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He has been commissioned to produce research reports, evidence papers, research advice, independent evaluations, policy insight reporting, and research mapping exercises. His most recent research outputs have included identifying the impact of Scottish housing under-occupancy in fuel poverty rates in Scotland.

Fuel poverty and the transition to net zero

Dr Fraser Stewart, Independent Consultant

Introduction

This paper for Energy Action Scotland examines the potential implications of Scotland's climate change and net zero ambitions for those households living in or at risk of falling into fuel poverty. The issues explored are intended to contribute to wider discussions about the nature and shape of Scotland's transition to net zero.

In 2019 the Scottish Parliament passed legislation that redefined fuel poverty as existing when a household spends more than 10% of its income on fuel costs and if the remaining household income is insufficient to maintain an adequate standard of living.[1] The Act also proposed that the mean fuel poverty gap of households in fuel poverty should be no more than £250 (in 2015 prices before inflation). In addition, the legislation set out new statutory targets to reduce fuel poverty by 2040 to no more than 5% of Scottish households and no more than 1% being in extreme fuel poverty. Provision was also made for a new fuel poverty strategy being published and the establishment of an independent fuel poverty advisory panel. These were both delayed due to the COVID-19 public health and economic crisis, with the final strategy being laid before the Scottish Parliament in November 2021.[2]

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[1] https://www.legislation.gov.uk/asp/2019/10/enacted
[2] https://tinyurl.com/4ndyew2s

Alongside fuel poverty and the pandemic, climate change has remained high on the political agenda in Scotland. The Scottish Parliament has reaffirmed its commitment to responding to the climate emergency by agreeing some of the toughest statutory climate change targets anywhere in the world: a 75% reduction in emissions by 2030, and net-zero by 2045.[3] This goes way beyond the recommendations of the UK Climate Change Committee's Sixth Carbon Budget that set out a pathway for the UK to be net zero by 2050.[4] In addition, the world's climate change focus was firmly on Scotland in autumn 2021 when Glasgow hosted the 26th United Nations Climate Change Conference (COP26).[5]

Scottish Ministers have been clear that responding to the pandemic and the climate emergency will need to deliver a resilient economy in a way that supports wellbeing and transitions toward a greener, net zero country.[6] The approach to date has been largely phased, with specific interventions tailored to meet economic and public health requirements as they emerge. However, while the combined impacts of the pandemic and climate change can be devastating, responding to both may also be a once in a generation opportunity to invest in Scotland's existing housing stock. This will help to finally eradicate fuel poverty by providing warm and healthy homes that are as near to zero carbon as possible.[7] To be a success, this radical transformation in housing must be planned carefully so that the costs of heat decarbonisation are minimised, shared fairly, and those at risk of fuel poverty are not left behind.

This paper addresses several key issues. It begins with an overview of recent fuel poverty developments in Scotland and how these link to the pandemic and the climate emergency. This is followed by a discussion on what exactly we mean by the term "net zero" and how we can get there. Scotland's climate change policy, and the potential implications for our most vulnerable citizens, is then considered alongside the idea of a just transition, centred on the notion of social justice. The final section examines rebound effects as offering both challenges and opportunities for policymakers, which should be carefully considered when designing and implementing housing and energy policies.

Fuel poverty in Scotland

In this section an overview of recent fuel poverty developments in Scotland is provided alongside a discussion on how these link to the COVID-19 pandemic and the climate

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[3] https://www.legislation.gov.uk/asp/2019/15/2019-11-01?view=extent
[4] https://www.theccc.org.uk/publication/sixth-carbon-budget/
[5] https://ukcop26.org
[6] https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/
[7] http://existinghomesalliancescotland.co.uk/information/home-retrofit-and-the-green-recovery-an-evidence-review/

emergency. It is generally accepted in Scotland that there are four key drivers of fuel poverty:

- low household income;
- high energy costs;
- poor energy performance of the housing stock; and
- how energy is used in the home.

