



Insight Report:

Scotland's transition to net zero heat

May 2022

The
Scottish
National
Investment
Bank



In this paper we discuss the nature of the challenge and significant opportunities for Scotland's net zero heat transition, and look at areas where further intervention from policy makers is needed to either scale up or accelerate progress. We also highlight the Bank's work to date in investing in decarbonised heat, and explore its role in the transition.

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Foreword

Moving to net zero heat for our domestic and commercial buildings is one of the most important and challenging issues in the transition towards a green economy.

The statistics bear out the scale of change required: of Scotland's circa 2.5 million homes, over 2 million use mains gas as their primary heating fuel. Poor energy efficiency in many of Scotland's buildings is contributing to wasteful use of energy for heat; it is also contributing to poor health that too often hits those least able to pay for the necessary improvements to their homes.

It has been estimated that £33 billion is required by 2045 to transition Scotland's heating away from carbon-intensive fuels and low efficiency; that sum requires private sector investment and financing structures to enter the market to aid the transition.

One of the primary challenges to address in the decarbonisation of heat in buildings is how the shift can be financed. That's true both in terms of individual homeowners who require policy makers to provide strong incentives and funding support to move away from fossil fuel heating, and in terms of commercial enterprises looking to build new heat networks – unless they are to rely on the support of either public money or guarantees on the number of buildings that will be connected.

The lack of certainty in the market is contributing to slow take-up in decarbonised heat sources; this must be tackled through direct intervention – be that policy, regulatory, or most likely both.

However: having published its Heat in Buildings Strategy in October 2021, the Scottish Government has made good progress towards setting out the pathway, actions and resources required for the nation to achieve net zero heat in its domestic and non-domestic buildings. The next step will be to develop detailed implementation plans that make policy a reality (such as the recently published Heat Networks Delivery Plan), alongside clarification of how the public



and private sectors can work together to accelerate towards net zero heat.

The Climate Change Committee (CCC)'s most recent Report for Parliament on Scotland's progress towards net zero heat highlights that, if Scotland is able to deliver on the plans and ambitions laid out in the Heat in Buildings Strategy, the nation will lead the way in net zero heat in the UK. However, the CCC calls for further detail on exactly how the planned investment of £1.8 billion over the term of the Parliament will contribute to the targets laid out – as well as asking for further understanding of the scale of private sector finance that will be required.

One solution that is under close assessment by Government is the deployment of hydrogen through the existing gas network, which would act as a pathway to begin to reduce emissions from heating. However, although hydrogen blending may prove a useful stepping stone towards low carbon heat, it is not economically viable to do so in the long term due to the level of electricity that would be required to produce the necessary amount of green hydrogen. The CCC has set out a possible solution to this in which low-carbon hydrogen is deployed through hybrid heat pumps, which largely run on electricity but are able to switch to hydrogen if required to meet



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demand. This in turn facilitates full decarbonisation at a later date, either via fully electric heat pumps or via a green hydrogen network. This illustrates one of the potential pathways to how the transition to net zero heat might play out in practice.

Wherever it can, the Scottish National Investment Bank will work with policy makers, businesses, the finance sector, researchers, and others working on net zero heat to develop the understanding of how our collective impact can be maximised. To date the Bank has made patient capital investments in the decarbonised heat sector, which helps to de-risk projects for private sector players. However, the heat transition will need much wider planning and collaboration across sectors to create a viable business model.

Through all this, it is important to remember that the move to net zero heat is a sizeable opportunity for Scotland if market creation gives rise to the birth and growth of successful Scottish businesses. There will be a need for the development, manufacture, and installation of decarbonising technologies, which brings with it economic opportunity. The transition will also support the building of skills and expertise needed for decarbonisation propositions that are deemed investable, which means a workforce with future-ready, high-demand skills. With appropriate foresight, this upskilling and deployment of associated jobs can also help to encourage better equality of opportunity and access to good-quality employment across Scotland's geographies.

Net zero heat goes hand-in-hand with energy efficiency and the concept of a fair transition. With around a quarter of households in Scotland living in fuel poverty and many households with low EPC ratings, it is critical that legislation is in place to improve the fabric of our buildings as we decarbonise how we heat them. Our analysis suggests that the initial focus should be on improving insulation in

“Wherever it can, the Scottish National Investment Bank will work with policy makers, businesses, the finance sector, researchers, and others working on net zero heat to develop the understanding of how our collective impact can be maximised.”

homes with low energy efficiency, as this will drive the greatest savings in running costs and help to build momentum in the market by creating demand at scale. However, this must be done in a way that prioritises those who are least able to pay the cost of change to existing buildings, and with supporting policy in place that requires new buildings to meet good standards of energy efficiency as well as net zero heat provision. It no longer makes sense to allow new builds to be developed with low energy efficiency that subsequently has to be addressed via retrofitting.

Given the clear risks in failing to quickly decarbonise one of the most emissions-heavy sectors, plus the potential social and economic opportunities if the challenges can be overcome, the Scottish National Investment Bank sees net zero heat as one of the top problems to solve for. It is one that calls for an intensified effort in building the widescale collaboration needed to develop the investible solutions and markets that will speed up the rate of transition.

Willie Watt
Chair



Executive Summary

In this report, The Scottish National Investment Bank aims to highlight some of the issues – and substantial opportunities – of transitioning to net zero heat for our buildings. We focus the discussion on how homes might be heated, as well as how to address the need for improved energy efficiency in many houses across the country. The data and evidence used draws on a number of publicly available sources, seeking to bring the Bank's own perspective to bear on a subject that is receiving increasing attention from both the public and private sectors.

The report is intended as a means to opening up a conversation on net zero heat – not as the last word on it – and we very much welcome engagement and feedback on how to build upon its themes.

In exploring the net zero heat landscape, the report has identified five main themes.

1. The transition to net zero heat is a challenge...

Today, 81% of Scotland's homes rely on mains gas for heating, and heating and cooling the nation's buildings contribute over 20% to total greenhouse gas emissions. The configuration of Scotland's housing stock differs significantly to that of the rest of the UK, with substantially more flats (primarily in the form of tenement buildings); this configuration presents an additional technical challenge in converting existing buildings to net zero heat.

