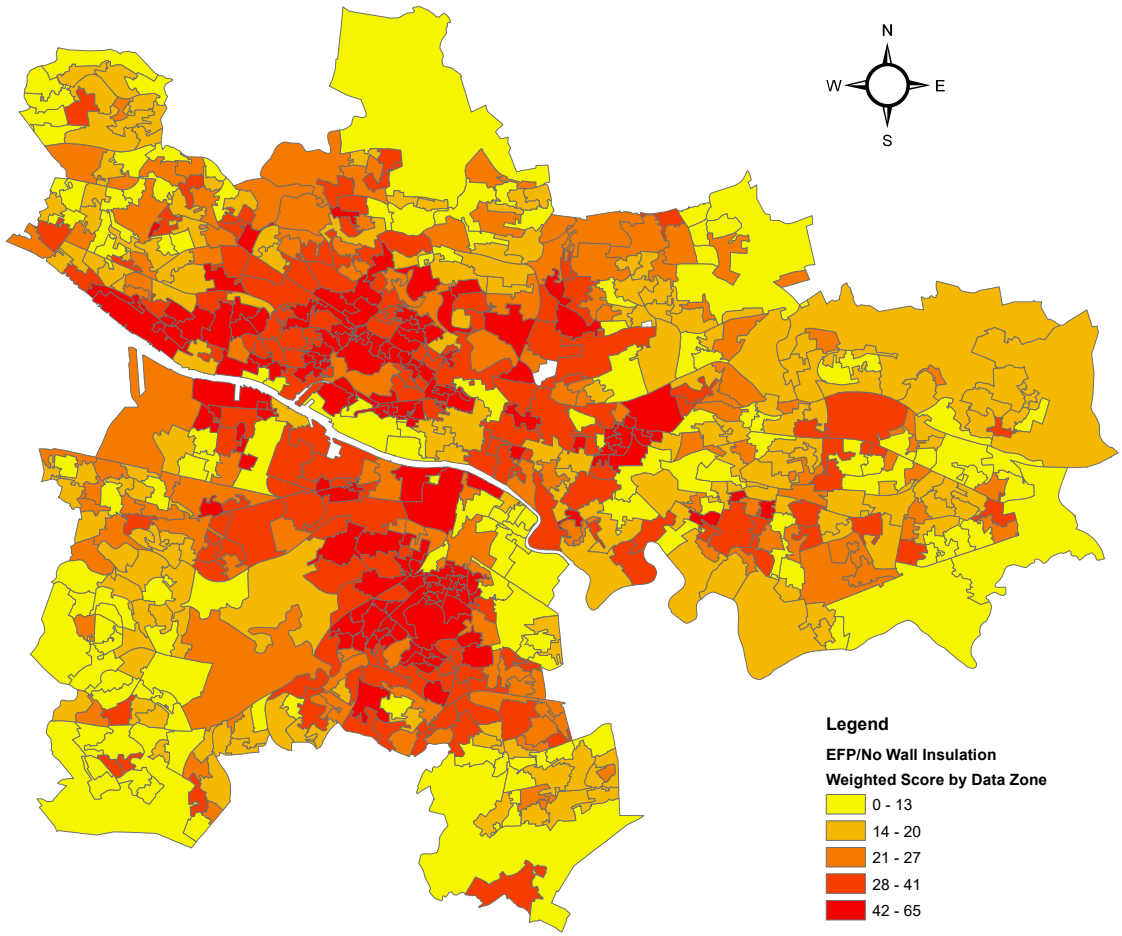
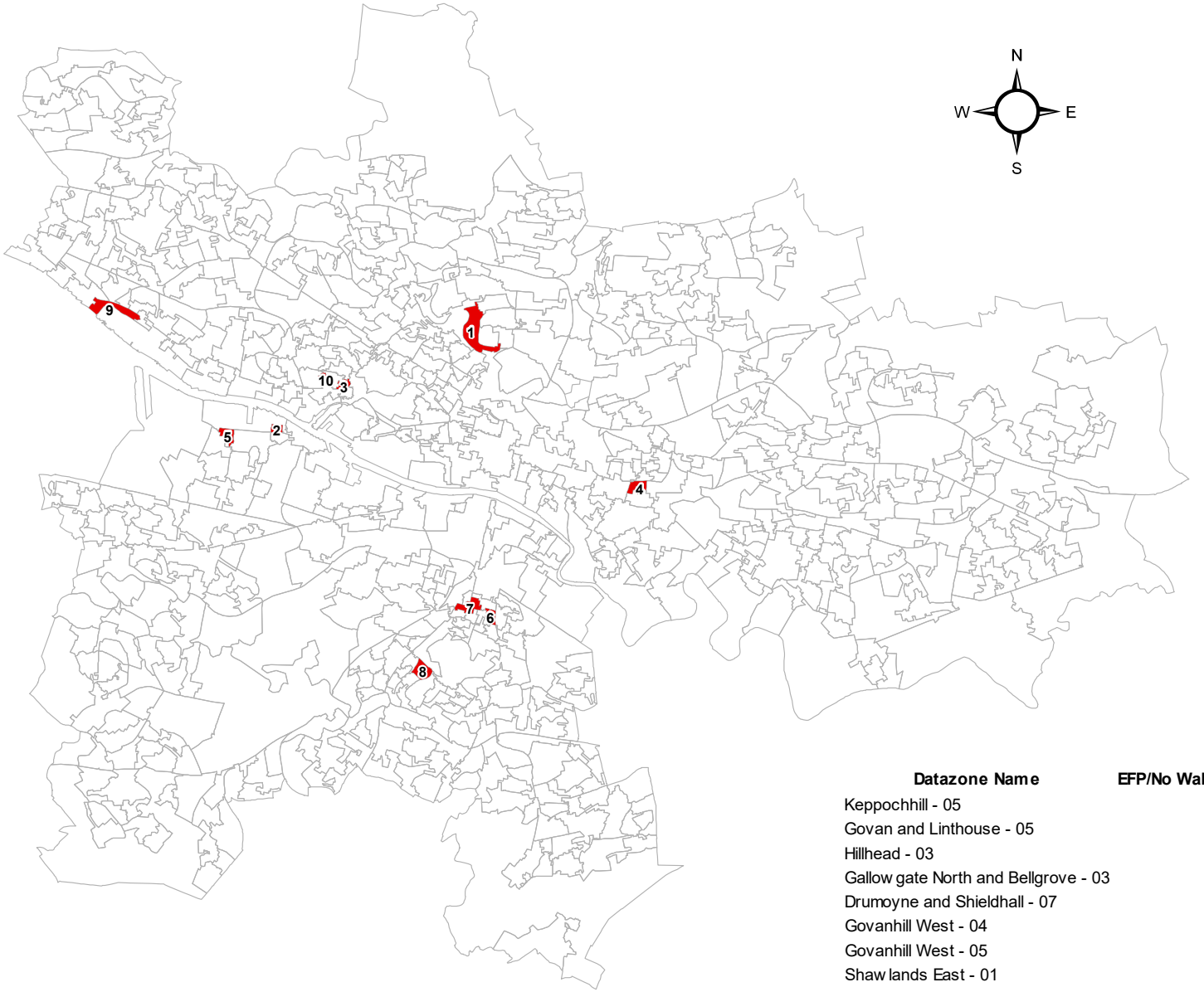





*Figure 24 - Extreme Fuel Poverty and No Wall Insulation by Data Zone*




**Legend**

**EFP/No Wall Insulation Top 10 Datazones**

**Datazones**

| Datazone Name | EFP/No Wall Insulation Rank |
|---|---|
| Keppochhill - 05 | 1 |
| Govan and Linthouse - 05 | 2 |
| Hillhead - 03 | 3 |
| Gallow gate North and Bellgrove - 03 | 4 |
| Drumoyne and Shieldhall - 07 | 5 |
| Govanhill West - 04 | 6 |
| Govanhill West - 05 | 7 |
| Shaw lands East - 01 | 8 |
| Scotstoun South and West - 01 | 9 |
| Hillhead - 05 | 10 |



Glasgow CITY COUNCIL

*Figure 25 Initial Prioritised Locations Identified for Wall Insulation Retrofit to Reduce Extreme Fuel Poverty*

## 7.1.3 Individual or Communal Heat Pumps (On Gas Grid)[34]

Concentrations of domestic properties with four different categories of suitability for individual heat pump installation were identified at data zone level[35]. Properties classified as highly suitable can also be used as a proxy for connection suitability into a heat network, either as a communal network or a larger district heating network. Fabric efficiency, planning restrictions (listed buildings or conservation areas) and type of heating system[36] were assessed in tandem to identify areas of strategic interest for Glasgow correlating to four distinct categories which are detailed below alongside some commentary of the maps presented in Figures 26, 27, and 28.

- **Category 1.** Figure 26, properties considered highly suited for heat pump retrofit (i.e., well insulated properties with a wet heating system, excluding consideration of electricity network or costs of network upgrades). Category 1 properties are most common in areas of Glasgow where the average building age is lower and there are less listed buildings or buildings within conservation areas. This highlights those areas further from the city centre, west end and southside and being particularly suitable for heat pump installation. The identification of Category 1 properties can also be used as a proxy for connection into a larger low temperature heat network.[37]
- **Category 2.** Figure 27, properties with secondary potential for heat pump retrofit (i.e., those in need of moderate fabric upgrade and/ or addition of wet distribution system to be heat pump ready). Category 2 properties are evenly spread across Glasgow with concentrations found both in the central area of the city alongside those areas nearer the authority boundary.
- **Category 3.** Figure 28, those with tertiary potential for heat pump retrofit (i.e., properties in need of significant fabric upgrade to be heat pump ready) or those less suited to heat pump technology. Category 3 properties are typically found in the west end and southside areas of the city where there are high concentrations of pre-1919 properties that can often have planning restrictions attached to them alongside a level of thermal efficiency considered challenging for individual heat pumps to be considered a viable decarbonisation pathway from a financial perspective

A full matrix of the default indicators, criteria and weightings are provided in Appendix D.

*[34] Domestic properties with varying degrees of suitability for heat pump installation*
*[35] https://spatialdata.gov.scot/geonetwork/srv/api/records/7d3e8709-98fa-4d71-867c-d5c8293823f2*
*[36] Wet or dry heating systems. Wet heating systems (gas boilers) are typically easier to connect into a heat network or retrofit for a heat pump than a dry system (electrical heating).*
*[37] It is important to distinguish between low and high temperature heat networks. Low temperature networks require a sufficient threshold of thermal performance from connected buildings to operate. Higher temperature networks can offer a heating solution to buildings with lower levels of thermal efficiency.*

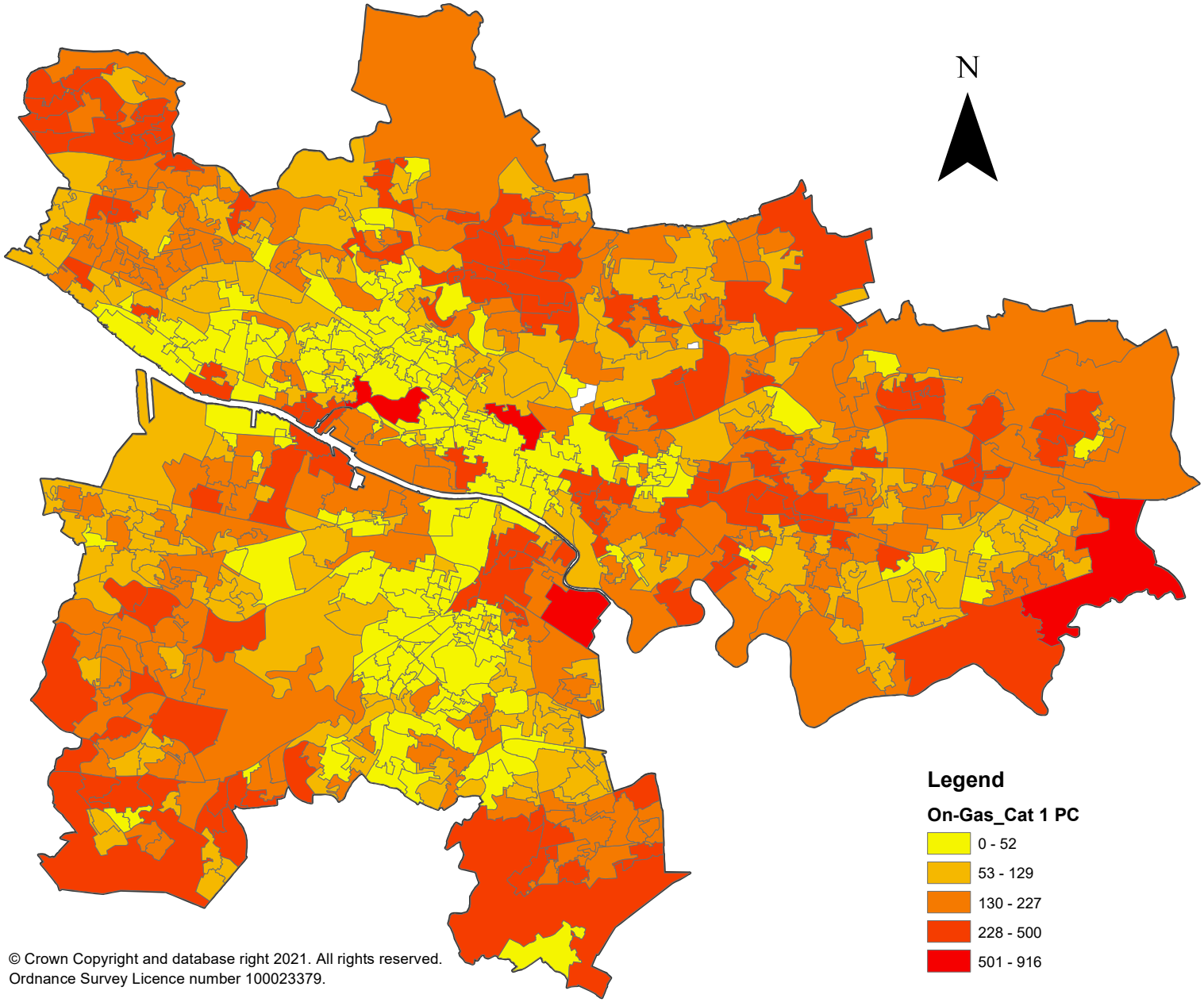



*Figure 26 Category 1 Properties that are most suitable to connect to individual or communal heat pumps*

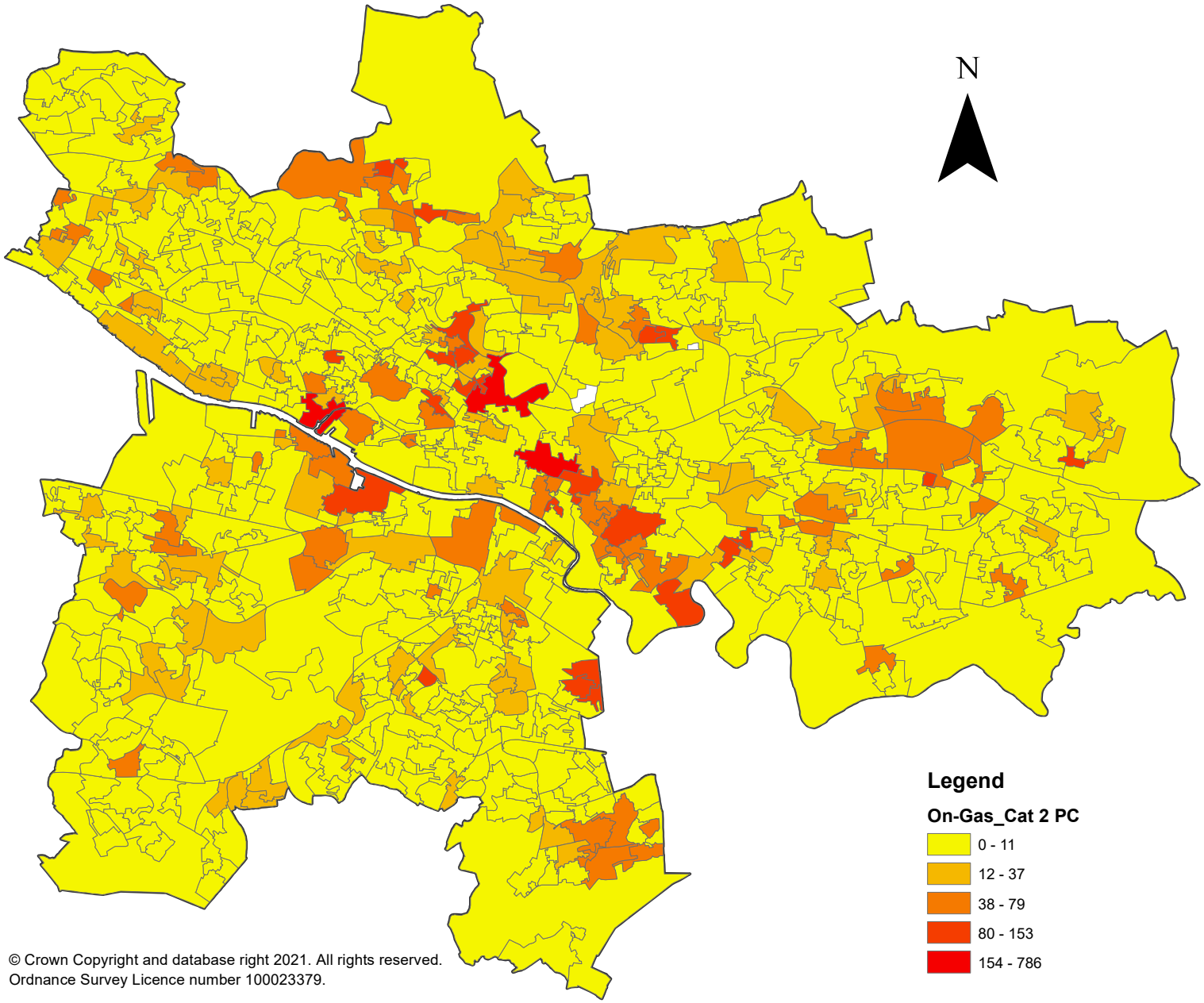



*Figure 27 Category 2 Properties that have secondary potential for an individual or communal heat pump*

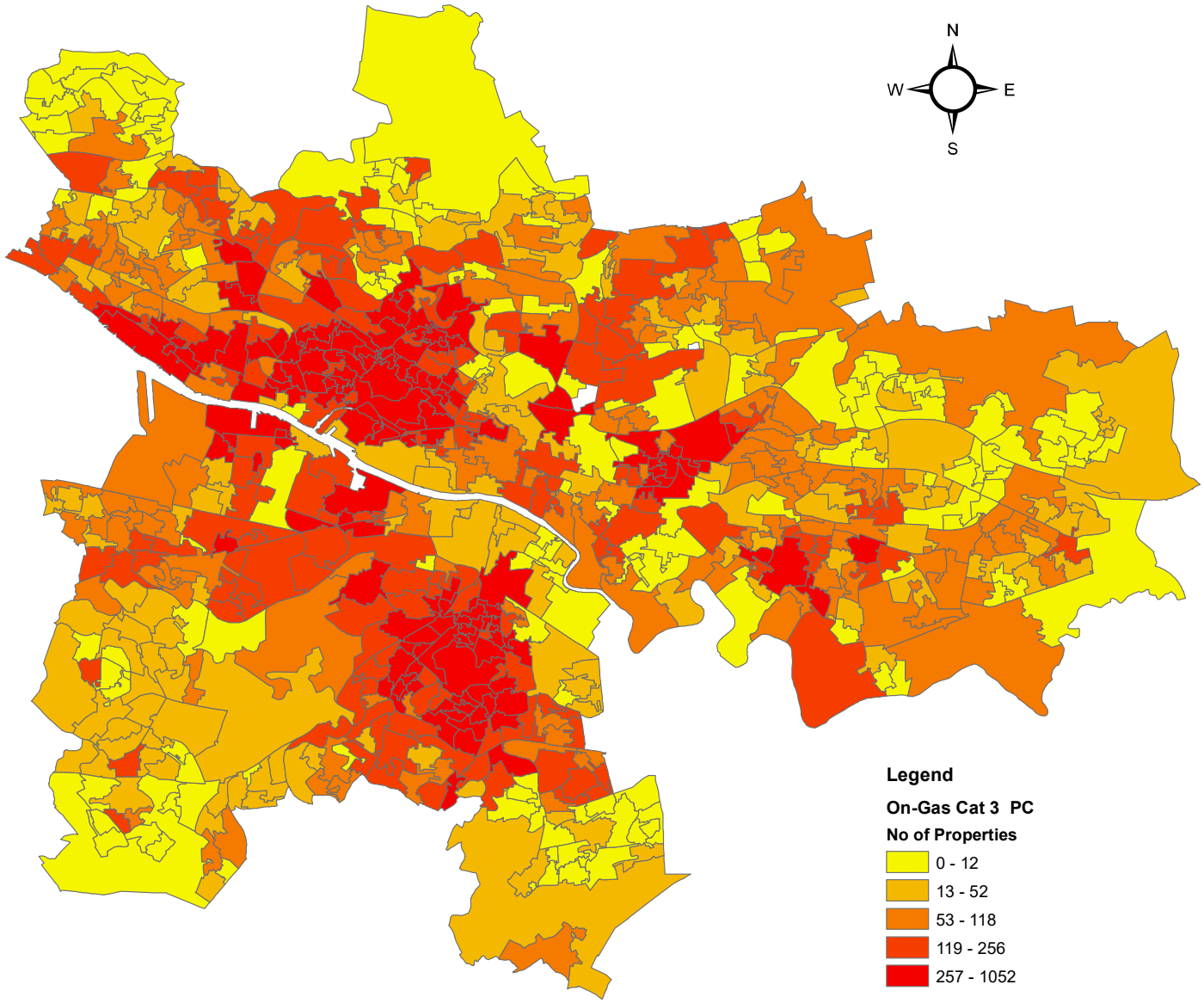





*Figure 28 Category 3 Properties that have tertiary potential for individual or communal heat pumps*

## 7.1.4 Pre-1919 Properties

Properties built before 1919 present a challenge from a retrofit perspective and require novel approaches to lower associated carbon emissions. Analysis was undertaken to identify where in the city there were the highest concentrations of pre 1919 properties. The resulting map, Figure 29, provides a property count aggregated to data zone level, showing the west end and southside areas of the city as having the highest prevalence of these properties.

To note, these locations and property density align closely with the Category 3 On Gas Grid mapping shown in Figure 28, underscoring the known challenges around decarbonising pre-1919 domestic dwellings with individual heat pumps. The upcoming Retrofit Strategy, which has a focus on pre-1919 tenements, will build on the mapping done in the LHEES to provide more granular outputs as to where interventions targeting pre-1919 tenements will have the greatest impact or success.

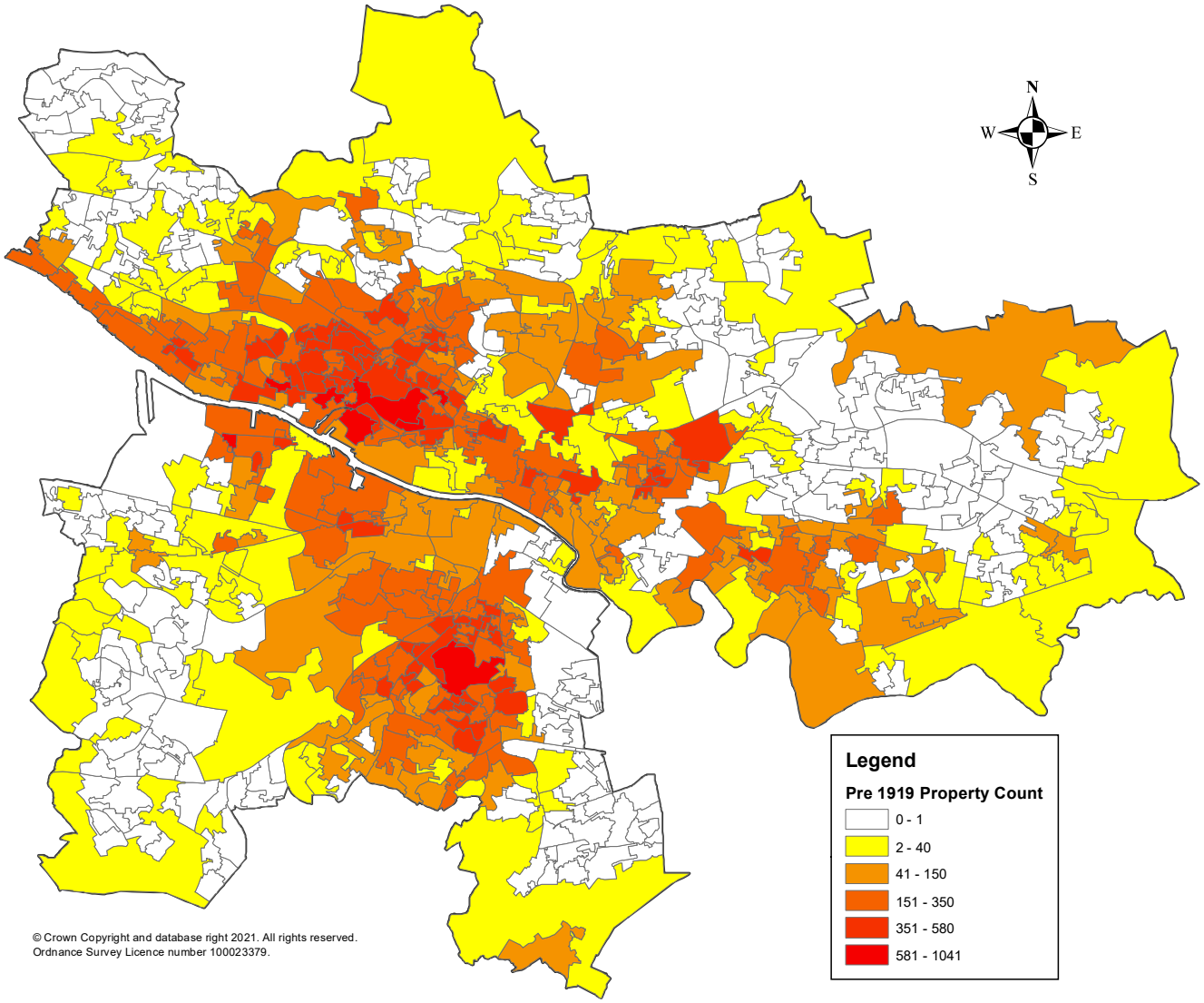



*Figure 29 - Pre-1919 Property Count by Data Zone*

## 7.2 Developing Indicative Heat Network Zones

Glasgow is a significantly heat dense area of Scotland. As a local authority, it has the highest heat density, registering as 35.53 kWh/yr/m2 on the Scotland Heat Map (Edinburgh by comparison registers at 19.79 kWh/yr/m2). Due to this, large areas of Glasgow are deemed as being particularly suitable for the deployment of heat networks which require a certain demand density to be considered feasible. Considering this, **heat networks are a primary focus for this LHEES**. However, the high demand density in the city has created challenges in developing discrete zones for heat network development using the LHEES process alone – further work will be required before Glasgow can confidently designate Heat Network Zones through the Heat Networks (Scotland) Act 2021.

The approach taken by Glasgow for this first iteration of the LHEES has therefore been to develop larger **indicative Heat Network Zones** where the initial opportunity presents as highest. These have been split into primary and secondary zones where a primary zone has sufficient demand density and a key renewable or low carbon supply opportunity within it, and a secondary zone has sufficient demand density but is unclarified from a supply perspective. Additionally, existing or planned activity relating to heat networks has been considered in determining whether a zone is classed as a primary or secondary zone. Where borders have been applied, these should be treated as a first pass and have been developed through the identification of physical constraints such as rivers and railways. These will act as a starting point for further inspection. **Moving from the indicative Heat Network Zones identified in this LHEES to designated Heat Network Zones in the regulatory sense forms a key part of Phase I in the delivery of LHEES.** This is discussed further in the Delivery Plan.

Identifying indicative Heat Network Zones has required the consideration of –

- **Heat Density.** The density of heat in Glasgow was plotted using an approach that creates buffers with varying degrees of stringency around potential anchor loads[38] corresponding to the size of their heating demand. This provided a first pass as to where heat networks could be viable from a demand perspective (see Figure 30). Please note this is shown in isolation of potential heat supply.
- **Renewable or Low Carbon Heat Supply.** Where there were demonstrable renewable or low carbon supply opportunities, indicative zones were classed as primary. Where zones had a less clarified supply option but sufficient demand density, these were classed as secondary.

*[38] Anchor Load - Building with a high heat demand and a stable heat use pattern. These buildings, assumed as connecting into a network, are typically critical in proving the initial economic case for any heat network project. Typical examples include leisure centres with swimming pools and hospitals.*

- Key supply opportunities were identified as
    - The River Clyde
    - Energy from Waste plants: The GRREC (operational) and the South Clyde Energy Centre (planned)
    - Shieldhall and Dalmarnock Wastewater Treatment Plants
- Building Form. The process for identifying indicative zones has considered the connection suitability of domestic properties though more work is required to clarify with confidence the suitability of non-domestic properties within indicative Heat Network Zones. Analysis has drawn from the On Gas Grid Consideration outputs (section 7.1.2)
- Fuel Poverty. The ability of heat networks to alleviate areas suffering from fuel poverty in Glasgow was considered in the development of indicative zones.
- Physical Constraints. Significant physical constraints such as roads, rivers and railways that may impede delivery were identified.
- Non-Domestic Stock. Context was added to buildings classed as anchor loads to identify clusters of buildings with high suitability.
- Land Supply Data. Housing Land Supply data was utilised to identify where future development may support the deployment of heat networks.
- Stakeholder Engagement. Mapping work completed through the LHEES methodology process was then augmented through engagement with internal and external stakeholders.

A full section on the methodology behind indicative Heat Network Zone development is included in Appendix B.

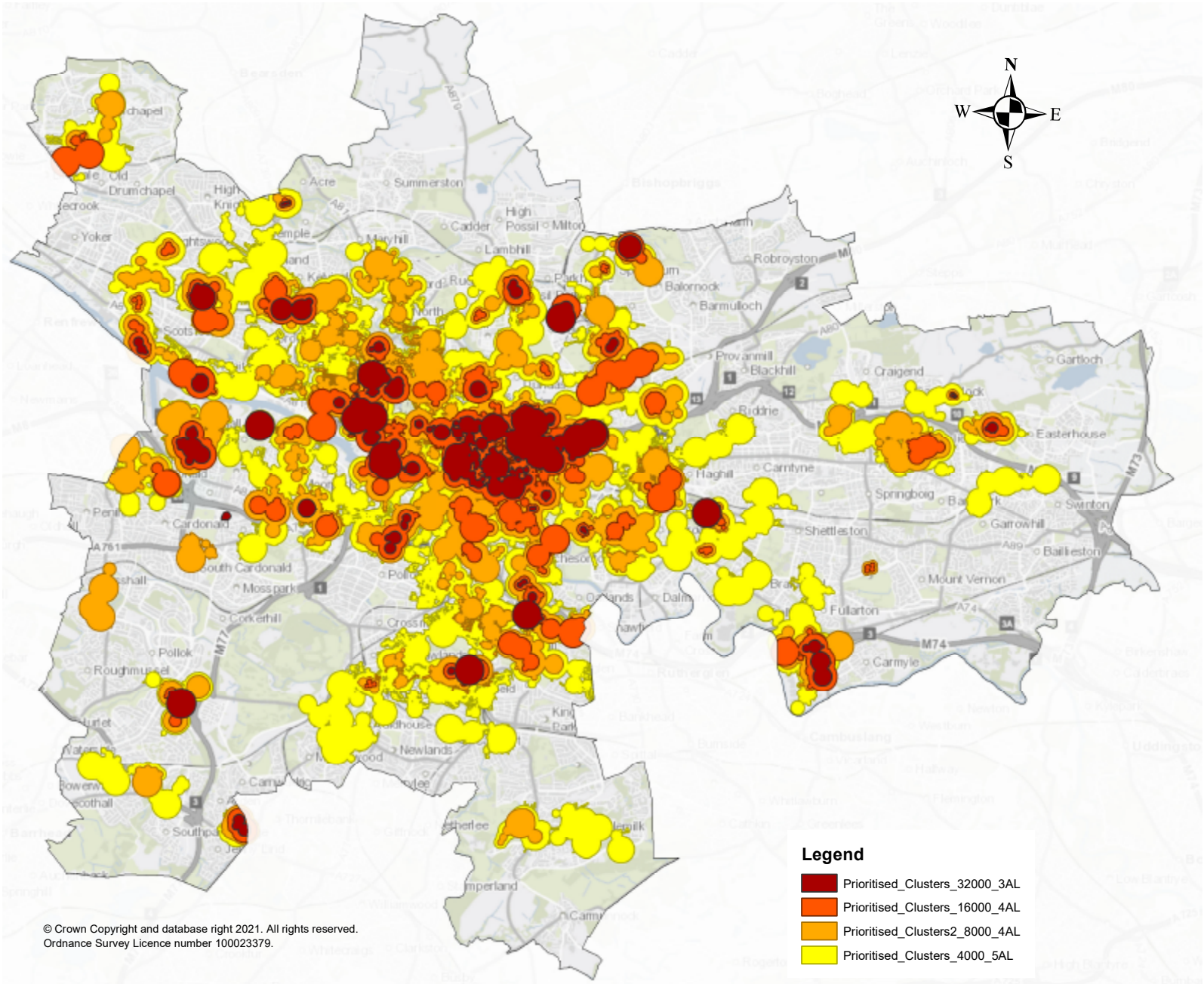



*Figure 30 Heat Demand Density Mapping*

## 7.3 Developing Delivery Areas for Other LHEES Considerations

Through the development of the LHEES, delivery areas for the Considerations below were identified.

- Energy Efficiency as a Driver of Fuel Poverty
- Individual or Communal Heat Pumps (On Gas Grid)

It should be noted that the criteria used for the identification of delivery areas was intentionally kept broad. The mapping completed through the LHEES is intended to provide a high-level evidence base and a live tool for Glasgow City Council and partners to identify interventions across a range of technical solutions and funding streams. Further rationalisation of the zones will characterise the first stages of LHEES delivery and as funding options become clearer at national level, future iterations of Glasgow's LHEES are likely to have focused delivery areas with more stringent criteria.

### 7.3.1 Poor Energy Efficiency as a Driver of Fuel Poverty

The LHEES aims to identify areas in Glasgow where retrofit interventions may help to alleviate fuel poverty. This process primarily utilised the Energy Saving Trust 'Home Analytics' dataset and was informed by the strategic mapping discussed earlier in section 7.1.2. This was then further refined through engagement with internal and external stakeholders.

Building on the decisions made in the strategic mapping stage through engagement from GCC NRS Housing Services a modification of the approach previously described in section 7.1.2 was introduced. SIMD data, Figure 31, was utilised alongside fuel poverty data (>50% probability, Figure 32) and the probability of no wall insulation, Figure 33, in the development of areas for this Consideration to evaluate locations at property level. This assisted in highlighting the socio-economic landscape in Glasgow whilst aligning the LHEES process, which evaluates fuel poverty data from Home Analytics, with the process used for identification of Area Based Schemes (ABS) projects.

Outputs from this process were plotted using a 100 m2 gridded raster approach, Figure 34, which identified the concentration of properties displaying selected criteria within a 100 m by 100 m square. This is based on the ratios of: Fuel Poverty 25%, SIMD 25%, and Wall insulation 50%. The inclusion of SIMD data helped align the outputs of the analysis to metrics used by the GCC NRS Housing Retrofit. Prior to mapping, those buildings with solid wall or stone construction (which are typically challenging to install wall insulation on) were filtered from the dataset. This provided outputs with a focus on the lack of wall insulation as a driver of fuel poverty that were potentially actionable.

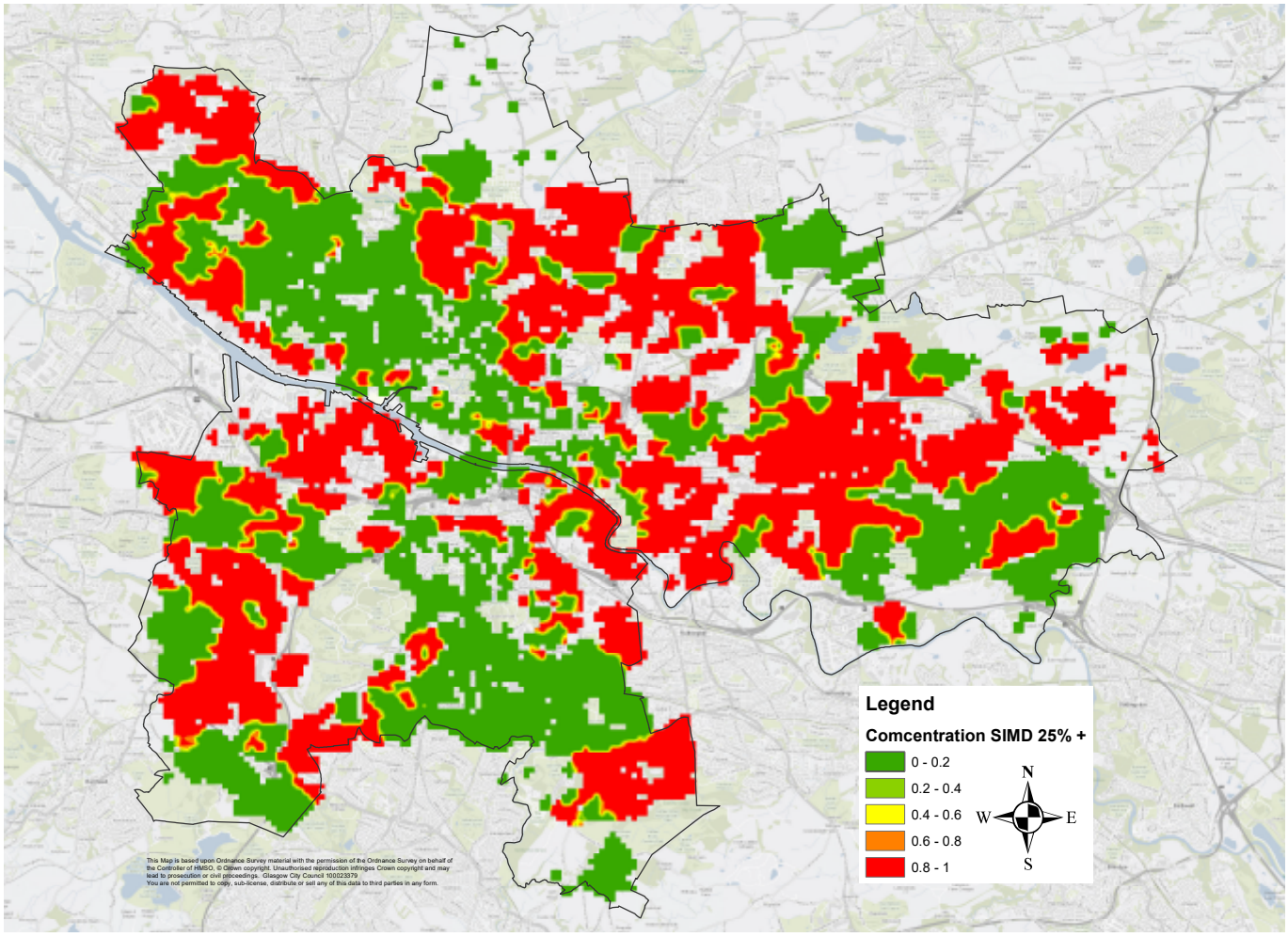



*Figure 31 – SIMD 25%+*

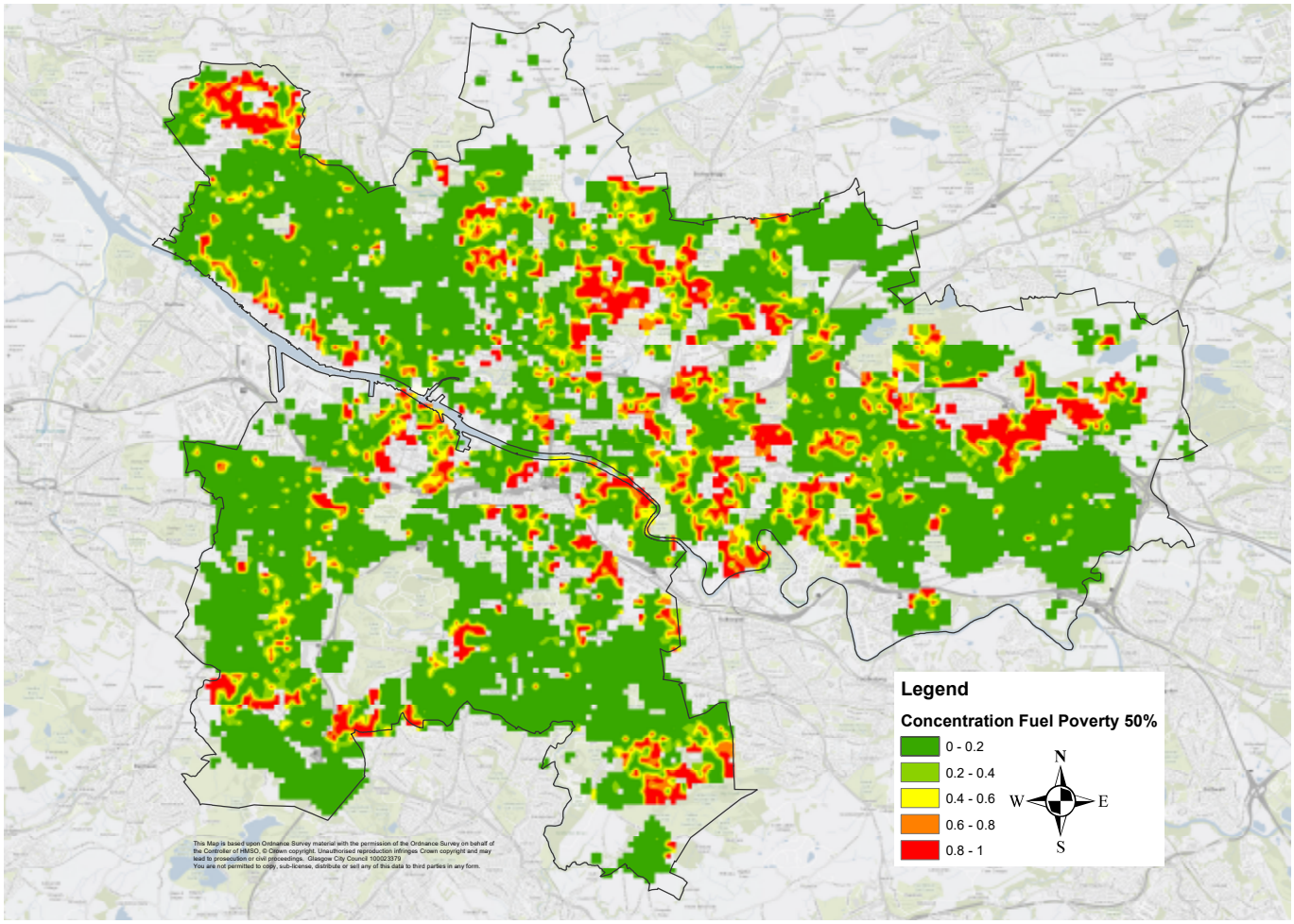



*Figure 32 – Fuel Poverty (>50% Probability)*

The outputs from the LHEES stakeholder engagement session, the public consultation alongside ongoing input from GCC NRS Housing helped further rationalise the zones and sense check outputs. Due to some building data not being representative of what is currently on the ground, it was challenging to confidently identify delivery areas prior to public consultation.

