Institute for Public Policy Research

ALL HANDS TO THE PUMP

A HOME IMPROVEMENT PLAN FOR ENGLAND

Jonathan Webb, Joshua Emden and **Luke Murphy**

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SUMMARY

This report makes the case for an ambitious investment programme to deliver household improvements across the country to be put at the heart of the economic recovery from Covid-19. With the worst employment crisis in a generation looming, this would provide rapid job creation as well as other public benefits such as lower carbon emissions and greater energy security. For households across the country it would also mean lower energy bills, warmer homes and better health outcomes. Moreover, if the government is to meet its legally binding commitment to reduce greenhouse gas emissions to net-zero by 2050 and reduce the UK's contribution to climate change, then such an investment is essential.

In its most recent economic statement, the UK government made a welcome commitment to investing £3 billion in an energy efficiency programme for homes and public buildings. However, despite this very welcome step made by government, its commitments do not yet go far enough either to maximise the job creation potential or to meet our climate change targets. This report lays out a Home Improvement Plan; a new comprehensive strategy, building on the government's recently announced measures, to deliver, at scale, energy efficiency measures to reduce energy demand along with measures to provide low-carbon heat to reduce the emissions of the energy that is supplied. It lays out where current policies are failing and why, before outlining the preferred technologies to deliver this home energy revolution, and how it should be delivered and paid for.

KEY FINDINGS

There are huge benefits to an energy efficiency and low-carbon heat programme delivered at scale

By 2035, up to 275,000 jobs could be created in England and 325,000 jobs in the UK. It will help make the government's commitment to 'levelling-up' a reality – with jobs created across every region in England, and often local to the area of need, providing a boost to local enterprise. It will be good for consumers, as people's incomes become more uncertain and concerns about living costs increase; a large programme at scale can bring down energy bills for millions and help tackle fuel poverty, which is a fact of life for 2.4 million households across England. It will also help improve people's health and save the NHS money – avoidable illnesses caused by poor-quality homes cost the NHS up to £2 billion a year.

Existing policies and proposals will not deliver and are unfair

The number of energy efficiency upgrades, heat networks and heat pumps delivered under current government policy are all far behind the average annual number required to meet the UK's legally binding net-zero target by 2050. Annually, the rate of installation of the required energy efficiency measures has dropped to 12 per cent of what is needed due to cuts in funding. The government's recent announcement of £2 billion for home energy efficiency and another £1 billion for public buildings is a positive step, though it needs to be extended beyond one year and there must be more investment and policy to support private and social renters too. Nevertheless, less than 2 per cent of heat pumps and 37 per cent of heat networks that are needed are being installed each year. Some of the government's existing policies and proposals also penalise the poorest households. In the case of energy efficiency, the government's flagship fuel poverty programme, the Energy Company Obligation (ECO), is paid for through energy bills, making it highly regressive, is underfunded, bad at targeting fuel-poor homes and far too slow. The current rate of installation

means that the 2.4 million fuel-poor homes in England would not achieve an Energy Performance Certificate (EPC) of C until 2091, missing the government's fuel poverty target by 60 years. The government's proposal for a Clean Heat Grant for heat pumps would also cost the poorest households up to 60 per cent of their average annual income.

We must act now

The scale of the delivery challenge facing the decarbonisation of housing is substantial. Across the UK, at least 21 million separate energy efficiency measures and 19 million heat pumps will need to be installed in the next 30 years along with the connection of five million homes to heat networks. Currently however, for each of these technologies, government policy (including the proposed Clean Heat Grant and recent funding announced for energy efficiency) underestimates the scale of investment needed to achieve this level of deployment. Any delay in uptake would decrease the likelihood of meeting the net-zero emissions target of 2050.