Consequently fuel poverty is experienced across the length and breadth of the country and should be seen as transitory. By this we mean that it is something that people can move in and out of depending on a range of factors, such as where they live, who with, how much income they have, what type of property they live in, and how it is heated.

The Scottish House Condition Survey (SHCS) remains the most reliable source of statistical data in fuel poverty in Scotland.[8] The most recent SHCS was published in December 2020.[9] The survey estimated that just under a quarter of Scottish households (24.6%) were living in fuel poverty in 2019, and of those 12.4% were living in extreme fuel poverty. The fuel poverty rate in remote rural areas was 43%, followed by 28% in other rural locations, and 24% in urban areas. Even though fuel poverty is something that can be experienced anywhere, the highest concentrations are to be found in Scotland's most remote rural areas and in parts of our cities.

The fuel poverty rate for Scotland across a range of key characteristics is summarised below in Figure 1, which has been taken from the latest SHCS Key Findings Report. In addition to these characteristics, the survey also estimates that there are high rates of fuel poverty amongst households in the social housing sector (37%), households using electricity as a primary heating fuel (43%), and households with pre-payment meters (36%). In addition, the SHCS demonstrates a strong association between fuel poverty and household income, with higher rates of fuel poverty being found in lower income band households.

Figure 1 Rate of fuel poverty across a range of key characteristics (SHCS, 2019)
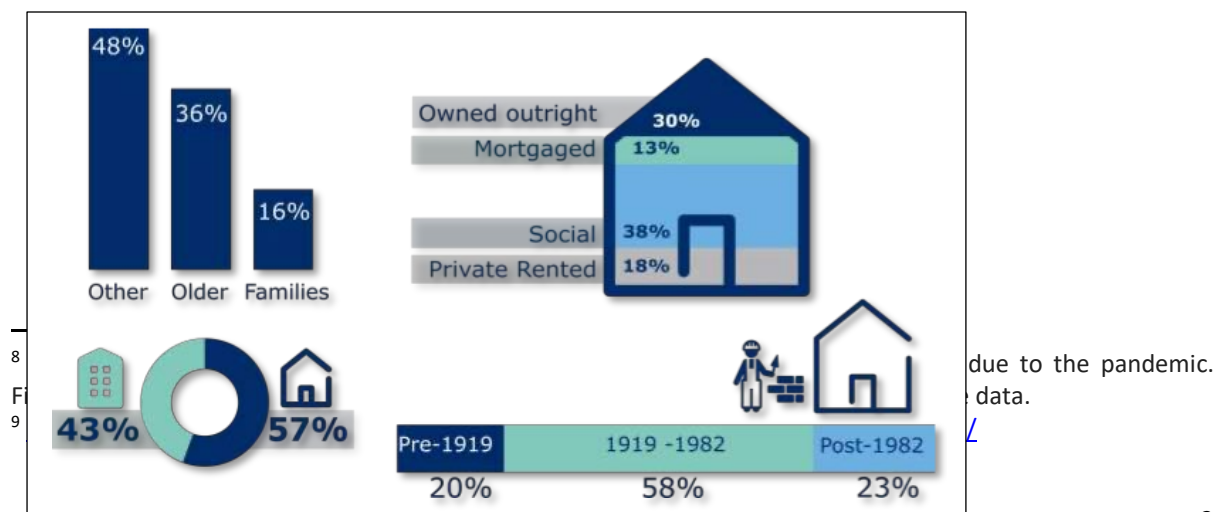
The lowest rates of fuel poverty in Scotland tend to be associated with higher energy efficiency standards, though not exclusively so. This is because of the multi-dimensional nature of fuel poverty. Social housing is generally more energy efficient than the private rented and owner-occupied sectors, which is linked to the overall energy performance of housing tenures. Over half (56%) of social housing properties achieve an EPC band C or better (under SAP 2012), compared to two-fifths in the private rented sector (40%) and owner-occupied sector (41%). This difference in energy performance across housing tenure has been attributed to higher minimum standards required for social housing through the Scottish Housing Quality Standard (SHQS) and the Energy Efficiency Standard for Social Housing (EESSH).[10]

Other relevant issues highlighted by the SHCS include households with a restricted electricity meter, which can limit the available choice of supplier or tariff. In addition, people living in areas off the mains gas grid can have limited fuel options, which in the case of LPG and heating oil can be more expensive and the price volatile.