As part of the consultation, the Council confirmed, and corrected where required, details such as property age which impacted on the accuracy of the energy efficiency aspect of the LHEES.

This consultation provided the opportunity to finalise proposed priority zones to tackle fuel poverty across the city to those worst affected.

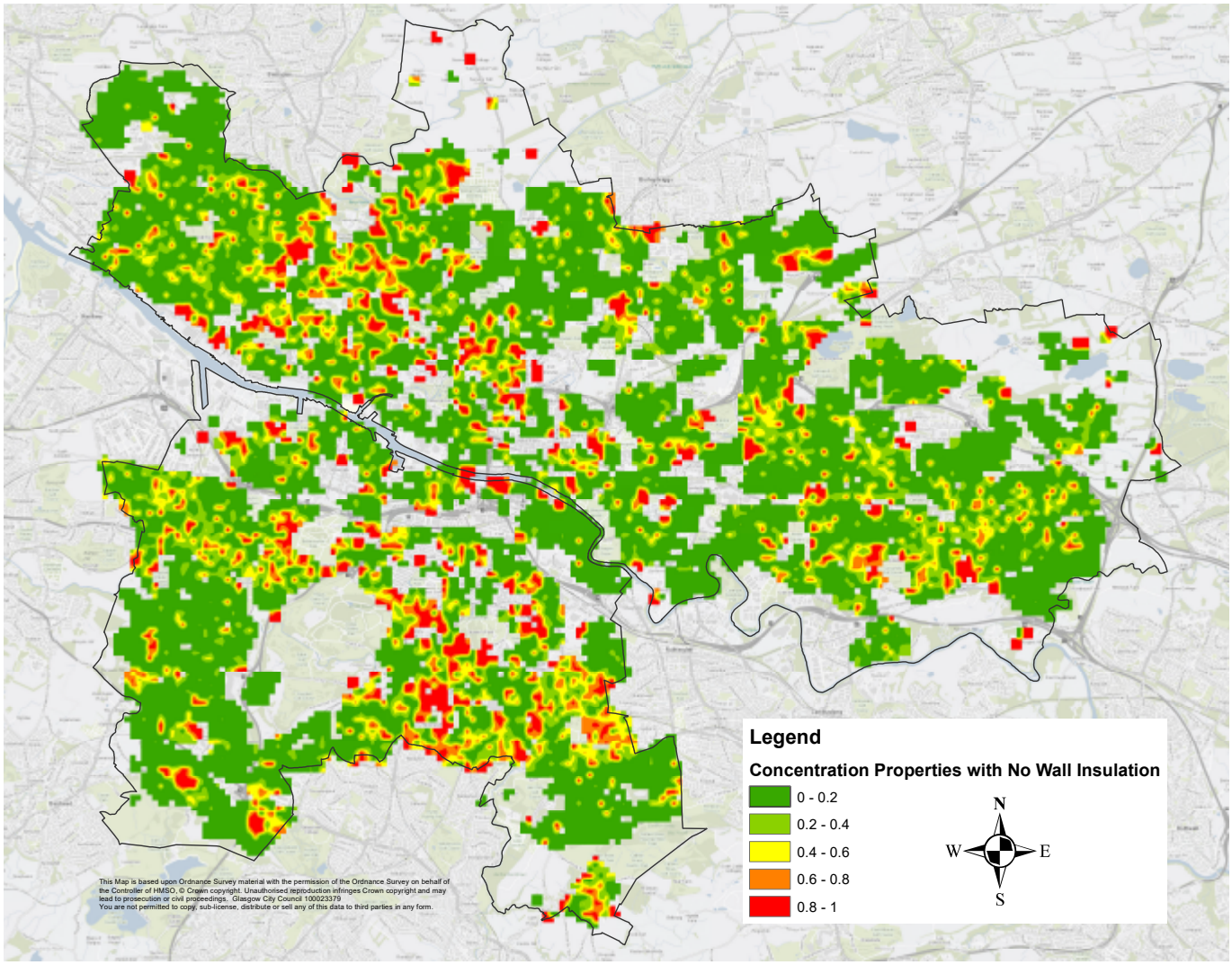



*Figure 33 – No Wall Insulation*

The outputs from the LHEES stakeholder engagement session, the public consultation alongside ongoing input from GCC NRS Housing helped further rationalise the zones and sense check outputs. Due to some building data not being representative of what is currently on the ground, it was challenging to confidently identify areas prior to public consultation.

As part of the consultation, the Council confirmed, and corrected where required, details such as property age which impacted on the accuracy of the energy efficiency aspect of the LHEES.

This consultation provided the opportunity to finalise the analysis for this Consideration to tackle fuel poverty across the city to those worst affected. Delivery areas were not developed as part of the LHEES process, rather the analysis undertaken through the LHEES will form the evidence base upon which GCC NRS Housing can determine optimal delivery areas in the development of the upcoming Retrofit Strategy.

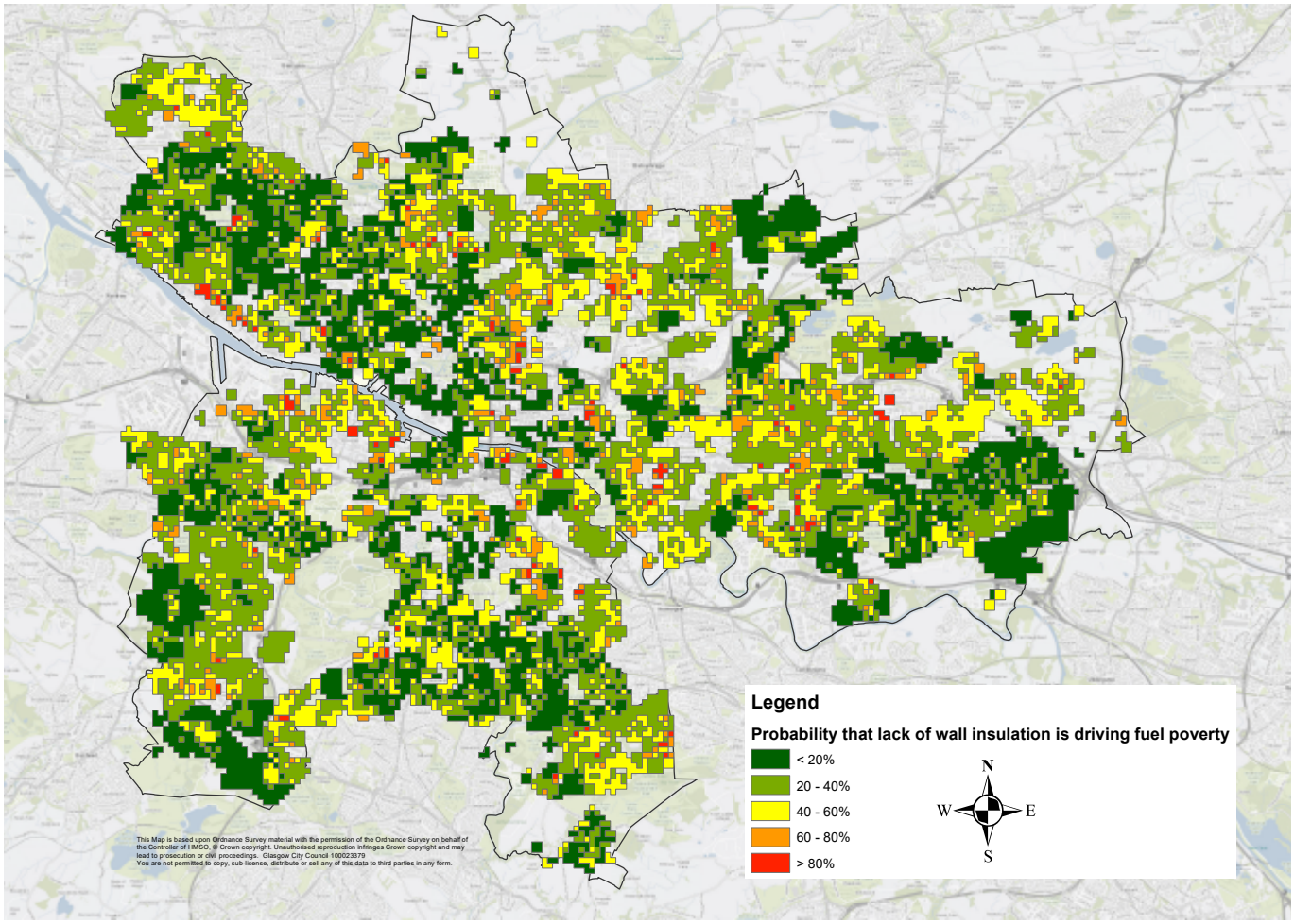



*Figure 34 - Combined Lack of Wall Insulation, 50% chance of Fuel Poverty and SIMD 25% (top quartile)*

## 7.3.2 Individual and Communal Heat Pumps (On Gas Grid)

Delivery areas were developed through the LHEES process to identify where in Glasgow there were concentrations of domestic properties suitable for heat pump installation. As discussed in section 7.1.3, domestic properties were categorised by suitability for: individual heat pumps, connection into small communal heat pump schemes or larger district heating schemes. At this stage all outputs (as per the LHEES Methodology) were included so as not to limit potential opportunities at this stage. This process primarily utilised Energy Saving Trust 'Home Analytics' data and was informed by the strategic mapping discussed in section 7.1. This was then further refined through engagement with internal and external stakeholders.

The following criteria informed the initial categorisation of domestic properties –

- **Current Heating System.** Existing connection to a heat pump or communal heating scheme
- **Potential Planning Restrictions.** Whether the property is a listed property or whether it exists within a conservation area.[39]
- **Thermal Efficiency required for Heat Pump Installation.** Whether the property has double/triple glazed windows, sufficient levels of loft insulation or insulated walls.

Category 1 (suitable for heat pump installation) and Category 2 (requiring minor upgrades to become suitable for heat pump installation) domestic properties were plotted. Infrastructure such as roads were then used to output discrete delivery areas. GCC NRS Housing were engaged to help further rationalise the zones and the outputs from the LHEES stakeholder engagement session was also used to further refine zoning. This resulted in a total of **36 delivery areas** being identified as suitable or near to suitable for heat pump installation or communal network connection. These outputs are shown in Figure 35 where the higher density delivery areas (shown in pink) are combined concentrations of Category 1 and 2 properties shown in green and blue respectively.

**It is important to note that Category 3 properties (those least suited to individual heat pumps) are not considered unsuitable, only less suitable, at present.** Due to the complexities in retrofitting pre-1919 buildings alongside the high cost of electricity, short term delivery focused on those properties that could have a heat pump installed at the lower installation and running cost. It is accepted that this analysis is inherently static in a field that is evolving at pace. As such, an online mapping tool intends to be published for the LHEES which can act as a live resource for internal and external partners.

Where these areas were located within Indicative Heat Network Zones, these were included.

[39] *The upcoming National Planning Framework (NPF4) may provide a mechanism to overcome planning constraints relating to heritage buildings.*

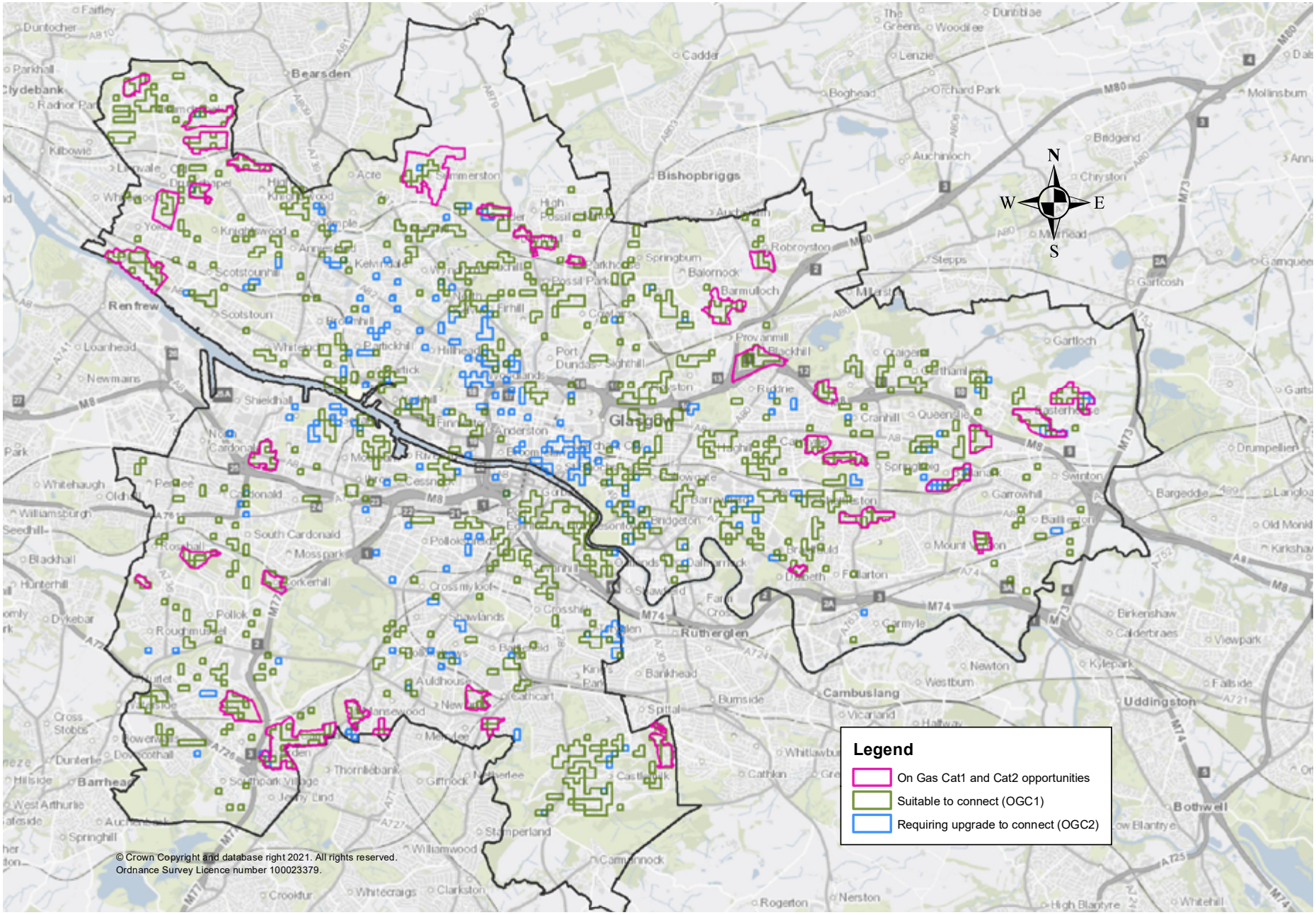



*Figure 35 - On Gas Category 1 and 2 Analyses with Potential Delivery Areas Shown in Pink.*


# DELIVERY PLAN

# 8

# INDICATIVE HEAT NETWORK ZONES FOR GLASGOW

# 8. Indicative Heat Network Zones for Glasgow

Figure 36 highlights the locations of the indicative Heat Network Zones (green for primary and purple for secondary). Work from the heat density buffering has been included (blue circular buffers) and primary heat supply opportunities have been added and The River Clyde has been included due to the heat recovery potential that it provides. These are shown with 750 m (red) and 1500 m (pink) buffers to provide an indicative distance from source.

Section 8.1 provides a detailed assessment of each primary zone. Secondary zones are located in Appendix H.

It is the intention of Glasgow City Council to publish an online version of all spatial analysis undertaken through the LHEES. This will allow stakeholder to interact with maps and allow GCC to have live analysis rather than solely the static analysis featured in this LHEES.

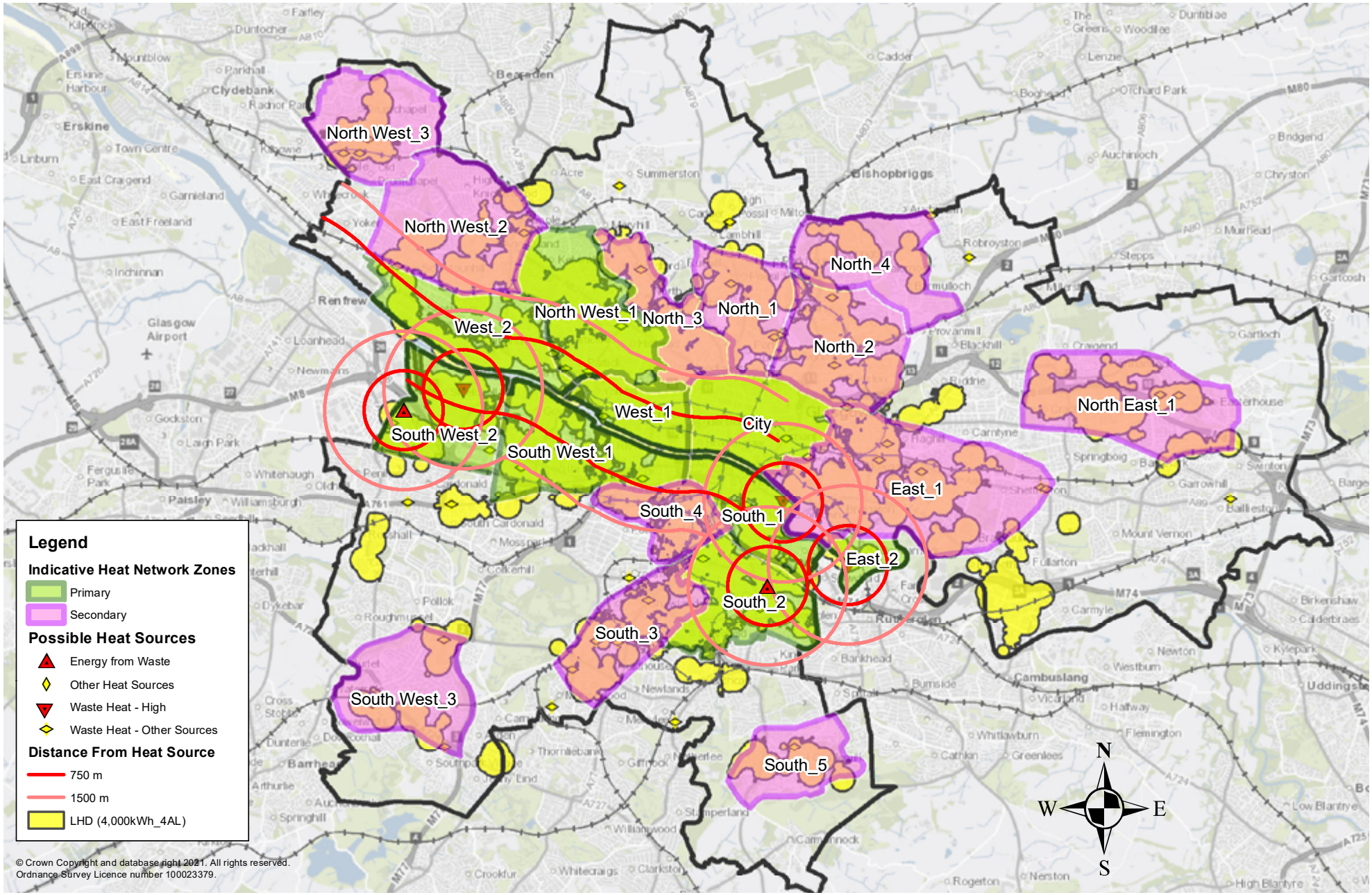



*Figure 36 - Indicative Heat Network Zones*

## 8.1.1 IHNZ: City

Category: Primary

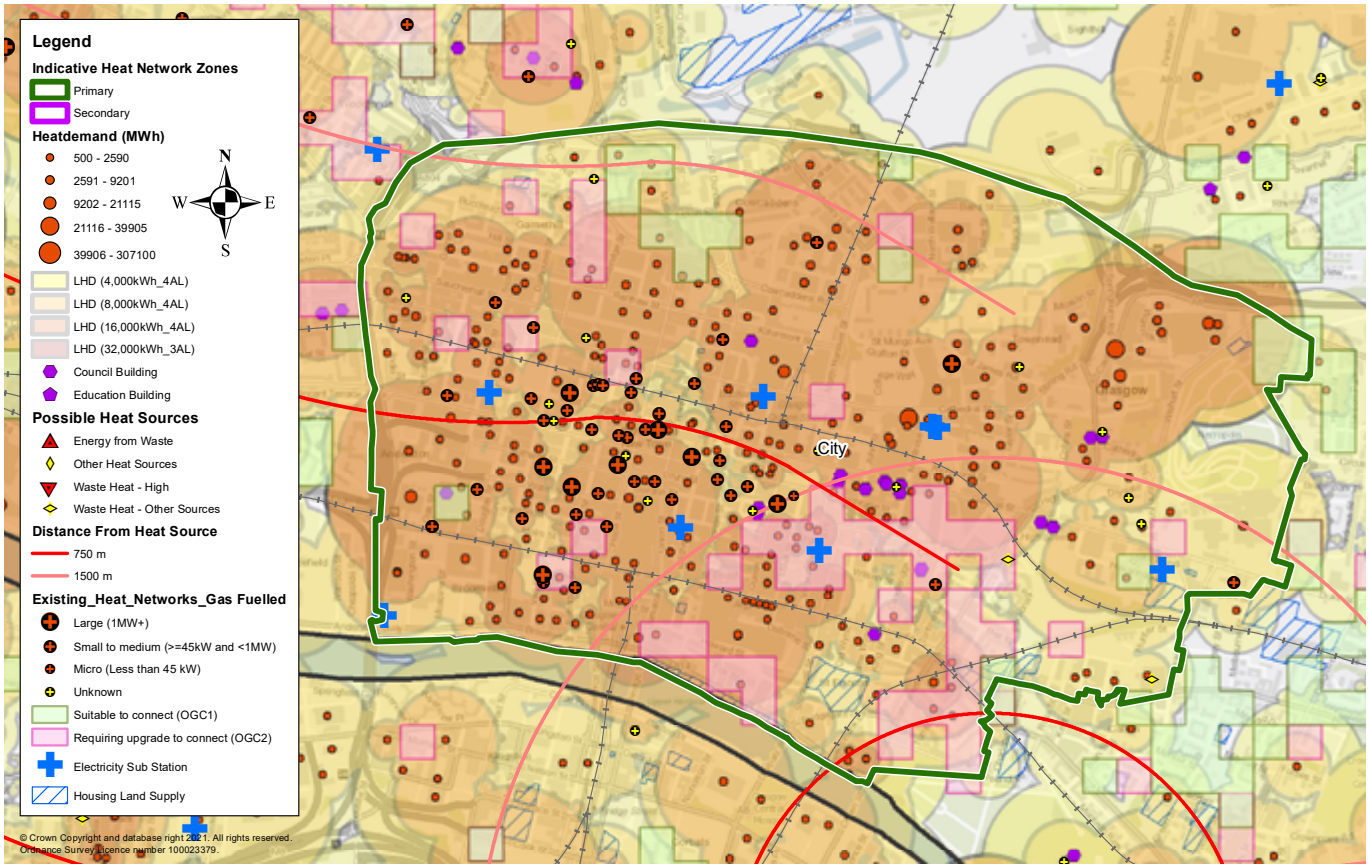



*Figure 37 - City Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 402 ha** | **Total Anchor Loads: 321** |
| **Zone Heat Demand: 870 GWh / year** | **Anchor Load Heat Demand: 582 GWh / year** |
| **Cat 1 On-gas property count: 2495** | **Cat 2 On-gas property count: 3140** |
| **Confidence per MWh: 2.17** | **Stakeholders: TBC during consultation** |
| **LDP sites: Several housing supply land sites are within the zone as well as the potential for redevelopment of existing sites within the city.** | |

*Table 10 – City IHNZ Characteristics*

The “City” Indicative Heat Network Zone has an area of 402 ha. Within the boundaries, see Figure 37, there are 321 anchor loads with an annual heat demand of 582 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 870 GWh per year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.17. The consultation process would aim to raise this closer to 5.

The zone contains eighteen (18) Council buildings and two (2) Education buildings which provide a potential dependable heat demand. Potential heat sources are River Clyde and Drygate Brewery with potential waste heat from other sources. Regarding current gas use, from data, sixty seven (67) gas fuelled heat networks (many of these will be building focused boilers or CHPs) of various sizes have been identified giving the potential for conversion to sustainable energy and decarbonisation. Development of this IHNZ will be influenced by the ongoing Climate Neutral Innovation Project (see section 4.2) alongside the redevelopment of Buchanan Galleries and the St Enoch’s Centre.

There are eight (8) electrical substations within the zone.

## 8.1.2 IHNZ: South 2

Category: Primary

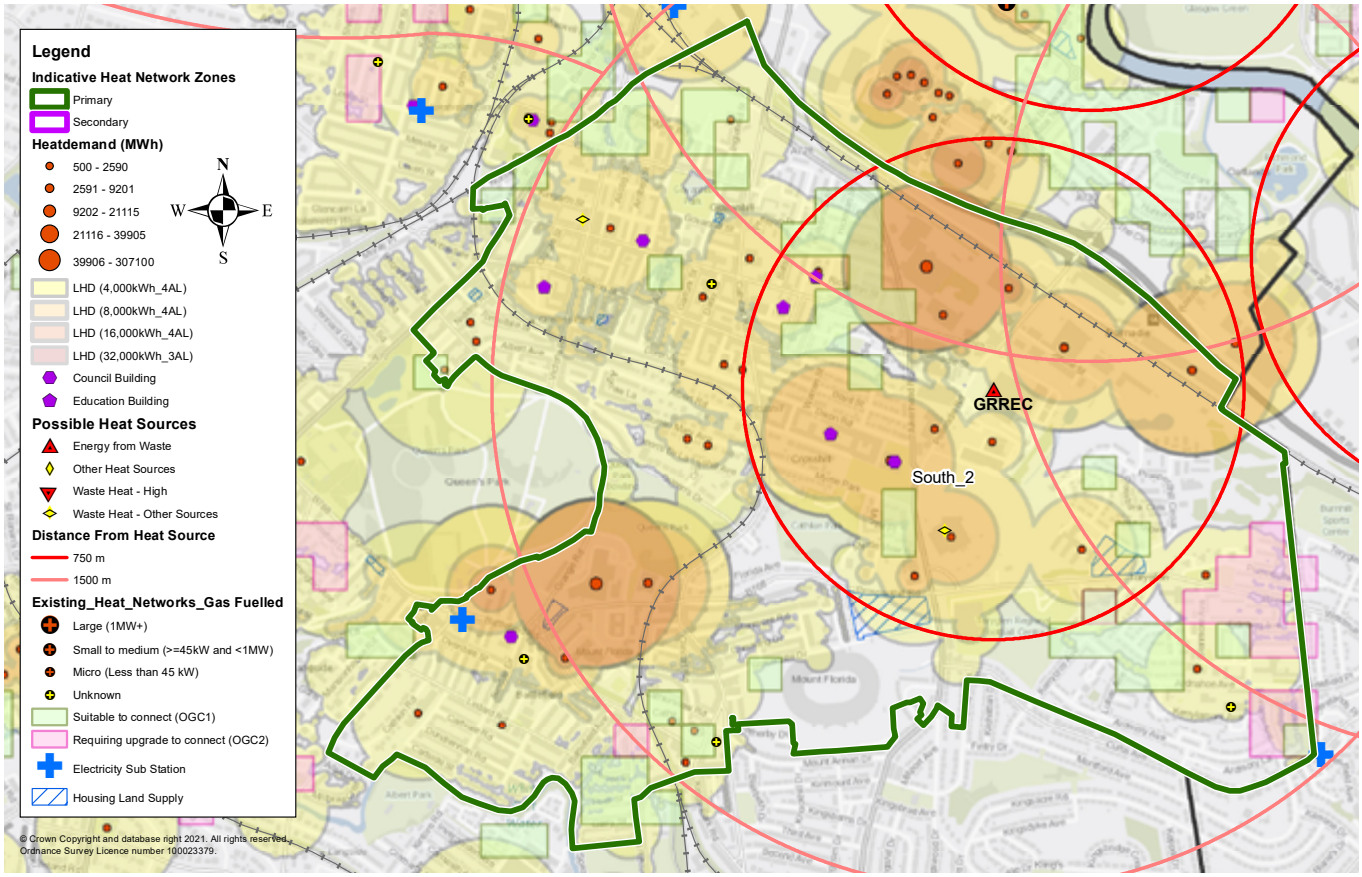



*Figure 38 - South 2 Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 413 ha** | **Total Anchor Loads: 38** |
| **Zone Heat Demand: 273 GWh / year** | **Anchor Load Heat Demand: 72 GWh / year** |
| **Cat 1 On-gas property count: 3892** | **Cat 2 On-gas property count: 1328** |
| **Confidence per MWh: 1.34** | **Stakeholders: TBC during consultation** |
| **LDP sites: Several Housing Supply Land sites are within the zone.** | |

*Table 11 - South IHNZ Characteristics*

The “South 2” Indicative Heat Network Zone has an area of 413 ha. Within the boundaries, see Figure 38, there are 38 anchor loads with an annual heat demand of 72 GWh. Total heat demand including domestic properties is 273 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.34. The consultation process would aim to raise this closer to 5. The zone contains three (3) Council buildings and eleven (11) Education buildings, providing a potential dependable heat demand. There is also interest from local housing associations and early engagement with possible heat demand customers has taken place.

The primary identified heat source within the zone is the Glasgow Recycling and Renewable Energy Centre (GRREC). A techno-economic feasibility study is currently underway to assess the potential for offtaking heat from the GRREC to supply a heat network in the area. A number of low level waste heat sources have also been identified. Regarding current gas use, from data, five gas fuelled heat networks/ comunal heating systems have been identified. These require to be verified.

There is one (1) electrical substation within the zone.

## 8.1.3 IHNZ: South West 2

Category: Primary

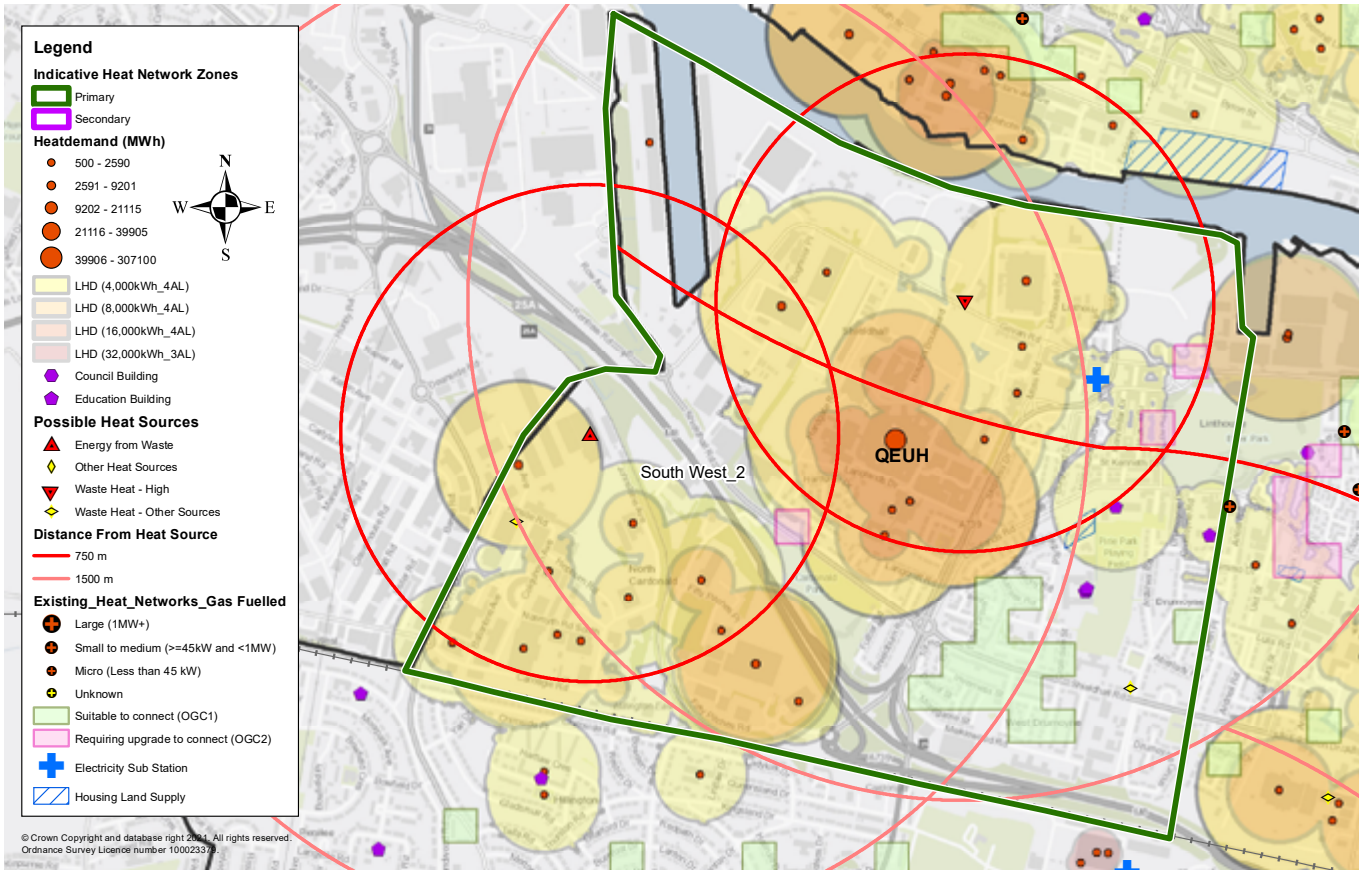



*Figure 39 -Southwest 2 Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 389 ha** | **Total Anchor Loads: 22** |
| **Zone Heat Demand: 199 GWh / year** | **Anchor Load Heat Demand: 139 GWh / year** |
| **Cat 1 On-gas property count: 1502** | **Cat 2 On-gas property count: 329** |
| **Confidence per MWh: 3.51** | **Stakeholders: TBC during consultation** |
| **LDP sites: Several Housing Supply and Vacant and Derelict Land sites have been identified within the heat dense areas of the zone.** | |

*Table 12 - Southwest 2 IHNZ Characteristics*

The “South West 2” Indicative Heat Network Zone has an area of 389 ha. Within the boundaries, see Figure 39, there are 22 anchor loads with an annual heat demand of 139 GWh. Total heat demand including domestic properties is 199 GWh/year.

Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 3.51. The consultation process would aim to raise this closer to 5. The zone contains the Queen Elizabeth University Hospital which has an extensive campus. Combined with the four (4) Education buildings, these provide significant potential for dependable heat demand and network development. The zone is situated in the south bank of the River Clyde providing good access for water source heat extraction. Additionally, there are two distinct heat sources within the zone, Shieldhall Water Treatment facility and the South Clyde Energy Centre which is an energy from waste plant which is scheduled for commercial operation in 2025. From data, there are no existing gas fuelled networks in this zone. However, this requires to be verified.

There is one (1) electrical substation within the zone.

## 8.1.4 IHNZ: West 1

Category: Primary

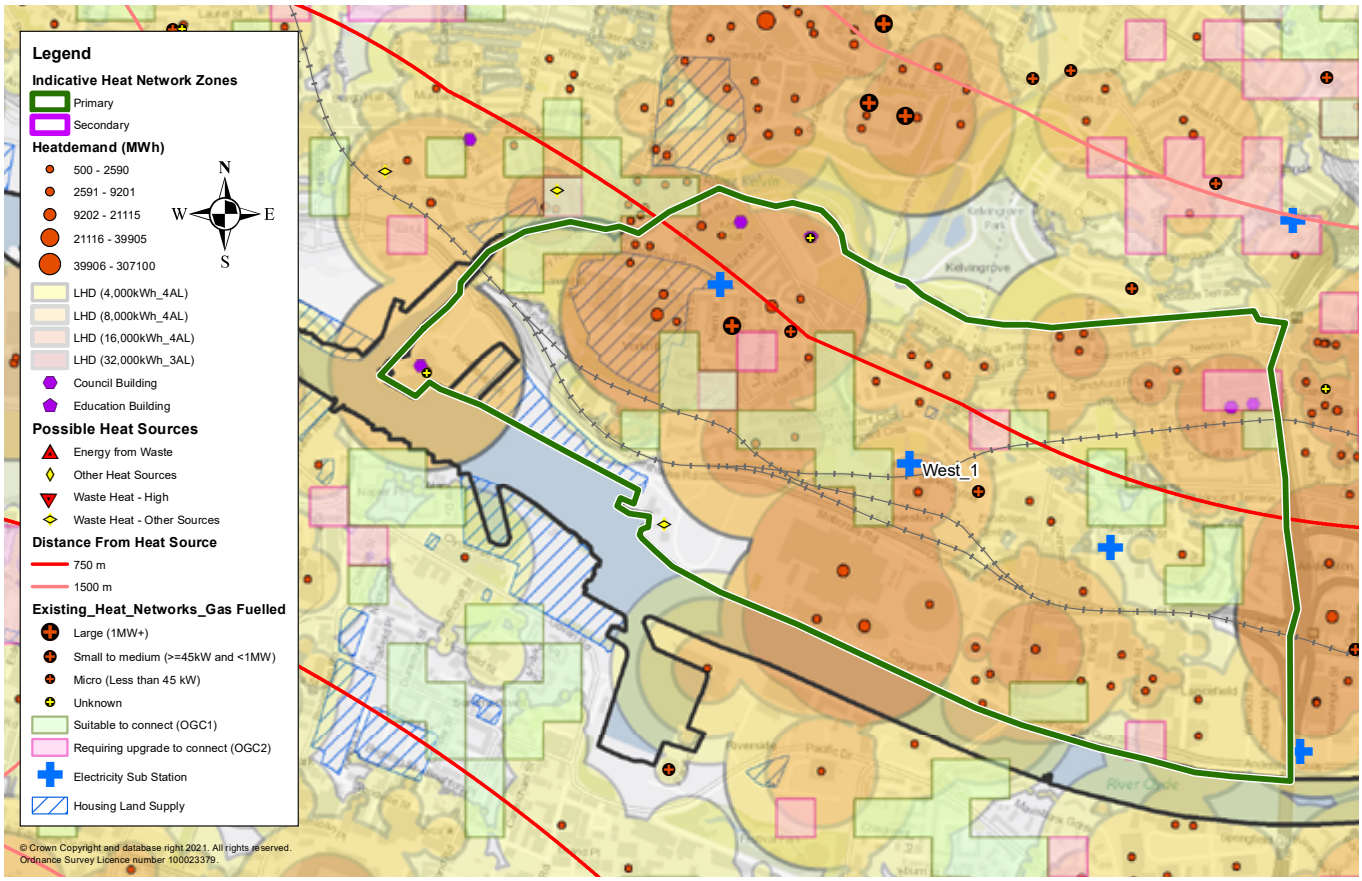



*Figure 40 - West 1 Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 203 ha** | **Total Anchor Loads: 51** |
| **Zone Heat Demand: 237 GWh / year** | **Anchor Load Heat Demand: 135 GWh / year** |
| **Cat 1 On-gas property count: 1978** | **Cat 2 On-gas property count: 427** |
| **Confidence per MWh: 2.11** | **Stakeholders: TBC during consultation** |
| **LDP sites: The zone contains significant housing supply land for future development.** | |

*Table 13 - West 1 IHNZ Characteristics*

The “West 1” Indicative Heat Network Zone has an area of 203 ha. Within the boundaries, see Figure 40, there are 51 anchor loads with an annual heat demand of 135 GWh. Total heat demand including domestic properties is 237 GWh/year.

Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.11. The consultation process would aim to raise this closer to 5.

The zone contains five (5) Council buildings and five (5) Education buildings, providing the potential for dependable heat demand. The zone is situated on the north bank of the River Clyde offering considerable potential for heat extraction. An additional waste heat source has been identified pending verification. Regarding current gas use, five gas fuelled heat networks/comunal heating systems of various sizes have been identified via data. These require to be verified. Key anchor loads include: The Scottish Exhibition Campus, Riverside Museum, and multiple NHS properties.

There are three (3) electrical substations within the zone.

## 8.1.5 IHNZ: North West 1

Category: Primary

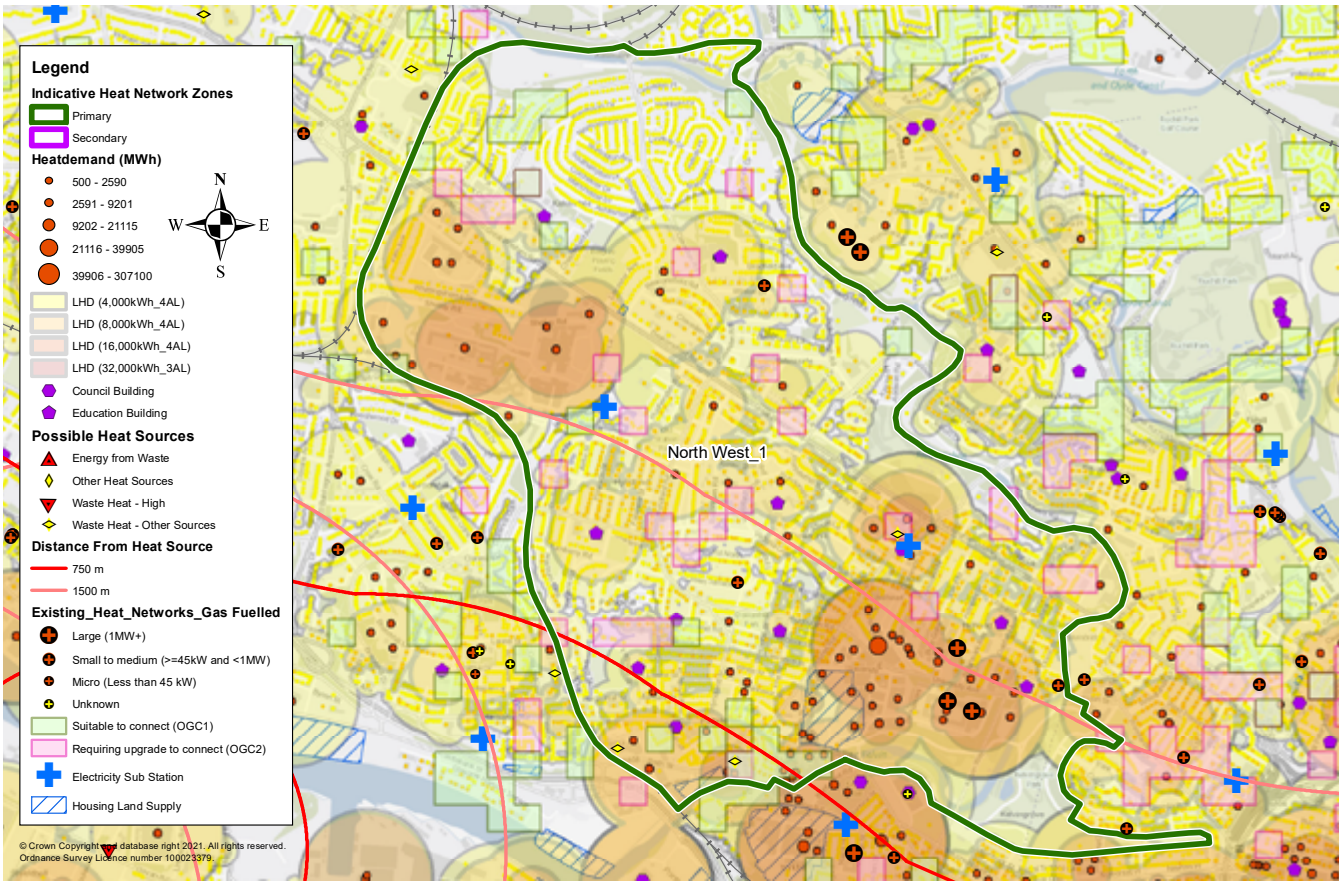



*Figure 41 -Northwest 1 Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 500 ha** | **Total Anchor Loads: 79** |
| **Zone Heat Demand: 440 GWh / year** | **Anchor Load Heat Demand: 147 GWh / year** |
| **Cat 1 On-gas property count: 3239** | **Cat 2 On-gas property count: 2767** |
| **Confidence per MWh: 2.85** | **Stakeholders: TBC during consultation** |
| **LDP sites: The area is dominated by pre 1919 tenements with several listed buildings with high heat demands including the extensive University of Glasgow campus.** | |

*Table 14 - Northwest 1 IHNZ Characteristics*

The “North West 1” Indicative Heat Network Zone has an area of 500 ha. Within the boundaries, see Figure 41, there are 79 anchor loads with an annual heat demand of 147 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 440 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.85. The consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and nine (9) Education buildings, providing potential for dependable heat demand. The south of the zone is within 1,500 m of the River Clyde and the River Kelvin is to the easterly boundary which provide potential heat sources. Regarding current gas use, there are seven existing gas fuelled heat networks/comunal heating systems, some large in size, that have been identified (via data) that offer potential for decarbonisation and conversion to sustainable energy.

There are two (2) electrical substations within the zone.

## 8.1.6 IHNZ: South 1

Category: Primary

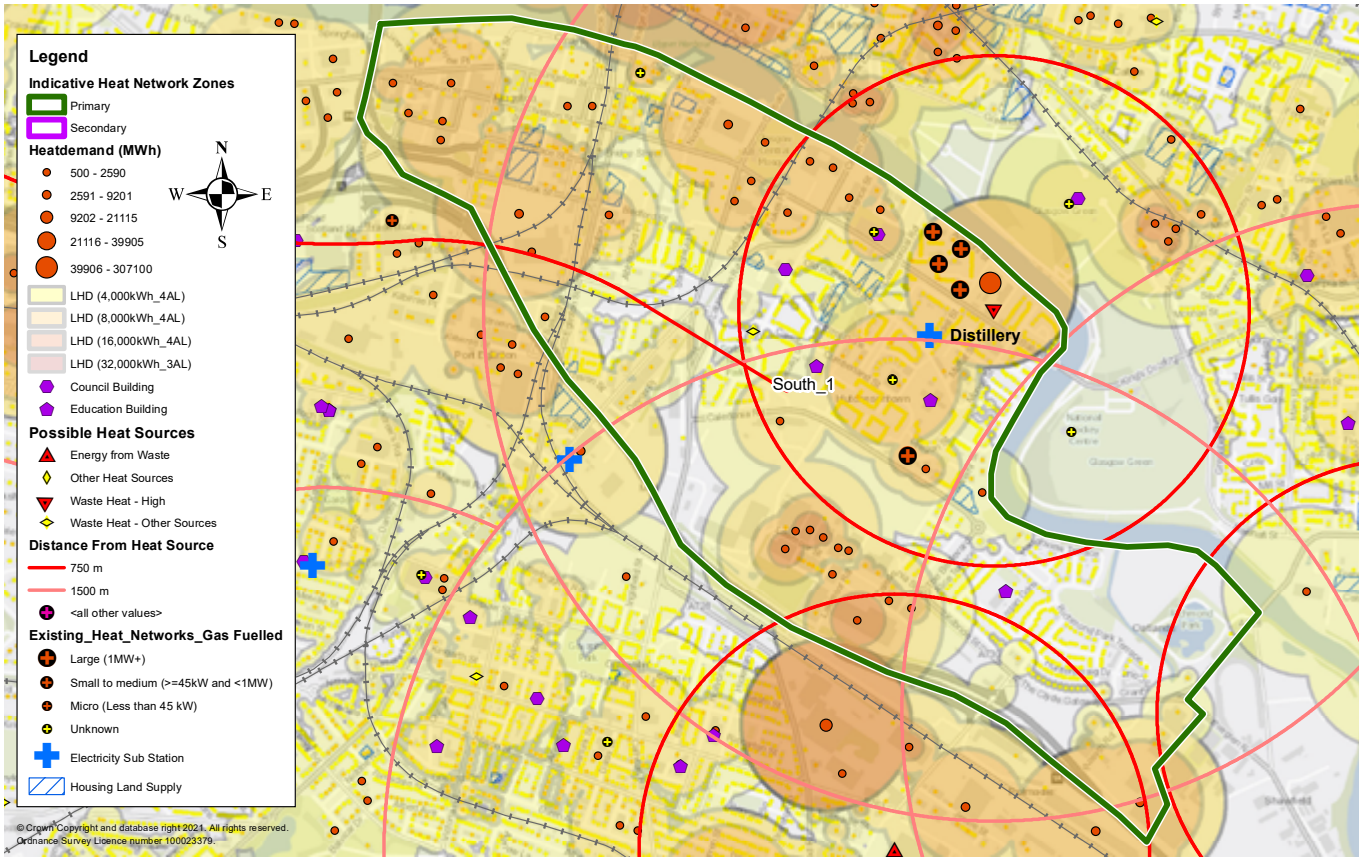



*Figure 42 - South 1 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 261 ha | Total Anchor Loads: 39 |
| Zone Heat Demand: 428 GWh / year | Anchor Load Heat Demand: 359 GWh / year |
| Cat 1 On-gas property count: 5052 | Cat 2 On-gas property count: 350 |
| Confidence per MWh: 3.7 | Stakeholders: TBC during consultation |
| LDP sites: The area has several housing supply land sites all within the heat dense areas of the zone. | |

*Table 15 - South 1 IHNZ Characteristics*

The “South 1” Indicative Heat Network Zone has an area of 261 ha. Within the boundaries, see Figure 42, there are 39 anchor loads with an annual heat demand of 359 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 428 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 3.7. Whilst this is a good level of confidence, the consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and three (3) Education buildings, providing a potential dependable heat demand. From available data, the zone has a high energy demand, mainly due to the Strathclyde Distillery (situated on the south bank of the Clyde). It also has many residences (cat 1) with suitability to connect to a network. Nine buildings have been identified as having an existing gas fuelled heat network/communal system in operation giving significant potential within the zone for conversion to sustainable energy and decarbonisation. Potential heat sources are the River Clyde and the distillery, offering the possibility for heat extraction and waste heat recovery.

There is one (1) electrical substation within the zone.

## 8.1.7 IHNZ: South West 1

Category: Primary

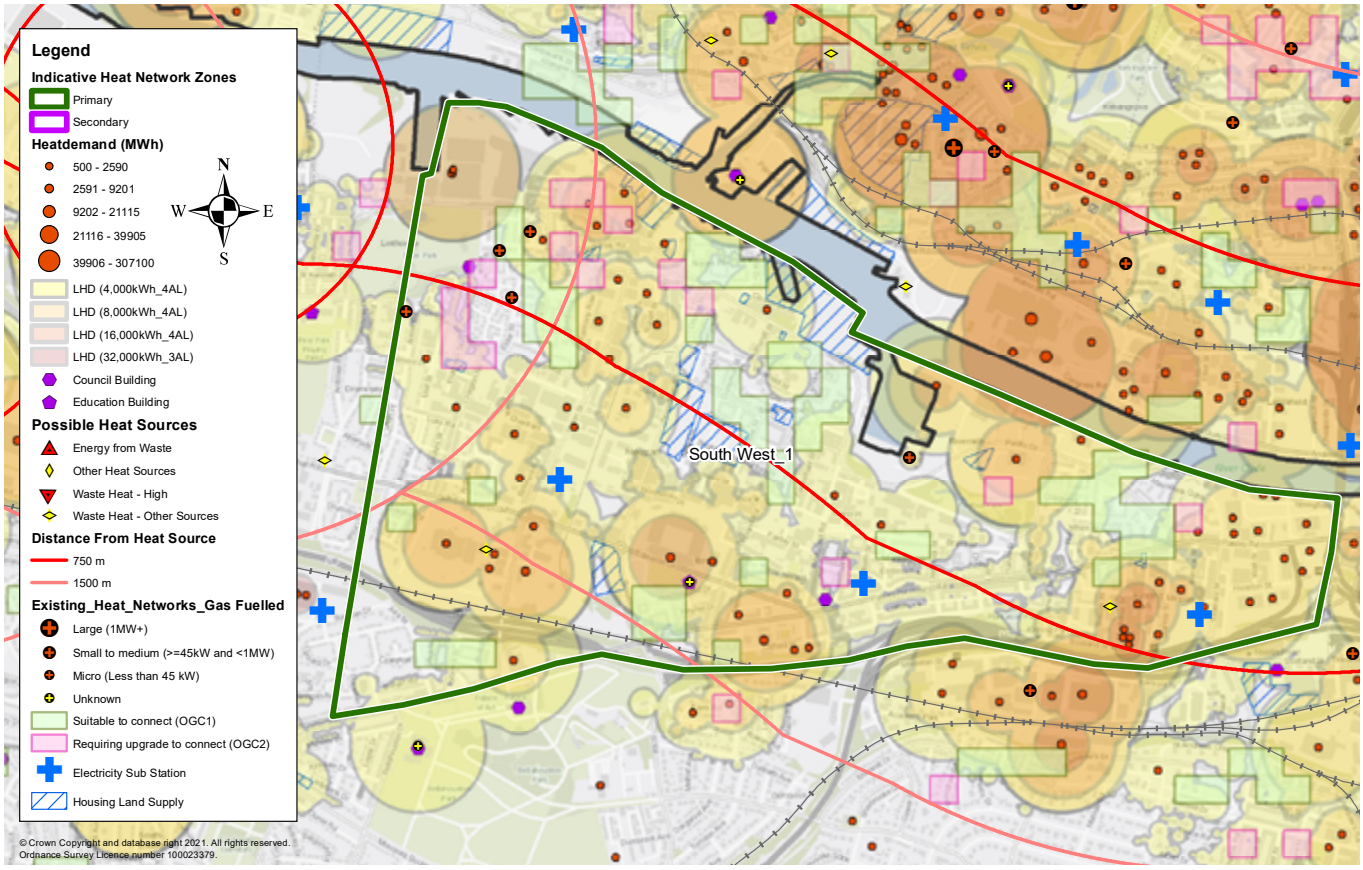



*Figure 43 - Southwest 1 Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 460 ha** | **Total Anchor Loads: 62** |
| **Zone Heat Demand: 231 GWh / year** | **Anchor Load Heat Demand: 74 GWh / year** |
| **Cat 1 On-gas property count: 3581** | **Cat 2 On-gas property count: 1149** |
| **Confidence per MWh: 1.54** | **Stakeholders: TBC during consultation** |
| **LDP sites: Several Housing Supply Land sites have been identified within the heat dense areas of the zone.** | |

*Table 16 - Southwest 1 IHNZ Characteristics*

The “South West 1” Indicative Heat Network Zone has an area of 460 ha. Within the boundaries, see Figure 43, there are 62 anchor loads with an annual heat demand of 74 GWh. Total heat demand including domestic properties is 231 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.54. The consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and seven (7) Education buildings, potentially providing dependable heat demand. The zone is situated on the south bank of the River Clyde offering considerable potential for heat extraction. Additionally, two possible waste heat sources have been identified pending verification. Key anchor loads include the Science Centre, the BBC Scotland Studios, the STV studios and the Glasgow Springfield Quay complex. Regarding current gas use, from data, there are six existing gas fuelled heat networks/comunal heating systems, some large in size, that offer potential for decarbonisation.

There are three (3) electrical substations within the zone.

## 8.1.8 IHNZ: West 2

Category: Primary

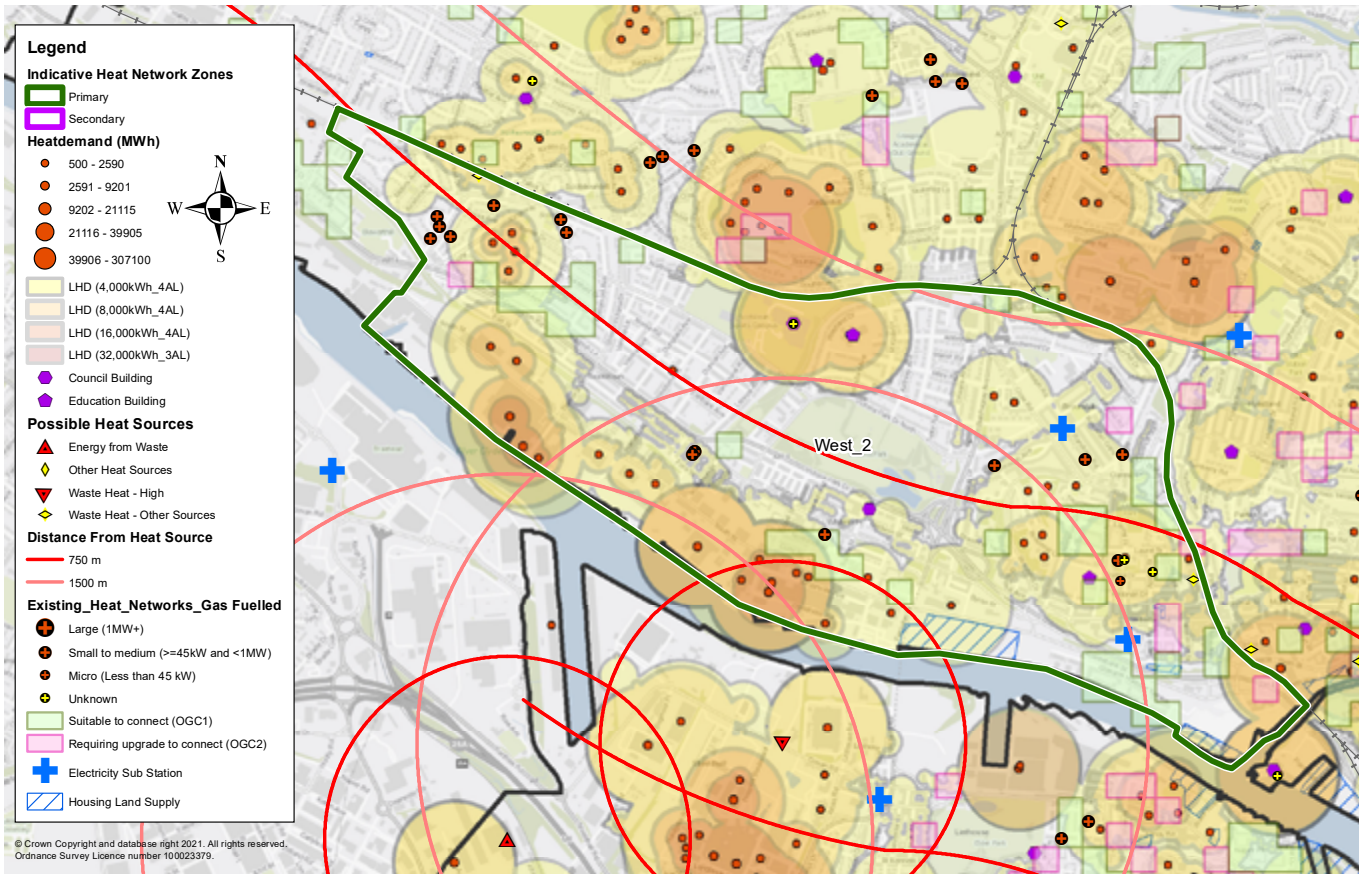



*Figure 44 - West 2 Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 451 ha** | **Total Anchor Loads: 39** |
| **Zone Heat Demand: 221 GWh / year** | **Anchor Load Heat Demand: 56 GWh / year** |
| **Cat 1 On-gas property count: 3623** | **Cat 2 On-gas property count: 1487** |
| **Confidence per MWh: 1.84** | **Stakeholders: TBC during consultation** |
| **LDP sites: Several Housing Supply and Vacant and Derelict Land sites have been identified within the heat dense areas of the zone.** | |

*Table 17 - West 2 IHNZ Characteristics*

The “West 2” Indicative Heat Network Zone has an area of 451 ha. Within the boundaries, see Figure 44, there are 39 anchor loads with an annual heat demand of 56 GWh. Total heat demand including domestic properties is 221 GWh/year.

Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.84. The consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and six (6) Education buildings, providing a potential for dependable heat demand across the zone. Positioned on the north bank of the river, potential heat sources are River Clyde and several low level heat sources within the zone. Current gas use, from data, have identified nineteen (19) existing gas fuelled heat networks/comunal heating systems that that offer potential for decarbonisation, subject to data verification. Plans are in place to develop a district heating scheme in the Yorkhill Quay area of this zone to service a new water park development alongside leisure facilities and offices. Further engagement is required to understand how the LHEES can support this development. There are two (2) electrical substations within the zone.

## 8.1.9 IHNZ: East 2

Category: Primary

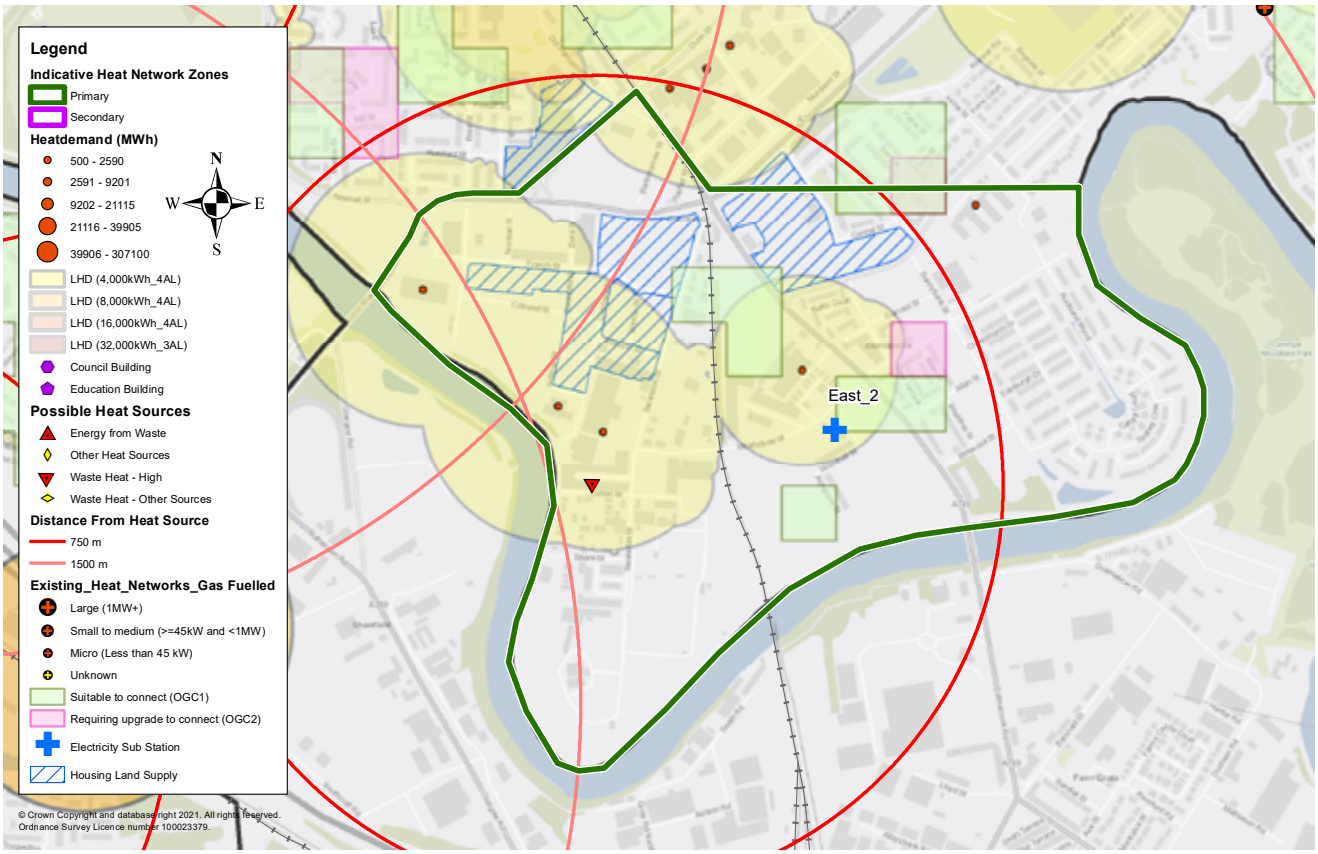



*Figure 45 - East 2 Indicative Heat Network Zone*

| | |
|---|---|
| **Zone Area: 96 ha** | **Total Anchor Loads: 5** |
| **Zone Heat Demand: 18.8 GWh / year** | **Anchor Load Heat Demand: 4.6 GWh / year** |
| **Cat 1 On-gas property count: 611** | **Cat 2 On-gas property count: 132** |
| **Confidence per MWh: TBC** | **Stakeholders: TBC during consultation** |
| **LDP sites: The area is currently being developed by Clyde Gateway within the area with over 16 ha of Housing Supply Land.** | |

*Table 18 - East 2 IHNZ Characteristics*

The “East 2” Indicative Heat Network Zone has an area of 96 ha. Within the boundaries, see Figure 45, there are 5 anchor loads with an annual heat demand of 4.6 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 18.8 GWh / year.

Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at TBC. The consultation process would aim to raise this closer to 5.

The Clyde Gateway D2 Grids project has already established a 5th generation heat network within this IHNZ, supplied via the Dalmarnock Wastewater Treatment Works (see section 4.2) Further engagement is required to understand how the LHEES can support this development.

There is one (1) electrical substation within the zone.

9

# DELIVERY AREAS: ON GAS GRID

## 9.1 Overview

A total of 36 delivery areas were identified from the process, previously shown in figure 34, for this Consideration in the LHEES. These areas act as an evidence base in identifying areas of the city with concentrations of domestic properties suitable for individual heat pump installation. Category 1 and Category 2[40] properties were clustered together to support project development across both decarbonisation and energy efficiency. These areas will be taken forward as a live tool in the development of the Retrofit Strategy and will likely be updated through engagement and consultation.

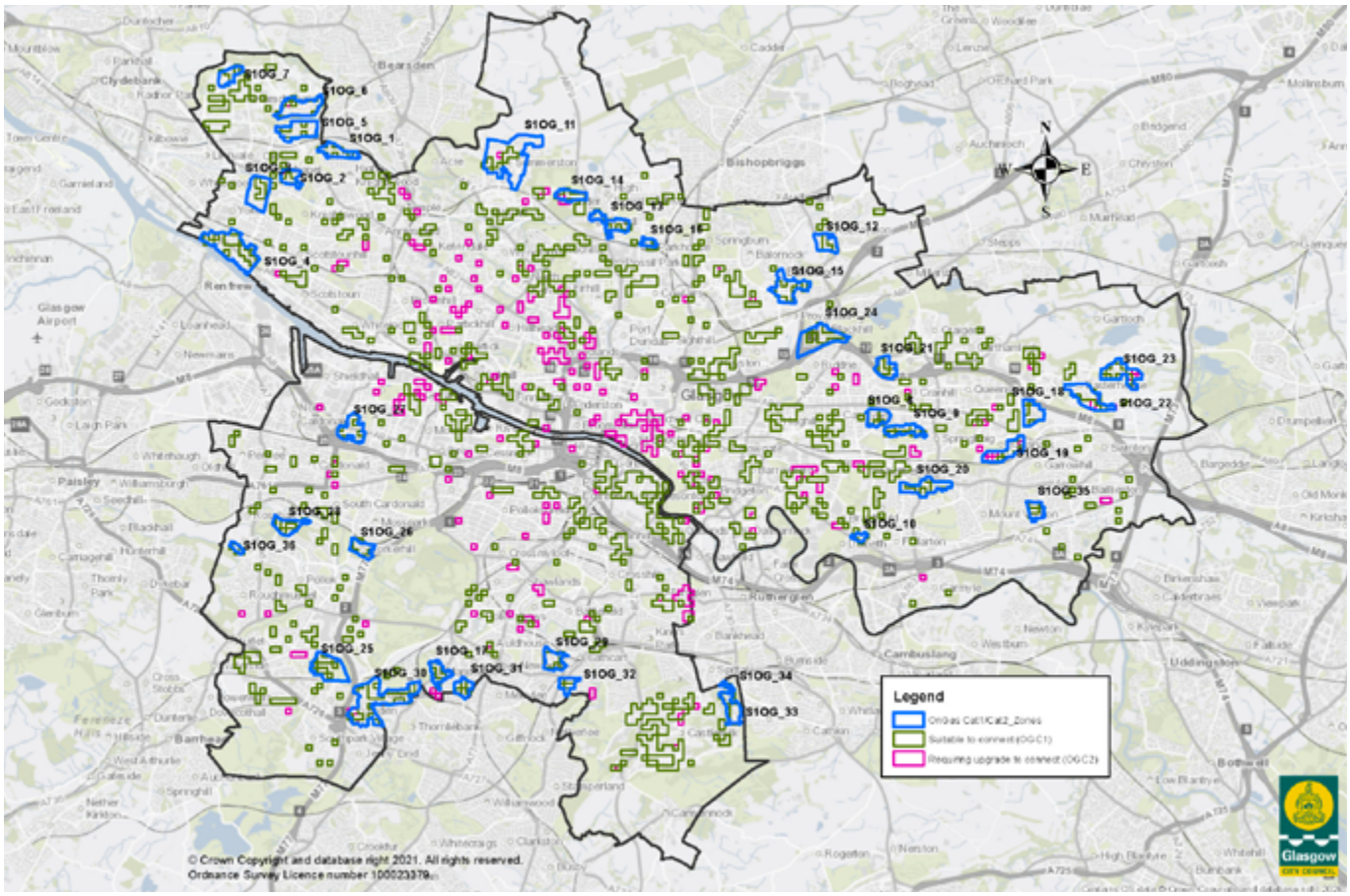



*Figure 46 - On Gas Grid Delivery Areas*

## 9.2 Portfolio Energy Asset Tool Assessment

Delivery area S1OG_30 (highlighted in Figure 47 on Page 100) was selected as an example to run through Energy Saving Trust's Portfolio Energy Asset Tool (PEAT)[41] to explore the potential costs and benefits associated with installing a heat pump into every domestic property within the area. There are 2,351 domestic properties within S1OG_30. The outputs from this exercise have summarised the predicted interventions required including costs, energy bill savings and carbon savings.

*[40] Cat 1 are properties that are particularly suitable for heat pump installation whilst Cat 2 properties need minor fabric upgrades to become feasible.*

*[41] Portfolio Energy Asset Tool: Tool to accompany Home Analytics; can be used to investigate and cost intervention options*

Outputs indicate that for an average cost of £10,132 each property with a heat pump installed could save £320 per annum on heating bills with an annual carbon saving of 766 $kgCO_2(e)$. The high capital cost and the long return on investment (31.6 years) underscores some of the challenges associated with enabling the mass rollout of individual heat pumps as a decarbonisation pathway for domestic buildings in the city.

These outputs come with caveats as to the data confidence attached to Home Analytics which is often modelled. Figure 47 highlights area S1OG_30, which is in the south of the city. Table 19 then summarised the outputs from the PEAT assessment which was ran on a 'high ambition' scenario which looked to install heat pumps in every home (with the corresponding fabric upgrades required) with no cost limit.

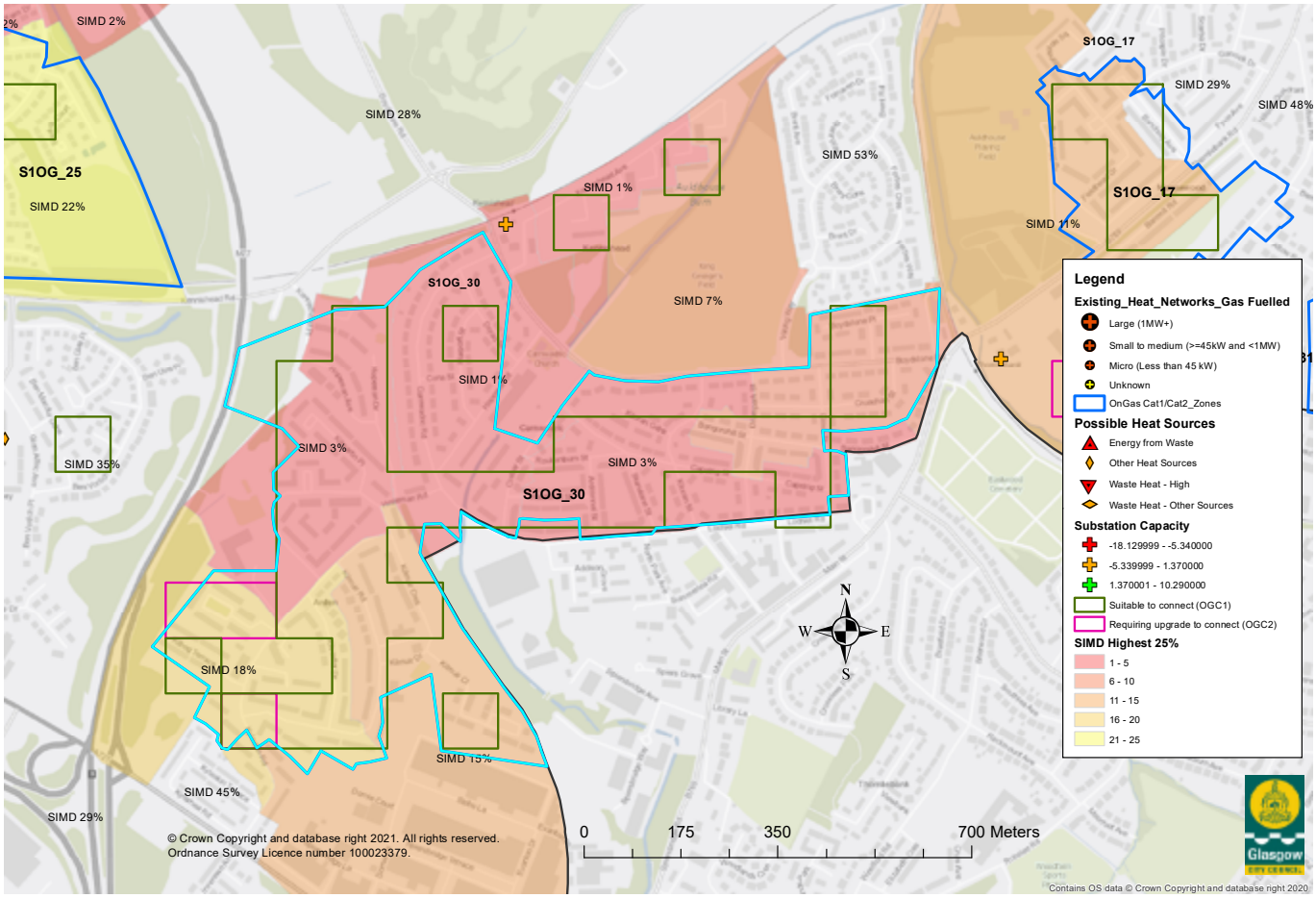



*Figure 47 - S1OG_30 Delivery Area*

| Measure description | Number of Measures | Total Cost of Measures | Total Energy saving (kWh pa) | Total Energy bill saving (£ pa) | Total Carbon saving ($kgCO_2(e)$ pa) | Total Lifetime Carbon saving ($kgCO_2(e)$) |
|---|---|---|---|---|---|---|
| 2.5kW Solar panels (photovoltaic cells) | 44 | £196,405.88 | 89,114 | £7,574 | 20,050 | 501,261 |
| Additional insulating jacket for existing foam insulated tank and new hot water controls (cylinder stat and water heater timer) | 1463 | £84,210.28 | 192,430 | £16,338.00 | 41,106 | 411,173 |
| Air source heat pump | 190 | £2,246,259.03 | 1,299,368 | £8,442.00 | 271,054 | 4,065,844 |
| A-rated glazing (uPVC) (replacingolder pvc framed double glazing) | 1878 | £7,270,768.46 | 1,102,906 | £103,094.00 | 236,465 | 4,729,444 |
| A-rated glazing (uPVC) (replacing older wood framed double glazing) | 5 | £17,189.51 | 2,280 | £182.00 | 486 | 9,719 |
| A-rated glazing (uPVC) (replacing wood framed single glazing) | 47 | £155,307.30 | 52,662 | £4,928.00 | 11,331 | 226,632 |
| External wall insulation | 73 | £497,636.60 | 144,443 | £12,702.00 | 30,866 | 1,111,197 |
| Hard to treat cavity wall insulation | 82 | £120,958.70 | 108,979 | £9,730.00 | 23,359 | 981,075 |
| Hard to treat cavity wall insulation - bead | 98 | £208,500.95 | 207,410 | £16,962.00 | 44,219 | 1,857,209 |
| High heat retention storage heaters | 113 | £499,526.66 | 71,702 | £31,868.00 | 16,149 | 322,975 |
| Insulation for flat roofing | 1 | £2,737.12 | 5,339 | £427.00 | 1,138 | 22,757 |
| Loft insulation top-up | 300 | £134,991.00 | 167,665 | £14,583.00 | 35,808 | 1,503,984 |
| Mains gas combi-condensing boiler | 35 | £142,306.40 | 54,149 | £4,084.00 | 11,526 | 138,308 |
| Mains gas condensing boiler | 402 | £1,834,734.41 | 709,241 | £55,775.00 | 151,099 | 1,813,218 |

*Table 19 - S1OG_30 PEAT Assessment Outputs*

| Measure description | Number of Measures | Total Cost of Measures | Total Energy saving (kWh pa) | Total Energy bill saving (£ pa) | Total Carbon saving ($kgCO_2(e)$ pa) | Total Lifetime Carbon saving ($kgCO_2(e)$) |
|---|---|---|---|---|---|---|
| New insulated uPVC external doors | 2194 | £1,102,141.65 | 296,217 | £27,721.00 | 63,479 | 1,904,620 |
| Replacement of remaining incandescent lightbulbs with low energy lightbulbs | 2351 | £27,854.40 | 199,975 | £108,740.00 | 47,497 | 237,499 |
| Room in roof walls and sloping parts, 100mm insulation | 23 | £98,330.94 | 65,675 | £7,050.00 | 14,165 | 594,950 |
| Solid floor insulation | 32 | £166,790.30 | 28,035 | £3,959.00 | 6,483 | 272,305 |
| Suspended wooden floor insulation | 760 | £1,918,912.21 | 1,119,381 | £95,629.00 | 239,035 | 10,039,615 |
| Time and temperature zone control for underfloor heating | 31 | £21,856.89 | 1,778 | £512.00 | 399 | 4,794 |
| **Total** | **10122** | **£16,747,418.69** | **5,918,749** | **£530,300.00** | **1,265,716** | **30,748,579** |
| **Average Per Property** | | **£10,131.53** | **3581** | **£320.81** | **765.71** | **18,601.68** |
| **Total Properties** | **1653** | | | | | |

*Table 19 - S1OG_30 PEAT Assessment Outputs*

10

# DELIVERY AREAS: POOR ENERGY EFFICIENCY AS A DRIVER OF FUEL POVERTY

*Delivery Areas for this Consideration will be finalised post-Consultation.*

## 10.1 Overview

As previously outlined, in section 7.3.1, the LHEES will not seek to finalise delivery areas for this Consideration. This action will be taken forward through the development of the upcoming Retrofit Strategy which will build on the evidence base created by the LHEES. This section highlights an area of the city that could become a potential delivery area and provides some discussion around this. The location selected is in the Govan area of the city to the southeast of Elder Park (see grid 2079 in Figure 48). The process used to identify 'hotspots' in the city, where retrofit may be practical and have a positive impact on fuel poverty rates, considered (i) SIMD data (ii) fuel poverty probability and (iii) the lack of wall insulation as key indicators.

Figure 49 provides some statistics on the condition of the domestic building stock within grid 2079. It is important to note that all properties were included within the statistics provided by Figure 49 rather than filtering for properties that met the threshold criteria.

Key points to note include

- The majority of properties (91%) are either owner occupied or housing association stock.
- Around two thirds of all properties are predicted to have uninsulated walls.
- 79% of properties were built after 1949.
- A large majority of properties are not in mixed tenure (80%). This is reflected by the statistics on property type which indicate only 35% of properties being flatted.