The Scottish Government estimates that £33 billion will be needed by 2045 to fund the scale of change needed, with the vast majority coming from the private sector. This figure spans a wide range of upgrade and improvement actions across Scotland's building stock as well as the energy sector, whilst also taking into account investment that homeowners, landlords or businesses would be making anyway to replace old heating systems and building fabric as part of its natural lifecycle. It therefore represents an array of potential benefits that can be achieved through the move to net zero heat, as long as the private sector – individuals, businesses and investors – have the means and motivation to finance it.

Much of the responsibility for action sits with individual homeowners, and yet there are a number of barriers they face: up-front costs that are unaffordable, time and disruption disincentives, and a lack of clarity on what is needed. Providing more detailed, practical information and support is going to be essential in driving the transition to net zero heat by helping individuals to fund the initial investment with a view to recouping the costs via energy savings over time. Ensuring this happens in a way that prioritises financial help for those least able to afford it is particularly important.

2. ...But it brings significant opportunity for Scotland

The scale of financing needed for the transition points to a significant opportunity for investment, including in the development of commercial propositions in relation to heat networks. It gives rise to a programme of substantial capital expenditure – leading to job creation – as well as ultimately resulting in cost savings for consumers through reduced energy usage.

The transition will require substantial change to employment in terms of both the development of new types of jobs and skills, and an increase in the number of jobs in existing skill areas such as insulation installation. The Scottish Government estimates that there will be a net impact of 16,400 jobs gained by 2030 as a result of the move to net zero heat, with the opportunity to build local supply chains that support greater equality of opportunity across Scotland's geographies.



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In moving to net zero heat there is the opportunity to help tackle issues of fuel poverty, which affects nearly 25% of Scotland's households. It also includes addressing poor energy efficiency to prevent heating being more costly than it needs to be: today, over 70% of dwellings in Scotland having an EPC rating D or C and 15% having the lowest ratings of E, F or G. The potential for cost savings due to increased efficiency of how we heat our homes is significant. Heat networks that draw on a communal heat source to provide reliable and cheaper warmth to people's homes have potential to deliver multiple benefits across poverty reduction, health and wellbeing – as well as reductions in emissions.

Finally, the Heat Networks (Scotland) Act, along with the Heat in Buildings Strategy, demonstrates that the necessary policy and regulation is increasingly being put in place to facilitate the transition to net zero heat – but there remains a need to go further in building this out to give confidence in the commerciality of the sector. The Heat Network Fund is a strong first step in providing public finance to support the capitalisation of heat network projects, and the recently published Heat Networks Delivery Plan has added substantial detail to how targets on heat networks can be achieved.

3. Priority should be given to insulating the homes with the lowest energy efficiency

By analysing EPC data, we can see that the homes with lowest efficiency ratings would benefit most financially from investing in improvements to insulation. This in turn will help to bring down emissions whilst wider action is taken to decarbonise heat in the nation's buildings.

It can also act as a lever for tackling fuel poverty, with those in low-efficiency dwellings significantly more likely to be living in fuel poverty than those whose homes are EPC C rating or above. This trend is true regardless of tenure.

The Bank believes that intervention should be targeted at those that would benefit most from improvements to insulation, and be means-tested to ensure that both financial and practical help is given to those who are least able to cover the cost of making changes to their homes.

4. There are barriers to market creation that need to be addressed to bring in private investment

Today, there remain a number of barriers to increasing private sector investment to support the transition to net zero heat.

Uncertainty as to the commercial viability of projects, and the rate of return over the long term, acts as an inhibitor to private finance. Large-scale infrastructure such as heat networks will be critical in building momentum behind net zero heat, and finding ways to ensure commercial returns on these is essential to attract investment. Government policy and the support of public sector finance can help to build the necessary confidence. It may also be that models such as Assignment of Rights, Heat as a Service or an equivalent of Contracts for Difference – all of which we discuss later in the paper – will be needed to help bring more assurance to investors.

There are also opportunities to go further in policy to give more clarity on the criticality of net zero heat and high energy efficiency. EPC requirements for different types of tenure are currently under review and may prove to be a useful lever in driving change if designed appropriately. Likewise, changes to building regulations to require higher standards of energy efficiency in new builds – wherever practical – will help to scale up demand. Clarity on timelines and the scale of opportunity through regulation change will send a crucial signal from government to the market, stimulating investment as a result.



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5. There is a clear role for the Bank to play in net zero heat, spanning a number of areas

The Scottish National Investment Bank sees a role for itself in the transition to net zero heat, and a strong alignment to its missions. Net zero heat is one of the biggest challenges facing Scotland today, and the Bank is keen to collaborate across the private and public sectors to develop solutions.

The Bank continues to seek opportunities to invest across the innovation, manufacture, installation, and maintenance of products and services relating to net zero heat. Beyond investments, the Bank can work with social and other landlords to develop solutions as well as partnering with financial institutions to create innovative financial instruments that help to fund the transition.