Recent fuel poverty policy & legislation

Fuel poverty policy has come a long way since 2002 when the then Scottish Executive set a statutory target to eradicate fuel poverty by 2016. While that target was not met, fuel poverty has remained high on the Scottish political agenda. Recent legislative changes and policy commitments have included:

- The **Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019**[11] received Royal Assent in July 2019. It has provided new statutory targets for eradicating fuel poverty, as well as a new definition focused on low-income households. The Act also obligated the Scottish Government to produce a fuel poverty strategy, with reporting to parliament, based on the advice of an independent fuel poverty advisory panel.

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[10] https://www.sfha.co.uk/news/news-category/sfha-news/news-article/sfha-releases-new-fuel-poverty-briefing
[11] https://www.legislation.gov.uk/asp/2019/10/enacted

- The **Heat Networks (Scotland) Act 2021**[12] received Royal Assent in March 2021. It has provided a legislative framework to support the growth of heat networks in Scotland to help meet climate change targets and tackle fuel poverty.
- The final **Heat in Buildings Strategy**[13] was published in October 2021. It has set out a pathway for homes and buildings to be net zero by 2045, including a commitment to tackle fuel poverty as part of the transition to zero emissions from buildings.

As required by the Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019, the Scottish Government consulted on a draft fuel poverty strategy in 2018.[14] A final version of the Strategy was due to be published in 2020, but this was delayed due to the COVID-19 pandemic. The Strategy was laid before the Scottish Parliament in November 2021.[15] It has set out policies and proposals on the four drivers of fuel poverty that the Scottish Government believes will need to be taken forward by national and local government, plus third sector partners, if progress is to be made on achieving targets. The Scottish Government's approach assumes less people will be at risk of fuel poverty in the future if the systemic change required to tackle fuel poverty happens alongside the decarbonisation of Scotland's homes.

Fuel poverty and the COVID-19 pandemic

Reductions in household incomes because of the global pandemic combined with people spending more time at home has led to changes in how energy is used domestically. This increased energy usage has the potential to increase the fuel poverty rate. In experimental modelling undertaken by the Scottish Government it was estimated across a range of scenarios that the Scottish fuel poverty rate could feasibly increase to 29% (compared to the 2019/20 baseline of 24%).[16] In the worst-case scenario it was predicted that an additional 126,000 households could fall into fuel poverty because of the pandemic, with a further 68,000 falling into extreme fuel poverty.

Importantly this analysis did not include a provision for rapidly increasing energy costs – as seen throughout autumn/winter 2021 with the collapse of numerous energy suppliers. This will likely have accelerated the number of households falling into fuel poverty. Analysis by the wealth management group Investec suggests that UK customers will have to bear a total cost of £3.2 billion to cover the cost of the energy firm collapses, which could see an extra £120 added to annual household energy bills.[17]

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[12] https://www.legislation.gov.uk/asp/2021/9/enacted
[13] https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/
[14] https://www.gov.scot/publications/draft-fuel-poverty-scotland-2018/
[15] https://tinyurl.com/4ndyew2s
[16] https://tinyurl.com/6m22dywx
[17] https://www.energylivenews.com/2021/12/01/price-tag-put-on-energy-supplier-collapses-every-home-to-pay-120/

The final Fuel Poverty Strategy laid before parliament has highlighted the range of support the Scottish Government has provided during the pandemic to help household's struggling with increased energy bills.[18] This has included funding to support local organisations to deliver a range of community-focused projects providing support around energy use and fuel insecurity. Funding was also available to allow organisations to provide same-day support to prepayment meter users and for those using unregulated fuels at risk of self-disconnection over the winter. In addition to providing funding, the Scottish Government also connected those needing help during the pandemic into wider advice and support services, covering energy efficiency, income maximisation, and how to reduce energy bills at home.