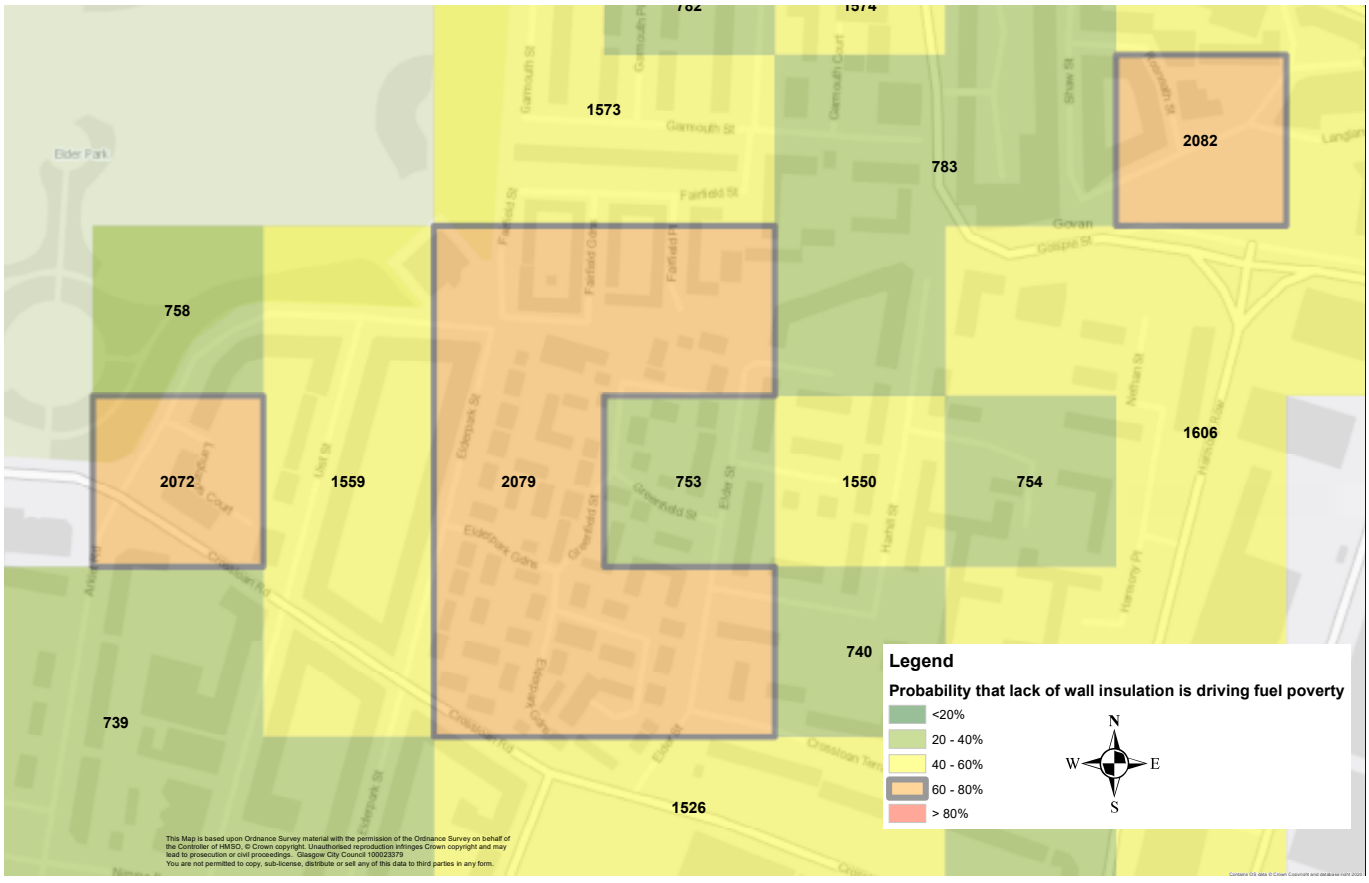



*Figure 48 - Potential Delivery Area for Poor Energy Efficiency as a Driver of Fuel Poverty (2079)*

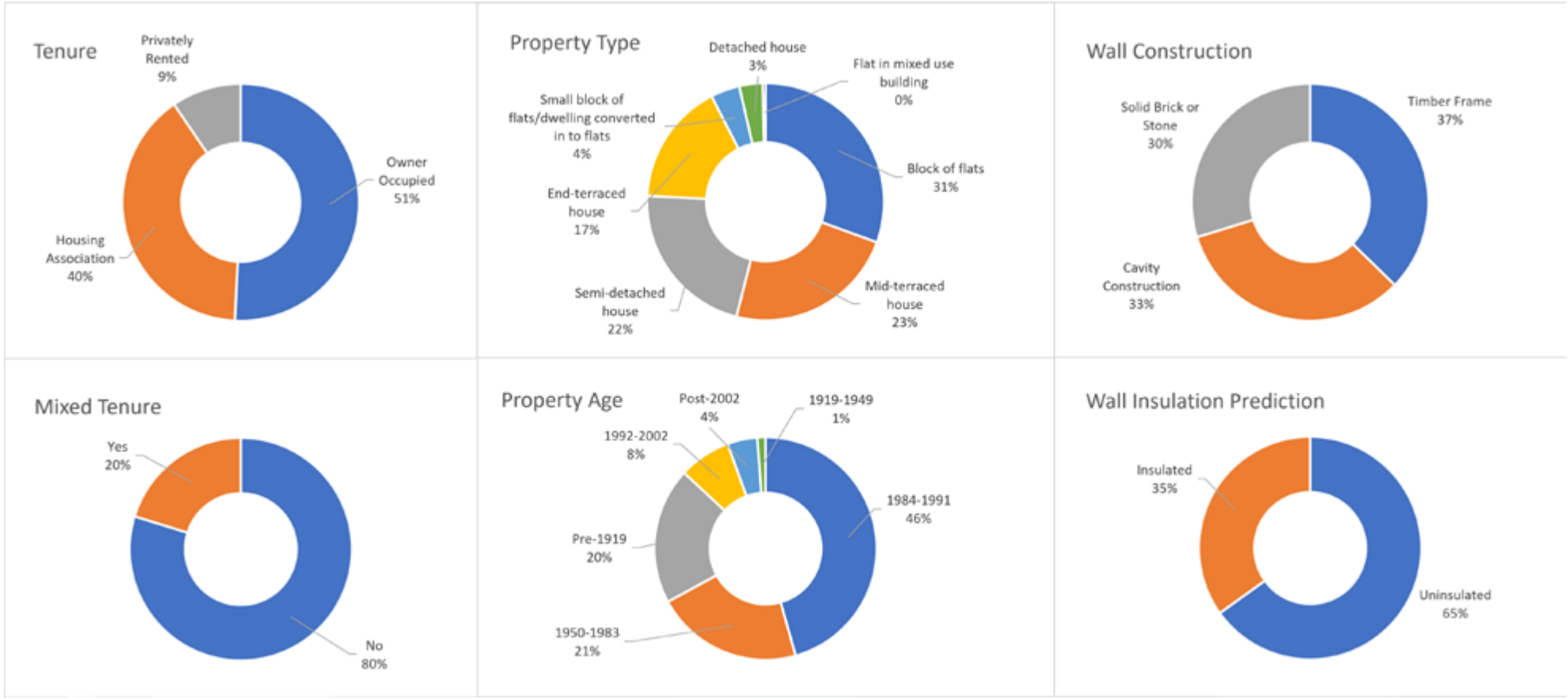



*Figure 49 - Delivery Area (2079) Statistics*

# 11

# DELIVERY MECHANISMS

# 11. Delivery Mechanisms

The LHEES delivery mechanisms and associated actions are grouped into six categories though it is noted that some actions cut across categories.

1. **Developing a Delivery Model for the LHEES**
2. **Moving from Indicative to Designated Heat Network Zones**
3. **Financing LHEES Delivery**
4. **Engagement and Collaboration**
5. **Embedding the LHEES**
6. **Energy Efficiency and Fuel Poverty**

## 11.1 Developing a Delivery Model for the LHEES

Glasgow City Council must develop an appropriate model to successfully deliver the LHEES. This is principally relevant to the ambition to accelerate the deployment heat networks in the city. Heat networks are a key focus for this LHEES and will be a primary mechanism in the provision of affordable, reliable, and sustainable heat for Glasgow which meets the needs of our city in an inclusive and just manner.

However, the Council will seek to consider the wider LHEES scope in the development of any delivery model. Whilst heat networks are a primary focus, any proposed heat network delivery model may also be applicable to unlocking development across the wider LHEES agenda and this must be considered.

### 11.1.1 Identifying Appropriate Delivery Structures

There are multiple delivery structures that can be deployed to deliver heat networks, as outlined in Figure 50. Options range from fully public sector led to fully private sector led models and include a variety of joint public/private or ‘hybrid’ arrangements. The balance of risk and reward tends to vary along with the level of control of the participating organisations.

Sharing (and potentially reducing) project risk is a key benefit to consider in any formal partnership arrangement between the public and private sector. Typically, partnership models have the benefit of sharing risk across organisations. Risks often associated with the delivery of district heating projects or energy projects for example could include:

- **Design risk** – the risk associated with the impact on a project of deficiencies in design (e.g., of heat mains, energy centres, control systems, internals).
- **Construction risk** – the risks associated with the building of physical assets to a specified design.
- **Operational risk** – the risk associated with operating and maintaining assets to meet specified requirements.
- **Demand/ market risk** - the risk associated with variances from anticipated demand (e.g., heat loads fail to materialise, or connection of loads to the network is significantly delayed, or loads choose to disconnect from the network)

- **Performance risk** – the risk associated with being able to supply customers to an agreed performance / service standard (e.g., due to demand being greater than forecast, or heat output being less than anticipated for the heat generation source(s))
- **Financial risk** – various financial risks capable of producing financial loss, including credit risk, interest rate movements, exchange rate risk, etc.
- **Regulatory risk** – the risk associated with changes to the legal / regulatory framework adversely impacting a project (e.g., heat networks regulation, planning control, metering, billing, consumer protection, technical standards).


| OPTION | DESCRIPTION | RISK ALLOCATION | EXAMPLE |
|---|---|---|---|
| 1. | Entirely public sector led: entirely publicly funded, developed, operated and owned | Public sector retains all risk. | Public sector procures contracts for equipment purchase only. Procurement could be direct, or via a publicly owned arm's length entity (e.g. an energy services company) |
| 2. | Public sector led: entirely publicly funded, greater use of private sector contractors | Private sector assumes design & construction risk, and possibly operational risk | Public sector procures turnkey asset delivery contract(s), possibly with maintenance and/or operation options |
| 3. | Public sector led, private sector invests/takes risk in some elements of the project | Private sector takes risks for discrete elements (e.g. generation assets) | As 2, with increased private sector operational risk, and payment or investment at risk |
| 4. | Joint venture – public sector & private sector partners take equity stakes in a special purpose vehicle | Risks shared through joint participation in JV vehicle / regulated by shareholders agreement | Joint Venture – both parties investing and taking risk |
| 5. | Public funding to incentivise private sector activity | Public sector support only to economically unviable elements | Public sector makes capital contribution and/or offers heat/power off-take contracts |
| 6. | Private sector ownership with public sector providing a guarantee for parts of project | Public sector underpins key project risks | Public sector guarantees demand or takes credit risk |
| 7. | Private sector ownership with public sector facilitating by granting land interests | Private sector takes all risk beyond early development stages | Public sector makes site available and grants lease/licence/wayleaves |
| 8. | Total private sector owned project | Private sector carries all risks | No or minimal public sector role (e.g. planning policy / stakeholder management) |

*Figure 50 - Generic Delivery Structures Representing a Variety of Public/Private Sector Roles*
*Source – Scottish Future's Trust "Guidance on Delivery Structures for Heat Networks" (2015), p. 8*

The absence of a comprehensive regulatory system for heat networks is also perceived as a risk. Forthcoming regulations under the Heat Networks (Scotland) Act 2021 ('the Heat Networks Act'), together with UK regulation (Energy Bill), will help address the latter concern to an extent, but local authorities can also help to de-risk other project aspects by acting as a mutual stakeholder as part of an energy partnership. This can be done through mechanisms including but not limited to -

- Co-investment in projects
- Facilitation – co-ordinating and brokering commitments from third parties.
- Local Regulation – through, for example, the planning system
- Committing Public Sector buildings as long-term anchor loads
- Underwriting certain project risks

At present, having considered the delivery options available, the Council believes that a partnership model, in which risks and benefits are shared between the Council and a private partner, would be a good approach to support the delivery of heat networks in Glasgow.

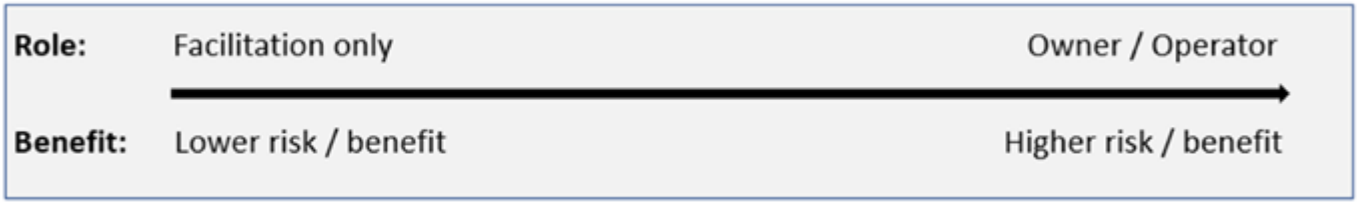



*Figure 51 Control v Risk Spectrum*

### 11.1.2 An Energy Partnership for Glasgow

In the context of deploying heat networks in Glasgow, an energy partnership could be a legally defined, collaborative arrangement between Glasgow City Council and an external organisation to bring capital investment and delivery capability into large energy-related projects. The projects taken forward by the energy partnership could deliver on local priorities relating to carbon reduction, fuel poverty and energy resilience. Glasgow City Council considers that an energy partnership could be the leading body responsible for the delivery of heat networks in Glasgow.

An energy partnership could primarily be a mechanism for securing significant levels of capital investment required for the development of heat networks, which the Council cannot supply alone. The Heat Vision 2030 project, which modelled how district heating could be deployed for the city centre of Glasgow, estimated capital expenditure of around £250 million and outlined that successful deployment of heat networks would be a function of investability. For heat networks in Glasgow, which can contribute to the delivery of strategic goals but are not without investment risk, an energy partnership may be the most appropriate delivery structure.

Formal partnership working between public and private sector organisations presents opportunities for local authorities to leverage private finance and expertise to progress large-scale and/or complex projects. Public sector projects can added value through collaboration with the private sector which can bring innovation, knowledge of new technologies, managerial effectiveness, and commercial skills. Private sector organisations also stand to benefit by working closely with the public sector partner and having exclusive access to a committed pipeline of project opportunities that can be offered up as part of the partnership arrangement.

Glasgow has a profile that is particularly suitable for district heating from a demand perspective and has the benefit of a major river running through its centre (with a large proportion of the river classed as tidal and therefore with additional capacity for heat offtake). What is required is a commercial model that can deliver heat networks for the city in a way that is attractive to customers and investors and can also contribute towards a reduction in carbon emissions and meeting fuel poverty targets.

The establishment of an energy partnership may also help to unlock heat network development in those areas of the city that are less commercially attractive but could benefit the most from what district heating can offer.

Additionally, an energy partnership may help to unlock delivery of the wider LHEES agenda. Within this, the Council will consider -

- The potential to use an energy partnership to twin revenue generating projects (such as heat networks) to the retrofit agenda, unlocking development by cross subsidy
- For an energy partnership to operate across the wider net zero agenda including the electrification of transport
- The possibility of working regionally in the establishment of an energy partnership to unlock greater access to capital
- The potential benefits that a technology agnostic partner may provide for the wider LHEES agenda rather than a partner focused purely on heat

### 11.1.3 Developing an Energy Partnership - Key Risks and Issues

Establishing an energy partnership with a private organisation would be a considerable undertaking for the Council with significant risks that will require to be carefully managed, including the potential for:

- Proper governance
- Misaligned priorities
- Under-representation of the public-sector in decision making
- Poor channels of communication
- Insufficient coordination and cooperation between partners
- Insufficient or unsustainable funding
- Lack of buy-in at senior level for both parties

If an energy partnership is deemed an appropriate delivery mechanism for heat networks and the wider LHEES agenda, in order to mitigate some of these risks and realise the full benefits the Council would require a strong understanding of how it would like control and risk to be shared between the parties whilst developing (and negotiating) the partnership model. Glasgow City Council would like to develop clear expectations in respect of desired outputs and preferred governance arrangements prior to formally launching any procurement.

Any proposed partnership would most likely be required to exist on a long-term basis and be able to provide up-front assurance on deliverability. Long-term arrangements carry their own risks, as the Council could find itself locked into a framework that is not delivering successfully on the ambitions of the LHEES.

Any proposed partnership model would need to be commercially attractive to potential partners. The Council would look to understand market requirements/ expectations,

captured via market engagement, prior to launching any procurement. In this respect, Phase I of LHEES delivery will be essential to clarify the commercial opportunity that would be available to any prospective partners.

As part of this, Glasgow City Council is considering whether to make its own capital investment in heat networks via an energy partnership. The Council investing capital (for example, through a joint-venture company similar to Midlothian Energy) could enable further de-risking of projects by sharing investment risk across two parties, increase overall capital, and offer the Council (as a shareholder) a greater level of control over the heat network business, and how it was run. It would also offer the Council a share in any profits generated by the partnership, which could be reinvested into other services.

However, if the partnership was not successful, the Council may not recuperate any investment made. Investing large amounts of capital in heat networks could also reduce capital available to spend on other priorities. The Council is considering how best to balance these different advantages and risks in developing options for an energy partnership. There is uncertainty at present on how the heat network regulations will interact with any proposed energy partnership, particularly around the granting of permits. More clarity will be provided as the secondary legislation around the Heat Networks Act is developed.

Though the Council can mitigate risks associated with an energy partnership through robust development and procurement processes, there will always inherently be underlying risks that cannot be fully mitigated. Balancing the risks against the potential benefits of establishing an energy partnership will be an important first step in LHEES delivery.

### 11.1.4 Concession Zones to Stimulate Investment

One delivery model the Council is considering is the potential development of a concession model to deliver heat networks within designated Heat Network Zones and to incentivise private sector investment. Further work is required to identify whether this could work in conjunction with, or as part of, a wider energy partnership.

A concession is a time-bound contract between a company and the procuring authority (in this case the Council) that gives the company the exclusive right to operate a specific business (in this case the supply of heat via heat networks to certain buildings) , subject to certain conditions and incentives. The delivery of district heating within each Heat Network Zone in Glasgow could be supported through the granting of one or more concessions, which would allow (and require) the company to design, build, finance, operate and maintain heat networks within the Zone for the duration of the concession period. Concessions can be used to transfer economic risk to the private sector, noting that this involves the private sector retaining control over elements of the project to protect its investment.

The Council will explore the use of concessions in cases where there is confidence that the operating model will work best to improve the overall investability of identified Heat Network Zones while also delivering the desired outcomes for heat for energy users Concessions can be used to transfer economic risk to the private sector, noting that this involves the private sector retaining control over elements of the project in order to protect its investment.

## 11.2 Moving from Indicative to Designated Heat Network Zones

Delivery of the LHEES in the short term will be focused on moving the indicative Heat Network Zones into a position where they can be formally designated under the Heat Networks (Scotland) Act 2021. Figure 52 illustrates the process this will follow. Where relevant, the delivery plan actions are based around this process.[42] Action in this regard will be centred around

- The clarification of renewable and low carbon supply opportunities
- The completion of Building Assessment Reports (BARs) for Glasgow City Council, other public organisations, and the wider non-domestic sector
- The initiation of techno-economic feasibility studies and then business cases to commercialise indicative Heat Network Zones and determine whether the zone would benefit from a permit being allocated to it

### 11.2.1 Clarification of Renewable and Low Carbon Supply

#### Developing a Delivery Model – What We Will Do

- Evaluate delivery models for deploying heat networks in Glasgow, including establishing an energy partnership, and agree a development route.

# Opportunities

Heat networks will be a key mechanism for Glasgow to reduce our heating-based emissions. Delivery on this will be framed around quantifying demonstrable supply opportunities within primary indicative Heat Network Zones alongside exploration of less clarified supply opportunities within secondary indicative Heat Network Zones. Action on this will allow for the eventual reclassification of secondary zones as either primary or not suitable. Future policy decisions around renewable supply options that are not considered in this LHEES (such as hydrogen) may provide sufficient project viability in secondary zones where supply opportunities were not able to be clarified. As such, the Council will maintain cognisance of all zones identified in the LHEES regardless of the outcome of actions to explore current supply opportunities.

For this, the LHEES will be focused on identifying reliable sources of renewable and low carbon heat. This will involve -

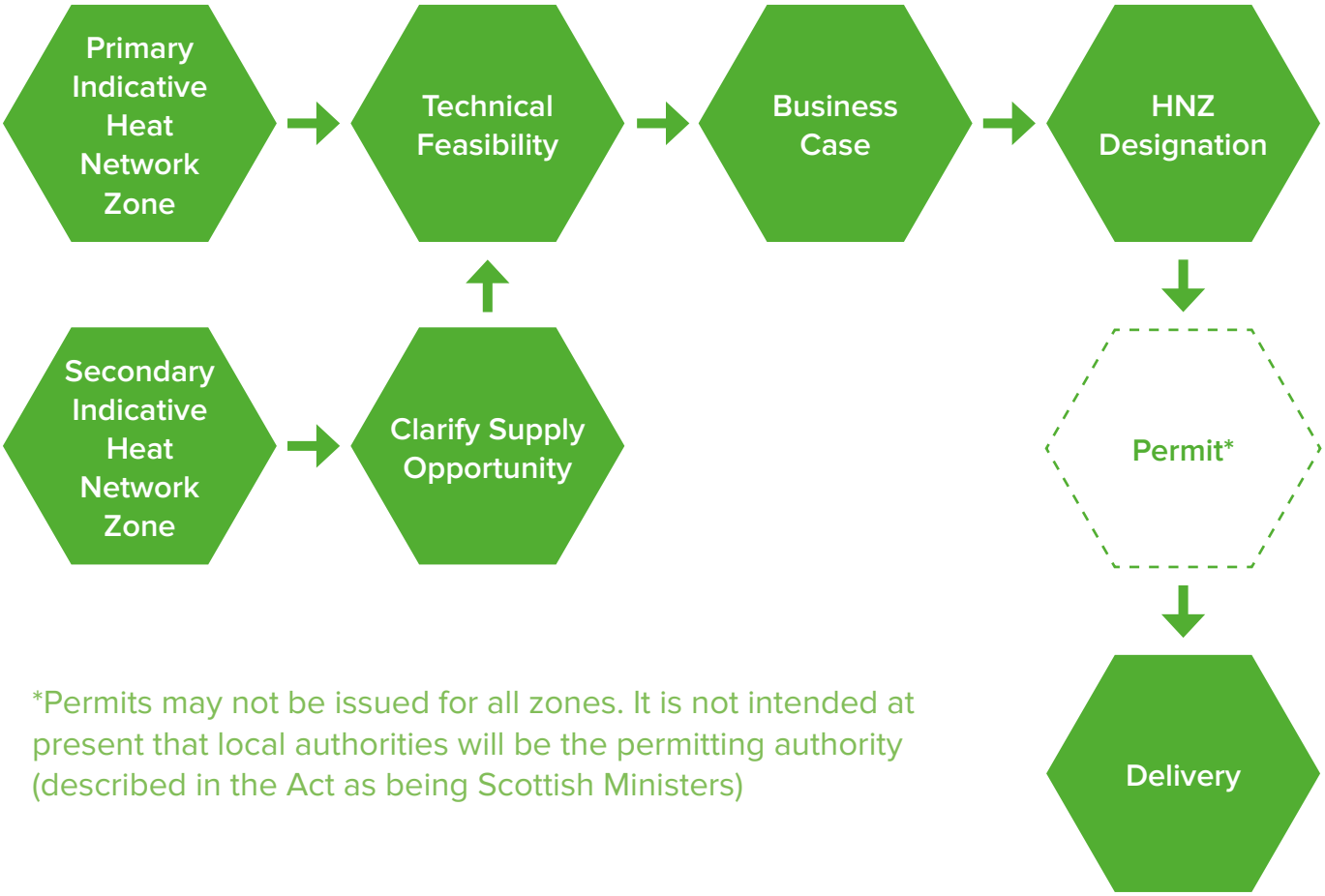



*Figure 52 - Moving from Indicative to Designated Heat Network Zones*

[42] *A primary zone is considered to have a more established renewable or low carbon supply opportunity alongside sufficient heat density. A secondary zone is considered to have a less clarified renewable or low carbon supply opportunity but with sufficient heat density.*

- Quantifying the maximum potential for heat extraction from the River Clyde
- Building on the outputs from the pilot study into potential for deep geothermal
- Engagement with academic research to clarify heat extraction feasibility whilst enhancing knowledge base as a whole
- Working with the Coal Authority to develop a comprehensive understanding of the opportunity to extract heat from mine workings
- Working with Scottish Water Horizons to clarify opportunity for heat extraction at their Shieldhall wastewater treatment works alongside exploration of heat extraction from the wastewater network
- Working with internal partners to scope initial opportunities for ground source heat pump installation
- Continuing to be actively involved with the newly formed Waste Heat Steering Group as a mechanism of unlocking waste heat potential in the city with a key focus on the Strathclyde Distillery.

### 11.2.2 Building Assessment Reports (BARs)

The requirement to undertake BARs for all publicly owned buildings as per the Heat Networks Regulations will provide more confidence in demand figures at property level which have largely been modelled in the Scotland Heat Map. Local authority buildings are prioritised in establishing a building connection hierarchy due to the higher likelihood of coordinating an agreement to connect.

**Glasgow City Council will prioritise completing BARs in indicative Heat Network Zones within one year of LHEES adoption**, then extending this to all buildings within the Council estate to develop an accurate picture of opportunities both inside and outside of indicative zones. This action will be captured in the upcoming Carbon Management Plan 3 which will update on plans for the Council to decarbonise its own estate. Additionally, the Council will facilitate and support other public sector organisations in discharging their duty to complete BARs.

It is anticipated that the statutory requirement to complete BARs will in time extend to all non-domestic buildings. Until this point, Glasgow City Council will work with the non-domestic sector to promote the voluntary submission of BARs, prioritising those buildings that present the highest opportunity within indicative zones. This will simultaneously assist in improving the average confidence levels for heat demand across non-domestic stock alongside acting as a mechanism for beginning connection dialogue with non-domestic property owners.

| | |
|---|---|
| **Building Assessment Reports (BARs)** | A duty on the public sector to assess their estate for suitable heat network connection. This will provide clarity on heat demand alongside connection suitability from an architecture perspective. Whilst this only applies to the public-sector at present, this may extent to all non-domestic buildings in the future. |

*Figure 53 - Building Assessment Reports Overview*

### 11.2.3 Techno-economic Feasibility into Business Case

Techno-economic feasibility works will be programmed for all indicative Heat Network Zones, subject to funding, that present clarified supply opportunities. For secondary zones where a reliable supply opportunity was not identified, techno-economic feasibility works will not be initiated.

Feasibility works will provide an assessment on the techno-economic viability of a heat network within an indicative zone. This will build on the work already completed in the LHEES by adding more granularity into the technical assessment whilst adding considerations of the economic and commercial cases for any heat network project. Upon completion, and with an outcome that indicates techno-economic viability, the development of business cases for heat networks in each indicative zone will commence.

Whilst the LHEES has provided the broad strategic case at city level for where heat networks may be the most appropriate, techno-economic feasibility works moving into business case development will allow for further, zone specific assessments to take place. This will be a key step toward the eventual designation of Heat Network Zones.

The development of full business cases will be prioritised for the City and South 2 Indicative Heat Network Zones. For IHNZ South 2, the completion of the feasibility study around harnessing surplus heat from the GRREC means that the Council can advance this to the next stage. Additionally, the development of the Climate Neutral Innovation District has placed IHNZ City in an accelerated position.

## 11.3 Financing LHEES Delivery

The overall approach to funding the LHEES considers long-term, strategic approaches to tackling heating-based emissions and fuel poverty. The Council will identify how funds can be made available to unlock opportunities in a way that makes best use of the needs, assets, and opportunities on an area basis. Within this, pathways to unlocking long-term, patient finance will be explored to leverage the significant capital required into the delivery of heat networks. Both the Scottish National Investment Bank and the Strathclyde Pension Fund have been identified as potential funding sources.

Glasgow City Council will also define opportunities for developing alternative funding models to support the delivery of specific plans, including revolving funds or private finance initiatives through partnerships (as discussed in section 11.1). The development of a local authority ECO-Flex scheme will assist the Council in fully harnessing the potential of the ECO fund to drive delivery on energy efficiency and fuel poverty. A full range of potential funding options has been included in Appendix C.

### Moving from Indicative to Designated Heat Network Zones – What We Will Do

- Quantify the maximum potential for heat extraction from the River Clyde to support identification and formal designation of Heat Network Zones where the River Clyde is the primary supply option.
- Quantify opportunities for low carbon or renewable heat supply in Glasgow where potential is less clarified including, though not limited to deep geothermal, heat from mine workings, heat from wastewater, ground source heating, and other sources of waste heat.
- Complete Building Assessment Reports (BARs) for required GCC owned buildings
- Facilitate and support public sector organisations to discharge their duty to complete BARs
- Work with the non-domestic sector in Glasgow to promote the voluntary submission of BARs ahead of expected national legislation
- Initiate techno-economic feasibility studies for all primary indicative Heat Network Zones
- Commence development of business cases for all zones where heat networks have been determined as a feasible heat decarbonisation pathway
- Initiate development of full business case for a heat network in indicative Heat Network Zones City and South 2

For the successful delivery of Glasgow's programmes and the achievement of our targets, it is essential that there is certainty on the scale and continuity of resources. Outcomes will not be delivered if the resource framework is based on annual competitive bidding processes, the corollary of this is that projects must meet viability and other criteria including fairness and equity. It is therefore important that the Scottish Government provides long term certainty on funding options, including multi-year models. Moving away from annual funding models will provide the long-term certainty needed for sectors to begin investing in skills and supplies required to deliver the LHEES. This is particularly relevant to the Area Based Schemes fund for which the LHEES will provide a live

## 11.4 Engagement and Collaboration

Engagement and collaboration with residents and stakeholders in Glasgow form a critical arm of LHEES delivery.

### 11.4.1 Engagement and Communications

In the absence of mandatory connection, **reducing offtake risk for heat network projects is a priority focus in the delivery of the LHEES.** Securing heat offtake agreements for those properties that are prioritised for connection will require strong engagement. Developing an approach to engagement that is tailored to the LHEES is therefore critical to delivery. As such, an engagement approach will be developed for the LHEES and then incorporated into the upcoming Climate Engagement Strategy which is currently under development. In tandem with this, much of the proposed activity outlined below is likely to sit more appropriately with a delivery partner if deemed the most appropriate delivery model. Determining responsibilities around engagement and communications will be taken forward through the process of identifying a suitable delivery model.

#### Financing Delivery – What We Will Do

- Work with GCC Climate Finance Framework to identify investment into required infrastructure. This will include identification of funding streams including though not limited to the Scottish National Investment Bank and the Strathclyde Pension Fund Organisation

Engagement must be done in a systematic manner, ensuring that the right type of engagement happens at the right time. Views from stakeholders and potential customers should be listened to and incorporated into project design and in this light, engagement will be a thread that runs throughout the entire lifecycle of a project to ensure that projects are tailored to those who are impacted most by it.
In developing an approach to engagement for the LHEES, Glasgow City Council will consider:

- **Anchor load connection dialogue.** In the short-term, LHEES delivery will focus on engagement with those properties with large heat demands (anchor loads) that will be prioritised for connection.
- **Engagement with Social Housing Providers.** Where social housing sits within any zones or areas identified through the LHEES, engagement with said providers will be an important step in building the business case for any project alongside ensuring that projects can help to alleviate fuel poverty.
- **The requirement for a zone coordinator role.** Such a role could be tasked with championing the case for district heating within HNZs, building the case for the projects and acting as a mediator, potentially through and energy partnership arrangement, between the Council, possible customers, stakeholders and more. It is not assumed that this will sit within the competence of the Council alone.

- **City-wide communications campaign.** Many residents in Glasgow are unaware of what heat networks are and those existing perceptions can often be negative due to challenges borne in previous projects. An extensive city-wide communications campaign could help to outline how heat networks can offer a viable pathway to Glasgow to benefit from reliable, affordable, and green heat in the long term. Any communications effort should include engagement with those domestic properties identified as being within areas suitable for individual heat pump installation.
- **Connection Blocks.** Whilst buildings identified as anchor loads will be prioritised for connection dialogue, the ambition of Glasgow's LHEES is to create conditions where smaller consumers of heat can have opportunity to connect into a network at a feasible point. One option that will be explored will be the creation of 'connection blocks' to provide operators with compounded heat demand across multiple individual homes, particularly in tenemental properties.

It is not assumed that the full scope of engagement activity necessary for delivering the LHEES will sit within the competence of the Council alone. Some of the proposed activity outlined above may sit more appropriately with a delivery partner if a partnership was deemed the optimal approach. Determining responsibilities around engagement and communications will be taken forward through the process of identifying a suitable delivery model.

### 11.4.2 Community Collaboration

It is vital that community groups operating within or close to any zones or delivery areas identified through the LHEES and are engaged with the strategy. This could assist in identifying possible opportunities through local knowledge or it could present pathways for the development of community heating schemes. In this respect, consideration of community heating will be incorporated into the upcoming Community Renewable Energy Framework being developed via the Climate Plan which will identify several sites potentially suitable for the development of community-energy projects.

### 11.4.3 The Dalmarnock Village

There are already multiple plans underway or completed projects to which the LHEES can either contribute to the development of or take learnings from. Notably, the future of the Dalmarnock Village heat network (formerly the Commonwealth Games Athlete's Village) must be determined in line with the trajectory set by the LHEES. The LHEES Delivery Plan commits the Council to develop an options appraisal report, in collaboration with GCC Asset Management, for the network alongside pathways to decarbonising the supply and reducing the demand of the network.

### 11.4.4 Cross Border Collaboration

Where potential projects have been identified on the boundary of the City, Glasgow City Council will commit to working closely with neighbouring authorities and regional bodies such as Glasgow City Region and Clydeplan to determine an optimal cross-border approach to delivery.

### 11.4.5 Individual or Communal Heat Pumps

A clarified pathway for the rollout of individual heat pumps has not yet been developed at national level. At present, the funding landscape is insufficient to initiate a mass rollout of individual heat pumps at national level. Furthermore, regulations to stipulate domestic and non-domestic buildings to disconnect from mains gas have yet to be set, including a deadline for this. In this regard, Glasgow City Council will monitor the outputs of the upcoming Heat in Buildings Consultation.

In the absence of regulation, mains gas will remain the counterfactual to heat pumps, making the business case for individuals and organisations to shift from gas difficult. In the absence of financial incentive, mains gas will likely continue to be a more cost-effective heating option.

Outcomes from the UK Government's **REMA consultation** currently underway may help to support the case for switching from mains gas to a heat pump by bringing the consumer cost of electricity down. However, long-term policy and financial commitments are required to support the skills and capacity building required to transition individual homes onto a heat pump where there is in sufficient density for a heat network.
Glasgow City Council will engage with domestic properties identified as suitable for individual heat pumps as part of the wider LHEES engagement agenda in order to better understand perceptions around low carbon heating and to support project development.

## 11.5 Embedding the LHEES

The scope of the LHEES is broad, and cuts across a range of projects, policies and remits. Taking specific action to ensure the LHEES complements and interacts with activity going on across the city is essential. A full policy review is included in Appendix A.

### 11.5.1 Net Zero Route map

The Council will also incorporate LHEES related plans and proposals into Glasgow's upcoming Net Zero Route map which will outline a pathway for the city to achieve net zero carbon by 2030 across all sectors. Integrating LHEES outputs into this will help to characterise the scope and pace of delivery as LHEES progresses. This should involve a more integrated assessment of the wider impacts on energy systems should heat networks be implemented in the zones, including an assessment on the interaction between retrofit and district heating.

### Engagement and Collaboration – What We Will Do

- Embed the LHEES into the upcoming Climate Change Engagement Framework
- Incorporate LHEES outputs into the development of the Community Renewable Energy Framework (CREF)
- Initiate the production of an options appraisal report for the ownership and future development of the existing heat network at the Dalmarnock Village (Formerly the Commonwealth Games Athlete's Village)
- Identify opportunities for project development across local authority boundaries.

## 11.5.2 Embedding into Related Council Policy

Delivering the LHEES will require the incorporation of the strategy and delivery plan into the range of strategies and policies being developed by the Council relating to heating and energy efficiency. Refer to Appendix A for an overview of related strategies. Additionally, the actions set out in the LHEES delivery plan will be embedded within the Climate Programme being developed to track and manage actions relating to Glasgow's push for net zero.

## 11.6 Energy Efficiency and Fuel Poverty

There are existing plans in place for the delivery of affordable heating and energy efficiency improvements, namely our Glasgow Housing Strategy and upcoming Retrofit Strategy Where projects and plans are already in place, the delivery of the LHEES will be incorporated into them. Where there are projects yet to be developed, the LHEES provides an evidence base, or live tool, to assist in project identification from a spatial perspective.

## 11.6.1 Maximising Existing Funding Mechanisms

Currently, there are multiple funding streams for energy efficiency improvements, each with corresponding criteria and allocated to local authorities on a competitive basis. For businesses to invest in staff skills and manufacturing capability, the current short-term funding model creates barriers. A multi-year funding model, that provides businesses with enough certainty to invest in capacity building in the long term, will be required if Glasgow is to succeed in reducing heat demand through retrofitting of our building stock.

### Embedding the LHEES – What We Will Do

- Ensure that the upcoming Net Zero Roadmap is developed in conjunction with the zone-specific outputs of the LHEES
- Ensure the LHEES is embedded into the development and delivery of Council policy on energy, housing, planning, and development.
- Embed the LHEES Delivery Plan into the Climate Programme to ensure appropriate governance established

- **The Energy Efficiency Scotland: Area Based Schemes (EES:ABS)** is currently seeking to move into a multi-year model and the City Council will explore how this can be replicated for other funding models available. This will be required if a pipeline of work at scale is to be developed that can drive us towards our targets relating to both carbon emissions and EPC ratings. The LHEES will seek to use the delivery areas where poor energy efficiency is believed to be driving fuel poverty as an evidence base to develop ABS projects at a higher scale than previously undertaken. Whilst funding will still be capped, a multi-year model will lower the risk attached for the retrofit sector to invest in projects with a wider scope and a longer lifespan. This will build on the progress made by GCC NRS Housing to date, including achievement full ABS grant drawdown prior to COVID-19.

  Area Based Schemes are designed and delivered by local authorities with funding from the Scottish Government. The funding targets areas at risk of or in fuel poverty that would benefit from energy efficiency measures and is intended for owner-occupiers or private landlords. Projects developed through EES:ABS have largely undertaken external wall insulation or have delivered a hybrid combination of both external and internal wall insulation tailored to sandstone tenement properties. From 2013 to 2022, there were 79 Area Based Schemes projects delivered across Glasgow using £35.6 million grant funding (contributing to a total spend of £96.4 million) to retrofit over 10,600 homes with external wall insulation.

- **ECO Local Authority 'Flex' Scheme.** The Energy Company Obligation (ECO) is a government energy efficiency scheme in Great Britain designed to tackle fuel poverty and help reduce carbon emissions. The current iteration is **ECO4**, the legislative basis is set out in the Energy and Gas (Energy Company Obligation) Order (2022).
  ECO obligates medium and large energy suppliers to promote measures that improve the ability of low-income, fuel poor and vulnerable households to heat their homes.

  There are four routes through which households can access ECO Flex funding which allows private tenure households, meeting the ECO4 criteria, to secure a financial contribution towards the installation of an energy efficiency measure in their home. The eligible measures, of which a table is included in Appendix G, may be funded through ECO Flex. The table has been taken from the OFGEM resource available **here** (ECO4 Measures Table v1.1). The Council is currently developing an LA Flex scheme to maximise the opportunities for qualifying households to secure ECO funding to install energy efficiency measures to their home for a reduced cost or in some instances no cost. The scheme, if progressed, will contribute the delivery of Glasgow's LHEES and the city's net zero carbon target.

## 11.6.2 A Targeted Approach to Pre-1919 Tenements

A Housing Retrofit Strategy and Delivery Plan is being produced by GCC NRS Housing. The strategy will focus particularly on the decarbonisation challenge presented by the city's pre-1919 tenements. It will provide:

- Technical advice to encourage appropriate "fabric first" repair and energy efficiency measures and the introduction of low carbon heating systems
- Funding options and an affordability assessment
- Support for partnerships that facilitate large scale housing retrofit in Glasgow to meet carbon emission and fuel poverty reduction targets and to harness wider job creation, circular and inclusive economy benefits. A scoping paper will be prepared in Sumer 2023 with a strategy and delivery plan expected by Autumn 2024.

Next Steps -

- GCC NRS Housing is currently at evidence gathering stage which involves a desktop review alongside stakeholder engagement.
- **Database of pre-1919 tenement properties** being developed and mapped using ARC GIS[43] to enable additional data layering and analysis. This work will build on the mapping provided through the LHEES and incorporate Registered Social Housing (RSL) housing stock data, EST Home Analytics data, building condition and repair data and RSL retrofit data.
- **Pre-1919 Retrofit Pilots** – Several projects are being carried out during 2023-25 to test different technical and funding approaches for retrofit.
- **Technical Working Group** to be established by Sept 2023 to bring retrofit designers, intermediaries, and academics together to share learning, peer review and collaboratively identify the technical specifications for pre-1919 tenement

## 11.6.3 Building Capacity for Retrofit at Scale

A Glasgow City Region Housing Retrofit Delivery Group has been established to explore the recommendations of the regional housing retrofit study undertaken by consultants Grant Thornton.[44] This group comprises officers working on retrofit from all 8 local authorities in Glasgow City Region, alongside other stakeholder organisations. Through this group, key challenges have been explored including delivery of the ABS funding, skills development, local supply chains, stakeholder engagement, and financing retrofit.

Recent work has been commissioned by Scottish Enterprise to better understand and baseline the local supply chain that may support retrofit activity. In addition to the above, Skills Development Scotland are also due to publish a report identifying the current skills pipeline and any potential gaps that require to be filled to support large scale retrofit delivery across the region. This action is captured in LHEES delivery and Glasgow City Council will continue to engage with the Glasgow City Region group alongside Skills Development Scotland and Scottish Enterprise to support progress and look for opportunities to collaborate.