Section 1: The net zero heat challenge

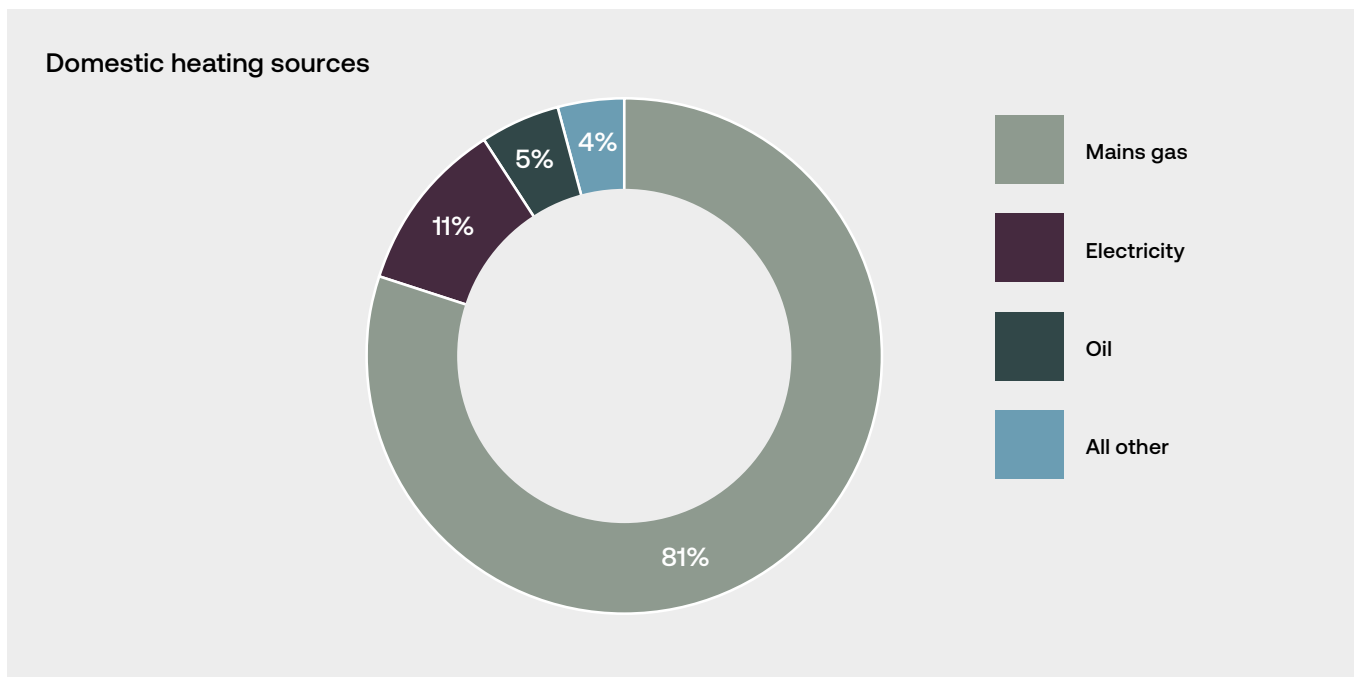
In summary:

- ◆ The vast majority of Scotland's buildings will need to be decarbonised in the move to net zero heat
- ◆ The Scottish Government estimates that £33 billion will be needed by 2045 to transition to net zero heat – the vast majority of which will be privately financed
- ◆ To date it has committed £1.8 billion in public funds to address the challenge, and has set out a broad set of policies in relation to net zero heat
- ◆ Homeowners and landlords will require guidance and financial support to take action

How we heat our buildings contributes substantially to Scotland's greenhouse gas emissions, with the vast majority reliant on fossil fuels

Scotland's homes accounted for around 15% of the nation's greenhouse gas emissions and non-domestic buildings account for a further 6%.*

The vast majority of domestic heating – 81% – is reliant on mains gas, with only 11% currently heated through electricity. These figures alone show just how substantial the challenge is for Scotland in moving away from fossil fuel heating systems onto renewable or net zero sources.



*Heat in buildings strategy - achieving net zero emissions: consultation - gov.scot (www.gov.scot)



Section 1: The net zero heat challenge

The scale of funding required to enable Scotland's transition to net zero heat is significant, but will be spread across a number of improvement areas

Reflecting the high proportions of the nation's buildings that will need to move away from their current heating methods, the Scottish Government estimates that around £33 billion will be needed by 2045 to transform Scotland's homes – the vast majority of which will be privately funded. However, this figure spans a range of improvement measures. It includes upgrading energy efficiency fabric and replacing heating systems in buildings, as well as improvements to energy networks and increased energy generation capacity. It also takes into account investment that would happen anyway as part of the natural lifecycle of heating systems and building fabric: for example, it is estimated that simply replacing existing fossil fuel heating systems in homes on a like-for-like basis would cost £5 billion. As such, the investment figures encompass a wide range of activities that bring potential benefits for both the environmental impacts and the cost of heating.

To date, the Government has committed £1.8 billion over the course of the parliament to aid the transition; this will take the form of a range of funds to address the need for large-scale heat infrastructure, changes to public sector buildings, support to transition social and affordable housing to net zero heat, and help for individual homeowners. The £33 billion gross figure underlines that further private finance will need to be unlocked alongside public funding to realise the scale of change required. The challenge now is to design and put in place mechanisms that facilitate this private finance.

Individual homeowners continue to face a number of barriers when it comes to taking action to improve the energy efficiency of their homes or installing low-carbon heating systems

For the individual homeowner the transition will very often include retrofitting with changes made either to energy efficiency (insulation), the heating system, or both. Given the diversity of Scotland's housing stock, and a substantially higher proportion of tenement buildings than in the rest of the UK, a range

of approaches will need to be developed to make progress. Some building types may have less potential for improvement – older tenement-style properties, for example – which means that solutions such as blended hydrogen may be one of the few practical routes for heat decarbonisation in the short to medium term. Conversely, many detached or terraced properties may be much more readily converted and can, therefore, be subject to more substantial upgrades in both insulation and heating source.

However, for certain solutions the financial return on an individual's investment can appear small given the upfront cost of equipment, although costs of equipment have already fallen and are expected to continue to do so. Many homeowners do not have the level of funds available to be able to afford the upfront investment, and will require either direct financial support from government or the creation of new financial instruments that allow them to pay over a period of time. To illustrate the current level of investment needed, the CCC estimates the average cost to a UK homeowner of installing an air-source heat pump – including ancillary actions such as decommissioning gas appliances and upgrading radiators – is around £10,000. Sufficient policy is needed to help individuals spread costs over the longer term, rather than in one lump sum.

Alongside the cost and disruption barriers faced by homeowners, the latest UK-level data from the Department for Business, Energy and Industrial Strategy (BEIS) suggests that awareness of the changes that homeowners will be required to make to their home heating remains low: only 36% felt they know a lot or a fair amount about the changes in the most recent survey.

Taken together, these factors lead to low levels of demand amongst consumers for decarbonised heat measures. Financial considerations are compounded by the time, effort, and disruption cost of having new heating equipment or insulation installed in the home, with such factors acting as a further barrier to change and underlining the need for robust policy that supports and motivates individuals to take action.



Section 1: The net zero heat challenge

Policy makers and regulators have a crucial role to play in creating the conditions for investment at an individual household level: to mandate energy efficiency improvements, to raise awareness of the action homeowners must take, and to subsidise and incentivise net zero heat – prioritising help for those least able to afford it.