Technology choices

The government must decide a clear technology pathway, scaling up technologies where they are most suitable, such as heat networks in dense urban centres. Both heat pumps, which draw in air outside the property and convert it to warm air inside the home, and boilers that use hydrogen gas as their main fuel source will be needed. In addition, energy efficiency measures like wall and loft insulation will be needed regardless of the low-carbon heating technology chosen. However, in this report, we conclude that heat pumps should be the dominant technology used to decarbonise the majority of home heating while hydrogen has a clear role in industrial heat. We make this choice for homes for several reasons:

- Readiness: Heat pumps are already available and give the UK the best chance of meeting its net-zero targets in the housing sector. The scale-up of hydrogen is possible but it is far from 'shovel-ready'. The supply chain for manufacturing hydrogen requires a substantial and rapid scale-up in investment in infrastructure combined with further technology innovation to ensure hydrogen is genuinely zero carbon.
- Costs for consumers: System costs of a hydrogen-dominant or heat pump-dominant scenario are comparable, but more important for people's everyday lives are the running costs. Heat pumps, provided they are paired with high energy efficiency standards, are expected to be cheaper than a hydrogen or gas boiler with the same package of retrofits.
- Energy security and supply chains: The hydrogen supply chain will require an approximate 60 per cent increase in natural gas imports. This would not only reduce energy security but would make pricing for hydrogen more uncertain at a time when the cost of renewable electricity needed to power heat pumps is falling.

Barriers and financing

Any scheme must focus on overcoming the barriers to delivery. Communication and engagement with households will be critical because the changes to homes are likely to cause a degree of disruption. Local government will be key to trust in the delivery of any programme. Capacity will be crucial and local authorities must be properly funded in order to build up the staff needed. The skilling-up and training of the workforce will be essential as will the provision of support for workers whose jobs may be at risk in higher carbon sectors like gas networks.

Retrofitting the majority of homes in England with heat pumps and high energy efficiency standards will require significant investment at approximately £10.6 billion per year from the public and private sectors through to 2030, reducing to £7 billion per year from 2030 to 2050. In the social rented sector alone, this would cost £36 billion through to 2030. However, with rapid, large-scale deployment

these costs could be reduced by 20 per cent by 2030. In the near term, public investment as part of an economic recovery package based on borrowing at record low interest rates is the best way to provide public funding for this programme, but this will need to be accompanied by private funding, unlocked by sending clear market signals.

IPPR'S HOME IMPROVEMENT PLAN FOR A WARM HOME REVOLUTION

This report sets out a comprehensive package of recommendations that form a new Home Improvement Plan for England's homes. The main recommendations include the following.

1. **A clear technological pathway:**
   - The UK government should prioritise electric heat pumps, heat networks and energy efficiency upgrades as the main technologies for retrofitting homes. These technologies should be the primary focus of government and private financing, with the majority of government funding supporting the installation and deployment of these technologies.
   - Where the installation of heat pumps is not possible, the use of hydrogen boilers and high heat retention storage heaters should be the preferred option. All households in need of boiler replacements should be signposted towards alternative low-carbon heat solutions.

2. **A strategy for financing retrofit:**
   - The government should adopt a blended approach for financing housing retrofit, raising the level of government support to half the cost, while also leveraging the remaining 50 per cent from private finance. In the near term, the public investment should form part of a government clean economic recovery package, taking advantage of record low interest rates.
   - The government has recently announced a £3 billion investment, with £2 billion in vouchers for homeowners to pay for retrofits that include energy efficiency measures like insulation and £1 billion to upgrade public buildings. This forms part of the £9.2 billion of investment committed to in the Conservative manifesto for energy efficiency of homes, hospitals and schools. However, according to our analysis, to maximise the chance of meeting net-zero targets and reducing energy bills for households, the government should capitalise a Retrofit Fund for England with £5.3 billion per year through to 2030 and £3.5 billion after this through to 2050 on heat pumps combined with high energy efficiency standards. Of this, £1.8 billion should be committed to the Social Housing Decarbonisation Fund every year until 2030, increasing the £380 million committed to this fund in the Conservative's manifesto over the next decade. A more rapid uptake in the social rented sector would help to develop domestic supply chains and help to attract more private finance. The remainder of the funding (£3.5 billion) should be used to fund means-tested grants for homeowners, which could be accompanied by low-cost loans for homeowners and private landlords (see below).
   - To leverage additional private finance, the Bank of England must work with financial institutions to ensure that the risk profile of retrofit activity is reduced, reflecting the long-term environmental benefits it brings. The environmental credentials of public works, which would include the retrofit of activities of social housing providers, should become a key lending criterion.
   - A new framework should be developed that helps local authorities and social housing providers aggregate areas of homes then securitise the investment in low-carbon heat technologies as a means of attracting private finance. The government could also play a role in securing low interest rates for the loans by using the UK Guarantees Scheme.