[43] *https://www.arcgis.com/index.html*

### 11.6.4 Continuing to Retrofit Our Own Estate

Glasgow City Council will continue its programme of reducing carbon emissions on our own estate through the development of the third Carbon Management Plan (CMP3). This will involve continued upgrades to BMS alongside improved demand side management. Additionally, the requirement for Glasgow City Council to complete Building Assessment Reports through the Heat Networks Act will be captured in the Carbon Management Plan 3.

#### Housing and Energy Efficiency – What We Will Do

- Embed the LHEES into the upcoming Climate Change Engagement Framework
- Incorporate LHEES outputs into the development of the Community Renewable Energy Framework (CREF)
- Initiate the production of an options appraisal report for the ownership and future development of the existing heat network at the Dalmarnock Village (Formerly the Commonwealth Games Athlete's Village)
- Identify opportunities for project development across local authority boundaries.

[44] https://www.glasgow.gov.uk/councillorsandcommittees/viewSelectedDocument.asp?c=P62AFQDNZLDNZLUTZ3

# 12

# ACTION PLAN

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L1 | Evaluate delivery models for deploying heat networks in Glasgow, including establishing an energy partnership, and agree development route | GCC NRS Sustainability, GCC Legal, GCC Finance, GCC Planning, GCC Legal, GCC CPU | GCC, Scottish Government, Scottish Futures Trust, Private Partner, GCC Finance, GCC NRS Planning, GCC Legal | Identify the most practical and feasible mechanism for delivering heat networks in Glasgow considering –<br>• GCC risk appetite<br>• GCC investment capacity<br>• GCC investment appetite<br>• Market appetite | Decision on appropriate delivery model to be made within 6 months of LHEES adoption | Establishment of appropriate model for delivering heat networks in Glasgow.<br><br>Launching of a procurement to deliver the preferred model. | NA |
| L2 | Initiate techno-economic feasibility studies for all primary indicative Heat Network Zones | GCC NRS Sustainability | Scottish Government, ZWS | Initiate techno-economic feasibility studies for all primary indicative Heat Network Zones.<br><br>A prioritisation list will be developed for sequencing of feasibility works. Primary zones will be prioritised first whilst supply opportunities are clarified for secondary zones. Where opportunities are identified, secondary zones will be reclassified as primary and proceed to feasibility.<br><br>This action will help to clarify specific Heat Network Zones for formal designation. | Completion 1 year from LHEES adoption | | Heat Network Support Unit, Internal Funding<br><br>Funding not secured |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L3 | Commence development of business cases for all zones where heat networks have been determined as a feasible heat decarbonisation pathway | GCC NRS Sustainability | Scottish Government, ZWS, SFT | Upon the completion of techno-economic feasibility studies, develop zone specific business cases.<br><br>Indicative Heat Network Zones that show the most potential will be prioritised. This LHEES serves as the citywide strategic business case. | Completion within 18 months of LHEES adoption. | Completion of business cases for all primary indicative Heat Network Zones. | Heat Network Support Unit, Internal Funding<br><br>Funding not secured |
| L4 | Initiate development of a full business case for a heat network in Indicative Heat Network Zone South 2 and City | GCC NRS Sustainability | Scottish Government, ZWS, SFT, Viridor, Private Sector | Build on the recently completed techno-economic feasibility study for harnessing surplus heat from the GRREC to develop a full business case for a heat network in indicative Heat Network Zone South 2.<br><br>Build on the development of the Climate Neutral Innovation District by initiating development of a full business case for City Indicative Heat Network Zone.<br><br>This action will help to clarify specific Heat Network Zones for formal designation. Heat Network Zones will be subject to a Strategic Environmental Assessment at the point of designation. | Within 1 year of LHEES adoption | Initiation of full business case development for indicative Heat Network Zones South 2 and City | Heat Network Support Unit, Internal Funding<br><br>Funding not secured |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L5 | Ensure that the upcoming Net Zero Roadmap is developed in conjunction with the zone-specific outputs of the LHEES | GCC NRS Sustainability | Scottish Government, ZWS, SFT | Ensure LHEES zone specific outputs are landed into the upcoming Net Zero Roadmap.<br><br>This should involve a more integrated assessment of the wider impacts on energy systems should heat networks be implemented in the zones, including an assessment on the interaction between retrofit and district heating. | Completion within 18 months of LHEES adoption | Completion of a Net Zero Roadmap that incorporates the outputs of the LHEES | Internal funding<br><br>Funding Secured |
| L6 | Complete Building Assessment Reports (BARs) for required GCC owned buildings | GCC NRS Sustainability, GCC Property | GCC | Complete Building Assessment Reports for required GCC owned buildings, prioritising those that are of a high suitability for heat network connection and are located within indicative Heat Network Zones.<br><br>Facilitate and support other public sector organisations in Glasgow to discharge this duty. | Completion within 1 year of LHEES adoption | Number of BARs completed.<br><br>Improved ‘confidence per MWh’ level within indicative Heat Network Zones | NA |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L7 | Facilitate and support public sector organisations to discharge their duty to complete BARs | GCC NRS Sustainability | GCC, Public Sector Organisations | Create a generic email for BAR submission to GCC.<br><br>Engage with public sector organisations to facilitate BAR submission | Completion within 1 year of LHEES adoption | Number of BARs completed.<br><br>Generic email created.<br><br>Improved 'confidence per MWh' for submitting organisations heat demand data. | NA |
| L8 | Work with the non-domestic sector in Glasgow to promote the voluntary submission of BARs ahead of expected national legislation | GCC NRS Sustainability | GCC, City Stakeholders | Promote the voluntary submission of BARs for non-domestic buildings, prioritising those within indicative Heat Network Zones.<br><br>This will refine the heat network zoning process as per the regulations and allow for building prioritisation based on suitability and connection interest from high heat consuming properties<br><br>GCC will work with organisations and groups already engaged with the non-domestic sector, such as the Sustainable Glasgow Board and the Chamber of Commerce, to facilitate delivery. | Completion within 1 year of LHEES adoption | Number of non-domestic BARs completed.<br><br>Improved 'confidence per MWh' level within indicative Heat Network Zones | NA |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L9 | Quantify the maximum potential for heat extraction from the River Clyde to support identification and legal designation of Heat Network Zones where the River Clyde is the primary supply option. | GCC NRS Sustainability | GCC, Scottish Government, ZWS, Peel Ports, University of Strathclyde | Build on the recently completed assessment of the renewable heat extraction potential in the River Clyde and incorporate the findings into the development of techno-economic feasibility studies and business cases for indicative Heat Network Zones where the River Clyde presents as a key supply opportunity.<br><br>This will be delivered in cognisance of the work being undertaken to better quantify the River Clyde as a supply opportunity for the Climate Neutral Innovation District though will consider the river as a whole. | Completion within 1 year of LHEES adoption | Completion of techno-economic feasibility studies for all indicative Heat Network Zones within proximity of the River Clyde that include the potential to extract heat form the river. | Heat Networks Support Unit, Internal Funding<br><br>Funding not secured |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L10 | Quantify opportunities for low carbon or renewable heat supply in Glasgow where potential is less clarified including, though not limited to:<br>• Deep geothermal<br>• Heat from mine workings<br>• Heat from wastewater treatment plants/ wastewater network<br>• Ground Source<br>• Other sources of waste heat | GCC NRS Sustainability | GCC, Scottish Government, ZWS, Scottish Water Horizons, Coal Authority, University of Strathclyde | Work with relevant stakeholders to quantify the renewable or low carbon heat opportunities in Glasgow to support the development of techno-economic feasibility studies and business cases for indicative Heat Network Zones. Including, though not limited to:<br>• Deep Geothermal. incorporate the outputs of the recently completed pilot study into the potential for deep geothermal heat extraction.<br>• Mine Workings. Work with the Coal Authority to produce a geospatial database highlighting any potential locations suitable for the extraction of heat from disused mine workings.<br>• This work will consider the outputs from the current project to develop a 3D Mine Map being delivered by the University of Strathclyde. | Completion within 1 year of LHEES adoption | Quantified assessment of the potential for renewable or low carbon heat supply for use in the production of techno-economic feasibility studies for all indicative Heat Network Zones.<br><br>Reclassifying of secondary indicative Heat Network Zones to primary | Heat Networks Support Unit, Internal Funding<br><br>Funding not secured |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L10 | | | | • Wastewater. Utilise Scottish Water Horizons recently launched tool for analysis of heat potential from the wastewater network to clarify supply opportunities within secondary indicative heat network zones.<br>• Work with Scottish Water Horizons to clarify the opportunity to extract heat from the Shieldhall Wastewater Treatment Plant.<br>• Geothermal. GCC will work internally with our Geotech team to provide initial ground suitability for heat pump install within indicative heat network zones.<br>• Other Sources of Waste Heat. GCC continue to be actively involved in the newly launched Waste Heat Steering Group which is evaluating how best to unlock the potential for waste heat in Scotland. | | | |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L11 | Embed the LHEES Delivery Plan into the Climate Programme to ensure appropriate governance established | GCC NRS Sustainability | GCC | Update the Climate Programme to include the LHEES Delivery Plan<br><br>This will be presented to the Climate Board to ensure buy-in across all GCC service areas | Completion within 6 months of LHEES adoption. | Updated Climate Programme | NA |
| L12 | Embed the LHEES into the upcoming Climate Change Engagement Framework | GCC NRS Sustainability | GCC, Residents, City Partners | Include LHEES engagement considerations within the upcoming Climate Change Engagement Framework. This should include mapping and phased engagement of potential customers within Heat Network Zones alongside a citywide communications campaign to raise the profile of district heating in Glasgow. | Completion within 1 year of LHEES adoption with connection dialogue to begin immediately | Production of a Climate Change Engagement Strategy that considers engagement relating to heating-based emissions. | NA |
| L13 | Incorporate LHEES outputs into the development of the Community Renewable Energy Framework (CREF) | GCC NRS Sustainability | GCC, Local Energy Cooperatives | Ensure that opportunities for community heating schemes are included in the upcoming CREF being delivered through the Climate Plan.<br><br>This will have a direct link to the delivery areas identified for the On Gas Grid LHEES Consideration | Completion within 6 months of LHEES adoption | The publication of a framework for community renewable energy schemes that incorporates considerations around community heating schemes. | NA |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L14 | Work with GCC Climate Finance Framework to identify investment into required infrastructure. This will include identification of funding streams including though not limited to -the Scottish National Investment Bank and the Strathclyde Pension Fund Organisation | GCC Economic Development, GCC NRS Sustainability, GCC Legal, GCC CPU | GCC, SNIB, SPFO, Private Sector, Scottish Government | Work with organisations including, though not limited to, SNIB and SPFO, 3CI to develop better understanding on how to leverage finance at scale for large scale district heating or energy efficiency projects.<br><br>This action will be delivered through the GCC Climate Finance Framework. | Ongoing | Annual updates on successful investments will be brought to Committee | NA |
| L15 | Initiate the production of an options appraisal report for the ownership and future development of the existing heat network at the Dalmarnock Village (Formerly the Commonwealth Games Athlete's Village) | GCC NRS Sustainability, GCC Asset Management | GCC NRS, Vital Energi | Develop an options appraisal report in conjunction with GCC Asset Management and Vital Energi to assess, though not limited to –<br>• Future ownership models<br>• Pathway to decarbonising the heat network including increased operational efficiency and decarbonised supply | Completion within 1 year of LHEES adoption | Decision on ownership model of Dalmarnock Village heat network<br><br>Options appraisal report highlighting potential routes to decarbonisation. | NA |
| L16 | Ensure the LHEES is embedded into the development and delivery of Council policy on energy, housing, planning, and development. | GCC NRS Sustainability | GCC NRS Sustainability, GCC NRS Planning, GCC NRS Housing | Work with GCC partners to ensure the LHEES is embedded into the delivery of the<br>- Local Housing Strategy<br>- Housing Retrofit Strategy and Delivery Plan<br>- City Development Plan<br>- Carbon Management Plan | Ongoing | Publication of strategies relevant to the LHEES with the ambitions of the LHEES embedded within them. | NA |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L17 | Identify opportunities for project development across local authority boundaries. | GCC NRS Sustainability | GCC, Clydeplan, Glasgow City Region, Local Authorities | Work with regional partners such as Clydeplan and Glasgow City Region alongside relevant bordering local authorities to identify scope for projects that may exist across authority boundaries. | Ongoing | Identification of LHEES related opportunities that exist across local authority boundaries | NA |
| L18 | Develop a local authority ECO-flex scheme | GCC NRS Housing | GCC, RSLs, Residents, Scottish Government, Energy Companies | GCC will work with partners to develop an ECO-Flex scheme for Glasgow which will allow the city to maximise on the funding opportunity presented by ECO | Completion within 6 months of LHEES adoption | Successful development of an ECO-Flex model.<br><br>Increased number of properties treated using ECO-Flex funding | |
| L19 | Develop a Housing Retrofit Strategy that focuses on addressing poor energy efficiency in pre-1919 tenement | GCC NRS Housing | GCC, RSLs, Historic Environment Scotland, Scottish Government | Work with partners in Housing to support the development of a pre-1919 strategy and ensure that this utilises and builds upon the LHEES | Completion within 1 year of LHEES adoption | Production of a Glasgow Retrofit Strategy with a focus on pre-1919 tenements | NA |
| L20 | Direct funding and advice for retrofit through EES:ABS and wider funding sources into Delivery Areas identified within the LHEES. | GCC NRS Housing, GCC NRS Sustainability | GCC, RSLs, Residents, Scottish Government | Ensure that the EES:ABS programme and other funding/programme opportunities are maximised and continue where feasible in conjunction with business as usual.<br><br>Utilise the Delivery Areas identified for the Poor Energy Efficiency as a Driver of Fuel Poverty consideration in the LHEES. | Ongoing | Amount of EES:ABS funding spent<br><br>Number of properties successfully treated<br><br>Positive impact on fuel poverty in targeted properties. | EES:ABS<br><br>Funding secured annually |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L21 | Run all Delivery Areas identified in the LHEES through Energy Saving Trust's Portfolio Energy Asset Tool (PEAT) | GCC NRS Housing, GCC NRS Sustainability | GCC, Energy Saving Trust | Run all identified Delivery Areas through PEAT analysis to better quantify those areas that present the highest opportunity | Completion within 6 months of LHEES adoption | Completion of PEAT analysis for all LHEES Delivery Areas | NA |
| L22 | Publish updated guidance and support to the public via the Council Website relating to fabric-based interventions, including finance options and EPC targets. | GCC NRS Housing | GCC, Energy Saving Trust, Home Energy Scotland | Ensure that the Council website has a dedicated information page, developed in partnership with other organisations, relating to how residents can reduce their demand for heat and decarbonise their heating systems. This will include links to relevant sites to ensure accurate information is provided without the need for continuous review.<br><br>This will include novel information on heat networks and the potential benefits.<br><br>This action will be delivered in conjunction with actions E1 and EEH2 | Completion within 1 year of LHEES adoption | Publication of content on GCC website<br><br>Number of interactions with webpage | NA |

| Action ID | Action | Owner | Stakeholders | How We Will Get There | Timescales | How We Will Measure Progress | Funding |
|---|---|---|---|---|---|---|---|
| L23 | Support the Glasgow City Region to explore the challenges and opportunities presented around regional housing retrofit delivery | Glasgow City Region Member Authorities | Glasgow City Region Member Authorities, Skills Development Scotland, Scottish Enterprise, Scottish Government | Explore the opportunities and recommendations of the following upcoming reports: Scottish Enterprise work on regional supply chain capacity, Skills Development Scotland's CESAP, and interim and final reports from the Scottish Government's Green Heat Finance Taskforce. | Reports are due to be published across Summer/ Autumn 2023 | Updates on the work of the Regional Housing Retrofit Delivery Group will be delivered to the Glasgow City Region Chief Executives' Group. | NA |
| L24 | Continue to implement a large-scale energy efficiency programme aimed at retrofitting the highest consuming buildings in the council estate, ultimately applying to all non-domestic buildings. | GCC NRS Sustainability | GCC NRS Sustainability, GCC Property | Continue with an energy efficiency retrofitting programme for public sector buildings and complete at least 25% of the highest consuming buildings in the council estate. | Completion within 2 years of LHEES adoption | Number of buildings retrofitted<br><br>Amount of energy saved from fabric improvements | SALIX<br><br>Funding not secured |
| L25 | Work with small businesses via Business Gateway to provide advice and support aimed at reducing energy consumption and improving energy efficiency. | GCC NRS Sustainability | GCC, Business Gateway | Ensure business advisors explain energy issues to 75% of businesses they support | Ongoing | Number of business engaged in relation to energy<br><br>Number of engagements with GCC/Business Gateway | NA |

# APPENDICES

# APPENDIX A – POLICY AND STRATEGY REVIEW

The LHEES is not an isolated strategy and is integrated across a broader environmental, social and economic landscape. It takes influence and direction from a range of different policies, strategies and targets at the local and national levels.

## 1. Local Policy Context

### 1.1 Glasgow Strategic Plan 2022-2027

The Strategic Plan sets out the priority themes and commitments that will be delivered in the period of 2022-2027 by the Council, its services and arm's length organisations. The vision of the Plan is to have a world class city with a thriving, inclusive, economy where everyone can flourish and benefit from the city's success. The LHEES will support the delivery of the Strategic Plan's 'Grand Challenges' including –

- Reducing poverty and inequality in our communities
- Increasing opportunity and prosperity for all our citizens
- Fighting the climate emergency in a just transition to net zero Glasgow

| Action Number/ Reference | Action |
|---|---|
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Invest in more council-owned renewable energy generation, including solar and wind energy, and support the development of green hydrogen. |
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Continue to improve the heat and energy efficiency of the council's property assets, ensuring high standards in new buildings and completing retrofit, where viable throughout the existing estate. |
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Develop a Community Energy Strategy to support the establishment of community energy organisations to generate renewable energy and support the development of local heat networks. |
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Work with the Scottish Government to ensure a minimum energy performance certificate grade C for all homes at point of sale or rental from 2025, with a target backstop date of 2030 for all properties, including those in mixed tenure blocks. |
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Promote and secure investment for the establishment of district heating networks throughout the city and develop planning policy to promote district heating in new build developments. |

| Action Number/ Reference | Action |
|---|---|
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Review planning and housing policy to improve energy efficiency standards, including through the building of Net zero/ Passive house standard development, and increase the development of large family housing/accessible housing. |
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Develop planning policy to address embedded carbon in buildings and seek ways to improve the viability of reuse and retrofit options, so there is reduced need for demolitions. |
| **Grand Challenge 3 – Mission 2: Become a Net Zero Carbon City by 2030** | Deliver place-based interventions and key local regeneration projects. |

*Table 20 - Glasgow Strategic Plan: Key Relevant Actions*

## 1.2 The Climate Plan

The Climate Plan was developed using the outputs of the Climate Emergency Working Group. The Group, after declaring a climat#?e and ecological emergency in 2019, produced 61 recommendations for the City Council and stakeholders that would be necessary to achieve net zero carbon by 2030.

The LHEES will supplement the Climate Plan this by providing a framework to decarbonise and improve the energy efficiency of our built environment, assisting in the delivery of multiple actions noted on the next page.

| Action Number/ Reference | Action |
|---|---|
| 1 | Develop a dynamic Climate Change Communications strategy for the city. This will be developed with Sustainable Glasgow and aligned with COP 26. |
| 3 | Create a declaration for city institutions to pledge to become Carbon Neutral by 2030 or sooner. |
| 8 | Continue to work with Scottish Government to maximise funding for Area Based Schemes to invest in improving energy efficiency and tackling fuel poverty in private sector housing. |
| 9 | Prepare an investment improvement plan for older (pre1919) tenements and private sector housing. |
| 14 | Adopt the Local Heat and Energy Efficiency Strategy (LHEES) which will identify areas suitable for investment in renewable energy generation and heating in the city. |
| 15 | Deliver projects that utilise the recovery of heat from geothermal sources learning from Duke Street and Tennent's Brewery projects. |
| 17 | Deliver heat and energy generation projects including distribution of heat and energy from parks in Glasgow based on existing feasibility studies. |
| 23 | Require Glasgow's Gold Hybrid plus 20% low and zero carbon generating technologies (LZCGT) or better, to be achieved for all new build new homes. |
| 24 | Require Glasgow's Gold Hybrid plus 20% low and zero carbon generating technologies (LZCGT) or better, to be achieved for all new non-domestic development. |
| 39 | Encourage and enable retrofit of all existing owner-occupied housing to EPC level C or above, and to reduce flood risk (where appropriate). |
| 40 | The city and partners to support the adoption of circular practices across the city through capacity building programmes, in line with the new Circular economy route map for the city. |
| 41 | Upgrade insulation and heating of all building stock in the city and install measures. |
| 42 | Ban gas heating systems in all new buildings within the city boundary. |
| 44 | Develop a Carbon Neutral Innovation District in the GCID. This will act as a catalyst and exemplar for rolling out across the city. |
| 46 | Establish a framework of engagement with local energy cooperatives, enabling them to be set up and providing support. |
| 50 | Review the need for an energy services company (ESCO) for the city as appropriate in relation to local energy generation and distribution projects. |
| 59 | Work with partners in the city to accelerate the transition of Glasgow's economy from linear to circular, making it more inclusive and sustainable. |

*Table 21 - Climate Plan: Key Relevant Actions*

## 1.3 City Development Plan

Glasgow's City Development Plan (CDP) was adopted in March 2017 and sets out the Council's vision and strategy for land use whilst also providing the basis for assessing planning applications along with its associated Supplementary Guidance.

The Plan's framework will involve achieving a city where natural and built resources contribute towards high environmental quality, are accessible to all and help Glasgow to adapt to the effects of climate change as well as contribute towards a low carbon and energy efficient future.

The second iteration of the City Development Plan (CDP2) is currently being developed and embedding the LHEES, particularly indicative spatial outputs, within the CDP2 will ensure that planning policy can direct development in alignment with the ambitions of the LHEES.

| Action Number/ Reference | Action |
|---|---|
| **CDP5: Resource Management** | Supporting energy generation from renewable and low carbon sources |
| **CDP5: Resource Management** | Promoting energy efficient design and use of low and zero carbon generating technologies in new development |
| **CDP5: Resource Management** | Safeguarding communities from the potentially adverse impacts of energy generation or oil/gas extraction |
| **CDP5: Resource Management** | Making efficient use of energy generation and/or industrial processes by supporting combined heat and power systems and district heating networks |
| **CDP5: Resource Management** | Benefitting from secure supplies of low carbon energy and heat |

*Table 22 - City Development Plan: Key Relevant Actions*

## 1.4 Glasgow Local Housing Strategy 2023-2028

Glasgow's Housing Strategy is the statutory Local Housing Strategy (LHS) submitted to the Scottish Government every five years. Its principal aim is to provide an evidence-based policy framework, housing needs assessment and investment platform (which is the related annual Strategic Housing Investment Plan or SHIP, discussed below) which will guide stakeholders in making the appropriate choices in terms of new development and continually raised maintenance and management standards.

Glasgow's Local Housing Strategy (LHS) 2023-2028 recognises the need for large scale retrofitting of domestic dwellings to meet the city's ambitious carbon emission and fuel poverty reduction targets. LHS Strategic Priority 2 sets out the intention to "improve the energy efficiency of Glasgow's homes, reducing fuel poverty and supporting a just transition to Net Zero through decarbonisation of domestic heating and energy". This is closely aligned with LHS Priority 3 "to improve the condition of Glasgow Homes and preserve Glasgow's tenements and built heritage".

LHEES is aligned with and is being developed in collaboration/conjunction with the Glasgow Local Housing Strategy 2023-28 and Housing Retrofit Strategy (expected 2024).

| Action Number/ Reference | Action |
|---|---|
| **Priority 2: Action 1** | Deliver Glasgow's Area-Based Schemes targeting investment towards hard-to-treat homes in fuel poor areas for external wall insulation and associated energy efficiency improvements |
| **Priority 2: Action 2** | Promote home energy safety information and advice |
| **Priority 2: Action 3** | Develop a LA-Flex Scheme for Glasgow to attract Energy Company Obligation funding |
| **Priority 2: Action 4** | Develop a Housing Retrofit Programme |
| **Priority 2: Action 5** | Continue to support the provision of free and impartial home energy and safety advice, assistance and advocacy services to all households in the city |
| **Priority 2: Action 6** | Support the development and implementation of Glasgow's Local Heat and Energy Efficiency Strategy (LHEES) |
| **Priority 2: Action 7** | Identify and promote projects where renewables and district heating are a cost-effective solution to the provision affordable and sustainable energy supply to homes in Glasgow. |
| **Priority 3: Action 1** | Update Action Plan to safeguard Glasgow's Built Heritage including pre-1919 tenements |
| **Priority 4: Action 2** | Expand Empty Homes work to include making greater use of compulsory purchase orders particularly where it achieves wider strategic objectives including increasing affordable housing supply, tackling area blight, improving the performance of factors and enabling whole-block retrofits |
| **Priority 5: Action 4** | Engage with partners to develop retrofit specifications that will improve pre-1919 tenement homes and investigate options for framework agreements/joint procurement. |

*Table 23 - Glasgow Housing Strategy: Key Relevant Actions*

## 1.5 Strategic Housing Investment Plan (SHIP)

The SHIP is a five-year plan that outlines how the City Council will use development funding to deliver new build and improved houses working with Registered Social Landlords (RSLs). The Plan demonstrates how investment will contribute to achieving the aims and objectives of the Local Housing Strategy. With respect to climate change these include specific energy efficiency and renewable heat standards described within the Glasgow Standard. The current SHIP (2023/24 to 2027/28) sets out potential for more than £526million AHSP funding to be invested across 175 development projects to deliver in excess of 7,700 new affordable homes over the next five years 2023-28, which will include social rent and intermediate Mid-Market Rent as well as low-cost home ownership options.

The updated SHIP (2024/25 to 2028/29) is currently in development and will go to Committee mid-October 2023. Updated figures will be produced during this period.

## 1.6 The Energy and Carbon Masterplan (ECMP)

The LHEES will build on the work undertaken through the ECMP, compounding it with the Glasgow Local Housing Strategy. The ECMP, which is no longer a live, took a multisector blended approach in looking at the city's emissions profile with the intention of identifying how Glasgow could significantly reduce its emissions. It also laid out a roadmap to meet a carbon reduction target of 30% by 2020 (based on a 2006 baseline) which Glasgow achieved five years ahead of schedule in 2015.

Within this there were a number of actions relating to energy efficiency and renewable heating that the LHEES will adopt and carry forward.

| Action Number/ Reference | Action |
|---|---|
| **Municipal Buildings: 1** | Conduct internal energy audits of municipal properties and identify those that will benefit most from energy efficiency measures actions and projects. |
| **Municipal Buildings: 2** | Decrease energy consumption in public buildings by developing Demand Side Management technology and procedures. |
| **Municipal Buildings: 3** | Conversion of remaining coal-fired boilers and oil boilers into gas boilers (or biomass where appropriate) in GCC buildings. |
| **Municipal Buildings: 6** | Reduce energy consumption of the Council estate through the council's Asset Management Strategy, including potential replacement of inefficient heating for more efficient heating in GCC temporary structures. |
| **Municipal Buildings: 9** | Installation of managed, centralised BMS control. Where possible this will integrate heating, lighting, and alarms. |
| **Municipal Buildings: 10** | All new (from 2014) GCC buildings to achieve Bronze Active standard by 2014; Silver Active standard by 2016 and Gold Active standard by 2018 (LDP, Resource Management Policy). |
| **Tertiary Buildings: 11** | Target tertiary buildings where there is high energy usage and encourage owners and tenants to take a pro-active approach to energy efficiency and reduce $CO_2$ emissions. |
| **Tertiary Buildings: 12** | Develop and maintain a heat mapping model for non-residential sector by source (gas and electricity) for Glasgow and combine datasets with the city energy modelling tool. |
| **Tertiary Buildings: 13** | All new (from 2014) non-residential buildings to achieve Bronze Active standard by 2014; Silver Active standard by 2016 and Gold Active standard by 2018 (LDP, Resource Management Policy) |
| **Industry: 14** | Identify areas with heat recovery potential to reduce waste and make productive use of excess heat. |
| **Residential Buildings: 15** | Improve energy efficiency, reduce energy consumption, and fuel poverty in social housing through the coordination and enhancement of existing schemes. |
| **Residential Buildings: 16** | Improve energy efficiency and promote renewable energy projects in private housing sector. |
| **Residential Buildings: 17** | Promote behavioural change in citizens in households to promote energy savings (through smart meters, online energy model, behavioural change). |
| **Residential Buildings: 18** | All new residential buildings to achieve Bronze Active standard by 2014; Silver Active standard by 2016 and Gold Active standard by 2018 (LDP, Resource Management Policy). |
| **Residential Buildings: 19** | Develop and maintain a heat mapping model for the residential sector. |
| **Local Electricity Generation: 27** | Promote local production of renewable electricity through GCC-led projects that bring a return on investment. |

| Action Number/ Reference | Action |
|---|---|
| **Local Electricity Generation: 28** | Promote local production of renewable electricity through community-based projects. |
| **Local Heat/Cold Production: 29** | Develop a Glasgow Recycling and Renewable Energy Centre to produce energy from waste to supply heat locally. |
| **Local Heat/Cold Production: 30** | Establish a city-wide Energy Services Company (ESCo) to facilitate, coordinate, maintain and develop a district heating network in Glasgow. |

*Table 24 - Energy and Carbon Masterplan: Key Relevant Actions*

## 1.7 The City Centre Living Strategy

The vision of the City Centre Living Strategy is to enable a sustainable, inclusive and diverse city centre population. It sets a key goal of doubling the residential population of the city centre to around 40,000 by 2035 and frames delivery around 6 key objectives.

| Action Number/ Reference | Action |
|---|---|
| **Objective 1** | Population: To increase the city centre population from its baseline of 20,245 in 2018 to 40,000 by 2035 |
| **Objective 2** | Vacant Commercial Space: To find productive outcomes for vacant commercial space, with particular focus on upper floors |
| **Objective 3** | Environment: To provide a quality city centre environment that is cleaner, greener, safer, more sustainable, and better connected |
| **Objective 4** | Investment: To offer a responsive, innovative approach to investment opportunities that support this strategy |
| **Objective 5** | Quality in Design: To deliver quality in design |
| **Objective 6** | Resilient Neighbourhoods: To enable resilient, empowered and socially cohesive neighbourhoods |

*Table 25 - City Centre Living Strategy: Key Relevant Actions*

## 1.8 Glasgow Economic Strategy

The Glasgow Economic Strategy 2022-2030 addresses Glasgow's most pressing challenges and opportunities. It sets out the clearly defined actions the City will take to deliver an inclusive, sustainable and more productive economy for our city.

The Strategy frames delivery around three "Grand Challenges": Enhancing Productivity, The Climate Emergency and Inclusive Growth. Our new economic strategy prioritises cross-sector collaboration to tackle these long-standing issues.

The previous strategy, published in 2016 and refreshed in 2029, was scheduled to run until 2023. However, so profound is the impact of the COVID-19 pandemic, that a fresh strategy is needed to reflect the new economic reality facing Glasgow and the city region.

| Action Number/ Reference | Action |
|---|---|
| **Developing a Green Economy - 01** | We will implement the Glasgow Green Deal and develop an action plan |
| **Developing a Green Economy - 03** | We will nurture research and innovation in mitigation and adaptation by participating in the Horizon Europe Missions for 100 Climate-neutral Cities and adaptation to climate change including societal transformation by 2030. |
| **Growing Our Economy - 11** | We will work with our key growth sectors to understand how investing in sustainability can translate into wider business benefits and what support they need to make it happen. |
| **Growing Our Economy - 12** | We will design and deliver a seminar series and work with key stakeholders in the city to help SMEs better understand key sustainability topics and how they can contribute to the wider city ambitions around net zero. |
| **Growing Our Economy - 13** | Recognising the challenges SMEs face in implementing changes that impact positively on the city's ambitions around net zero, we will develop a Green Business Support offer and grant. |
| **Inwards Investment and Internationalisation - 21** | In addition to targeting overseas markets, including the USA and Europe, we will develop and deliver a programme of events in London to promote Glasgow's interests and reputation, building stronger links with institutional investors and global corporations to attract higher levels of FDI, capital investment and bring benefits to the indigenous business base. |
| **Innovation - 23** | We will work with Glasgow City Innovation District (GCID) and Glasgow Riverside Innovation District (GRID) to accelerate development and work to secure investment by delivering on current UK and Scottish Government innovation and industry research priorities. |
| **Innovation - 24** | We will support the city's innovation districts to become net zero and climate-resilient. |
| **Innovation - 27** | We will explore the feasibility of a Climate Innovation Cluster and associated accelerator programme to support growth in the green economy. |
| **Innovation - 28** | We will encourage mixed used development within the Innovation Districts to support the respective business ecosystems and sector specialisms. |
| **Innovation – 29** | We will work with funders, including the Scottish National Investment Bank (SNIB) and UK Infrastructure Bank, to support mission-led, patient capital investment to businesses, projects, and communities. |

| Action Number/ Reference | Action |
|---|---|
| City Investment and Financing - 31 | We will develop a climate investment framework to mobilise finance for net zero and climate resilience. |
| Employment and Skills – 36 | In collaboration with key stakeholders, we will implement the Just Transition Skills Action Plan (JTSAP) for Glasgow. The JTSAP will support the future labour market needs and help ensure a net zero, climate-resilient city. |
| Employment and Skills – 37 | We will support the ongoing work of the Council's Just Transition Working Group. |
| A Fairer Glasgow – 45 | We will maximise community benefit and carbon reduction through Glasgow City Council procurement spend. |
| A Fairer Glasgow – 47 | We will develop a Community Wealth Building strategy. |
| Infrastructure and Place - 48 | We will accelerate the delivery of the Clyde Mission regeneration programme of works including new and innovative partnership approaches, and technical solutions, to land reclamation and mixed-use development. |
| Infrastructure and Place - 52 | Deliver the Glasgow housing retrofit programme to low carbon heating systems and work with the private sector to develop mechanisms to encourage non-domestic energy retrofit. |
| Infrastructure and Place - 57 | We will deliver our City Deal infrastructure projects:<br>• Canal and North Gateway<br>• Enabling Infrastructure: Integrated Public Realm (EIIPR) – City Centre 'Avenues'<br>• Collegelands Calton Barras<br>• Metropolitan Glasgow Strategic Drainage Partnership<br>• Waterfront and West End Innovation Quarter |

*Table 26 - Glasgow Economic Strategy: Key Relevant Actions*

## 1.9 Open Space Strategy (OSS)

The OSS is a corporate strategy that will align the work of various council services to deliver a variety of benefits for people and nature in Glasgow in line with the strategy's three outcomes - enhancing:

- The City's Liveability, increasing its attractiveness as a place in which to live, work, move around, study and invest.
- The Health and Wellbeing of the City's human population and of its flora and fauna.
- The long-term Resilience of the City in relation to issues such as climate change.

| Action Number/ Reference | Action |
|---|---|
| 10 | We will consider the need for new grey/green civic spaces to serve major development schemes and regeneration projects |
| 22 | We will ensure that the OSS Delivery Plan process reflects the full scope of the Council's ambitions for the River Clyde corridor, aligning with the aspirations of the River Clyde Corridor SDF and helping deliver benefits for people and nature. |
| 27 | We will investigate the potential of the City's open spaces to deliver renewable energy and heat and whether any associated financial savings could be used to help deliver the ambitions of this Strategy. |

*Table 27 - Open Space Strategy: Key Relevant Actions*

### 1.10 Carbon Management Plan

The next iteration of the Carbon Management Plan (CMP3) is currently under development the third and will set out how the Council intends to utilise its Estate, assets and resources to catalyse the net zero transition for Glasgow.
CMP Phase 1 saw the Council emissions reduced by 9% between 2008 and 2013. Phase 2 of the plan, CMP2, built on this work and helped the Council to reduce its carbon emissions by 46.6% between 2013 and 2020.

## 2. National Policy Context

There is an extensive national policy landscape that relates to Glasgow's LHEES. From the 2015 Heat Policy Statement moving through the Energy Efficient Scotland Routemap into the current Heat in Buildings Strategy, the policy journey for Scotland has increasingly sought to align ambitions on decarbonising heat supply with reducing overall heat demand.

### 2.1 Climate Change Plan 2018–2032 - Update

The Climate Change Plan sets out the path (2018-2032) to a low carbon economy for Scotland while helping to deliver sustainable economic growth and secure the wider benefits to a greener, fairer and healthier Scotland in 2032.

The Plan was updated in the "Securing a green recovery on a path to net zero: climate change plan 2018–2032" which sought to align with the new targets set out in the Climate Change Act (Emissions Reduction Targets) whilst outlining how the Plan had been impacted by COVID-19 and what mitigating measures should be pursued.

| Action Number/ Reference | Action |
|---|---|
| **Buildings – Outcome 1** | The heat supply to our homes and non-domestic buildings is very substantially decarbonised, with high penetration rates of renewable and zero emissions heating |
| **Buildings – Outcome 2** | Our homes and buildings are highly energy efficient, with all buildings upgraded where it is appropriate to do so, and new buildings achieving ultra-high levels of fabric efficiency |
| **Buildings – Outcome 3** | Our gas network supplies an increasing proportion of green gas (hydrogen and biomethane) and is made ready for a fully decarbonised gas future |
| **Buildings – Outcome 4** | The heat transition is fair, leaving no-one behind and stimulates employment opportunities as part of the green recovery |

*Table 28 - Climate Change Plan: Key Relevant Actions*

## 2.2 Heat in Buildings Strategy (2021)

The Heat in Buildings Strategy (HiBS) provides an update to the Energy Efficient Scotland Route Map and the Heat Policy Statement, further building on the work to integrate demand reduction and supply decarbonisation ambitions in Scotland.

The HiBS sets out the Scottish Government's vision for the future of heat in buildings, and the actions they are taking in the buildings sector to deliver climate change commitments, maximise economic opportunities, and ensure a just transition, including helping address fuel poverty. Building on the policies and actions set out in the Climate Change Plan Update, this Strategy sets out a pathway to zero emissions buildings by 2045 and details a series of near-term actions to put Scotland on a clear path towards this, as well as a range of further, longer-term commitments to accelerate the transformation of the nation's building stock. It sets out the principles the Scottish Government will apply to ensure our zero emissions heat delivery programmes support fuel poverty objectives.

The HIB sets the framework for the LHEES and includes key actions and targets (please refer to Annex A in the Heat in Buildings Strategy for a comprehensive list) that the LHEES will contribute to including –

- Zero emissions buildings by 2045; 75% by 2030; 90% by
- By 2040, no more than 5% and 1% of households are in fuel poverty and extreme fuel poverty respectively
- Where technically and legally feasible and cost-effective, by 2030 a large majority of buildings should achieve a good level of energy efficiency, which for homes is at least equivalent to an EPC band C, with all homes meeting at least this standard by 2033.
- All private rented sector properties to reach a minimum standard equivalent to EPC C by 2028 where technically feasible and cost-effective, at change of tenancy, with a backstop of 2028 for all remaining existing properties.

- All domestic owner-occupied buildings should meet EPC C standard by 2033. Where it is not technically feasible or cost-effective to achieve the equivalent to EPC C rating, it is proposed that a minimum level of fabric energy performance through improvement to walls, roof, floor and windows, as recommended in the EPC, would apply.
- All social housing to meet, or be treated as meeting, EPC B, or be as energy efficient as practically possible, by the end of December 2032.
- By 2030 over 1 million homes and the equivalent of 50,000 non-domestic buildings are converted to zero emissions heat.
- Maintaining progress towards our statutory emission reduction targets, this must scale up to provide a total of at least 124,000 systems installed between 2021 and 2026. The installation rate will need to peak at over 200,000 new systems per annum in the late-2020s – which is above the natural replacement rate for boilers.
- New zero emissions heat standard be phased in for off-gas grid areas from 2025 and on-gas grid areas from 2030, with all buildings needing to meet this standard no later than 2045.

## 2.3 Heat Networks Act (2021) and associated Heat Networks Delivery Plan

The Heat Networks Act recognises that heat networks can act as an enabling technology for Scotland's emissions targets over the next thirty years and aims to encourage heat network deployment in Scotland by creating a regulatory framework that will de-risk investment in the market. The Act sets ambitious targets for heat to be supplied by heat networks (as discussed in section 3.1.2) – **2.6 Terawatt hours (TWh) of output by 2027 and 6 TWh of output by 2030, 3% and 8% respectively of current heat supply.**

The Act focuses on regulating the construction and operation of a heat network; making provisions about the powers of persons holding a heat networks licence; making provisions about conferring rights in heat network assets where a licence holder ceases operations; and for connecting purposes. The Heat Networks Delivery Plan sets out how the provision in the Act will be used to accelerate the deployment of heat networks in line with national targets.

Heat Network Zones (designated by Local Authorities as per regulatory requirement) will be put out to a competitive tender process whereby operators who have first gained a licence and project-specific consent will bid for a zone permit (likely granting exclusivity to operate over a long-term period though this is yet be clarified).