All this support is welcomed; however it was principally as a response to the pressures of the pandemic. Many of these difficulties continue for households due to unprecedented challenges currently faced by society and economy. This implies a need to keep under review Scotland's strategies and investment programmes that can help deliver a recovery that meets the needs of everyone. This kind of approach is consistent with the recommendations of the Independent Advisory Group established by the Scottish Government to provide urgent advice to government on the private sector and business aspects of the economic response and recovery from the pandemic.[19]

What is "net zero" and how can we get there?

The term "net zero" has increasingly entered everyday parlance to describe the balance that needs to be struck between the amount of greenhouse gas being produced and removed from the atmosphere.[20] Net zero will be achieved when the amount of greenhouse gases being added is no more than the amount being taken away.[21] Climate change remains at the top of the political agenda for many governments, as well as of increasing concern for many companies, the media, and the public.

As the planet's temperature rises, nature and people are experiencing evermore negative impacts, often in the form of extreme and unpredictable weather patterns. Scientists believe that it is only by lowering or removing the amount of excess greenhouse gases in the atmosphere that climate change will be successfully tackled. This can be done by changing the most polluting activities, such as industrial processes and power generation. But changes in how goods and people are moved around and how homes are heated can also help reduce or eliminate emissions. There are a range of options available including:

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[18] https://tinyurl.com/4ndyew2s
[19] https://www.gov.scot/news/advisory-group-on-economic-recovery/
[20] https://energysavingtrust.org.uk/what-is-net-zero-and-how-can-we-get-there/
[21] https://data.climateemergency.uk/media/data/plans/westminster-city-council-2a33154.pdf

- Capturing and storing emissions as they are produced in industrial processes.
- Planting more trees to reduce emissions through carbon offsetting.
- Developing low or zero carbon alternatives to existing practices that emit less or no emissions.

The 2015 Paris Agreement treaty committed 197 countries to keeping temperature rises "well below" 1.5°C to avoid the worst impacts of climate change.[22] It has been claimed by experts that to achieve this, net zero must be reached by 2050 or earlier if possible.[23] The UK was the world's first major economy to set a nationwide target of being net zero by 2050.[24] Scotland set an even tougher target of being net zero by 2045, with an interim statutory target to reduce emissions by 75% by 2030.[25] The UK's Climate Change Committee has previously stated it believes Scotland's 2030 interim target will be incredibly difficult to meet and goes beyond their recommended Balanced Net Zero Pathway for the UK which would reach a 64% reduction by 2030.[26]

In autumn 2021, the world's nations gathered in Glasgow for COP26.[27] This was the latest global climate change conference looking to limit the rise in global average temperatures. At the conference the world's nations set out the steps they will take individually and collectively to reduce the amounts of emissions released into the atmosphere as a way of limiting further global temperature increases. While there has been a mixed response to what was agreed at COP26, it has been suggested that it has at least highlighted the need for action sooner.[28] Around the world experts agree that if the most devastating impacts of climate change are to be avoided, rapid action will be required over the next decade. While current pledges will see emissions increase by 2030, the pact agreed in Glasgow has included a work programme on faster cuts in what is described as the critical decade we are in, with further work needed in the run up to and at COP27 next year to meet a pre-2030 ambition.

The impact of evermore extreme and unpredictable weather patterns was brought to the fore in the UK in November 2021 when Storm Arwen caused extensive damage to parts of the UK's electricity distribution network.[29] The loss of power and heat lasting for days on end for thousands of households illustrates the exposure of households from infrastructure that may be ill prepared for dealing with the worst effects of a changing climate. This is a broad concern that has long been held, as detailed in the 2012 Special Report on Managing