Helping homeowners to gain a clearer picture of their energy efficiency and practical solutions for poor efficiency is going to be crucial in mobilising action

The Bank notes that the Scottish Government is in the process of renewing the approach for EPC assessments, which is a welcome step: under current practices, for example, homeowners are often recommended to install new fossil fuel boilers as the solution to improving heating system efficiency. Whilst this is almost certainly useful in ensuring less fossil fuel is wastefully and inefficiently consumed, it does not help homeowners move towards net zero heat via the installation of heat pumps or use of heat networks.



Section 2: The net zero heat opportunity

In summary:

- ◆ Poor energy efficiency and fuel poverty affect significant numbers in Scotland. The transition to net zero heat offers an opportunity to address this
- ◆ The delivery of net zero heat will require new skills to be developed, as well as more jobs in existing areas such as insulation installation
- ◆ The demand for manufacture and installation of new equipment and infrastructure brings opportunity for the development of local supply chains, supporting local economies and job creation
- ◆ Given the scale of the transformation, we expect significant investment opportunities if models for commercial returns can be developed
- ◆ Progress is being made on policy and the support needed to support transition – although more is needed to unlock the private sector finance potential

In the nation's move towards net zero heat, Scotland has the chance to address long-standing issues of poor energy efficiency and high levels of fuel poverty

Increasing the energy efficiency of existing homes and buildings whilst decarbonising heat presents a sizeable opportunity to reduce fuel poverty alongside reducing energy costs. Today, 24.6% of households in Scotland are in fuel poverty, with 12.4% in extreme fuel poverty. There is evidence of a link between fuel poverty and increased winter mortality or excess winter deaths: in 2018-19 Scotland saw 2,060 excess deaths attributed to fuel poverty.

The Scottish Government has set targets of no more than 5% of households being in fuel poverty by 2040, and no more than 1% in extreme fuel poverty in the same timeframe. However, housing stock in Scotland continues to have a poor standard of energy efficiency, with over 70% of dwellings having an EPC rating D or C and 15% having the lowest ratings of E, F or G.

There is a clear opportunity for job creation and re-skilling to make existing roles future-fit

With an increase in demand for the manufacture and installation of low carbon heating equipment and efficiency fabric, as well as infrastructure such as heat networks, businesses in Scotland should see opportunities to build local supply chains to serve regional needs. This in turn offers potential for job creation and the building of new skills, as well as supporting local economies.

Skills Development Scotland, in conjunction with the Scottish Government, published its Climate Emergency Skills Action Plan* in December 2020. In it, three areas are identified where jobs are likely to change as part of the transition to net zero heat:

- ◆ **New and emerging jobs.** In the context of net zero heat, this may include the installation and maintenance of heat networks and heat pumps.
- ◆ **Jobs affected by the transition,** such as architects and urban planners.
- ◆ **Existing jobs** that will be needed in greater numbers, including insulation installers.

*climate-emergency-skills-action-plan-2020-2025.pdf (skillsdevelopmentscotland.co.uk)



Section 2: The net zero heat opportunity

The Scottish Government estimates that there will be a net impact of around 16,400 jobs gained by 2030 through the move to net zero heat*. It does however also recognise the need to ensure that jobs lost (11,600) are offset by those created (28,000) by putting in place jobs- and skills-matching – an absolutely crucial step in making sure the transition is fair across society.

There are sizeable investment opportunities through the transition to net zero heat – if markets with commercial returns can be developed. Heat networks is an area with substantial investment potential, but where the model for returns is not yet established.

There is a significant opportunity for businesses in Scotland to develop expertise in the financing, installation, and maintenance of heat networks. The Heat Networks (Scotland) Act 2021 and the Scottish Government's Heat in Buildings Strategy both set a clear direction for the expansion of heat networks in Scotland, and place new duties on local authorities to review areas potentially suitable for heat networks.

The recent publication of the Heat Networks Delivery Plan helps to provide additional detail which will be essential for guiding the feasibility of future heat network projects and developing them as a mainstream, investable proposition. The announcement of a £300 million Heat Network Fund is a welcome signal of Government intent to support and capitalise heat network projects. The purpose of the Fund is to enable the delivery of projects that provide heat to multiple properties via a communal source; the aim is to stimulate the delivery of viable, capital-ready projects that currently have a funding gap.

Focusing the development of large-scale heat networks in cities will be the critical step in their roll-out, as they are well-suited to high-density housing and tenement flats. Whilst this will require new infrastructure, it brings significant advantages and opportunities in the sheer number of properties that can use the network, as well as potentially less



Heat networks explained

Heat networks (also sometimes referred to as district heating) are a way of taking heat from a central source and distributing it via a network of insulated pipes to either domestic or non-domestic buildings. Because they draw from a central source, the model allows for cheaper and lower-carbon heat sources to be added over time without the need for re-laying pipes or installing new equipment in people's homes – saving both cost and disruption. Heat networks are largely seen to be most appropriate for use in urban locations, where population density (and therefore heat requirement) is over a smaller area.

There are a number of heat networks already in operation or in development across Scotland, which draw on a range of energy sources. These include: district heating in West Whitlawburn Housing Co-operative in South Lanarkshire, connecting 543 homes to a renewable biomass boiler; a joint venture between Midlothian Council and Vattenfall, with the first project being a heat network in the new Shawfair development that will draw from an energy from waste facility; and in future, the H100 Fife project in Methil and Buckhaven aims to provide renewable hydrogen for heating and cooking via a heat network that will serve around 300 homes.

*Decarbonising heating - economic impact: report - gov.scot (www.gov.scot)



Section 2: The net zero heat opportunity

intervention – and therefore disruption – in individuals' homes as the internal pipes and radiators often do not need to change as part of being connected to the network. There is also the potential for smaller-scale networks in remote towns** and areas such as Inverness and Fort William, where a large number of homes are off the gas grid; this in turn can help to address lower levels of efficiency in individual homes' heating systems in more remote areas.

To date, much of the development of heat networks in Scotland has been public sector-led and funded on a grant or sub-commercial basis. To deliver the investment required it is crucial that public and private sector commercial investment increasingly steps in, and that public sector grant or sub-commercial finance remains in place but focused on the key areas where it can deliver impact. This could include the development of full business cases and the de-risking of otherwise commercially viable projects, as with the Heat Network Fund.