3. **A framework for policy and incentives:**
    - In the social rented sector, providers should set themselves the ambition of ensuring that all retrofit activity brings homes to EPC B standard or higher by 2030. In cases where this is not possible, EPC C should be the minimum target. Under this option, the money given to the sector through the Decarbonisation Fund would be matched with private finance through models like Energiesprong. Attractive borrowing rates would need to be offered to the social rented sector to ensure retrofit can be delivered at scale. The use of the UK Guarantees scheme currently used to lower interest rates for large infrastructure projects could be used to secure attractive borrowing rates.
    - The government should offer means-tested grants for homeowners which could be supported by low-cost loans to cover any remaining costs for homeowners and also to support private landlords who would not be eligible for the means tested-grants. Grants for homeowners would cover at least half the cost of installing a heat pump, with the remaining 50 per cent subject to means testing.
    - The government should consider a range of taxation options on council tax and stamp duty. In the case of council tax, consideration should be given to linking council tax rates to energy efficiency, modifying them so that less efficient homes pay an added premium or matching them to energy efficiency. Another option would be variable stamp duty, with a higher rate charged for energy-inefficient properties and vice versa.
    - Incentives should be matched with new regulation and enforcement actions to ensure compliance. For the private rented sector, Minimum Energy Efficiency Standards (MEES) should be gradually brought up to at least B by 2030, with an exception of C for hard-to-treat stock. These MEES standards should also be applied across all private residential properties, including for owner-occupied properties, at the point of sale or when other renovations are carried out. The target standards could be increased over time. There will need to be exemptions for certain households and properties.

4. **A blueprint for delivery:**
    - The UK government should develop an area-based approach to housing retrofit, which incorporates a local plan for retrofit taking place on a street-by-street basis and prioritising fuel poor homes and the social rented sector. This work would be led by local government, with significant input from housing providers and democratic engagement with residents' associations, accompanied by further support from the UK government to develop the capacity of local authorities to deliver this programme.
    - Clear guidance needs to be offered to households and consumers on how low-carbon heat solutions work. For tenures beyond the social rented sector, guidance on funding opportunities to carry out retrofit work would need to be provided. As is already the case in Scotland and Wales, clear and consistent advice should be given to households in England. We recommend the UK government creates a dedicated advice service to support households with the operation of their low-carbon heating systems, accessed via text, letter, telephone, email or online.
    - The government should also commit to investing in a large-scale training and retraining programme for installers: the Heat Engineer Accreditation Training (HEAT) scheme. This would help provide the capacity needed to install heat pumps at scale. This can offer hundreds of thousands of new jobs and provide opportunities for young people through appropriate apprenticeship schemes.

1. INTRODUCTION

In his recent economic statement, the Chancellor Rishi Sunak set out the government's plans to invest in 'shovel-ready' projects with a priority on those that stimulate new jobs at pace, in every region of the UK. This included £3 billion of investment focused on energy efficiency. The government is right to make a programme to retrofit the nation's homes and prioritise energy efficiency. Such a programme will bring a range of benefits including: mass job creation; a boost to local enterprise; the growth of local supply chains around the country, supporting the government's levelling-up agenda; savings on energy bills for consumers; and help for those homeowners who are amongst the 2.4 million households in fuel poverty, and improved health arising from warmer homes and better air quality (BEIS 2019c).