[22] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[23] https://www.bbc.co.uk/news/science-environment-58874518
[24] https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law
[25] https://www.gov.scot/news/scotland-to-become-a-net-zero-society/
[26] https://www.theccc.org.uk/wp-content/uploads/2020/12/Lord-Deben-CCC-Letter-to-ECCLR-CabSec.pdf
[27] https://ukcop26.org
[28] https://www.carbonbrief.org/cop26-key-outcomes-agreed-at-the-un-climate-talks-in-glasgow
[29] https://www.theguardian.com/uk-news/2021/dec/01/storm-arwen-uk-must-prepare-for-more-extreme-weather

the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX).[30] The SREX assessment concerned the interaction of climatic, environmental, and human factors that can lead to impacts and disasters, options for managing the risks posed by impacts and disasters, and the important role that non-climatic factors play in determining impacts. The report points out that even where the evidence base is weaker, the character and severity of climate change will depend not only on the extremes themselves, but also on exposure and vulnerability.

Climate change policy in Scotland

Scotland's homes account for 15% of Scotland's direct emissions and heat accounts for half of all energy use.[31] Central to the Scottish Government's response to the climate emergency has been a commitment to the widespread deployment of energy efficiency measures in homes, and low or zero carbon heat to reduce energy demand and thereby emissions. If statutory targets and milestones are to be met, the Scottish Government's policies and programmes need to ensure that energy efficiency and renewable heat are the first and most appropriate choice for homeowners and landlords. However, it is essential that the most vulnerable in society are adequately protected. To do this Scotland's climate change and fuel poverty policies need to be aligned so that no one is left behind.

The Scottish Government's updated Climate Change Plan has set out a pathway where Scotland will be a place that prioritises the environment and the wellbeing of its people, while driving inclusive and sustainable economic growth.[32] In addition, the Heat in Buildings Strategy has committed the Scottish Government to converting over 1 million homes by 2030 to using low or zero emissions heating systems so that emission reduction targets in the buildings sector are achieved.[33] It is vital that this is done in a manner that protects the most vulnerable from increased costs and avoids placing a burden on those least able to pay.

To create the right conditions that will enable action will require raising public awareness, providing advice, offering financial support where required, supporting and upskilling the supply chain, and ensuring adequate consumer protections are in place. The Scottish Government has committed to invest over £1.8 billion over the next parliament to decarbonise the way Scotland's homes and buildings are heated.[34] However, far greater public and private investment will likely be required if the challenge is to be met and the

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[30] https://www.ipcc.ch/site/assets/uploads/2018/03/SREX_Full_Report-1.pdf
[31] https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/
[32] https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/
[33] https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/
[34] *Ibid.*

heat decarbonisation agenda provides real and tangible benefits to everyone on an equitable basis.

What should a "just transition" look like?

To support Scotland's transition to a net zero future, the Scottish Government has committed to developing a regulatory framework for zero emissions buildings within the extent of its devolved powers.[35] The intention is for the framework to be introduced between 2023-2025. This will include reform of the energy performance assessment process, address both heat decarbonisation and energy efficiency, and aim to achieve EPC band C by 2035 and zero emissions from heating by 2045. A more ambitious target for households in fuel poverty is proposed which will look to maximise the number of fuel poor households having attained the equivalent of an EPC band B by 2040. Though with increased ambition comes increased cost, particularly if technologies consistent with a net zero approach is taken.

Scotland is in a good position to accelerate and scale up the action taken to date by building on a strong track record of effective energy efficiency programme delivery through its Area Based Schemes and Warmer Homes Scotland. However, current rates of progress will not be enough to achieve net zero even with new and replacement fossil fuel-based heating systems being excluded from government energy efficiency and heat programmes following the SNP-led Scottish Government agreeing a cooperation agreement with the Scottish Green Party.[36] The challenge for government will be how to ensure all of Scotland's homes are as energy efficient as possible and by implementing a low regret heating strategy. A first step to locking in emission reductions needs to be tackling fuel poverty as well as other notable benefits, such as jobs creation, saving money on energy bills, and improving health and wellbeing for everyone.