The secondary legislation is currently in development and will clarify the scope of the Act and how operators and public sector bodies will interact with it. A summary of the key provisions in the Act is included in Table 29 on the next page.

| Heat Networks Act Element | Description |
|---|---|
| **Heat Networks Licence** | Prospective heat network operators will have to first obtain this licence with the intention of ensuring that market participants are solvent, competent, fit and proper and can provide their essential service in line with conditions set by a Licensing Authority, with ongoing monitoring and enforcement where necessary. This, in turn, will provide assurances to both consumers and investors in deciding whether to become involved in the sector. |
| **Heat Network Consents** | The requirement to attain project-specific consent will ensure that projects are vetted to assess how they will contribute to targets on emissions reduction or fuel poverty. Heat network operators will have to obtain this consent if they are to progress with any prospective heat network project in Scotland. The consenting authority would most likely be Scottish Ministers due to the risk of self-regulation if local authorities were to take on this responsibility. |
| **Heat Network Permits** | Heat networks are in-effect mini grids, isolated from the wider gas grid. This means that operators do not have the same floating customer base in which to recover their costs from that gas and electricity operators benefit from.<br><br>Granting operators long-term permits seeks to mitigate against this by providing a natural monopoly following a competitive tender process. The guarantee that operators will have exclusivity within a designated Heat Network Zone will provide certainty of a steady return on investment. Giving operators confidence that they will be able to recover their costs over a long period of time increases the commercial viability of a heat network. This confidence will allow investors to target more ambitious projects.<br><br>It is not yet clear what the permitting element of the Heat Networks Act will mean for operators and Glasgow City Council will continue to engage with the Scottish Government on the development of secondary legislation for the Act. |

| Heat Networks Act Element | Description |
|---|---|
| **Heat Network Zones** | To fully maximise the benefits of a heat network, strategic planning is required to identify zones that have the most potential. This zone-specific approach allows buildings with significant heat demands (anchor loads) to be identified, along with possibilities to utilise renewable sources for the supply.<br><br>The requirement to identify and legally designate heat networks zones by local authorities will provide an informed evidence base which will enable long-term planning around where a heat network is commercially attractive and how they can advance key strategic goals around decarbonisation and fuel poverty.<br><br>This provision of the Act has now come into force and more information can be accessed **here**. |
| **Building Assessment Reports (BARs)** | This puts a duty on the public sector to assess their estate for suitable heat network connection. This will provide clarity on heat demand alongside connection suitability from an architecture perspective. Whilst this only applies to the public-sector at present, this may extent to all non-domestic buildings in the future.<br><br>his provision of the Act has now come into force and more information can be accessed **here**. |
| **Powers of Licence Holders** | This aspect of the Act will equip heat network licence holders with statutory undertaking powers. Operators will have similar wayleave and access rights granted to other utility providers. Such rights can be in relation to compulsory acquisition of land, wayleaves, survey works, and access to carry out work. This aims to reduce capital costs connected to construction and the associated delays often suffered. The Scottish Government are currently considering whether to extend this right to the road network, something that conventional utilities have rights over.<br><br>Network wayleave rights will also be granted to operators. This will enable operators to request from the Scottish Ministers the right to install pipework and other apparatus up to any building. The building owners will be under no obligation to connect, but the ability to connect in the first place will provide operators with a higher degree of confidence in future asset connection. |
| **Heat Networks Assets Schedule and Transfer Regime** | This element of the Act requires heat networks to have a scheme in place to transfer operational rights to a third party to ensure sustained supply, if and when needed. |

*Table 26 - Glasgow Economic Strategy: Key Relevant Actions*

## 2.4 Scottish Energy Strategy and Just Transition Plan

The strategy sets out how Scotland will meet the challenge of reducing demand within main energy-using sectors such as heat in buildings, transport, industry and agriculture whilst using energy more efficiently, and becoming largely decarbonised by 2030.

The Strategy identifies the requirement of significant investment to fund the transition. In this respect, the Strategy will outline plans to scale up activity to move from a funding to a financing policy model. This will more effectively leverage private sector investment and action to better amplify the impact of public investment.

The Plan is currently under consultation.

## 2.5 Housing to 2040

Housing to 2040 sets out a vision for housing in Scotland to 2040 and a route map to get there. It aims to deliver our ambition for everyone to have a safe, good quality and affordable home that meets their needs in the place they want to be.

## 2.6 National Planning Framework (NPF4)

The National Planning Framework (NPF) identifies where development and infrastructure are required to assist Scotland in meeting its goals. Scotland's fourth National Planning Framework (NPF4) is a long-term plan looking to 2045 that guides spatial development, sets out national planning policies, designates national developments and highlights regional spatial priorities.

The outputs from NPF4 will be key to guiding the development of Glasgow's second City Development Plan and will stipulate how planning policy can be used at local level towards the achievement of strategic goals. NPF4 will be a critical element in the delivery of the LHEES in relation to incentivising developers to switch onto communal heating systems or connect to a larger district heating scheme, particularly in designated Heat Network Zones. NPF4 will also place greater emphasis on the environment and sustainability against aspects relating to heritage protection. This is an important consideration when developing solutions to retrofitting Glasgow's pre-1919 tenemental properties which are often either listed buildings or located in conservation areas.

## 2.7 New Build Heat Standard

From the 1st of April 2024, new buildings in Scotland applying for a building warrant will be prohibited from using direct emissions heating systems to meet their space and hot water heating and cooling demands. Instead, buildings will be required to use zero direct emissions heating (ZDEH) systems such as heat pumps and heat networks.
Glasgow City Council will work to understand how the second City Development Plan could be used alongside the New Build Heat Standard and NPF4 to incentivise heat network connection where practical and feasible.

## 2.8 Hydrogen Policy Statement (2020)

The 2020 Hydrogen Policy Statement sets out vision for Scotland to become a leading hydrogen nation in the production of reliable, competitive, sustainable hydrogen, securing Scotland's future as a centre of international excellence as the innovation, skills and supply chain to underpin our energy transition are established.

## 2.9 Tenements (Scotland) Act 2004

The Tenement Management Scheme, as outlined in Schedule 1 of the Tenements (Scotland) Act 2004, lists the 'scheme property' (explaining what parts for the tenement every flat owner should maintain) and explains how to come to arrangements about maintenance ('scheme decisions') and how costs are shared between owners.

The Climate Change (Scotland) Act 2009 amends the Tenement Management Scheme to log insulation installation as a maintenance measure rather than an 'improvement' so changes can be approved via a majority rather than unanimously.

## 2.10 Historic Environment Policy for Scotland (May 2019)

The Historic Environment Policy for Scotland (HEPS) is a policy statement directing decision-making that affects the historic environment. It is non-statutory, which means that it is not required to be followed as a matter of law or statute. It is relevant to a wide range of decision-making at national and local levels. It is supported by detailed policy and guidance. HEPS outlines six policies on managing change to the historic environment:

- HEP1 - Decisions affecting any part of the historic environment should be informed by an inclusive understanding of its breadth and cultural significance.
- HEP2 - Decisions affecting the historic environment should ensure that its understanding and enjoyment as well as its benefits are secured for present and future generations.
- HEP3 - Plans, programmes, policies and strategies, and the allocation of resources, should be approached in a way that protects and promotes the historic environment. If detrimental impact on the historic environment is unavoidable, it should be minimised. Steps should be taken to demonstrate that alternatives have been explored, and mitigation measures should be put in place.
- HEP4 - Changes to specific assets and their context should be managed in a way that protects the historic environment. Opportunities for enhancement should be identified where appropriate. If detrimental impact on the historic environment is unavoidable, it should be minimised. Steps should be taken to demonstrate that alternatives have been explored, and mitigation measures should be put in place.
- HEP5 - Decisions affecting the historic environment should contribute to the sustainable development of communities and places.
- HEP6 - Decisions affecting the historic environment should be informed by an inclusive understanding of the potential consequences for people and communities. Decision-making processes should be collaborative, open, transparent and easy to understand.

### 2.11 The Planning (Listed Building Consent and Conservation Area Consent Procedure) (Scotland) Regulations 2015

Listed building consent is the mechanism by which planning authorities ensure that any changes to listed buildings are appropriate and sympathetic to their character. It helps to protect what is a rare and unique resource.

Conservation area consent controls the demolition of unlisted buildings in conservation areas.

### 2.12 Review of Electricity Market Arrangements (REMA) (UK Government)

The UK Government in 2022 launched a major review into Britain's electricity market design to identify opportunities for consumers to benefit from cheaper energy and enhanced energy security in the longer term.

Proposals under the scope of REMA include the exploration of fundamental changes to the electricity market to disable volatile gas prices from setting the wholesale cost of electricity, allowing consumers to benefit from lower cost renewable energy.

The outcomes of REMA are critically important to the successful delivery of the LHEES where it relates to heat pumps and district heating where the supply relies on electricity. To remove the influence of gas on electricity prices will reinforce the business case for the electrification of heat in Glasgow.

# Appendix B – Heat Network Zoning Methodology

Glasgow is a significantly heat dense area of Scotland. As a local authority, it has the highest heat density, registering as 35.53kWh/yr/m2 on the Scotland Heat Map (Edinburgh by comparison registers at 19.79kWh/yr/m2). Due to this, large areas of Glasgow are deemed as being particularly suitable for the deployment of heat networks which require a certain demand density to be considered feasible.

Considering this, **heat networks are a primary focus for this LHEES**. However, the high demand density in the city has created challenges in developing discrete zones for heat network development using the LHEES process alone – further work will be required before Glasgow can confidently designate Heat Network Zones through the Heat Networks (Scotland) Act 2021.

The approach taken by Glasgow for this first iteration of the LHEES has therefore been to develop larger **indicative Heat Network Zones** where the initial opportunity presents as highest. These have been split into primary and secondary zones where a primary zone has sufficient demand density and a key renewable or low carbon supply opportunity within it, and a secondary zone has sufficient demand density but is unclarified from a supply perspective. Additionally, existing or planned activity relating to heat networks has been considered in determining whether a zone is classed as a primary or secondary zone. Where borders have been applied, these should be treated as a indicative and have been developed through the identification of physical constraints such as rivers and railways. These will act as a starting point for further inspection. **Moving from the indicative Heat Network Zones identified in this LHEES to designated Heat Network Zones in the regulatory sense forms a key part of Phase I in the delivery of LHEES**. This is discussed further in the Delivery Plan. Identifying indicative Heat Network Zones has required the consideration of –

- **Heat Density.** The density of heat in Glasgow was plotted using an approach that creates buffers with varying degrees of stringency around potential anchor loads[45] corresponding to the size of their demand. This provided an initial output as to where heat networks could be viable from a demand perspective (see Figure 55 on Page 158).
- **Renewable or Low Carbon Heat Supply.** Where there were demonstrable renewable or low carbon supply opportunities, indicative zones were classed as 'primary'. Where zones had a less clarified supply option but sufficient demand density, these were classed as secondary. Supply options considered are summarised in section 4.1. Key supply opportunities were identified as
    - The River Clyde
    - Energy from Waste plants: The GRREC (operational) and the South Clyde Energy Centre (planned)
    - Shieldhall and Dalmarnock Wastewater Treatment Plants
    - The Strathclyde Distillery
- **Building Form.** The process for identifying indicative zones has considered the connection suitability of domestic properties though more work is required to clarify with confidence the suitability of non-domestic properties within indicative Heat Network Zones. Analysis has drawn from the On Gas Grid Consideration outputs (see section 7.1.2)
- **Fuel Poverty.** The ability of heat networks to alleviate areas suffering from fuel poverty in Glasgow was considered in the development of indicative zones.
- **Physical Constraints.** Significant physical constraints such as roads, rivers and railways that may impede delivery were identified.
- **Non-Domestic Stock.** Context was added to buildings classed as anchor loads to identify clusters of buildings with high suitability.
- **Land Supply Data.** Housing Land Supply data was utilised to identify where future development may support the deployment of heat networks.
- **Stakeholder Engagement.** Mapping work completed through the LHEES methodology process was then augmented through engagement with internal and external stakeholders.

*[45] Anchor Load - Building with a high heat demand and a stable heat use pattern. These buildings, assumed as connecting into a network, are typically critical in proving the initial economic case for any heat network project. Typical examples include leisure centres with swimming pools and hospitals.*

# 1. Heat Demand Density Mapping – Buffering Approach

Heat demand density mapping was carried out based on both domestic and non-domestic heat demand data. Anchor loads were mapped for the city (as outlined in Figure 55 on Page 158) and then buffers were applied around each load. The buffer size was determined by the heat demand of the building (the larger the demand, the larger the buffer)[46] and this provides a proxy for estimated viable pipework length travelling in any direction from the anchor load (linear heat density – a means of relating heat demand to distance to indicate initial network viability).

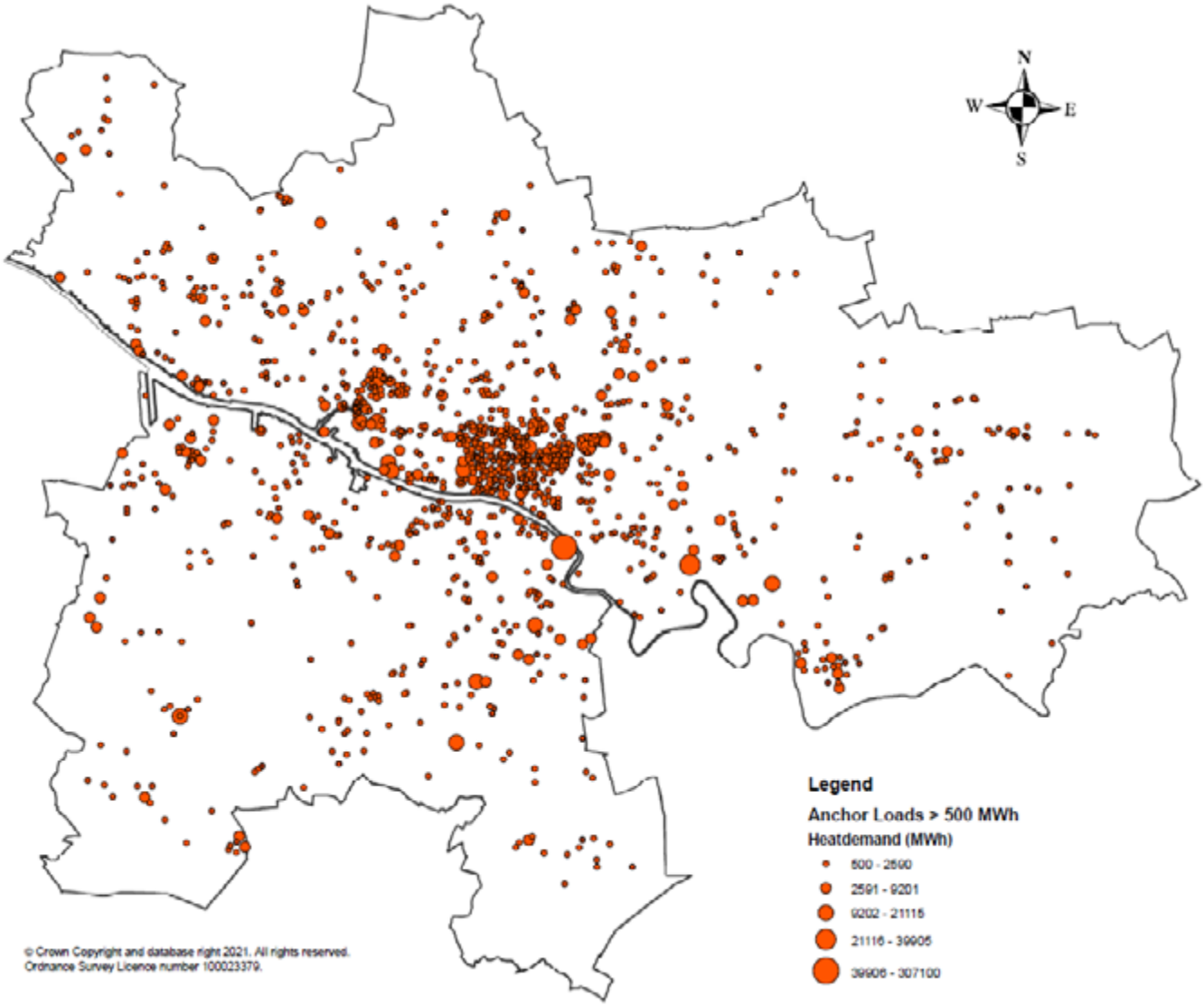



*Figure 54 – Anchor Loads in Glasgow*

The linear heat density was calculated at four different thresholds[47], beginning at 4,000 kWh/m/yr (the accepted minimum density threshold) and then 8,000 kWh/m/ yr, 16,000 kWh/m/yr and 32,000 kWh/m/yr for increasingly stringent analysis. Using the lower density thresholds helped to illustrate the significant opportunity for heat networks in Glasgow whilst the more stringent thresholds have directed focus to those areas with significant heat density. Figure 55 highlights initial outputs from this work with Table 30 providing some key statistics for the mapping of each LHD threshold.

*[46] Analysis required a maximum limit of 250m for buffer radii. This restriction is included to prevent large heat loads causing unworkably large buffers (suggesting connection viability across whole towns or cities).*
*[47] With more stringent thresholds providing a higher confidence in opportunity. Higher thresholds are more suited to analysis of high-density urban environments.*

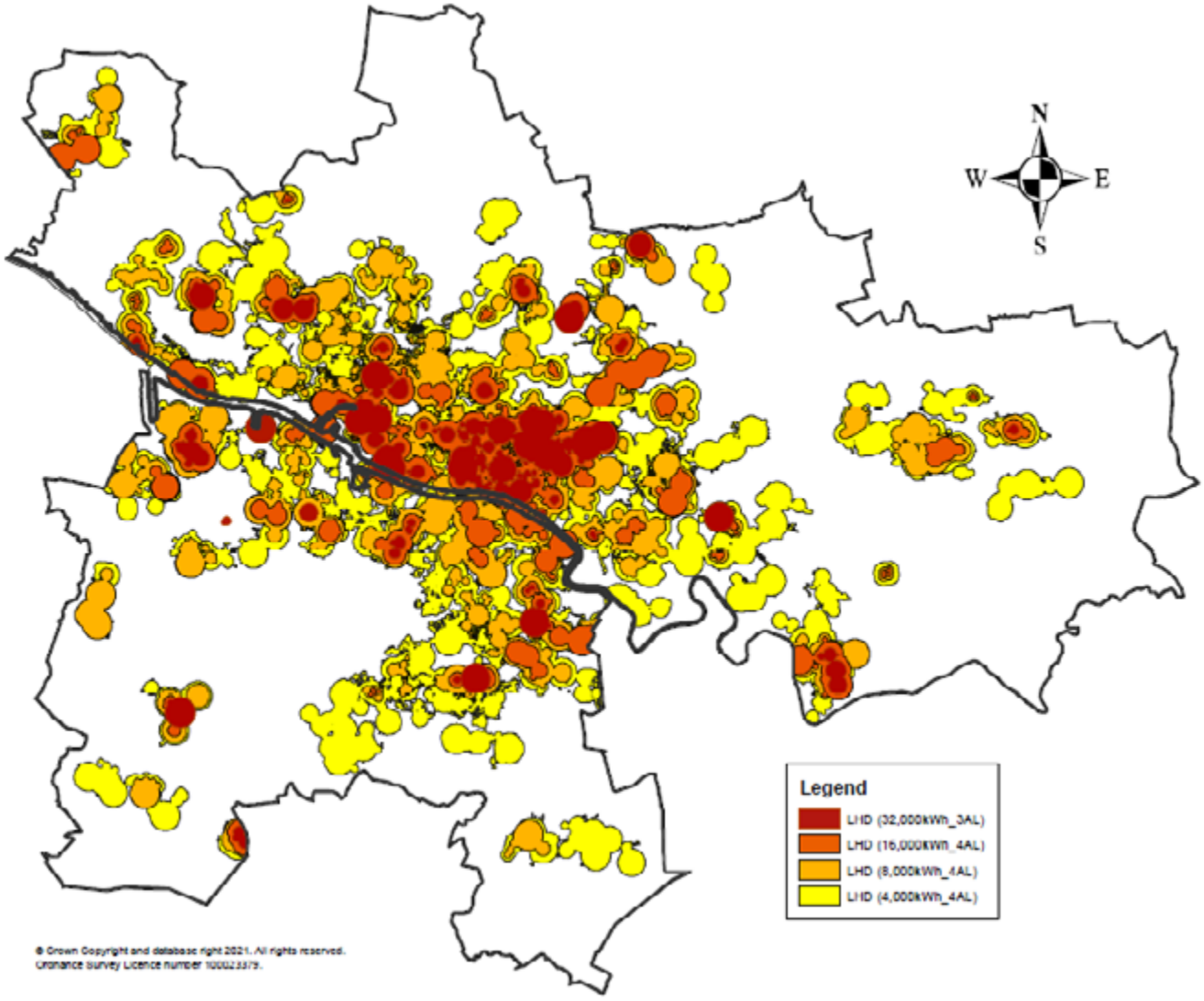



*Figure 55 - Heat Density Mapping*

| LHD Threshold (kWh/m/yr) | No. of Zones Identified | Total Area (ha) | Anchor Loads | Total Anchor Load Heat Demand (TWh/yr) | Total Heat Demand (TWh/yr) |
|---|---|---|---|---|---|
| 4,000 | 22 | 6,200 | 1,105 | 2.21 | 4.47 |
| 8,000 | 43 | 3,317 | 953 | 1.90 | 3.23 |
| 16,000 | 46 | 1,581 | 700 | 1.65 | 2.23 |
| 32,000 | 38 | 642 | 463 | 1.04 | 1.31 |

The extents covered by the 4,000 kWh/m/yr LHD threshold has a total heat demand of 4.37 TWh/y (just over 70% of Glasgow's total heat demand) across almost 50,000 domestic and non-domestic properties. and, geographically, include almost 40% of Glasgow. When viewed against census data this indicates that 47% of the Glasgow population is potentially within range of a viable heat network.

Proximate anchor loads were then notionally linked to provide initial outputs as to where heat networks may be feasible as highlighted in Figure 56 below. This was further guided by the presence of physical constraints such as roads and rivers. Due to the significant heat density of the city centre, this was treated as one indicative network. In total, this process identified 41 indicative networks from a heat demand perspective. This was then augmented by the consideration of renewable or low carbon supply alongside the other considerations noted in Appendix B, section 4.

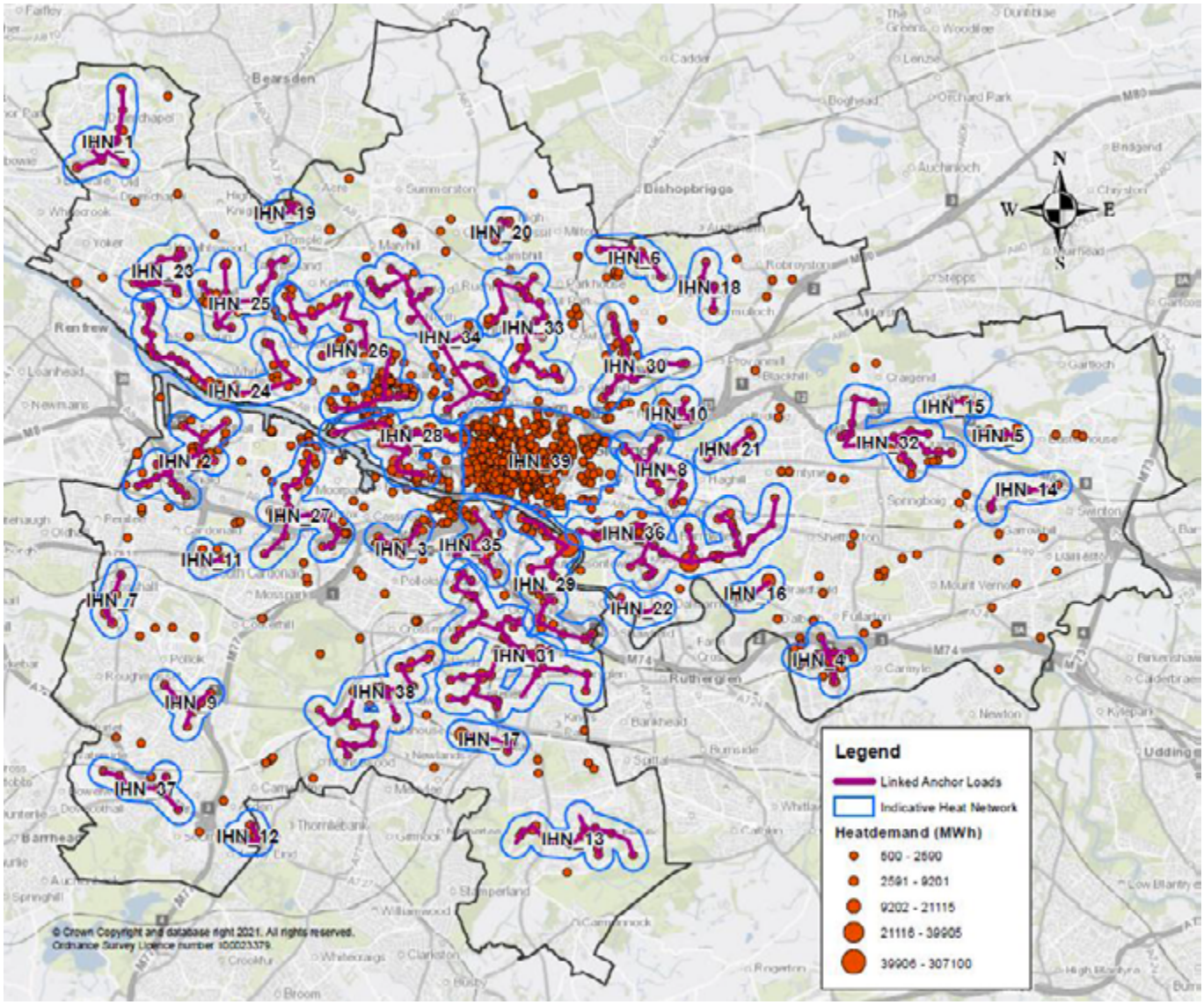



*Figure 56 - Heat Density Connective Mapping*

# 2. Building on the Scotland Heat Map Data

After the import and mapping of the Scotland Heat Map dataset, work was undertaken to rectify any errors identified during the buffering exercise and to improve the quality of the data where possible.

- **Parent UPRNs.** Each property in the UK has a Unique Property Reference Number (UPRN). When a property is part of a larger building (a high rise flat, for example), the larger building should also have a parent UPRN. Parent UPRNs were found to be missing for a notable number of properties in Glasgow (circa 40,000) that should have had one and this created challenges with accurately plotting cumulative heat demand as demands could then be underrepresented (see Figure 57 below). A process was developed in-house that matched longitude and latitude to rectify this.
- **Data Confidence.** Each heat demand data point in the Scotland Heat Map is attributed a confidence level according to how the data was gathered or generated. Figure 58 outlines the initial spread of confidence levels with a significant majority of the data being classed as confidence 1 (the lowest level). Providing accurate data is a key aspect in building the case for district heating in Glasgow and whilst further work will certainly be required through LHEES delivery, where possible, accurate consumption data was collected from the following sources and used to re-map the buffer approach:
    - Scottish Fire and Rescue
    - Police Scotland
    - The NHS
    - Glasgow Life
    - Council-owned buildings

Improving average confidence levels on heat demand for Glasgow's anchor load buildings is a key KPI for LHEES delivery[48] and will be essential in building the business case for district heating in the city. This will be aided by the duty on public sector bodies to complete their Building Assessment Reports (BARs) under the Heat Networks (Scotland) Act 2021 but Glasgow's LHEES will also promote the voluntary submission of BARs from the non-domestic sector, ahead of anticipated national legislation, to ensure the city is working at pace to stimulate the conditions conducive to investment in heat networks.

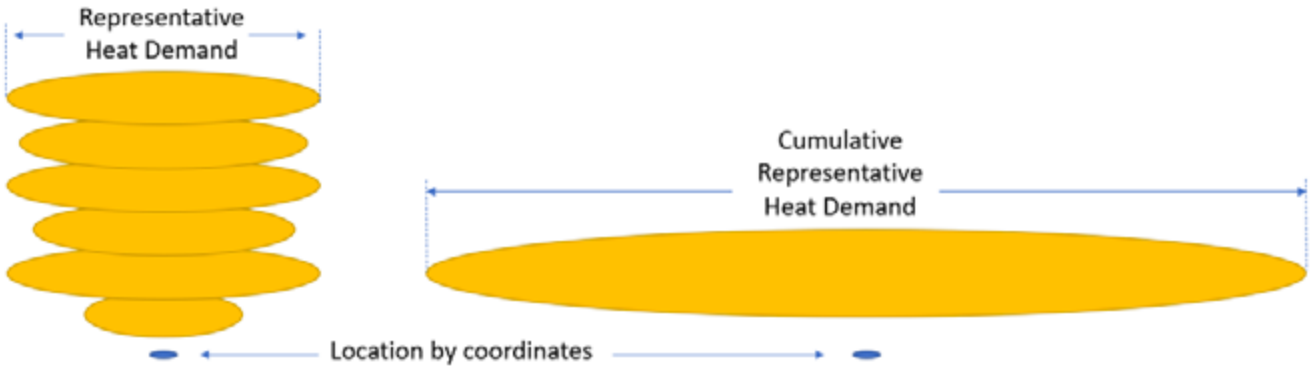



*Figure 57 - Addressing Cumulative Demand Data Points*

[48] *This KPI will be tracked as confidence per MWh rather than confidence per property to provide a uniform measure of progress*

# 3. Renewable or Low Carbon Heat Supply Mapping

In growing the footprint of heat networks across the city, Glasgow must work to ensure these are supplied using renewable or low carbon sources of heat. However, at present, data on potential heat supply is not as readily available as data on heat demand. Supply opportunities were mapped as point data including –

- Potential for river source heat pumps
- Wastewater treatment works
- Energy from waste plants (active and proposed)
- Other potential sources of waste heat (including distilleries)

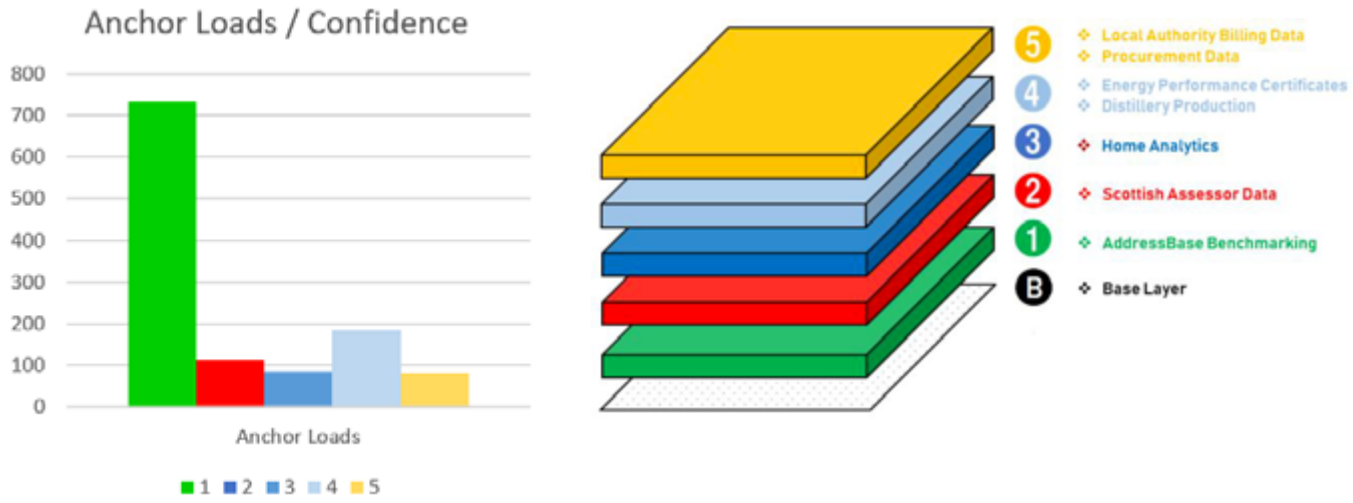



*Figure 58 - Heat Demand Data Confidence*

Further work undertaken through LHEES delivery will help to clarify supply opportunities in more granularity including potential for extracting heat from mine workings, deep geothermal and other suitable locations for heat extraction from the wastewater network (the latter will use the newly developed tool by Scottish Water Horizons to identify potential sewerage network locations for heat extraction using pipe diameter and flow rates). This will have a key influence over the designation of Heat Network Zones through the Heat Networks (Scotland) Act 2021.

Where supply opportunity was the most clarified, buffers of 250m, 500m and 1000m were placed around as an initial indication of the potential network size they could serve. Key supply opportunities were determining factors in the categorisation of an indicative Heat Network Zone as either primary or secondary. Key initial supply opportunities included[49] –

- The River Clyde
- The Glasgow Recycling and Renewable Energy Centre (GRREC) (Energy from Waste plant)
- The proposed energy from waste plant at Shieldhall (South Clyde Energy Centre)
- The wastewater treatment plant at Shieldhall (the Dalmarnock WWTP latter already in use as part of Clyde Gateway's D2 Grids project).

[49] *These supply opportunities are summarised in section 4.1.*

Where a supply opportunity was identified but with less confidence, this was included as point data for consideration within the secondary indicative Heat Network Zones so as not to rule out any opportunity at this early stage of development. Supply opportunities are highlighted in Figure 59 below.

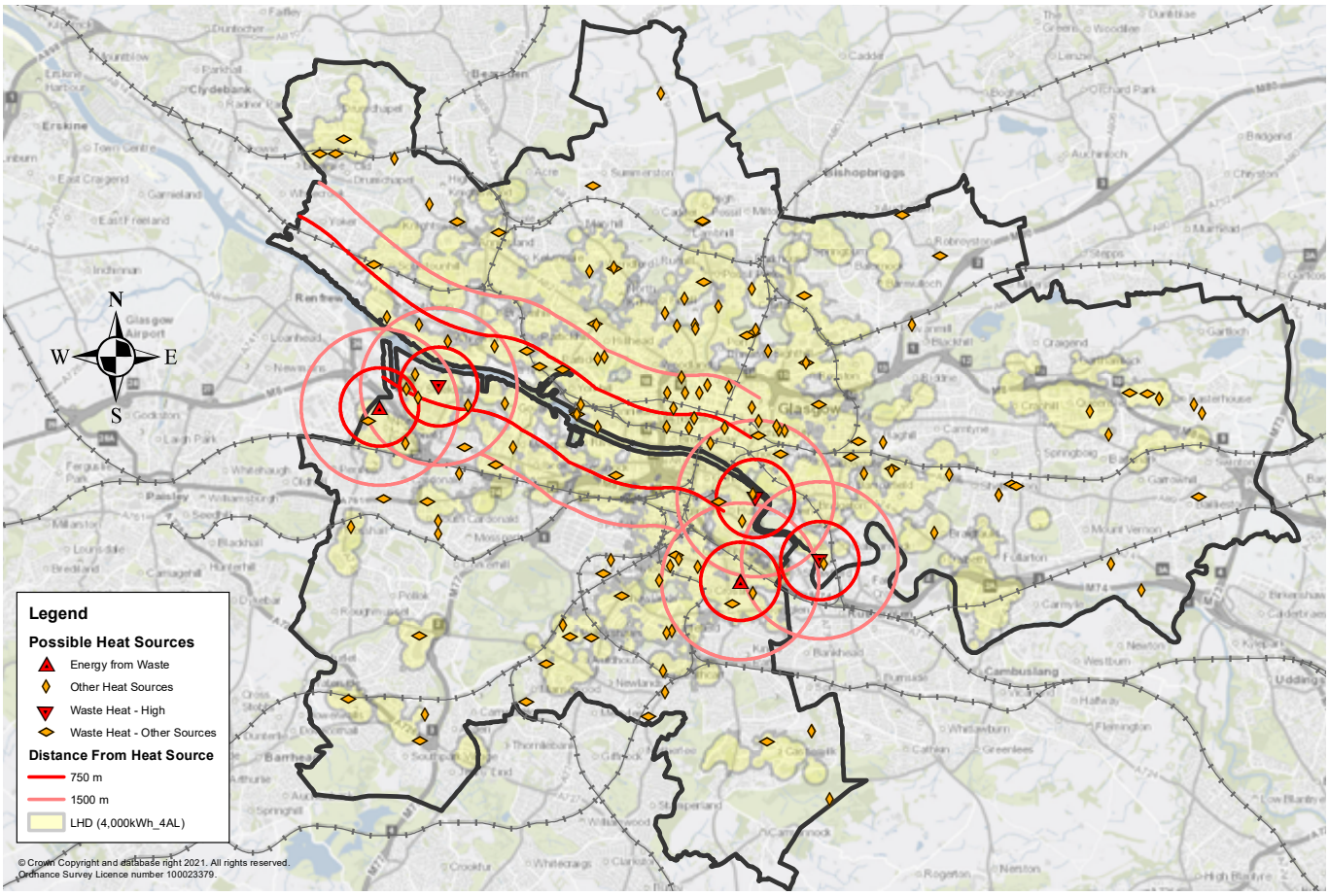



*Figure 59 - Renewable or Low Carbon Supply Opportunities*

# 4. Other Considerations for Indicative Heat Network Zoning

Alongside matching heat demand with renewable or low carbon heat supply, other considerations influenced the identification of indicative Heat Network Zones. These included:

- **Physical Constraints.** Ordnance Survey data was utilised to identify major physical constraints such as roads, rivers and railways that may impede delivery. These constraints were used as indications of where zone borders could go the disaggregate the large heat dense central area of Glasgow into indicative Heat Network Zones. Whilst these constraints are likely to maintain influence over zone borders, further technical work will be required to ascertain with confidence where a Heat Network Zone border should be.

- **Non-Domestic Assessment.** Energy Saving Trust's Non-Domestic Analytics dataset was utilised to provide context to identified anchor loads within indicative Heat Network Zones. There are limitations on the confidence of this dataset due to the lack of robust information from the non-domestic sector compared to the domestic sector. As such, analysis was limited to exploring groupings of building typologies as a mechanism for assessing concentrations of connection suitability.

- **On Gas Grid.** The mapping completed for the On Gas Grid LHEES Consideration[50] was used to identify domestic properties within indicative Heat Network Zones that present as suitable for connection into a heat network. This will influence targeted engagement within the indicative zones through LHEES delivery. It is important to note that this refers to a low temperature heat network (such as one supplied using a heat pump). The suitability of domestic properties increases when high temperature heat networks are considered.

- **Housing Land Supply Data.** Housing and commercial land supply was mapped to outline where future developments may benefit from connecting into a heat network within indicative zones.

- **Stakeholder engagement.** Mapping work completed through the LHEES methodology process was then augmented through engagement with internal and external stakeholders. This included an LHEES stakeholder engagement event in the City Chambers held in May 2023.