But the programme is also a necessity if the government is to deliver on its climate commitments, which it is currently not on course to meet. While carbon emissions from residential properties have declined significantly since 2013, the UK's housing stock is still not being decarbonised at the required pace. The Committee on Climate Change (CCC) estimates that residential buildings need to reduce emissions by 83 MtCO2e by 2050 – a reduction of approximately 83 per cent (CCC 2019a). The vast majority of these reductions will need to come from reducing the emissions of existing homes, but it is important to remember that newly built housing is also falling short – only 1.3 per cent of new housing met the highest possible energy efficiency standards in 2019 (MHCLG 2020a).

In its manifesto, the Conservative Party committed to investing £9.2 billion in the energy efficiency of homes, schools and hospitals (Conservative and Unionist Party 2019) over the course of the next decade. Some of this funding was committed in the chancellor's mini budget, with funds for public buildings and vouchers for homeowners. While these commitments are welcome, the UK needs to go faster and further. The current state of the UK's housing stock hits the poorest households the hardest, with households living in fuel poverty being forced to make the unacceptable choice between 'heating or eating' (BEIS 2020a). The lack of policy progress to tackle the issue means this number has remained stagnant for at least three years (ibid).

This report outlines an ambitious plan for decarbonising homes across all tenures in England, building on the government's recent announcements, but makes the case for the social rented sector to be placed at the vanguard of a wide-reaching green infrastructure programme that meets the scale of the climate challenge. The ability of providers to manage stock on behalf of their tenants would allow retrofit activity to be developed in this sector and then scaled up across other tenures.

Our work for this project combines a review of the existing evidence with primary analysis. It has included desk-based research, a literature and data review, and qualitative work through interviews and research events with key stakeholders across the sector. The research includes analysis of the relevant UK government datasets from Ministry of Housing, Communities & Local Government (MHCLG), Department for Business, Energy & Industrial Strategy (BEIS) and others. To develop our understanding and test the report's policy recommendations, a series of roundtables with recognised experts and key policymakers was also held. While the focus of the report and its recommendations are for England, we have consulted with experts from across the UK to ensure that positive lessons learnt from the devolved administrations can be transferred to the English context.

2. WHAT IS THE OPPORTUNITY?

The scale of the retrofit challenge across tenures is huge: over 26 million homes will need to be retrofitted across the UK (IET 2020). However, within this challenge lie substantial opportunities. In the context of a looming economic recession, a committed scale-up in retrofitting our homes could provide a wealth of benefits including job creation, savings on energy bills, reduced fuel poverty, and better health from warmer homes and improvements in air quality.

JOB CREATION

There is a substantial opportunity to create many jobs quickly in the low-carbon heating sector. As a recent report from the Energy Efficiency Infrastructure Group finds, investing in energy efficiency alone could create 34,000 full-time jobs within the next two years (EEIG 2020). In the longer term, as table 2.1 shows, by 2035, in the UK over 325,000 jobs could be created in the low-carbon heating sector by deploying heat networks, heat pumps and energy efficiency measures.

Furthermore, energy efficiency is a particularly labour-intensive sector in the low-carbon economy (Laybourn-Langton et al 2017), and a substantial proportion of the installation process therefore goes to labour costs as opposed to material costs (Palmer et al 2017). For example, between 45 and 70 per cent of the cost of installing cavity wall insulation goes to labour costs. Because most of the cost for retrofit work falls on labour costs and not materials, any money invested in retrofit will stimulate labour activity and directly contribute to workforce demand.

TABLE 2.1: OVER 325,000 JOBS IN THE UK COULD BE CREATED IN THE HEAT SECTOR ALONE BY 2035

Job creation projections by technology and projected year

Technology	Jobs	Date
Heat networks	59,730[1]	2030
Heat pumps	44,058	2035
Energy efficiency	223,387	2030
Hydrogen (in industry)	43,000	2050

Sources: Emden et al (2017); HPA (2019); Laine (2020); Baltac and Durusut (2019)

BOOSTING UK ENTERPRISE

The supply chains involved in installing energy efficiency and heat pump upgrades can often be highly localised, providing jobs in the communities where homes are retrofitted (Killip et al 2018). Furthermore, there is an opportunity to establish local manufacturing hubs for the piping needed for heat networks and district heating. Pipe manufacturers are currently not commonly found in the UK, meaning

1 Based on 40TWh projected by CCC for 2030 for homes and simple pro-rata calculations from IPPR modelling for jobs at 54TWh (Emden et al 2017).