There is broad agreement about the need to tackle climate change, however where debate most often appears is around the need for speed, the costs of the transition, and ultimately who pays. An approach consistent with just transition principles should look to avoid additional costs for lower income and other vulnerable groups.[37] With high rates of fuel poverty in Scotland it is essential that climate change policies remain affordable for all. Central to this is heat decarbonisation policy design and implementation considering as a priority those living in or at risk of falling into fuel poverty. Warm words from the UK and Scottish governments have expressed a commitment to helping aid a "green recovery" and "build back better" from the pandemic. These turns of phrase illustrate that ambition is there, but often the practical details are missing.

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[35] *Ibid.*

[36] https://tinyurl.com/2b5hp256

[37] https://www.gov.scot/groups/just-transition-commission/

The latest UK Fuel Poverty Monitor (UKFPM), jointly published each year by NEA and EAS, is useful in this regard. It makes a compelling case for the UK's fuel poor households needing to be the first to benefit from decarbonising the way our homes are heated.[38] This year's monitor identifies: the opportunities for fuel poor households associated with decarbonising heat; the barriers fuel poor households might face in doing so; the likely risks of the decarbonisation agenda for those living in fuel poverty; the value of transparency, in terms of how energy policies are paid for; and which policy developments and interventions will be required if the transition to decarbonised domestic heating is to be fair and affordable for all.

Consequently, the Scottish Government's commitment to supporting the least able to pay and protecting those who are most vulnerable from any increase in costs arising from the transition to net zero is welcome. However, while the government has previously stated that they will only pursue policies where they do not have a detrimental impact on fuel poverty, recent ministerial answers to Parliamentary Questions prioritise emission reductions. For example, the Minister for Zero Carbon Buildings, Active Travel and Tenants' Rights has stated that Scottish Government programmes that target fuel poor households, will take a "zero emissions first" approach to the provision of new heating systems.[39] Further clarity about what this will mean in practice for those in fuel poverty is needed urgently because dedicated resources and support will be needed if everyone is to benefit equally from the transition. Given the complexity of decarbonisation and the challenges it presents for those at risk of fuel poverty, the government should consider using dedicated Fuel Poverty Impact Assessments for policy decisions that may have unintended consequences for our most vulnerable citizens.

Meeting the costs of the transition

The issue of costs is a fundamental one but there are several elements to it. The Heat in Buildings Strategy estimates that the total investment required to transform all of Scotland's homes and buildings is likely to be more than £33 billion.[40] Using the current EPC framework – despite its limitations – the Scottish Government estimates that delivering EPC band C across fuel poor households will cost up to £3 billion if they were to allow the installation of fossil fuel heating systems in reach EPC band C.[41] The required level of capital expenditure required where existing fossil fuel heating systems are replaced with zero emissions heating

[38] https://www.nea.org.uk/wp-content/uploads/2021/11/0000_NEA_Fuel-Poverty-Report-and-Exec-Summary_v2.pdf
[39] Scottish Parliamentary Question (ref. S6W-03254) asked by Liam McArthur, Orkney Islands (Date lodged: 23 September 2021). Answered by Patrick Harvie on 6 October 2021.
[40] https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/
[41] https://tinyurl.com/4ndyew2s

(e.g. heat pumps, electric resistive heating, microgeneration technologies, and fabric measures, etc.), the total capital cost of upgrading fuel poor households to EPC band C could be as much as £6 billion.

It is assumed by the governments of the UK that a range of very low or zero carbon options will be available for heating in future. It is likely that hydrogen, heat pumps, and/or heat networks will be the main new technologies utilised. Hydrogen as a domestic fuel is yet unproven, but it is a very low emissions fuel that the Scottish Government states will be part of the energy mix in the future. Cost estimates have suggested hydrogen-ready boilers will be comparable in cost as existing gas boilers, costing around £1,200.[42] These would be sold as a replacement when current boilers reach the end of their useable life. However, according to the above analysis, given that hydrogen fuel for heat is a new technology, it is likely to be more expensive than natural gas to begin with.[43] The UK Government plans to consult on how various market frameworks could help decrease the costs for hydrogen gas in the future.