[50] *Identification of domestic properties that are suitable for heat pump installation or in need of minor upgrades to become feasible for installation*

# Appendix C - Funding Matrix

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Energy Company Obligation (ECO4)** | Insulation, district heating connection, renewables, heating installation and repair. | Lower income and vulnerable to cold domestic owner occupiers, private sector tenants and social tenants, depending on eligibility criteria | Fourth round of a grant/subsidy scheme providing (subject to eligibility), insulation and heating measures for:<br>• Owner occupied households in an Affordable Warmth Group (AWG) of benefit and tax credit recipients or declared eligible under a flexible eligibility scheme by a local authority or energy supplier via routes approved by BEIS, and living in properties rated EPC D, E, F and G<br>• Private renting households meeting the same eligibility criteria as owner occupied households but living in properties rated E, F and G<br>• Social housing tenants in properties with lodged EPC ratings of E, F or G<br>• Non-fuel poor private sector households (for solid wall insulation and district heating connection) in properties linked to one ECO eligible property in a flat block or three ECO eligible in a street for housing.<br><br>There is also an innovation stream, which will allow energy suppliers to support some innovative measures, for eligible households, which is also available to EPC D rated social housing. The measures available vary in each tenure (particularly for heating install and repairs)<br><br>https://www.ofgem.gov.uk/sites/default/files/2022-06/ECO4%20Delivery%20Guidance%20v01%20publication%20final1656413397400.pdf | Obligated energy suppliers | Ofgem through | Commenced 1st October 2018, with ECO4 commencing on 1 April 2022 and ending on 31 March 2026. | ECO funding can't fund individual measures that are funded by UK and devolved government funded initiatives. ECO4 requires properties to reach minimum target ratings (EPC D for EPC F and G rated properties and EPC C for D and E rated properties). Therefore, usually more than one measure will need to be installed and funded by ECO. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Energy Efficient Scotland: Area Based Scheme (ABS)**<br><br>**(Formerly HEEPS: ABS)** | Targets wall and roof insulation measures and has supported other fabric insulation measures. There is also a funding stream for low carbon heat and micro generation measures. Funding is also available for special projects funding activity that is usually beyond the scope of ABS and WHS. | Domestic owner occupiers and private renting landlords where the landlord owns three properties or less. | Area Based Schemes delivered by local authorities and prioritising fuel poor areas (Council Tax band A-C usually).<br><br>https://www.gov.scot/policies/home-energy-and-fuel-poverty/energy-saving-home-improvements/ | Scottish Government | Scottish Local authorities (often route enquiries through Home Energy Scotland) | Currently open | The restriction in households receiving Warmer Homes Scotland support after receiving ABS support has been removed. However, ECO4 can't fund any measure that is part funded through ABS and ABS funded measures can't contribute to the ECO4 EPC minimum target requirements. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Heat Network Fund** | District and community heating. | All tenures and sectors. Open to applications from public and private sector organisations where there is a consortium lead and partners. | £300 million available over the next parliamentary session to support the development and rollout of zero emission heat networks across Scotland.<br><br>Projects must be of a large scale and must be based in Scotland. As well as delivering emissions reductions, successful projects will also demonstrate a positive social and economic benefit for Scotland. Scotland's. Projects at capital readiness that can clearly demonstrate a funding gap will be considered. For capital-ready projects, support may be offered in the form of financial assistance based on this funding gap, up to a maximum of 50% of the total eligible capital costs of a project where capital costs cover financial costs associated with the build and installation of an exemplar project.<br><br>https://www.gov.scot/publications/heat-network-fund-application-guidance/ | Scottish Government | Scottish Government | April 2026 | ECO4 would not be able to match fund connections to networks. |
| **Heat Network Support Unit** | Heat Networks | Public sector | Works with the public sector to identify, support and develop heat network projects to capital readiness through expert advice and grant funding. Also builds capacity and expertise across the public (and private) sector in Scotland to develop and run successful heat networks.<br><br>Can offer grant funding towards:<br>• developing feasibility studies and Outline Business Cases<br>• procurement of technical, financial and legal advisors.<br><br>https://www.heatnetworksupport.scot/ | Scottish Government | The Heat Network Support Unit is part of the Scottish National Public Energy Agency and its Centre of Expertise. | Currently available | |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Scottish National Investment Bank** | The Bank will provide patient (long term) capital to businesses and projects throughout Scotland to support the development of a fairer, more sustainable economy. | Project proposals from all public and private sector applicants will be assessed. | The Bank will identify, develop and assess investment opportunities in the following way:<br>• Originate investment opportunities proactively through the Bank's networks and wider ecosystem<br>• Assess and appraise investment opportunities identified following a robust investment appraisal process in line with market best practice<br>• Make investments with appropriate terms and conditions and expected returns in line with the risk profile of each investment and market<br>• Manage its individual investments and investment portfolio to both protect its invested capital and maximise its financial and impact returns | Scottish Government | Scottish National Investment Bank | Open | The Bank is not a grant making body, so when it invests it does so commercially and seeks to ensure its capital is returned to it at the end of the investment term with additional income generated over the period of the investment from that capital being invested |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Clyde Mission Fund** | Capital projects that deliver economic stimulus and jobs and contribute to the strategic goals of the Clyde Mission. | The Clyde Mission Fund is open to public sector, private sector and third sector or community organisations. Funding will be targeted at projects within the footprint of the Mission (broadly 500 metres either side of the river from Clyde Gateway through to Gourock/ Dunoon) though projects which fall within natural communities which are partially within the footprint and/or can demonstrate a strong link to the purpose of the Mission will also be considered. | The Fund will support capital projects that deliver economic stimulus and jobs and contribute to one or more of the Scottish Government's five National Outcomes that underpin the Clyde Mission:<br>• we have a globally competitive, entrepreneurial, inclusive and sustainable economy<br>• we tackle poverty by sharing opportunities, wealth and power more equally<br>• we value, enjoy, protect and enhance our environment<br>• we live in communities that are inclusive, empowered, resilient and safe<br>• we have thriving and innovative businesses, with quality jobs and fair work for everyone | Scottish Government | Scottish Government | Previous programme ran from 2020-2021. Launch of successor programme expected. | There is no requirement for matched funding, although State Aid rules remain applicable. Where the project cost exceeds the value of any award from this fund, applicants are required to meet the shortfall via other funding sources. Applicants must provide evidence of the additional funding being secured. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **SALIX Finance** | Energy efficiency measures that provide cost savings | Scottish public sector which are subject to the Public Bodies Duties in the Climate Change (Scotland) Act 2009. | This loan scheme offers zero interest loans to the public sector to enable them to undertake spend to save retrofit energy efficiency improvement projects to help them towards achieving net zero carbon in their estates.<br><br>The available funding allows Salix to offer up to 75% of the total compliant project value.<br><br>Project criteria in Scotland are up to a 12 year payback at a cost of £305 per tonne of $CO_2$ over the lifetime of the project on all new loan agreements. | UK Government | SALIX | Applications approved on a first come first served basis until all funding has been allocated | SALIX funding will meet 50% of the funding requirements, potentially rising to 75% under certain conditions. |
| **Energy Efficient Scotland: Warmer Homes Scotland** | Energy efficiency, heating and Renewable measures (subject to survey).<br><br>Heating measures not available in private rented properties | Domestic owner occupiers and private renting tenants | Installation of energy efficiency home improvements and heating systems, including in some cases renewables, to help alleviate fuel poverty. Also includes energy advice, benefits checks and tariff advice support to all tenures. Households must meet qualification criteria and live in a property with SAP rating of 72 or below.<br><br>Split between a fabric only stream for 16 years or older and in receipt of a passport benefit and a core stream providing heating and insulation measures for households with additional vulnerabilities such as having children under 16, elderly householders, caring responsibilities, or a disability and those aged 75 or over with no heating and not in receipt of passport benefits. Accessed via Home Energy Scotland via the following link:<br><br>https://www.homeenergyscotland.org/funding/warmer-homes-scotland/<br><br>Costs usually met by Scottish Government but if customer contribution required, funding options are available and will be discussed by Warmworks (see WHS loan). | Scottish Government | Warm works for measure installs<br><br>Energy Saving Trust/ Home Energy Scotland for enquiries and referrals | Referrals for Warmer Homes Scotland have been paused from Friday 31 March 2023 and will be re-starting in October 2023.<br><br>Applications received by Home Energy Scotland from Saturday 1 April 2023 onwards will be assessed under the new eligibility criteria and referrals are being held onto until Monday 2 October 2023. | There are no longer restrictions to accessing Warmer Homes Scotland funding for households previously having received Energy Efficient Scotland Area Based Funding. Does not operate alongside cashback element of the HES loan scheme. WHS will not be able to partially fund individual measures in tandem with ECO. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Home Energy Scotland (HES) Grant and Loan** | Energy efficiency measures and renewables, (from a specified list), energy storage and connections to a renewably powered heat network scheme. | Owner occupiers | Grant funding for energy efficiency improvements is up to 75% of the combined cost of the improvements, up to the maximum grant amount of £7,500, or £9,000 for households which qualify for a rural uplift.<br><br>Grant funding for heat pumps is up to £7,500, or £9,000 for households which qualify for the rural uplift. The remainder of funding requested can be taken up as an optional interest-free loan A grant of £2,500 is available for high heat retention storage heaters, if taken as part of a package of measures.<br><br>The rural uplift is available to households in Remote Rural and Island areas, as well as off-gas Accessible Rural areas, as defined by the Urban Rural Classification. The repayment period varies based on the amount borrowed. Higher value loans can pay back over a period up to 12 years.<br><br>http://www.energysavingtrust.org.uk/scotland/grants-loans/home-energy-scotland-loan | Scottish Government | Energy Saving Trust | Open | Grant elements of the scheme would not operate alongside other Scottish Government grant schemes. ECO funding would not be available where a grant is being claimed. |
| **Energy Efficient Scotland: ABS Loan Scheme (through the Home Energy Scotland loan scheme)** | Energy efficiency measures delivered through EES:ABS and associated repairs | Qualifying owner occupiers and private landlords where the landlord owns up to three properties and the tenant or landlord meet fuel poverty criteria. | Up to £5,000 interest free loan funding available to meet householder contributions for energy efficiency measures delivered through EES:ABS and up to £5,000 for approved repairs necessary to allow measures to be installed. An admin fee is applied to all paid loans.<br><br>Repayments are made over a maximum of 10 years. | Scottish Government | Energy Saving Trust | As for the general Home Energy Scotland loan scheme | Only available in conjunction with EES:ABS support. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **EES: Warmer Homes Scotland Loan Scheme (through Home Energy Scotland Loan scheme)** | Energy efficiency measures delivered through Warmer Homes Scotland | Qualifying owner occupiers. | Interest free loans of up to £10,000 for homeowners or landlords whose properties are in receipt of an offer of support from the Warmer Homes Scotland Programme managed by Warmworks and who need further assistance to help pay a contribution towards the work. An admin fee is applied to all paid loans.<br><br>Repayments are made over a maximum of 5 years, if less than £5,000 and ten years if between £5,000 and £10,000. | Scottish Government | Energy Saving Trust | As for the general Home Energy Scotland loan scheme | Only available in conjunction with Warmer Homes Scotland support. |
| **HEEPS Loan scheme for Registered Social Landlords** | Energy efficiency, renewables and associated repairs (from a specified list based on ECO eligible measures excluding district heating). | RSLs | Interest free loans of between £30,000 and £1 million for housing associations and housing co-operatives to install energy saving measures with the aim of progressing properties towards the required Energy Efficiency Standard for Social Housing (EESSH) standard. Funding is also available for repairs or enabling work to allow eligible energy saving measures to go ahead.<br><br>Repayments are made over 10 years.<br><br>https://energysavingtrust.org.uk/service/social-housing/ | Scottish Government | Energy Saving Trust | Applications must be submitted by 30 November 2022 and will be reviewed on a first come, first served basis subject to available funding. Successful applicants must complete work and claim their funds by 30 June 2023. | None |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Private Rented Sector Landlord Loan** | Energy efficiency and renewable measures | Registered private sector landlords | Up to £15,000 can be borrowed per property for insulation measures and £17,500 for up to two home renewable systems per property plus an energy storage system up to a maximum of £6,000.<br><br>The amount depends on the number of supported energy efficiency or renewable improvements installed and there are fixed maximum rates for individual technologies. Landlords with five properties or fewer in their portfolio could borrow up to £100,000.Landlords with six or more properties in their portfolio could borrow up to £250,000. The loan is repayable over up to eight years.<br><br>Successful loans are subject to an administrative fee of 1.5% of the total loan value, up to a maximum of £250. The fee will automatically be added to the loan value and included in the amount repayable. Applicants with five or fewer properties in their portfolio will not be subject to interest. Applicants with six or more properties in their portfolio will be subject to interest at a rate of 3.5% APR.<br><br>https://www.homeenergyscotland.org/find-funding-grants-and-loans/private-landlord-loans/ | Scottish Government | Energy Saving Trust | Currently available | Other Scottish Government loan schemes |
| **Smart Export Guarantee** | Renewables (electricity producing only) | Potentially all sectors, although arrangements for social housing being considered | A scheme that allows sale of surplus electricity to energy companies https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/807393/smart-export-guarantee-government-response.pdf<br><br>https://www.ofgem.gov.uk/environmental-programmes/smart-export-guarantee-seg/about-smart-export-guarantee-seg | Energy suppliers | Ofgem | Opened 1 January 2020 | Can't combine with historic FITs arrangements. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Social Housing Net Zero Heat Fund** | Renewable and energy efficiency measures | Registered social landlords, local authorities and ESCOs | £200 million available in five years up to 2026 to support social landlords across Scotland to install zero emissions heating systems and energy efficiency measures across their existing stock.<br><br>The funding round for 2022 has two themes:<br>theme 1 – zero emissions heating system for social housing across Scotland<br>theme 2 – "fabric first" energy efficiency only projects<br><br>Theme one projects must have completed installation and commissioning by 30 November 2022. Projects submitted under theme two must complete installation by 31 March 2024.<br><br>https://www.gov.scot/publications/social-housing-net zero-heat-fund---call-for-funding-applications---2021/ | Scottish Government | Scottish Government | Various checkpoint dates for submitting applications in 2022, the last one being on 30 November 2022.<br><br>Scheme continues in further phases up to 2026, | All financial support provided under the Social Housing Net Zero Fund will be in compliance with Subsidy Control obligations.<br><br>Will not be able to fund individual measures jointly with ECO or contribute towards ECO minimum rating requirements. |
| **District heating loan fund** | Capital funding support for heat networks/ district heating generated by renewables fuel. | Local authorities Registered social landlords/HA's Businesses Energy Services Companies (ESCOs) Legally constituted community groups | Unsecured loans of up to £1M+ towards capital measures for district heating projects/heat network projects. Large stand-alone anchor load buildings can also be supported. Interest rate typically 3.5%. Repayable over 10-15 years.<br><br>http://www.energysavingtrust.org.uk/scotland/grants-loans/district-heating-loan | Scottish Government | Energy Saving Trust | Currently open for expressions of interest and applications. | |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Warm Homes Fund (WHF)** | Gas and low running cost heating installations | Social housing providers, local authorities and other organisations working in partnership with them, to address some of the issues affecting fuel poor households | The WHF is a £150million fund administered by AWS across England, Wales and Scotland, primarily designed to address some of these issues by incentivising the installation of affordable heating solutions in fuel poor households who do not use mains gas as their primary heating fuel. It is envisaged that this fund will be used to supplement local strategic plans and funds blended with local support.<br><br>The last funding round closed for applications on 21 January 2022 for projects to be delivered by end of 31 March 2024 in two lots:<br>• Lot 1 – Low carbon first time central heating solutions.<br>• Lot 2 – Specific energy efficiency/health related solutions – programmes which bring together relevant organisations and charities to promote energy efficiency and/or health related programmes in relation to fuel poverty. Bids would only be made in Lot 2 if a Lot 1 application has also been made, and consequently funding only awarded to organisations who is successful in Lot 1.<br><br>https://www.affordablewarmthsolutions.org.uk/warm-homes-fund/ | National Grid and Community Interest Company, Affordable Warmth Solution | National Grid and Community Interest Company, Affordable Warmth Solution | Planned closure in April 2024 and closed to new applications at present. | Dependent on programme but may work alongside ECO4 if funding separate measures. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Energy Industry Voluntary Redress Scheme** | The scheme can support anything from making a home more energy efficient, to providing advice that helps consumers keep on top of their bills. Measures will be dependent on the projects that are approved. | Charitable organisations that support energy customers in England, Scotland and Wales.<br><br>Local authorities and other organisations working directly with charities in relation to such projects can play a role in projects funded by the scheme, however only their charitable partner will be able to submit an application and be responsible for the funding and project delivery. | Supports initiatives through an application process for projects that cover activities including, making homes more energy efficient and providing advice that helps consumers keep on top of their bills. Projects should be of benefit to people in England, Scotland and Wales.<br><br>The minimum grant that can be requested is £20,000 and the maximum amount is the lesser of £2 million or the total value of the current fund.<br><br>The scheme can fund projects lasting up to two years, can fund 100 per cent of the project cost and can cover revenue and capital measures.<br><br>Applications are made through an online system and closing dates for applications will be determined each quarter.<br><br>https://energyredress.org.uk/about-us | Payments from energy companies who may have breached rules | Energy Saving Trust on behalf of Ofgem | Ongoing | Charities will not be able to apply for funding through this scheme if they or their delivery partners have close links to energy companies in England, Scotland and Wales regulated by Ofgem (examples include suppliers of electricity or gas, electricity or gas network operators and energy generators).<br><br>Funding can't support delivery of ECO or other supplier obligations. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Energy Investment Fund** | Provides financial assistance for renewables development and low carbon technologies | Companies and community groups working in the area of renewable energy at the test or commer-cialization stage and trying to assemble a funding package. | Building on the Renewable Energy Investment Fund, provides financial assistance for projects that will:<br>• Deliver energy from low carbon and renewable sources, reduce the cost of renewable energy or provide key solutions for renewable energy generation<br>• Provide benefit to the economy of Scotland<br>• Have a demonstrable funding gap for EIF to consider<br>• Increase community ownership of energy projects in Scotland (including community stakes in commercial developments)<br><br>https://www.scottish-enterprise.com/support-for-businesses/funding-and-grants/accessing-finance-and-attracting-investment/energy-investment-fund | Scottish Government and its enterprise agencies | Scottish Investment Bank (applications supported by Local Energy Scotland) | Previous bidding round deadline for the Energy Investment Fund, was in March 2020. | Dependent on programme |
| **SPRUCE- Scottish Partnership for Regen-eration in Urban Centres.** | Renewable energy projects and energy efficiency schemes | 13 LAs, determined eligible for loans and equity investments until end of 2015. Other Local areas may be eligible during the recycling period 2016-2022. Can support social housing schemes. | The programme is split between revenue generating property & infrastructure investments and energy efficiency investments. On the 2nd of these, social housing providers were invited to develop renewable energy projects and energy efficiency schemes as part of the retrofit of their existing housing stock. | Financed through the JESSICA initiative, ERDF (EU) funds and the Scottish Government | AMBER – as the fund manager (with the European Investment Bank acting as Holding Fund Manager) | Initial loan funding was to be utilised / drawn down by the end of 2015.<br><br>Loan funding is however being recycled by 2022, with stage 7 application process for Regeneration Capital Grant Fund (RCGF) opening in April 2019 and closed for applications on the 10th June 2019. | Dependent on programme. |

| Scheme name | Measures supported | Sectors supported | Description | Funder | Managed by: | End date/ status | Match funding restrictions |
|---|---|---|---|---|---|---|---|
| **Warm Homes Discount – Industry Initiatives** | Has funded gas boiler repair and replacement, and other support delivered through specific schemes. Energy efficient appliances. | Mostly owner occupiers. | Some energy suppliers offer a Warm Home Discount indirectly by providing customers with the services of a third party to help reduce the cost of their energy. Indirect Warm Home Discounts are also known as Industry Initiatives. Schemes have included boiler and electric appliance replacement. Information on delivery in Scotland expected in late summer 2022.<br><br>https://www.ofgem.gov.uk/system/files/docs/2018/08/warm_home_discount_whd_guidance_for_suppliers_-_version_6.1.pdf chap 7 | Energy suppliers | Ofgem | Opens again later in 2022 and running from 2022 until March 2026 | Project dependent, can't mix with ECO for measures. |
| **SPEN Green Economy Fund** | Heat - provision of affordable energy for consumers – addressing fuel poverty Local energy systems – creation of local energy solutions to match generation and demand | Scottish Organisations - charities, community groups, housing associations, local authorities, schools, academic institutions and businesses. Not open to individuals. | SP Energy Networks have committed to voluntarily contribute up to £20m over a two year period up to 2020, to support initiatives that will benefit the people of Scotland and support Scotland's ambitious green energy plans and local economic growth. The fund will focus on helping our communities invest in low-carbon heating and transport technology, building the infrastructure and the learnings needed for the changes in heating and transport expected over the next decade. The fund will support the Scottish Government's ambitious energy strategy and the UK's drive to a low carbon economy.<br><br>https://www.spenergynetworks.co.uk/pages/green_economy_fund.aspx | SP Energy Networks | SP Energy Networks | Funding rounds to be announced, with closing dates for two earlier bid rounds having past | The minimum grant award is £10,000 and whilst there is no stated maximum threshold the funder is looking to support a range of small, medium and large projects. |
| | Capital funding support for heat networks/ district heating generated by renewables fuel. | Charitable organisations that support energy customers in England, Scotland and Wales. | Works with the public sector to identify, support and develop heat network projects to capital readiness through expert advice and grant funding. Also builds capacity and expertise across the public (and private) sector in Scotland to develop and run successful heat networks. | Energy suppliers | Energy Saving Trust on behalf of Ofgem | Currently open for expressions of interest and applications. | |

# Appendix D - Indicators, Weightings and Criteria

| Indicators | | | | | | |
|---|---|---|---|---|---|---|
| **LHEES Priority** | **Theme** | **Indicator** | **Criteria** | **Weighting** | **Description** | **Data source (domestic & non-domestic), if known** |
| **1. Heat Networks** | | | | | | |
| | Identification of Potential Zones | Heat demand (existing) | Definition of a Tier 1 anchor load as heat demand > 500,000 kWh/a | | Anchor loads are the basis for the identification of Potential Zones in Stage 4 | Scotland Heat Map |
| | Identification of Potential Zones | Heat demand (existing) | Maximum radii distance for buffer is 250m | | Buffers around anchor loads are used to define boundaries for Potential Zones, this restriction is applied to prevent very large loads resulting in buffers over unrealistic connection distances | Scotland Heat Map |
| | Baseline assessment | Heat demand (existing) | Linear heat density (LHD) of 4,000 kWh/m/a to determine buffer radii for baseline assessment | | There is a lack of information on LHD thresholds that might indicate viability for low carbon heat supplied heat networks. Adiitionally, these thresholds will vary by supply technology and will be highly project-specific in nature. As such, for strategic assessment, a range of LHD values are used in the analysis, with 4,000 kWh/m/a being a typical lower threshold used in UK analysis. | Scotland Heat Map |
| | Baseline assessment | Heat demand (existing) | Minimum number of anchor loads per Potential Zone = 2 for baseline assessment | | A minimum number of anchor loads within a Potential Zone is used to carry out an initial screening dependent on local considerations | Scotland Heat Map |
| | Stringent assessment | Heat demand (existing) | Linear heat density (LHD) of 8,000 kWh/m/a to determine buffer radii for stringent assessment | | There is a lack of information on LHD thresholds that might indicate viability for low carbon heat supplied heat networks. Adiitionally, these thresholds will vary by supply technology and will be highly project-specific in nature. As such, for strategic assessment, a range of LHD values are used in the analysis, with 16,000 kWh/m/a being a threshold that was effective for highlighting the most promising zones in very heat dense regions when testing different thresholds during development of the methodology. | Scotland Heat Map |
| | Stringent assessment | Heat demand (existing) | Minimum number of anchor loads per Potential Zone = 5 for stringent assessment | | A minimum number of anchor loads within a Potential Zone is used to carry out an initial screening dependent on local considerations | Scotland Heat Map |
| | Opportunity identification | Existing networks | Proximity to Potential Zones | | The Stage 4 Heat Network methodology indicates if a Potential Zone is close to an existing network | Scotland Heat Map |
| | Opportunity identification | Local Development Plan (LDP) sites | Proximity to Potential Zones and / or existing networks | | The Stage 4 Heat Network methodology indicates if a Potential Zone is close to an LDP site. Consideration could also be given to LDP sites in close proximity to existing networks in identifying extension opportunties, and to LDP sites in isolation if of significant scale and density. | Locally held / Improvement Service data used for national assessment |

| Indicators | | | | | | |
|---|---|---|---|---|---|---|
| **LHEES Priority** | **Theme** | **Indicator** | **Criteria** | **Weighting** | **Description** | **Data source (domestic & non-domestic), if known** |
| **4. Poor building energy efficiency as a driver for fuel poverty** | | | | | | |
| | Indicators of fuel poverty | Probability of fuel poverty | % likelihood | 50% | 50% is default but set to 0% if extreme fuel poverty is to be analysed. | Home Analytics |
| | | Probability of extreme fuel poverty | % likelihood | 0% | 0% is a default Weighting applied. User can adjust balance by selecting 0% or 50% to switch analysis focus between fuel poverty or extreme fuel poverty. | Home Analytics |
| | Building energy efficiency | Loft insulation | <100mm (prediction) (Yes) | 16.67% | Poor energy efficiency Indicators sum to 50% of overall Weighting, each have an equal Weighting. | Home Analytics |
| | | Single glazed windows | Binary (Yes) | 16.67% | | Home Analytics |
| | | Wall insulation prediction (all construction types) | Binary (Uninsulated) | 16.67% | | Home Analytics |
| | Additional example Indicators that could be used to support Delivery Level Area identificaiton as part of LHEES Stage 4 and Delivery Plan | Tenure type | User defined | | Four types; housing associaion, owner/ occupier, private rented, local authority. User can filter by interest. | Home Analytics |
| | | Building age | User defined | | Defined in six age brackets. User can filter by interest. | Home Analytics |
| | | Non-traditional build design type | Solid wall (binary) | | User can filter by interest. | Home Analytics |
| | | EPC Rating | E, F or G | | User can filter by interest. | Home Analytics |
| **5.1 Mixed-tenure and mixed-use** | | | | | | |
| | Identification of multiple properties in building | Dwellings in building | Dwellings in building >1 | | Domestic count for properties where there are multiple dwellings in a building | Home Analytics |
| | | Mixed tenure | Binary (Yes) | | Domestic count for properties for properties identified as being mixed tenure in building. | Home Analytics |
| | | Parent and child UPRN's | Multiple dwellings in building when multiple child UPRN's to a single parent | | To identify counts of non-domestic where there are multiple properties in a building, or where there is a mix of non-domestic and domestic properties in a single building | One Scotland Gazeteer |
| **5.2 Listed buildings** | | | | | | |
| | Identification of listed buildings | Listed building grade | Listed A, B, or C | | Domestic property is registered as a listed building. No data was available to identify listed non-domestic properties. | Home Analytics |
| **5.3 Conservation areas** | | | | | | |
| | Identification of properties in conservation areas | Conservation area | Binary (Yes) | | Domestic property within a conservation area | Home Analytics |
| | Identification of properties in conservation areas | Conservation area | Within shapefile boundary | | Provided as geographic boundary within Scotland Heat Map | Scotland Heat Map |

| Indicators | | | | | | |
|---|---|---|---|---|---|---|
| **LHEES Priority** | **Theme** | **Indicator** | **Criteria** | **Weighting** | **Description** | **Data source (domestic & non-domestic), if known** |
| **6. On-Gas Grid** | | | | | | |
| | Select properties | On-gas grid | Off gas grid = No, OR off gas grid = Unknown AND main fuel type is mains gas | Filtering step | Property is connected to the gas grid | Home Analytics |
| | Category 0 already has a communal heating system installed. | Main heating system | Main heating system = Communal | | Property is connected to a communal heating system. Properties on communal heating system are considered to be highly suited to a heat pump solution. | Home Analytics |
| | Category 1 required criteria for properties with immediate potential for heat pump retrofit (for all categories, excluding any consideration of network upgrade or associated costs) | Category 0 property | Is a Category 0 property (No) | | Exclude properties included in Category 0 | Home Analytics |
| | | Listed property | Property is listed (No) | | Listed buildings require additional considerations for retrofit such as planning permission/listed building consent | Home Analytics |
| | | Conservation area | Not within a conservation area | | Buildings in conservation areas require additional considerations regarding some retrofit works | Home Analytics |
| | | Insulated walls | Walls insulated (Yes) | | Required to have thermal efficiencies needed for heat pumps. | Home Analytics |
| | | Double/triple glazed windows | Windows double or triple glazed (Yes) | | Required to have thermal efficiencies needed for heat pumps. | Home Analytics |
| | | Loft insulation 99mm+ | Loft is insultated: 99mm+ (prediction) | | Required to have thermal efficiencies needed for heat pumps. | Home Analytics |
| | Category 2 required and weighting criteria for properties with secondary potential for heat pump retrofit (requiring fabric / heat distribution system upgrade) | Category 0 or 1 property | Is a Category 0 or 1 property (No) | | Exclude properties included in Category 0 or 1 | Home Analytics |
| | | Insulated walls | Not uninsulated solid wall or system built or timber frame (prediction) | | Insulation of these wall types is considered beyond a moderate upgrade. This property type with suitable walls are captured in Category 1. More information is required to determine if necessary thermal efficiency could be achieved. | Home Analytics |
| | | Risk of narrow uninsulated cavity | Likely to have narrow uninsulated cavity (No) | | These walls will be challenging to bring up to the required thermal efficiency. | Home Analytics |
| | Additional Category 2 Indicators and Weightings to support Delivery Level Area identification (LHEES Stage 4 only) | Double/triple glazed windows | Windows double or triple glazed (Yes) | 20% | Required to have thermal efficiencies needed for heat pumps – being in place reduces costs | Home Analytics |
| | | Wall insulation | Wall insulation prediction = Insulated | 20% | Required to have thermal efficiencies needed for heat pumps – being in place reduces costs | Home Analytics |
| | | Loft insulation | Loft insulation prediction: 100-249mm, 250mm+ or No Loft | 20% | Required to have thermal efficiencies needed for heat pumps – being in place reduces costs | Home Analytics |
| | | Property tenure | Property tenure = housing association or local authority | 20% | Easier to install due to ownership levers | Home Analytics |
| | Category 3 properties are on gas properties not classified as either Category 0, 1 or 2. | Category 0, 1 or 2 property | Excess on-gas properties that do not fall within either Category 0, 1 or 2 . Binary (No). | | On-gas properties that may be challenging to transition to heat pumps. | Home Analytics |

# Appendix E - Pre-1919 Tenement Retrofit Pilots

| Project | Summary |
|---|---|
| **Niddrie Road EnerPHit Project – Southside Housing Association** | This project involved the detailed retrofit of a typical tenement that included eight single bed flats in one traditional tenement close on Niddrie Road in Strathbungo. The project features ultra-high levels of insulation and airtightness combined with new heating and ventilation systems. The project is being evaluated as part of a wider research partnership led by the UK Collaborative Centre for Housing Evidence (CaCHE) which will assess how residents are using their homes and the impact on energy costs.<br><br>More information can be found here. |
| **Old Shettleston Road Pre-1919 Tenement Retrofit – Shettleston Housing Association** | Shettleston Housing Association is currently testing the feasibility of deep-retrofitting 6 pre-1919 tenement closes at Old Shettleston Road. The study aims to identify a technical specification and funding solution to enable 39 flats (majority (37) are social rent and 2 owner occupied properties) to be retrofitted with tenants and occupiers in situ. Partners include ECD Architects & Hub West Scotland. Currently at RIBA Stage 1-2 (working toward concept design). A variety of surveys and modelling of properties using Passive House Planning Package (PHPP) is being carried out to inform the technical specification, and a monitoring framework established to measure outcomes including reduction in energy demand, fuel bills and improvement in comfort and healthy living conditions. |
| **105 Allison Street – Southside Housing Association and Loco Homes** | Southside Housing Association is working with partners Mast Architects, FBN Passivhaus and Loco Homes to retrofit pre-1919 properties at 105 Allison Street. Works are currently on site. This is a mixed tenure project that involves improving homes owned by the RSL and private owners. Retrofit measures are only being undertaken to improve properties owned by Southside HA. Currently RIBA Stage 5 Construction. |

| Project | Summary |
|---|---|
| **Linthouse Pre-1919 Tenement Retrofit Pilot – Linthouse Housing Association** | Linthouse Housing Association is bringing forward deep retrofit whole-building proposals for 5 mixed-tenure pre-1919 tenement closes including 3 within Govan Conservation Area. Partnering with Hoos & Grant Murray Architects, in-situ retrofit solutions are being sought for 41 properties. High thermal performance insulation, windows, doors and low carbon heat pump technology are being investigated alongside innovative funding options to find a replicable approach for this challenging property type. Currently RIBA Stage 1-2 (working toward concept design). Again surveys and modelling underway and negotiations with contractors to ascertain access to Energy Company Obligation (ECO) funding where possible. |
| **Retrofit Study – Queens Cross, Maryhill, Barrhead and Paisley Housing Associations** | Queens Cross, Maryhill, Barrhead and Paisley Housing Association have commissioned a study to identify the best value approach to retrofit a variety of property archetypes including pre-1919 properties. Currently RIBA Stage 1 (preparation & briefing). |
| **Pre 1919 Tenement Repair and Shallow Retrofit – 535 Eglington Street. New Gorbals Housing Association** | Led by the Association in partnership with GCC and HES, in a mixed tenure tenement. Comprises repairs and energy efficiency works including insulation to the external gable wall and roof. Tenement has a complicated flat roof structure. Energy efficiency works specification agreed with HES/GCC. 9 HA flats 3 private owners and commercial on ground floor. Currently RIBA Stage 4 (Technical Design/ Tender). |
| **Pre 1919 Tenement Contracts- Voluntary schemes-Major fabric repairs** | A number of tenements where owners have accessed grants for voluntary repairs. Loft insulation as standard and sub-floor insulation where possible. |
| **Building Repair and Shallow Retrofit 318 Langside Road – NRS and Historic Environment Scotland** | Led by NRS (Private Sector Housing) in partnership with Historic Environment Scotland, repairs and energy efficiency works were recently completed to an empty listed building that was focus of a statutory repair notice. Findings are being used to establish the correct technical specification and cost of installing shallow retrofit measures on a listed property comprising 8 residential flats to ensure it is heat pump ready. |

# Appendix F - Data and Tools Dictionary

| LHEES Data and Tools Library | | | |
|---|---|---|---|
| **Row** | **Data Resource or Tool** | **Description** | **Summary of Use Categorisation** |
| | Name of data item or tool | High-level description of data item or tool | Comment on categorisation |
| 1 | Scotland Heat Map (SHM) (summer 2020) | Valuable spatial dataset with point-level heat demand data for all properties in Scotland / various other useful data fields and additional information layers. Updated approximately annually. Source data (including from public sector) requested at each update | Heat demand estimates for all properties in Scotland are used primarily in the Heat Networks analysis<br><br>Geographic boundaries used in analysis for all Priorities |
| 2 | Ordnance Survey (OS) product data | Various mapping data, central to the development and use of Scotland's Heat Map and other GIS information sources | OS product data and licences are required to use SHM & other OS-derived datasets<br><br>Key to GIS analysis elements of LHEES |
| 3 | Home Analytics | Database covering all domestic properties in Scotland, built using information from the domestic EPC register and other sources; statistical models are used to provide estimates giving 100% property coverage | Used extensively in the analysis stages across the LHEES Priorities<br><br>NOTE: ~6 month update cycle - changes to field names and additional of fields in future releases could impact on functionality of tools and templates used within the methodology |

| LHEES Data and Tools Library | | | |
|---|---|---|---|
| **Row** | **Data Resource or Tool** | **Description** | **Summary of Use Categorisation** |
| **4** | Non-Domestic Analytics | Database covering all non-domestic properties in Scotland, built using information from the non-domestic EPC register and various other sources, with extensive modelling to provide estimates giving 100% property coverage | Primary data resource for LHEES non-domestic analysis<br><br>NOTE: ~annual update cycle - changes to field names and additional of fields in future releases could impact on functionality of tools and templates used within the methodology |
| **2** | | Tool to accompany Home Analytics; can be used to investigate and cost intervention options for a portfolio of up to 500 properties; can be driven by a price cap or a target EPC score | |
| **5** | Portfolio Energy Analysis Tool (PEAT) | Tool to accompany Home Analytics; can be used to investigate and cost intervention options for a portfolio of up to 500 properties; can be driven by a price cap or a target EPC score | Tool to investigate cost interventions used for a number of LHEES Priorities in Stage 5 |
| **6** | One Scotland Gazetteer (OSG) - Address Gazetteer (AG) | Central database for all addresses within an authority | Key to GIS elements of LHEES for identifying multi-tenure non-domestic properties |
| **7** | Local Development Plan sites | Information, ideally in spatial format, on development sites in the LDP and LDP2. To include detail on development type and expected build-out where available. | Used in Heat Networks analysis to understand proximity of new development to existing networks or opportunity areas |

| LHEES Data and Tools Library | | | |
|---|---|---|---|
| **Row** | **Data Resource or Tool** | **Description** | **Summary of Use Categorisation** |
| **9** | Electricity distribution network information | Information on existing electricity network showing primary substation locations / constraints | Supports understanding of Low Carbon Heat (LCH) supply options, constraints and existing infrastructure elements |
| **10** | National Atmospheric Emissions Inventory (NAEI) | Large emitters point data show potential sources of waste heat and likely large process heat demands | Supports understanding of LCH supply options |
| **11** | Waste sites capacity tool (SEPA) | SEPA waste heat data | Supports understanding of LCH supply options and existing infrastructure elements<br><br>Some waste sites could provide a potential heat resource – anaerobic digestion, incineration, co-incineration etc.<br><br>Sites will be screened to only present those most relevant and suitable for heat networks |

| LHEES Data and Tools Library | | | |
|---|---|---|---|
| **Row** | **Data Resource or Tool** | **Description** | **Summary of Use Categorisation** |
| **12** | OS OpenMap Local | Rivers and waterbodies and physical constraints (roads and railways) | Supports understanding of LCH supply options and constraints<br><br>Rivers and waterbodies can act as a heat source/sink while also be a potential constraint if intersecting a Potential Zone in the Heat Networks analysis<br><br>Major roads and railways can act as physical barriers to heat network development, and may influence decisions on Potential Zone boundaries |
| **13** | British Geological Survey | Geology and hydrogeology | Supports understanding of LCH supply options<br><br>Hydrogeology base map for initial assessment of open or closed loop ground source heat pump systems |
| **14** | Coal Authority and British Geological Survey | Interactive map showing where coal mines are and the extent to which temperatures increase with depth | Supports understanding of Low Carbon Heat (LCH) supply options<br><br>Map for initial assessment of the potential for heat pumps, drawing heat from abandoned coal mines |
| **15** | Green Heat in Greenspaces | GHiGs investigated the suitability of many types of urban open space across Scotland for use as low carbon heat sources, heat storage sites and heat transmission corridors. Database. | Supports understanding of Low Carbon Heat (LCH) supply options |

| LHEES Data and Tools Library | | | |
|---|---|---|---|
| **Row** | **Data Resource or Tool** | **Description** | **Summary of Use Categorisation** |
| **17** | SEON Benchmarking or other LA energy data for buildings | Local data covering the energy performance of public sector building stock. SEON Benchmarking standardises format - the majority of Scottish local authorities took part in this work. | May be more accurate than Scotland Heat Map, could be used to update SHM prior to Heat Networks analysis if desired |
| **19** | OS Addressbase Premium | Information about addresses, properties and land areas | An alternative to the Corporate Address Gazetteer (CAG) should it not be available. This is used in the GIS elements of LHEES for identifying both non-domestic multi-tenure properties and domestic multi-tenure properties with a parent UPRN |
| **20** | Local authority or RSL property data | Local records of social housing estates / Local House Condition Survey | Key information for LHEES should be reflected in Home Analytics but may be slightly out of sync with local records due to HA update frequency; local data may also contain supplementary detail not captured in HA |
| **21** | Geographic boundary datasets | Shapefiles or feature classes with the geographic boundaries such as data zone, intermediate zone or postcode | Offers additional geographic boundaries to those contained in SHM geodatabase |
| **22** | Council owned assets map | Information, ideally in spatial format, on council owned assets | Could be used to inform low carbon heat resource potential or Heat Network zoning |

| LHEES Data and Tools Library | | | |
|---|---|---|---|
| **Row** | **Data Resource or Tool** | **Description** | **Summary of Use Categorisation** |
| **23** | Relevant strategy work / feasibility studies / reports not publicly available / LHEES pilot reports | Various studies for review to aid contextual understanding of local opportunities | Supplementary information that could inform Heat Network zone finalisation in particular |
| **24** | Planning permission records | Approved planning permission information | Supplementary information that could inform Heat Network zone finalisation in particular |
| **25** | EP | Database of Energy Performance Certificates | Could be used to provide additional information for non-domestic buildings, if records exist<br><br>Key information will be captured in Non-Domestic Analytics |

# Appendix G - ECO-Flex Eligible Measures

| Measure Category | Measure Type | Owner Occupied D | Owner Occupied E-G |
|---|---|---|---|
| **Boiler** | Boiler - Upgrade to a non-renewable heating system | ✓ | ✓ |
| | Boiler - Upgrade to a renewable heating system | ✓ | ✓ |
| | First time central heating | ✓ | ✓ |
| **Fixed Value Increase** | Boiler - Repair of a broken heating sytem 5 | ✓ | ✓ |
| | Boiler - Replacement of a broken efficient heating system | ✓ | ✓ |
| **Electric Storage Heating** | ESH - Upgrade of an inefficient electric storage heater | ✓ | ✓ |
| **Fixed Value Increase** | ESH - Repair or replacement of a broken efficient ESH | ✓ | ✓ |
| **District Heating Connection** | Connection to a district heating system | ✓ | ✓ |
| **Heating Controls** | Programmer & room thermostat | ✓ | ✓ |
| | Smart Thermostat | ✓ | ✓ |
| | TRV | ✓ | ✓ |
| | Time and temperature zone control | ✓ | ✓ |
| | Compensation (Pre HC / no pre HC) | ✓ | ✓ |
| **Micro-Generation** | Solar PV | ✓ | ✓ |
| **Cavity Wall Insulation** | Cavity wall insulation- partial fill | ✓ | ✓ |
| | Party cavity wall insultation | ✓ | ✓ |
| | Cavity wall insulation | ✓ | ✓ |
| **External/Internal Wall Insulation** | External / Hybrid / Internal insulation of a solid wall | ✓ | ✓ |
| | External / Hybrid / Internal wall insulation of a cavity wall | ✓ | ✓ |
| **Loft Insulation** | Loft insulation where there is less than or equal to 100mm pre-existing insulation | ✓ | ✓ |
| | Loft insulation where there is greater than 100mm pre-existing insulation | ✓ | ✓ |

| Measure Category | Measure Type | Owner Occupied D | Owner Occupied E-G |
|---|---|---|---|
| Other Insulation | Flat roof insulation | ✓ | ✓ |
| | Pitched roof insulation | ✓ | ✓ |
| | Room-in-roof insulation insulated | ✓ | ✓ |
| | Room-in-roof insulation uninsulated | ✓ | ✓ |
| | Solid floor insulation | ✓ | ✓ |
| | Underfloor insulation | ✓ | ✓ |
| | Window glazing - single to double | ✓ | ✓ |
| | Window glazing - improved double glazing | ✓ | ✓ |
| | Draught proofing | ✓ | ✓ |
| | Higher performance external doors | ✓ | ✓ |
| | Park home insulation | ✓ | ✓ |

# Appendix H – Secondary Indicative Heat Network Zones in Detail

## 1. IHNZ: North West 3 Category: Secondary

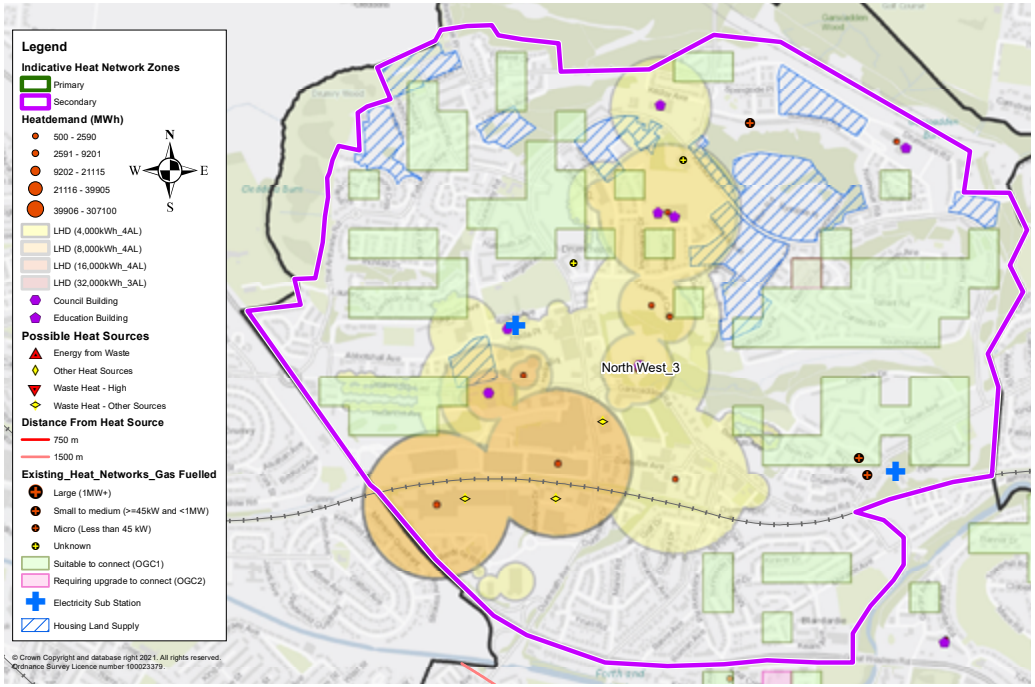



*Figure 60 - Northwest 3 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 409 ha | Total Anchor Loads: 11 |
| Zone Heat Demand: 103 GWh / year | Anchor Load Heat Demand: 20 GWh / year |
| Cat 1 On-gas property count: 5052 | Cat 2 On-gas property count: 469 |
| Confidence per MWh: 1.68 | Stakeholders: TBC during consultation |
| LDP sites: The area has multiple sites providing for potential development. | |

*Table 31 - Northwest 3 IHNZ Characteristics*

The "North West 3" Indicative Heat Network Zone has an area of 409 ha. Within the boundaries, see Figure 60, there are 11 anchor loads with an annual heat demand of 20 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 103 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.68. The consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and nine (9) Education buildings, providing a potential dependable heat demand. From recent building, there are nearly 6,000 domestic properties that would be suitable for connection to a heat network (using on-gas Cat1 as a proxy).