As part of this next phase in establishing the commercial case for widescale deployment of heat networks, it will be important to create the means of giving confidence to private sector investors in the number of users of a network once built. This is a crucial requirement in ensuring projects will deliver a return, and one which could be addressed as part of the Heat Network Fund.

Policy is increasingly being put in place to support the transition to net zero heat; but it must go further in driving practical implementation

The actions put forward by the Scottish Government in the Heat in Buildings Strategy span policy and regulatory frameworks to mandate minimum standards, funds to support homeowners to move towards net zero heat, and market development actions such as the establishment of a Green Heat Finance Taskforce to find ways to encourage private sector investment.



The support available to homeowners

Today there are a number of Government-funded schemes available in Scotland to help with improving the energy efficiency of people's homes. Warmer Homes Scotland provides guidance and funding to private sector households (both tenants and owner-occupiers) that are living in, or at risk of living in, fuel poverty, with help to insulate and provide more affordable means of heating homes. Alongside this, the interest-free Home Energy Scotland Loan provides financial help to owner occupiers looking to spread the cost of making efficiency improvements, with funding capped at £15,000 for energy efficiency measures and £17,500 for renewable heating systems (plus up to £6,000 for energy storage). The funds provided through the scheme are granted on a first-come, first-served basis, and are subject to credit assessments.

At a local authority level, the Home Energy Efficiency Programmes for Scotland (HEEPS) provides funds to help local authorities in delivering energy efficiency programmes in areas where there is high fuel poverty.

**Typically those with a drive time of more than 30 minutes to a settlement of more than 10,000.



The Climate Change Committee (CCC) assessed the Scottish Government's Strategy as part of its Report to Parliament on Scotland's progress (December 2021). It views the Strategy as ambitious and one that – if achieved – would put Scotland at the forefront of heat decarbonisation in the UK.

The CCC does however call for more clarity on how the commitment to invest £1.8 billion over the course of the Parliament relates to the specific targets set out in the Strategy, as well as seeking further information on how the Scottish Government sees private sector investment playing a role in the financing of the net zero heat transition.

This picture is beginning to take shape with the announcement of the Heat Network Fund and accompanying Social Housing Net Zero Heat Fund, which will provide up to £500 million in support to help small- and medium-sized social landlords to develop a plan for moving their stock to net zero heating sources. Further initiatives will be needed over time as part of the output from the Green Heat Finance Taskforce, to continue to build momentum in a changing net zero heat market.



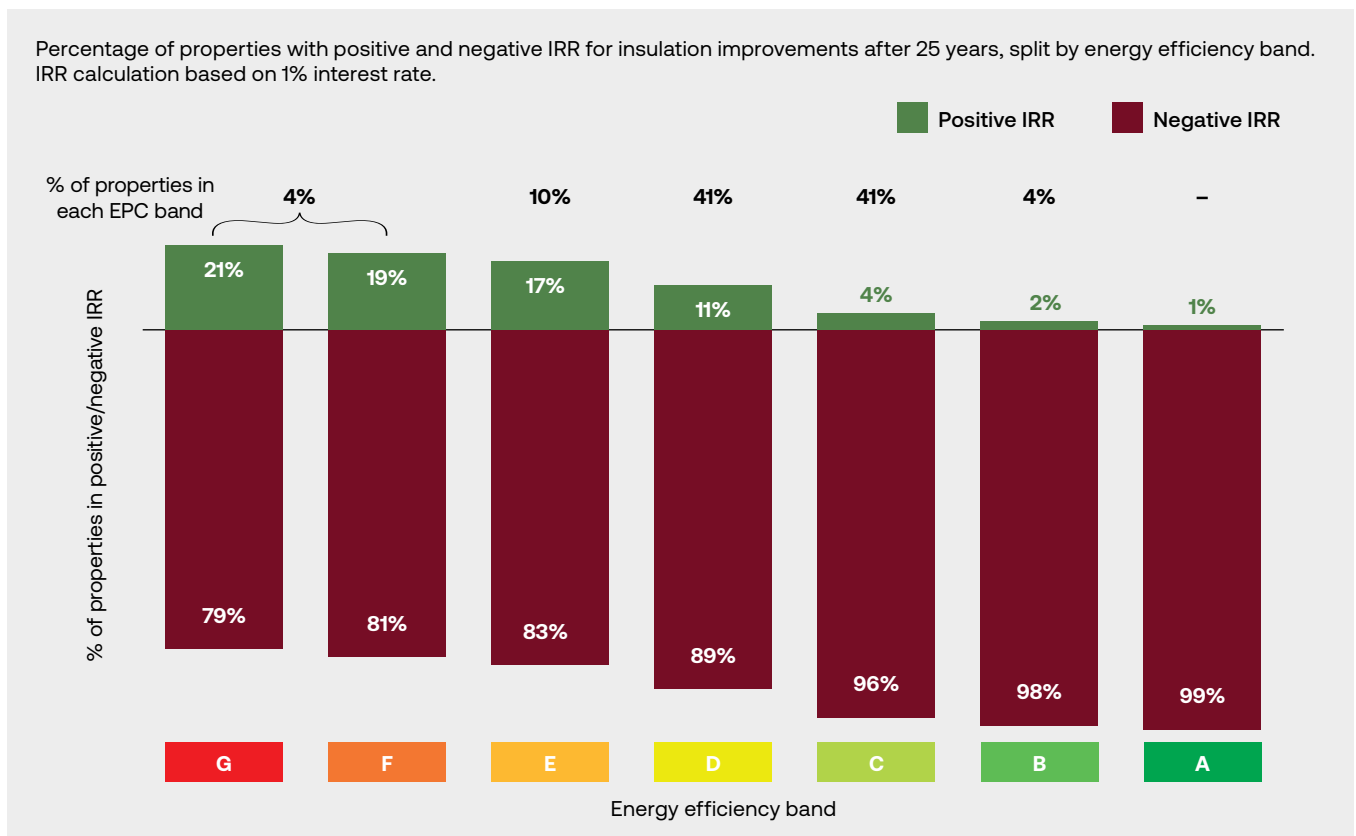
Section 3: Prioritising insulation in low-efficiency homes

In summary:

- ◆ Our in-house analysis of EPC data suggests that there is a core of very low-efficiency homes that would benefit substantially from improved insulation
- ◆ Identifying and targeting these properties will help to bring down emissions in the short term
- ◆ Interventions should be means-tested to ensure financial and other support is given to those least able to take on the burden of up-front cost, whilst providing information on loan funding for those able to afford it

By looking at the likely returns on the upfront cost of making improvements to insulation, we can identify where to prioritise energy efficiency interventions

By analysing Scotland's EPC data, we can form a more detailed understanding of the complexities faced by individual homeowners looking to make improvements to their property. Figure 1 below provides an illustrative example of the internal rate of return (IRR) over a 25-year period for investments in changes to improve insulation. It assumes the homeowner has borrowed money to cover the upfront cost of investing in changes, at an interest rate of 1%; it then calculates the subsequent savings made to running costs each year. Essentially, where the IRR is positive the improvements will deliver a net gain in savings over the 25 years compared to the upfront cost; but if negative, the savings will not have made up for the initial cost even by the end of the 25-year period.





Section 3: Prioritising insulation in low-efficiency homes

This view reveals an important factor in considering how best to support and encourage the transition to better energy efficiency in our nation's homes: under current cost levels, there is very often a negative rate of return on the insulation measures that can be undertaken according to EPCs. In other words, even over 25 years in many (but not all) cases the homeowner would not make back the money they spent upfront in making improvements recommended through their EPC assessment, if they also have to pay 1% interest on money borrowed to cover the costs.

The other finding is that where there is a positive rate of return, it most often comes from the properties that have the lowest energy rating to begin with. This suggests that identifying these properties and making improvements to their insulation will have a significant positive impact on running costs. Insulation measures can be relatively inexpensive depending on the action taken: the Energy Saving Trust estimates that a 3-bed semi-detached home would cost £450-£500 for cavity wall insulation, £300 for loft insulation, and £530 for (timber) floor insulation.

Analysis by the Scottish Government* suggests that households with the lowest levels of energy efficiency are more likely to also be living in fuel poverty: fuel poverty rates are 20% for those in dwellings of EPC C or above, but 33% for bands E, F or G. This pattern is true across all tenure types, although overall the highest levels of fuel poverty are amongst those in social housing with low efficiency (E, F or G), at 65% vs. 31% in social housing with EPC C or above.

These factors – low rate of return for changes made to more efficient properties, plus stronger returns for those with the lowest efficiency ratings today – suggest that it will continue to be necessary to offer public sector funding to support those least able to finance changes to homes, as well as provide educational / informational resources and incentives to those who may be able to fund improvements but are either unaware of the best course of action or do not see sufficient motivation in doing so (resulting in no action being taken).

Forensic targeting of support to those with the lowest efficiency ratings may help to kick-start momentum in the market, creating larger-scale demand that helps to drive down costs as scale increases. This could be deployed via a means-tested pilot model which assesses the homeowner's ability to pay costs, the property's energy efficiency rating, and feasibility of installing insulation alongside net zero heating systems in order to maximise each property's decarbonisation potential.

There may be merit in a tiered approach in which publicly-funded grants are provided to those with the least means to pay; development bank-subsidised lending is put in place for those who are able to afford only a low level of interest (with access to these funds provided via mortgage lenders); and more traditional private sector lending to all others.

*fuel-poverty-strategy-analytical-annex.pdf (www.gov.scot)



Section 4: Creating investible markets for net zero heat

In summary:

- ◆ Currently there are a number of factors inhibiting the large-scale deployment of private sector investment for net zero heat solutions
- ◆ This is partly driven by a lack of certainty in how returns can be structured or guaranteed
- ◆ Continued development and firming up of key policy areas is needed to give the market confidence

Private capital is critical in ensuring the net zero heat challenge is met; but currently there is often too much uncertainty for this to be unlocked at scale

With the scale of funding in Scotland estimated to be £33 billion – a figure far beyond that which government is able to finance – there is a need for private sector capital to be unlocked if ambitions for net zero heat are to be realised.

Decarbonising heat in Scotland will require the development of large-scale new markets that can deliver solutions to individual households and non-domestic buildings, and the proliferation of new infrastructure such as heat networks. Heat, particularly for households, is often decentralised and will rely on individual households to make changes. It will therefore be delivered through a range of solutions encompassing heat pumps and other heat supply technology, retrofit insulation, and heat networks. This contrasts with electricity, where the supply is centralised and can be addressed at a system-wide level; the challenge for transitioning away from our reliance on gas for heat is far bigger and more complex.

From the financial community, de-risking of heat network investments, and changes to the regulatory regime to enable longer-term capital for efficiency upgrades, is required. Allowing for business models such as Assignment of Rights and Heat as a Service could help to unlock institutional investors whilst decarbonising property across Scotland.

Assignment of Rights was introduced as an option to the Domestic Renewable Heat Incentive (RHI), allowing a process by which an investor helped to fund the cost for a renewable heating system, in exchange for the right to payments from the RHI scheme. The Domestic RHI, set up by the UK Government to encourage more homeowners to install and use renewable heat sources, ended on 31st March 2022 and is replaced by the Boiler Upgrade Scheme (England & Wales only). Assignment of Rights has the benefit of avoiding the need for large upfront costs to be paid by the homeowner, whilst providing guarantee of income to the investor in the form of RHI payments. It therefore has potential to help to catalyse the flow of further private sector investment into the market to 'unblock' issues relating to affordability.

Likewise, Contracts for Difference in the renewable electricity sector has shown that government intervention can provide price certainty to investors and developers, whilst simultaneously helping to bring stability of costs to consumers. It aims to provide certainty and stability for low carbon generators by agreeing a fixed price for the energy they produce; if the market price falls below the agreed fixed price, the generator receives a top-up payment to cover the difference (which is funded by the Low Carbon Contracts Company, owned by UK Government). Conversely, if the market price is above what is agreed in the contract, the generator pays back the difference. This form of policy approach allows public



finance to facilitate an increase in private sector investment; an equivalent developed specifically for net zero heat is likely to bring similar benefits.