Air source heat pumps, which convert energy from the air into heat for domestic properties, are an existing technology capable of widespread deployment. Air source heat pumps are currently priced between £7,000 and £14,000, with the alternative ground source heat pumps costing between £15,000 and £35,000.[44] Installation prices are often driven up by the limited number of installers currently. Heat pump costs may come down as the technology becomes more prevalent, however this is not guaranteed given the pervasiveness of the technology across Europe and in other parts of the world.

Heat networks are not sold to consumers, but instead involve homes being connected to or built into communal supplies. They have been described as "central heating for cities", with the potential to deliver heat to large numbers of people with zero emissions depending on the fuel source.[45]

Understanding in detail and comparing the future running costs of these new(er) technologies is difficult because no one can currently connect to a hydrogen grid or buy hydrogen to run a hydrogen boiler.[46] Although heat pumps are extremely efficient, on a standard electricity tariff they are more expensive to run compared to a mains gas boiler. Introducing new tariffs to make heat pump usage cheaper could help, however the costs of heating would still be more expensive due to the way carbon taxes and other social costs are applied to the cost of electricity. The Scottish Government has supported calls for the UK Government to rebalance policy/social costs by shifting these to mains gas. This would

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[42] http://www.social-policy.org.uk/spa-blog/climate-justice-and-uk-heat-decarbonisation/
[43] *Ibid.*
[44] *Ibid.*
[45] https://www.gov.uk/government/news/new-central-heating-for-cities-to-help-reduce-energy-bills
[46] http://www.social-policy.org.uk/spa-blog/climate-justice-and-uk-heat-decarbonisation/

reduce the costs of using electricity for heat and to disincentivise natural gas as a more carbon-intensive heating option. However, there may be unintended consequences if it were to make gas more expensive for heating, thereby increasing the risk of moving thousands of gas users into fuel poverty. The fairest approach may be to move these additional costs to general taxation.

Whatever route the net zero transition takes, public support and buy-in will be critical to successful decarbonisation. While governments may prescribe the energy supply mix and which technologies should be available to people and households, it is essential that this should encompass an element of consumer choice and appropriate support being made available. The difficulty is how to decarbonise at the scale required given the enormity of the challenge. At the current time, 40% of electricity generation is derived from gas power stations and mains gas boilers remain the dominant form of heating in Scotland, heating over 80% of homes. In rural and remote areas not on the mains gas grid, LPG, oil, and direct electric heating are expensive and ubiquitous. Taken together this illustrates the huge scale of the challenge in both energy generation and end consumption.

Many of the technological alternatives put forward as potential solutions remain unfamiliar to the general population, or they may only be suitable in certain circumstances. For example, heat pumps provide heat over the course of the day by slowly warming a property, which is very different from mains gas, LPG, and heating oil that provide instant heat. In addition, heat pumps can take up space inside and outside the home and may not be suitable for many homes if space for components and water cylinders are required.

Other alternatives for heating, such as district heating or heat networks, can be challenging to retrofit, particularly in densely populated areas and in heritage properties or homes made up of multiple dwellings in one building. A further consideration is the time and convenience factor, with like-for-like boiler replacements typically taking only a few hours, compared to a few days for a heat pump or even longer for district heating or heat networks if entire streets need to be dug up and essential infrastructure is installed or replaced.

Evidence indicates consumers prioritise cost and control when it comes to heating systems.[47] This is not always possible with some of the technologies being put forward as a way of decarbonising heat. This will require significant public engagement on the part of government and other agencies to make sure that the long-term benefits outweigh any short-term inconveniences, as new habits and practices are formed. Public confidence in energy efficiency and renewable technologies will only be built from increased engagement and awareness. It is essential that the transition is also underpinned by a strong consumer

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[47]
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/251785/what_people_want_from_their_heating_controls_qualitative_study.pdf

protection framework for low carbon technologies with clear routes to redress for when things go wrong, as proposed in the Heat in Buildings Strategy.