The southern section of the zone is proximate to the Clyde Canal which may offer some opportunity for heat extraction. Additional to this, initial geotechnical assessment has indicated some potential for ground source geothermal. There are also several possible sources of waste heat, the quality of which requires to be investigated, within the zone. Three gas fuelled heat networks/comunal heating systems have been identified via data. These require to be verified.

There are two (2) electrical substations within the zone.

## 2. IHNZ: East 1 Category: Secondary

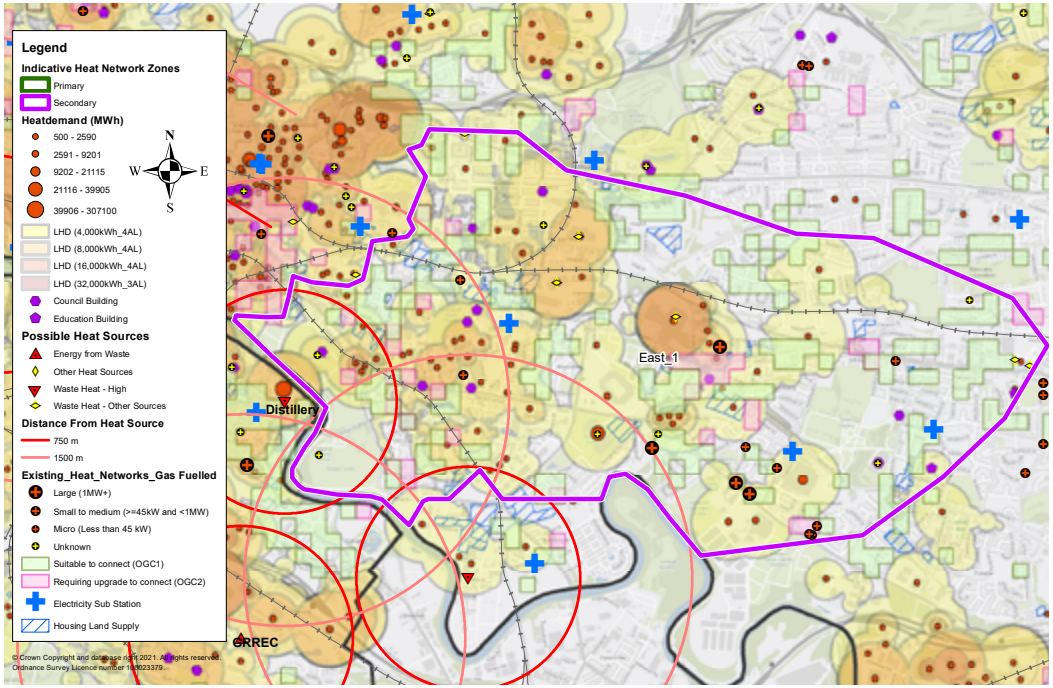



*Figure 61 - East 1 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 945 ha | Total Anchor Loads: 67 |
| Zone Heat Demand: 404 GWh / year | Anchor Load Heat Demand: 114 GWh / year |
| Cat 1 On-gas property count: 5052 | Cat 2 On-gas property count: 3185 |
| Confidence per MWh: 1.94 | Stakeholders: TBC during consultation |
| LDP sites: The zone has over 22 ha of identified Housing Supply Land, many within the heat dense areas (> 4000 kW / m). | |

*Table 32 - East 1 IHNZ Characteristics*

The “East 1” Indicative Heat Network Zone has an area of 945 ha. Within the boundaries, see Figure 61, there are 67 anchor loads with an annual heat demand of 131 GWh. Total annual heat demand including non-anchor load non-domestic and domestic properties is 404 GWh.

Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.94. The consultation process would aim to raise this closer to 5.

The zone contains nine (9) Council buildings and three (3) Education buildings, providing potential dependable heat demand. Whilst no direct heat sources are evident within the zone at this stage, it is close to the River Clyde and the Strathclyde Distillery. There are also six (6) low level heat sources identified via the available data. Regarding current gas use, from data, there are nineteen (19) existing gas fuelled heat networks/comunal heating systems, including the CHP for the Dalmarnock Village District Heat Network that offer potential for decarbonisation via conversion to sustainable heat sources. This data requires to be verified.

There are four (4) electrical substations within the zone.

## 3. IHNZ: North 4

**Category: Secondary**

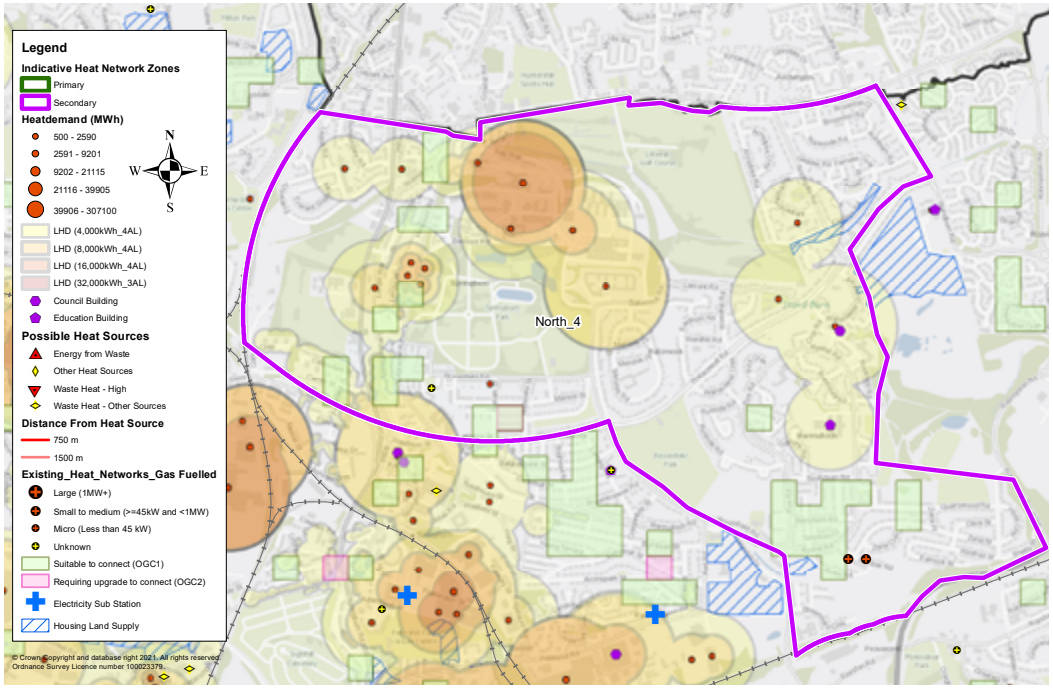



*Figure 62 - North 4 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 393 ha | Total Anchor Loads: 17 |
| Zone Heat Demand: 91 GWh / year | Anchor Load Heat Demand: 19.6 GWh / year |
| Cat 1 On-gas property count: 3604 | Cat 2 On-gas property count: 665 |
| Confidence per MWh: 2.35 | Stakeholders: TBC during consultation |
| LDP sites: The zone has a narrow band of Housing Supply Land proximate to one of the identified heat dense areas. Considerable open land which may be suitable for ground source systems or PV generation. | |

*Table 33 - North 4 IHNZ Characteristics*

The “North 4” Indicative Heat Network Zone has an area of 393 ha. Within the boundaries, see Figure 62, there are 17 anchor loads with an annual heat demand of 19.6 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 91 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.35. The consultation process would aim to raise this closer to 5.

The zone contains one (1) Council buildings and five (5) Education buildings, providing a potential dependable heat demand. No primary heat sources have been identified. However, there is considerable park land which may provide opportunity for ground source heat extraction. In regard to current gas use, three gas fuelled heat networks/comunal heating systems have been identified via data and require to be verified. However, they do indicate the potential for conversion to sustainable energy and decarbonisation.

The New Stobhill Hospital is located in this zone alongside several NHS properties. The NG Homes tower blocks which are heated using air source heat pumps on the roofs are also located in this zone. There are no electrical substations within the zone.

## 4. IHNZ: North 1

**Category: Secondary**

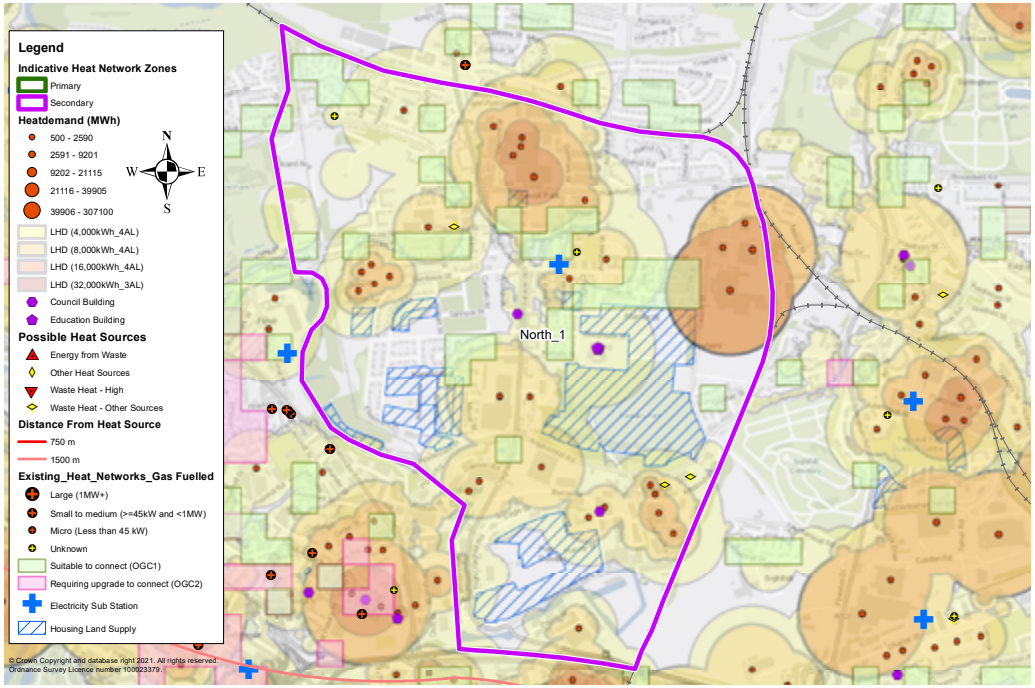



*Figure 63 - North 1 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 322 ha | Total Anchor Loads: 33 |
| Zone Heat Demand: 99.4 GWh / year | Anchor Load Heat Demand: 44 GWh / year |
| Cat 1 On-gas property count: 2638 | Cat 2 On-gas property count: 301 |
| Confidence per MWh: 2.19 | Stakeholders: TBC during consultation |
| LDP sites: Multiple locations identified as housing supply land which could tie into fututre development. | |

*Table 34 - North 1 IHNZ Characteristics*

The “North 1” Indicative Heat Network Zone has an area of 322 ha. Within the boundaries, see Figure 63, there are 33 anchor loads with an annual heat demand of 44 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 99.4 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.19. The consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and six (6) Education buildings, providing a potential dependable heat demand. No primary heat sources have been identified. However, there are three sources of low level waste heat. Regarding current gas use, two gas fuelled heat networks have been identified via data which requires to be verified.

There is one (1) electrical substation within the zone.

## 5. IHNZ: North East 1

**Category: Secondary**

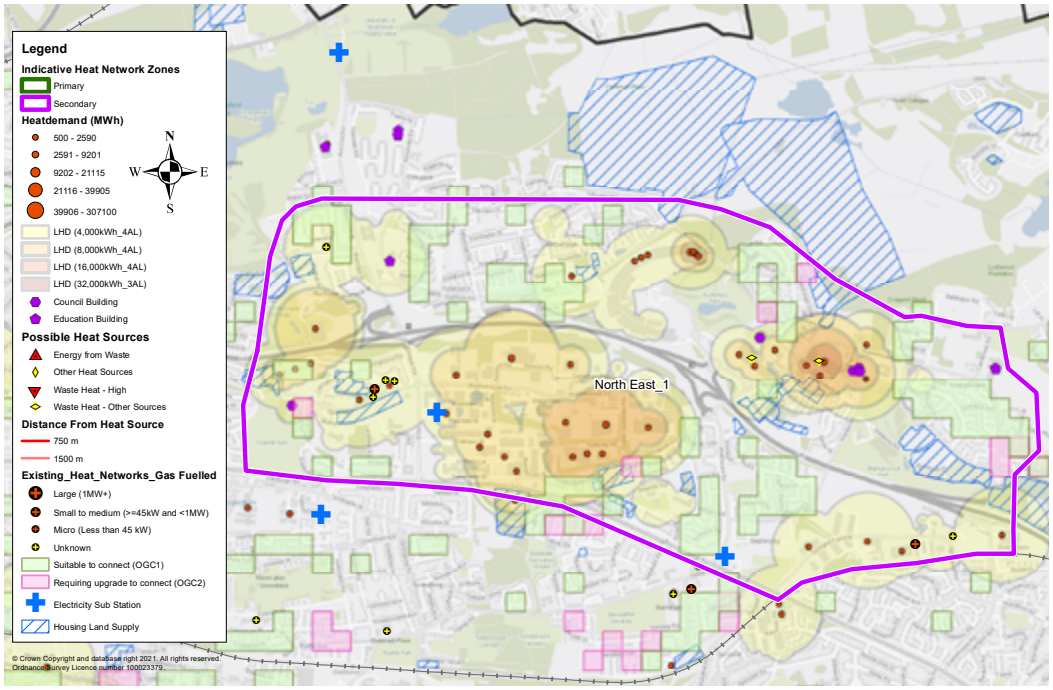



*Figure 64 - Northeast 1 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 664 ha | Total Anchor Loads: 44 |
| Zone Heat Demand: 152 GWh / year | Anchor Load Heat Demand: 47 GWh / year |
| Cat 1 On-gas property count: 6062 | Cat 2 On-gas property count: 861 |
| Confidence per MWh: 1.78 | Stakeholders: TBC during consultation |
| LDP sites: There are numerous plots of land identified as Housing Supply land that may offer potentail for future renewable projects. | |

*Table 35 - Northeast 1 IHNZ Characteristics*

The “North East 1” Indicative Heat Network Zone has an area of 664 ha. Within the boundaries, see Figure 64, there are 44 anchor loads with an annual heat demand of 47 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 152 GWh/year.

Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.78. The consultation process would aim to raise this closer to 5.

The zone contains five (5) Council buildings and twelve (12) Education buildings, providing considerable potential for dependable heat demand although no primary heat sources have been identified. Two sources of low level waste heat are within the zone. Seven existing gas fuelled heat networks/ comunal heating systems have been identified that offer potential for decarbonisation.

There are two (2) electrical substations within the zone.

## 6. IHNZ: South 3

**Category: Secondary**

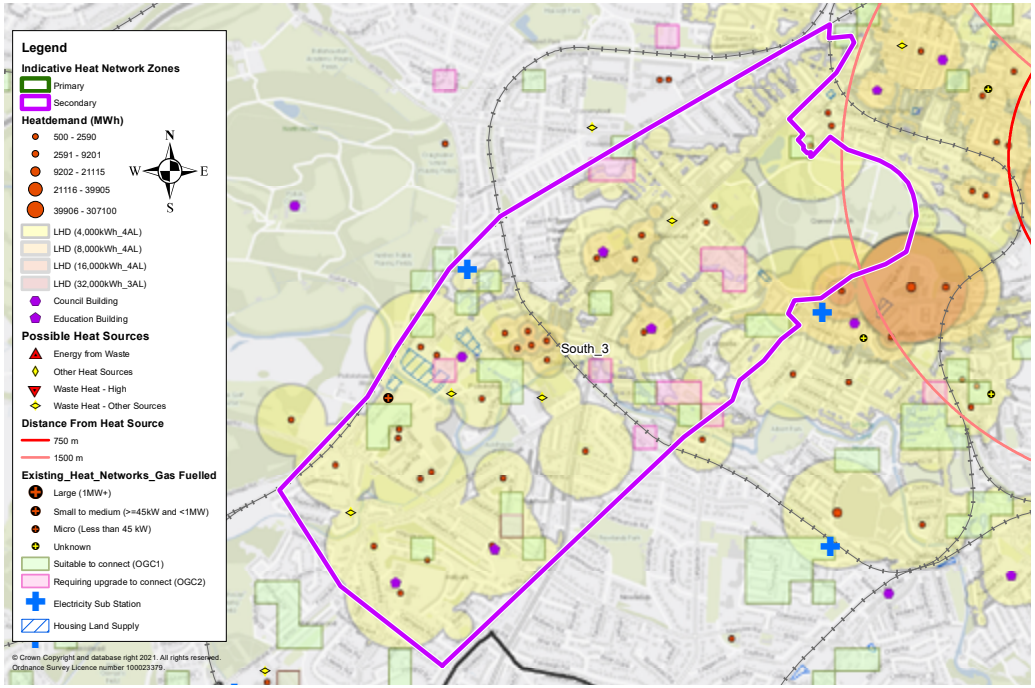



*Figure 65 - South 3 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 349 ha | Total Anchor Loads: 27 |
| Zone Heat Demand: 185 GWh / year | Anchor Load Heat Demand: 21 GWh / year |
| Cat 1 On-gas property count: 2328 | Cat 2 On-gas property count: 1040 |
| Confidence per MWh: 2.37 | Stakeholders: TBC during consultation |
| LDP sites: Available park land may offer the potential for ground source heat extraction. | |

*Table 36 - South 3 IHNZ Characteristics*

The “South 3” Indicative Heat Network Zone has an area of 349 ha. Within the boundaries, see Figure 65, there are 27 anchor loads with an annual heat demand of 21 GWh. Total heat demand including domestic properties is 185 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.37. The consultation process would aim to raise this closer to 5.

The zone contains one (1) Council building and seven (7) Education buildings, providing a potential dependable heat demand across the zone. No direct heat sources have been identified. However, the zone contains park land and is proximate to Pollok Park which may provide some potential for renewable generation. Four potential waste heat sources have been identified subject to verification.

Regarding current gas use, one existing gas fuelled system has been identified from available data providing the potential for conversion to decarbonisation through a move to renewable sources.

There is one (1) electrical substation within the zone.

## 7. IHNZ: North 2

**Category: Secondary**

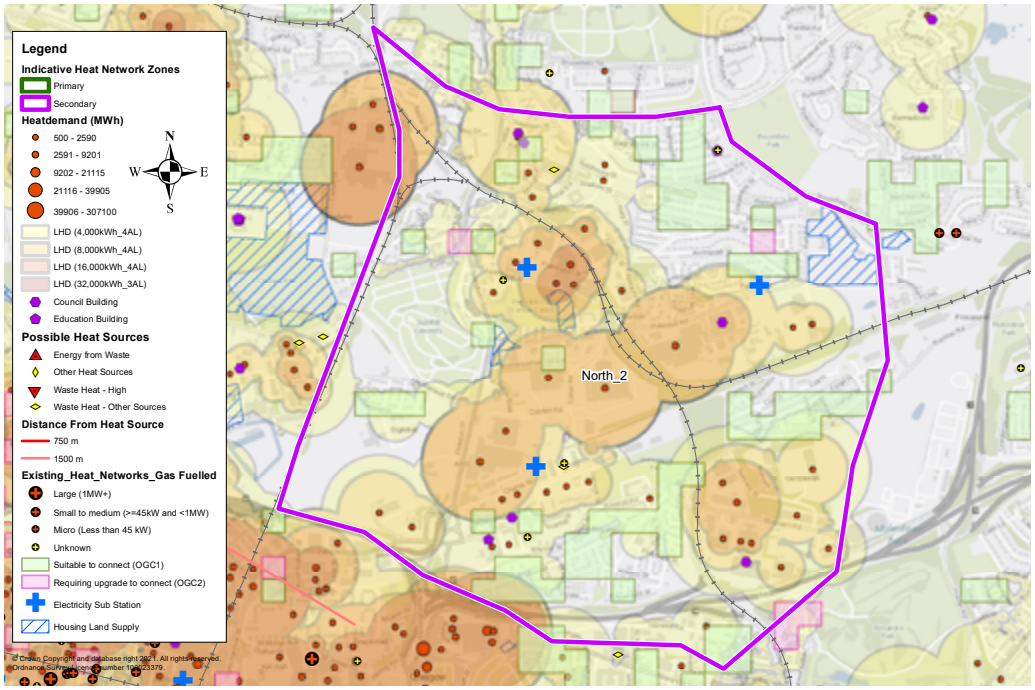



*Figure 66 - North 2 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 467 ha | Total Anchor Loads: 42 |
| Zone Heat Demand: 140 GWh / year | Anchor Load Heat Demand: 58 GWh / year |
| Cat 1 On-gas property count: 4216 | Cat 2 On-gas property count: 866 |
| Confidence per MWh: 1.8 | Stakeholders: TBC during consultation |
| LDP sites: Housing supply land as well as a number of high rise accomodation provide potential for future development. | |

*Table 37 - North 2 IHNZ Characteristics*

The “North 2” Indicative Heat Network Zone has an area of 467 ha. Within the boundaries, see Figure 66, there are 42 anchor loads with an annual heat demand of 58 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 140 GWh. Confidence in anchor load data is currently scored at 1.8. The zone is complicated by rail infrastructure, although a number of crossings are already in place.

The zone contains five (5) Council buildings and eleven (11) Education buildings, providing a potential dependable heat demand. No primary heat sources have been identified. However, there are two sources of low level waste heat. Regarding current gas use, from data, three existing gas fuelled heat networks/comunal heating systems have been identified giving the potential for conversion to sustainable energy and decarbonisation.

There are three (3) electrical substations within the zone.

## 8. IHNZ: North 3

**Category: Secondary**

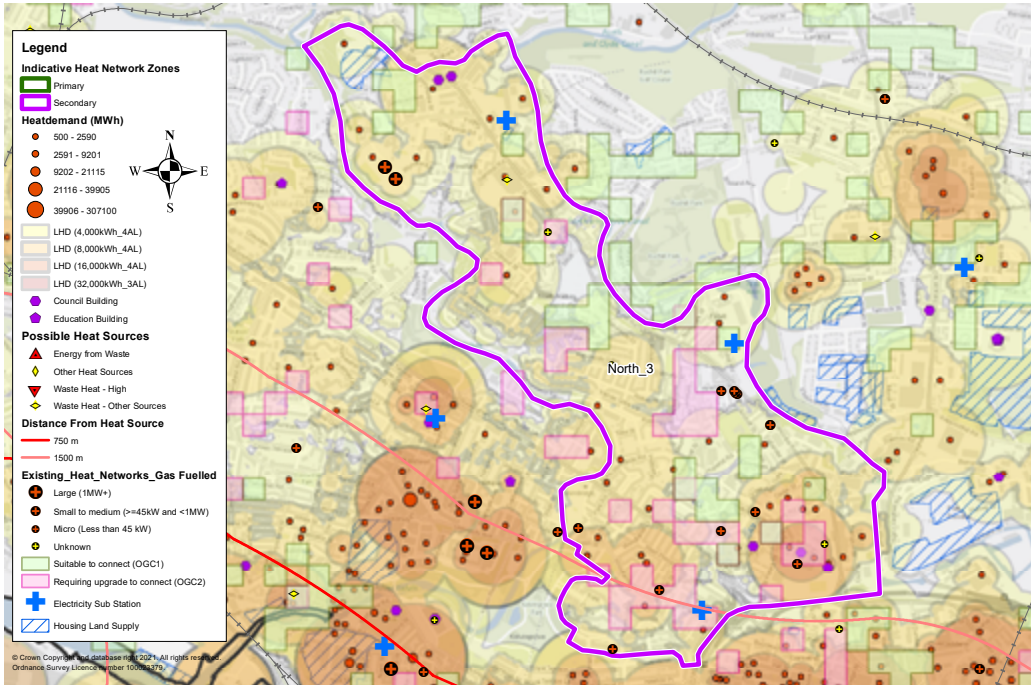



*Figure 67 - North 3 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 298.5 ha | Total Anchor Loads: 42 |
| Zone Heat Demand: 233 GWh / year | Anchor Load Heat Demand: 43 GWh / year |
| Cat 1 On-gas property count: 1981 | Cat 2 On-gas property count: 2448 |
| Confidence per MWh: 2.14 | Stakeholders: TBC during consultation |
| LDP sites: Housing supply land has been identified to the north of the zone to the fringes of the 4000 kWh/m linear heat density zone generated via the anchor load analysis. | |

*Table 38 - North 3 IHNZ Characteristics*

The “North 3” Indicative Heat Network Zone has an area of 298.5 ha. Within the boundaries, see Figure 67, there are 42 anchor loads with an annual heat demand of 43 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 233 GWh. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.14. The consultation process would aim to raise this closer to 5.

The zone contains four (4) Council buildings and eight (8) Education buildings, providing a potential dependable heat demand. The area is dominated by pre 1919 tenements with 7,821 On Gas Category 3 properties. Potential heat extraction sources include the River Kelvin and the Clyde and Forth Canal. Additionally, the south of the zone is within 1,500 m of the River Clyde. Regarding current gas use, from data, eighteen (18) natural gas fuelled heatworks / comunal systems have been identified providing potential for conversion to sustainable energy and decarbonisation. A key communal network in this zone is the Wyndford heat network scheme.

There are three (3) electrical substations within the zone.

## 9. IHNZ: North West 2

**Category: Secondary**

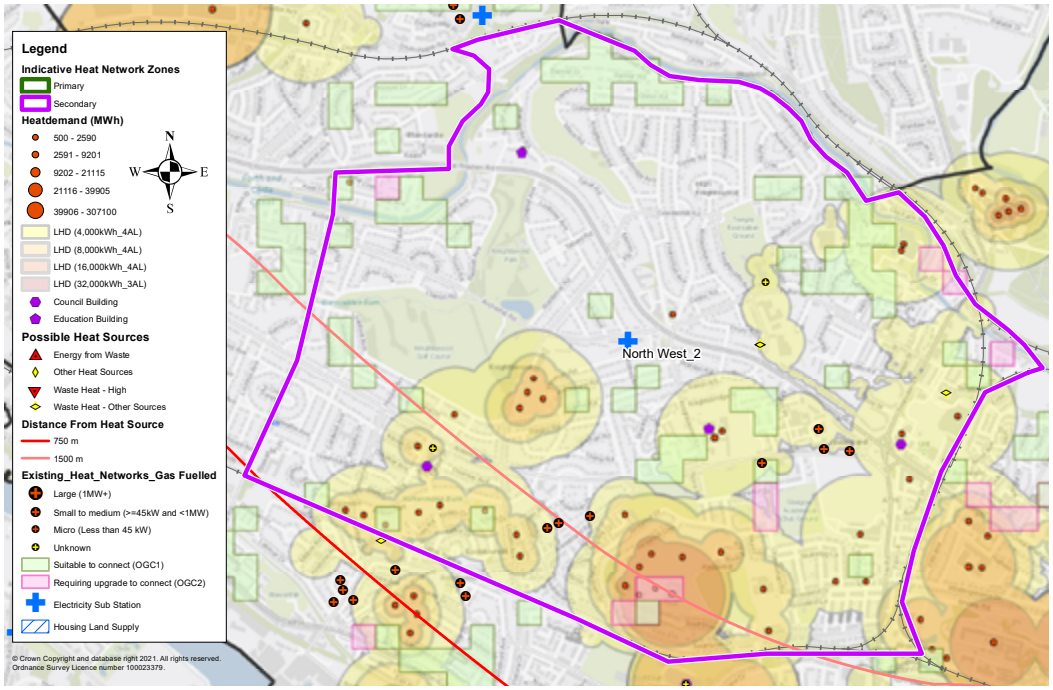



*Figure 68 - Northwest 2 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 579 ha | Total Anchor Loads: 38 |
| Zone Heat Demand: 212 GWh / year | Anchor Load Heat Demand: 48 GWh / year |
| Cat 1 On-gas property count: 7416 | Cat 2 On-gas property count: 1559 |
| Confidence per MWh: 2.02 | Stakeholders: TBC during consultation |
| LDP sites: The zone is bounded by rail infrastructure on the south and east with the canal to the north. | |

*Table 39 - Northwest 2 IHNZ Characteristics*

The “North West 2” Indicative Heat Network Zone has an area of 579 ha. Within the boundaries, see Figure 68, there are 38 anchor loads with an annual heat demand of 48 GWh. Total heat demand including non-anchor load non-domestic and domestic properties is 212 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.02. The consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and five (5) Education buildings, providing a potential and dependable heat demand. The southern section of the zone is partially within the 1,500 metre buffer from the River Clyde, providing a potential heat extraction source. Additionally, two possible sources of waste heat have been identified. Regarding current gas use, nine gas fuelled heat networks/comunal heating systems have been identified via data. Figures for these require to be verified.

There is one (1) electrical substation within the zone.

## 10. IHNZ: South West 3

**Category: Secondary**

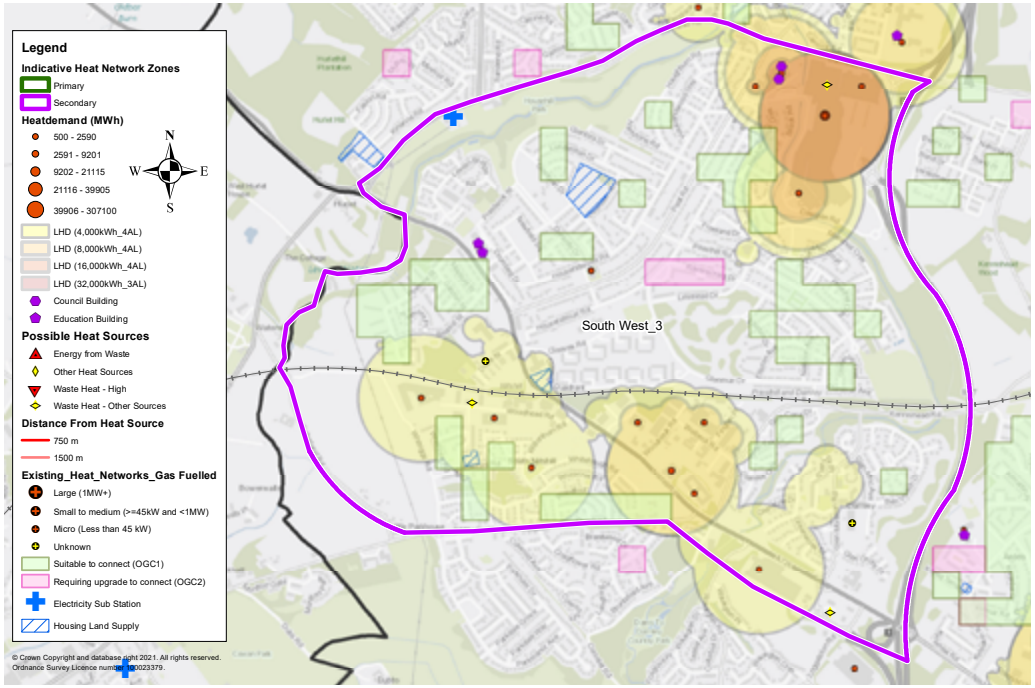



*Figure 69 - Southwest 3 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 421 ha | Total Anchor Loads: 16 |
| Zone Heat Demand: 102 GWh / year | Anchor Load Heat Demand: 36 GWh / year |
| Cat 1 On-gas property count: 4434 | Cat 2 On-gas property count: 501 |
| Confidence per MWh: 1.64 | Stakeholders: TBC during consultation |
| LDP sites: Several Housing Supply and Vacant and Derelict Land sites have been identified within the heat dense areas of the zone. | |

*Table 40 - Southwest 2 IHNZ Characteristics*

The “South West 3” Indicative Heat Network Zone has an area of 421 ha. Within the boundaries, see Figure 69, there are 16 anchor loads with an annual heat demand of 36 GWh. Total heat demand including domestic properties is 102 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.64. The consultation process would aim to raise this closer to 5.

The zone contains two (2) Council buildings and seven (7) Education buildings, providing a potential dependable heat demand. No direct heat sources have been identified within the zone. However, three potential waste heat sources have been identified subject to verification. The zone is also proximate to park land which may provide some potential for renewable generation. Regarding current gas use, from data, two existing gas fuelled heat network/comunal heating systems are in operation (subject to verification) giving the potential for conversion to sustainable energy and decarbonisation.

There is one (1) electrical substation within the zone.

## 11. IHNZ: South 5

**Category: Secondary**

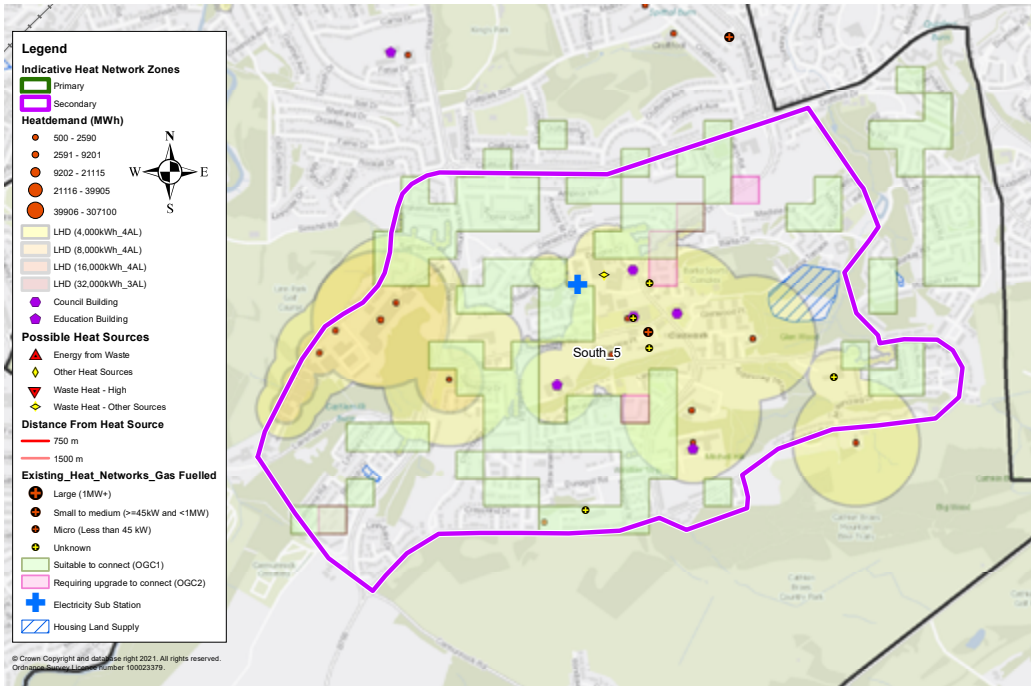



*Figure 70 - South 5 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 264 ha | Total Anchor Loads: 13 |
| Zone Heat Demand: 75 GWh / year | Anchor Load Heat Demand: 13 GWh / year |
| Cat 1 On-gas property count: 4964 | Cat 2 On-gas property count: 695 |
| Confidence per MWh: 2.28 | Stakeholders: TBC during consultation |
| LDP sites: Two sites have been identified as Housing Supply Land, the largest of which is within the LHD 4000 kW/m area of the zone. | |

*Table 41 - South 5 IHNZ Characteristics*

The “South 5” Indicative Heat Network Zone has an area of 264 ha. Within the boundaries, see Figure 70, there are 13 anchor loads with an annual heat demand of 13 GWh. Total heat demand including domestic properties is 75 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 2.28. The consultation process would aim to raise this closer to 5.

The zone contains three (3) Council buildings and eight (8) Education buildings, providing an opportunity for dependable heat demand. Whilst no direct heat sources have been identified within the zone, there is also considerable open land and park land that may be suitable for ground source heat extraction and/or PV development. Additionally one potential waste heat source requires further investigation. From available data, there are six (6) existing gas fuelled heat networks/comunal heating systems that offer potential for decarbonisation.

There is one (1) electrical substation within the zone.

## 12. IHNZ: South 4

**Category: Secondary**

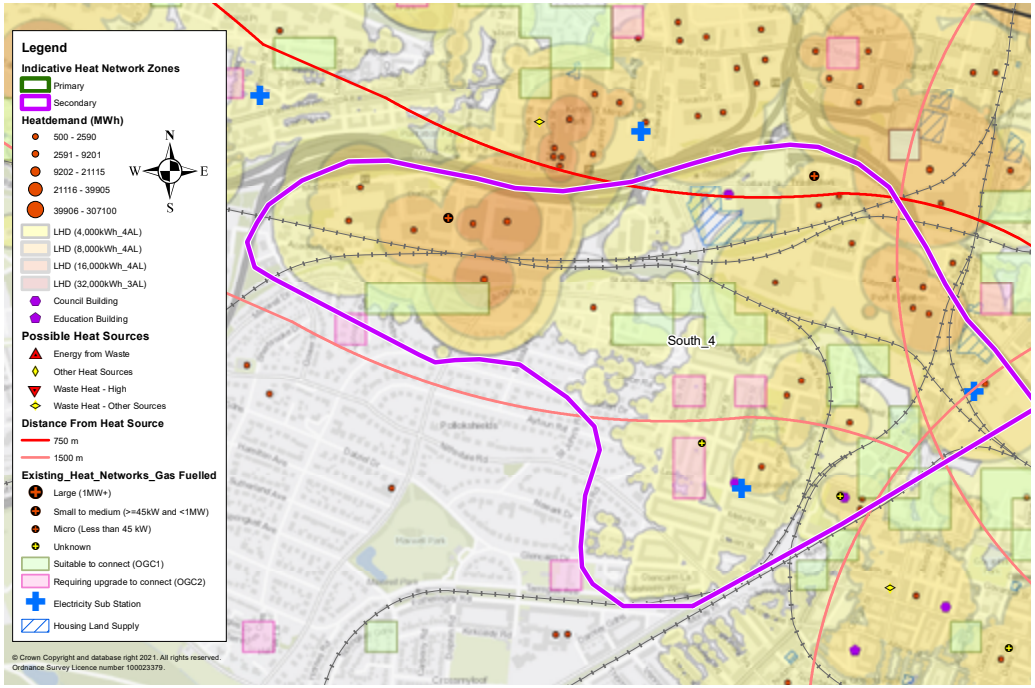



*Figure 71 - South 4 Indicative Heat Network Zone*

| | |
|---|---|
| Zone Area: 210 ha | Total Anchor Loads: 24 |
| Zone Heat Demand: 110 GWh / year | Anchor Load Heat Demand: 30 GWh / year |
| Cat 1 On-gas property count: 1155 | Cat 2 On-gas property count: 437 |
| Confidence per MWh: 1.96 | Stakeholders: TBC during consultation |
| LDP sites: The zone contains areas of housing supply land proximate to one of the heat dense (LHD > 4000 kWh/m) areas. | |

*Table 42 - South 4 IHNZ Characteristics*

The “South 4” Indicative Heat Network Zone has an area of 210 ha. Within the boundaries, see Figure 71, there are 24 anchor loads with an annual heat demand of 30 GWh. Total heat demand including domestic properties is 110 GWh/year. Confidence in anchor load data is based on a weighted process from 1 (modelled) to 5 (billing data) and is currently scored at 1.96. The consultation process would aim to raise this closer to 5.

The zone contains three (3) Council buildings and four (4) Education buildings, providing a potential dependable heat demand. Situated to the south of the M77 /M8 motorway, the zone is within 1,500 m of the River Clyde but does not currently have any direct heat sources within the zone. From data, four (4) gas fuelled heat networks of various sizes have been identified giving the potential for conversion to renewable energy sources and subsequent decarbonisation. These locations require to be verified.

There are two (2) electrical substations within the zone.