An alternative approach to bringing investment into net zero heat is through Heat as a Service, whereby consumers pay an energy provider to deliver an agreed level of warmth to their home (e.g., by defining the hours in which specific rooms in their house are maintained at a specific temperature, or by agreeing a consistent temperature that the supplier

must maintain). Again, this can help to provide certainty to the provider in the form of an agreed level of service, whilst also ensuring homeowners receive a consistent level of warmth and comfort.

There are also potential roles for the investment community to help incentivise the decarbonisation of heat by investing in innovative technologies, and in providing capital to scale-up firms engaged in the supply chain to decarbonise our buildings and heat supply.



Section 4: Creating investible markets for net zero heat

There are a few key areas of policy where further clarity would help to give assurance of sufficient demand being in place to deliver commercial returns

There is now a requirement by the Scottish Government that all private rented sector properties meet a minimum standard of EPC C by 2028 (at the point of change in tenancy) wherever technically feasible and cost-effective. There have also been proposals for the social rented sector to achieve EPC B by 2032, with the Scottish Government stating that it may be necessary to introduce owner occupier mandates from 2030 if sufficient progress is not being made towards the proposed minimum EPC C by 2040.

For new homes there is a requirement for new buildings to have zero direct emissions from heating systems by 2024, but as yet the energy efficiency requirements for new homes are 'under review'. The Bank notes that EPC

certificates provided for homes built after 2008 show that only around 18% of these newer homes meet a rating of A or B. Strengthening minimum standards in new buildings' energy efficiency would appear to be an obvious requirement to bring in – and do so sooner rather than later – to prevent costly and disruptive retrofits further down the line.

An example of the practical application of this principle is the Bank's investment in PfP Capital to build mid-market rental properties, in which the homes built will adhere to a high standard of energy efficiency. This investment illustrates the way in which The Scottish National Investment Bank can work with social housing providers to not only enable more people to access good quality affordable homes, but to push for change in the net zero standards of new buildings.



Section 5: The Bank's role in net zero heat

In summary:

- ◆ The Scottish National Investment Bank is keen to collaborate across the public and private sectors to stimulate the net zero heat market and find solutions to the barriers outlined in this paper
- ◆ There are a number of levers it can pull on, including: working with social and other landlords to devise solutions to retrofitting and other challenges; partnering with financial services providers to create innovative financial instruments that help homeowners meet the cost of installations; and, of course, exploring investment opportunities across a number of areas of the net zero heat landscape

The Bank's place in the investment ecosystem

As a development bank, the Scottish National Investment Bank can play a key role in unlocking investment in innovative businesses and projects. The Bank can invest in projects and businesses that have a clear alignment with the Bank's missions and where the investment is commercial; it can also partner with other financial services institutions to develop novel financial instruments to help fund the net zero transition.

The Bank expects to focus its investment activity on those businesses that are in their scale-up phase, demonstrating commercial progress, and seeking debt or equity investment to support their growth.

The Bank seeks to ensure a commercial return on its investments and that its investments deliver positive social, environmental, and economic impacts that support the delivery of the Bank's missions. The Bank has been set 3 missions, focussed on the transition to net zero, building communities and harnessing innovation. Investments in decarbonising heat can potentially speak to each of those missions. Identifying commercial projects and investing in net zero heat will be key to delivering positive mission impacts across Scotland.





Section 5: The Bank's role in net zero heat

The Bank is already investing in net zero heat in Scotland and, looking forward with the right policy landscape, there are many opportunities for the crowding in of private investment.*

There is a significant opportunity for the development of innovative Scottish businesses to deliver on decarbonisation of heat in Scotland and in external markets. Opportunities also exist for projects to deliver decarbonisation of the existing housing stock beyond individual household level, particularly through social landlords, and investment from the Bank can play a role in unlocking those projects.

At a household level further policy and regulatory change – both mandates and incentives – can create the conditions for investment by owner-occupiers and landlords, building a market for decarbonisation solutions that innovative businesses in Scotland can help serve. The standards and requirements of new build housing should also continue to improve, driven by regulatory changes. The Bank will look to ensure that the housing it invests in is delivered to high standards of energy efficiency and makes use of net zero heat sources wherever possible.

The growth of innovative businesses and SMEs working on the decarbonisation of heat in Scotland in turn supports growth in innovation, emissions reductions, and exports. Two of the Bank's early investments – in **Sunamp** and **IndiNature** – provide an example of this impact.

*By 'crowding in' we are referring to the process of bringing private investment in alongside the Bank to increase the overall scale of capital available.



Net Zero Mission case study: Sunamp



Amount Committed: £6 million

Location: East Lothian

Mission Alignment and the Transition to Net Zero

Heat: Sunamp's mission to decarbonise heat globally aligns directly with the Bank's Net Zero mission. Sunamp develops and markets heat and cold batteries, helping optimise heating, cooling, hot water, and refrigeration energy use.

The huge opportunity and Sunamp's established product make the business exciting for the Bank – both to decarbonise heat in Scotland and providing growth capital to expand the business globally. The Heat Batteries offered by Sunamp not only allow heat to be stored, but also allow the heating load to be shifted – allowing electrified heat users to take advantage of electricity prices at their lowest, a key part of the decarbonisation of heat. Sunamp are also engaged in the delivery of small-scale heat networks.

Impact of the Bank's investment: The Bank's investment will cornerstone Sunamp's next funding round, while allowing them to continue to grow their business and to develop their market internationally. The Bank has invested in Sunamp through a convertible loan note. This mechanism = further supports a business' growth in the interim, while they put in place the next funding round they require to meet their growth ambitions. Since the Bank's investment Sunamp have continued to grow and have announced an agreement with a distributor in China that is expected to lead to £50 million of sales over the next five years, and the opening of a factory under licence.

7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION





Net Zero Mission case study: IndiNature



Amount Committed: £3 million

Location: Edinburgh & Jedburgh

Mission Alignment and the Transition to Net

Zero Heat: Promoting the growth of a sustainable construction materials manufacturer with a focus on natural fibre building insulation. Working towards the Bank's net zero mission, our investment in IndiNature funds carbon negative hemp-based insulation, usable in new builds and retrofits of commercial and residential buildings. The manufacture of the product will move to Scotland, also aiding in the Bank's Place and Innovation missions.