Rebound effects, offering both challenges and opportunities

In this final section rebound effects are considered as offering both challenges and opportunities for policy makers. The Centre for Energy Policy (CEP) at the University of Strathclyde defines rebound effects as "the reduction in expected gains from new technologies that increase the efficiency of resource use, because of behavioural or other systemic responses".[48] This can occur at the micro- or macro- economic level. At the micro-level these effects can be direct (e.g. turning up the heating in a newly insulated house), or indirect (e.g. spending any money saved on bills on a flight to go on holiday). At the macro-level, improved efficiency should – in a well-functioning market – lead to lower prices and therefore more demand.[49]

In relation to fuel poverty rebound is a key consideration because energy efficiency policies are not just energy policies, they retain a social element too. The CEP has pointed out that while a programme like Energy Efficient Scotland is targeted at reducing emissions from buildings by improving the energy efficiency of residential properties, it also has an objective to remove energy efficiency as a driver for fuel poverty.[50] A further consideration is that when fuel poor households improve the energy efficiency of their homes, they may use the same or more energy than they previously did. This can potentially reduce or even wipe out any energy savings made. While this would be reflected by a large rebound, making achieving emission reduction targets harder to achieve, it should not be forgotten that often these households were not adequately meeting their energy needs if they were under heating their homes. It is the act of improving energy efficiency that has helped alleviate their fuel poverty.

Why does this matter? Estimates suggest that energy savings associated with increased energy efficiency could be cut in half by the rebound effect.[51] It is for this reason that energy system models need to take account of the rebound effect. While some do, this is not universally the case, with some models not taking them into account at all. This failure has the potential to make it harder for countries to achieve the emission reductions needed

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[48] https://www.strath.ac.uk/humanities/centreforenergypolicy/newsblogs/energysavingsandtheupsanddownsofrebound/

[49] https://www.theguardian.com/environment/blog/2011/feb/22/rebound-effect-climate-change

[50] https://www.strath.ac.uk/humanities/centreforenergypolicy/newsblogs/energysavingsandtheupsanddownsofrebound/

[51] https://www.strath.ac.uk/humanities/centreforenergypolicy/newsblogs/energysavingsandtheupsanddownsofrebound/

to meet their net zero ambitions. However, rebound effects are not only challenges to be overcome, but they may also present as opportunities, such as positive economic and wellbeing outcomes that are a crucial part of delivering a fair and green recovery. The rebound effect should therefore be carefully considered when policymakers are deciding which policies should be prioritised.

Conclusion

This discussion paper has examined a range of potential implications of Scotland's climate change and net zero ambitions for those households living in or at risk of falling into fuel poverty. With climate change remaining a top priority for many of the world's nations, and it is only through collective global ambition that the amount of greenhouse gas being produced and removed from the atmosphere will be balanced. However, fuel poverty remains stubbornly persistent in Scotland and elsewhere.

This persistence highlights the need for the Scottish Government to not delay in implementing the final Fuel Poverty Strategy. While there may be some weaknesses in what has been proposed, struggling households need help now to meet the high costs of energy at a time of unprecedented challenge. The establishment of the new independent Fuel Poverty Advisory Panel is an important first step, which will allow it to work closely with the Scottish Government to help achieve statutory obligations and commitments to not only reduce emissions from buildings, but also respond to the worst effects of the pandemic and alleviate fuel poverty for the most vulnerable members of our society.

While the range of evidence and issues covered in this paper are not exhaustive, it is hoped that by opening dialogue it will contribute to wider discussions about the nature and shape of Scotland's transition to net zero. Improving the energy performance of Scotland's homes will help combat poor energy efficiency performance as a driver of fuel poverty. However, it is essential that this is done in a fair and equitable manner so that no one is left behind. Here the notion of a just transition is fundamental to helping shape our understanding of what is required and the principles that should guide policy development.

This transition is not however just about overcoming challenges – there are opportunities to be realised too. The evidence on rebound effects highlights what some of these might be for the fuel poor, as well as for the wider economy and for emission reduction targets. These opportunities will only be realised however if they are adequately taken into consideration by governments when designing and implementing policies.