Anchoring the business in Scotland, the Bank's investment can further decrease the Scottish carbon footprint by enabling and encouraging IndiNature to source their hemp from Scottish farmers and deepen their local supply chain. At capacity, IndiNature's new site is anticipated to be able to capture a net 10,500 tonnes of CO2 per year.

Impact of the Bank's investment: The Bank's £3 million investment enabled the company to establish its first manufacturing plant in Jedburgh, creating long term jobs and increasing economic activity in the Scottish Borders. Support from the Bank allows IndiNature to bring its unique and exciting product range to market at scale.

Furthermore, the Bank's investment supported the unlocking of significant grant funding provided by Zero Waste Scotland (£803k) and South of Scotland Enterprise (£250k).

The Bank's investment is also anticipated to de-risk the proposition to investors in subsequent funding rounds, multiplying the impact the company can have on decarbonising heat in Scotland and beyond.

IndiNature's development is illustrative of the opportunities that exist for innovative businesses to provide the products and technology that will reduce the carbon impact of our homes and buildings in the coming decades.

7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION





Section 5: The Bank's role in net zero heat

As well as having impact through its investments, the Bank is keen to work with landlords to develop solutions that help to transition more social housing towards net zero heat

Arguably, the change required in homes can be more readily delivered at a greater scale by landlords, including social landlords – this is an important lever given 24% of Scottish households are in social housing and a further 14% are privately rented. The social housing sector has already delivered successes in the decarbonisation of heat: over half of social housing is already in EPC band C or better, compared to two-fifths of private rented and owner-occupied housing. By 2025 all changes of tenancy in rental properties will require a minimum EPC rating of C.

Social landlords may have opportunities to invest at scale in the further decarbonisation of their housing stock. However, there are also challenges for the

sector with over a third of tenants in social homes being in fuel poverty and the need to keep rents affordable. The Social Housing Net Zero Heat Fund is intended to provide financial support to small- and medium-sized social landlords to help them develop plans for the transition to net zero heat across their existing dwellings.

The Bank can also work with landlords to explore solutions which support the decarbonisation of their stock, reduce emissions, and address fuel poverty. One such project is the Bank's investment in PfP Capital to build mid-market rental properties, in which the homes built will adhere to a high standard of energy efficiency. This investment illustrates the way in which The Scottish National Investment Bank can work with housing providers to not only enable more people to access good quality affordable homes, but to push for change in the net zero standards of new buildings.



Section 5: The Bank's role in net zero heat

Looking forward, the Bank sees a role for itself in providing funding alongside public and private sector capital across six primary areas of the net zero heat landscape:

1. Accelerating heat network rollout	As heat networks are usually at a larger scale to begin with, there could be opportunities around decarbonising and expanding existing networks as well as funding new networks and connections.
2. Retrofitting	As a fabric-first approach is needed, the Bank's capacity for patient financing could be of key benefit in <i>large-scale</i> building retrofitting, allowing interventions to be financed over a longer time period. What is needed is to understand how markets and financial products can be created to make investable propositions for the Bank at the size that we have been created to fund commercially, aiming to crowd in private finance at scale.
3. Fostering innovation	The Bank is interested in supporting innovation across a number of forms, such as: investing in companies, research and development and innovations in net zero heat, as evidenced by Sunamp; innovation in financial products and instruments (see #6 below for more detail); innovation in the manufacturing of net zero heat solutions, which allows them to scale, becoming cheaper and more widely accessible; and innovation in how low carbon heat infrastructure is serviced (for example, maintenance that improves the longevity of physical assets).
4. Working with landlords	As with our PfP Capital investment, there is significant scope for the Bank to work with social and other landlords to find solutions to improving energy efficiency and low carbon heating in existing social housing, as well as improving standards towards net zero in new builds.
5. Investing in delivery and installation of net zero heat solutions	The Bank also sees a role for investment in businesses looking to develop and install low carbon heat (be that heat networks or heat pumps), as well as retrofitting / insulation to improve building energy efficiency, to enable them to scale up and serve a greater number of Scotland's buildings.
6. Working with the financial services sector to create financial instruments for net zero heat	There is the potential to develop new and innovative financial instruments in conjunction with mortgage providers, to pilot schemes that help homeowners to cover the upfront costs required for changes to their property.



What next?

Throughout this report we have highlighted areas where the Bank considers there to be opportunity to either take direct action to address issues now, or where further policy development can help to foster the confidence needed for crucial private-sector investment.

We summarise those areas below and would welcome further discussions on them from across the public and private sectors.

Actions for policy:

- ◆ The Heat Networks (Scotland) Act 2021 sets out a broad framework for Scotland; now the focus must be on creating and implementing the legislation that will allow heat networks to enter the mainstream. As part of delivery of the Heat Network Fund there should be a focus on building confidence that sufficient users will be connected to projects in order to deliver a commercial return; this is an important factor in building private sector demand for heat network investment.
- ◆ Alternative models such as Assignment of Rights and Heat as a Service may provide more innovative approaches to the financing and delivery of net zero heat, which in turn may help to unblock some of the uncertainty surrounding the market today. Similarly, a net zero heat equivalent of Contracts for Difference may be useful in providing certainty of pricing to the private sector. These approaches should be actively considered as part of future policy development.
- ◆ Revisions to Buildings Regulations must prioritise the role of low-carbon heat and high energy efficiency standards, with the aim of avoiding the need for (costly) retrofitting in future.
- ◆ In revising the EPC assessment, the Government must make sure that recommendations to homeowners focus on net zero / low carbon solutions, and that they are clear about how and where individuals can seek both financial and practical support.

Actions for addressing energy efficiency & skills:

- ◆ Identify the homes with the lowest energy efficiency and greatest potential to reduce emissions through insulation improvements. Pilot a means-tested scheme to target individuals with tailored financial and practical support where it is most needed.
- ◆ A plan is needed to address the shortage in skills for areas such as retrofitting; doing so provides new employment opportunities as well as preventing lack of skills becoming a blocker in the transition to net zero heat.

Actions for The Scottish National Investment Bank:

- ◆ Finally, the Bank commits to undertake analysis into developing specific products or models that can help to stimulate private sector investment in net zero heat. This includes exploring the potential to partner with mortgage lenders to help homeowners fund decarbonisation and insulation of their property.