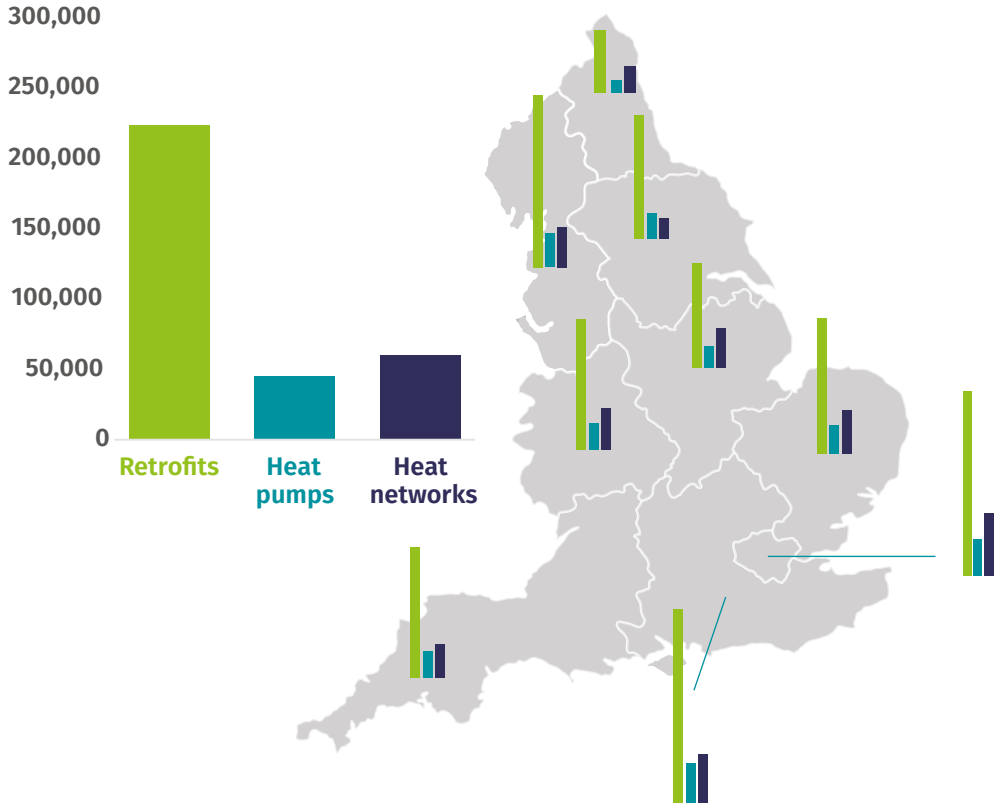
an emphasis on building a home-grown supply chain could ensure the creation of domestic jobs (Emden et al 2017).

FITTING THE LEVELLING-UP AGENDA

An ambitious retrofit programme fits well with both the policy response to Covid-19 and the government's levelling-up agenda, since jobs will be in demand across every region in England, as figure 2.1 shows. The social rented sector in England alone will need to retrofit over 1.7 million homes with energy efficiency upgrades to ensure that its stock meets a minimum rating of EPC C, which is the government's target for 2035.[2]

FIGURE 2.1: RETROFITS, HEAT PUMPS AND HEAT NETWORKS CAN GENERATE NEARLY 275,000 JOBS ACROSS EVERY REGION IN ENGLAND

Number of jobs by technology and by region by 2035



Source: Jung and Murphy (2020)

SAVINGS ON ENERGY BILLS

Retrofitting homes can have an immediate and positive impact on household finances. Domestic fuel represents one of the most significant costs incurred by households, particularly lower income households (Hirsh 2019). By ensuring all homes have modern energy-efficient and low-carbon heating solutions, savings can be directly passed on to tenants. This has the potential to reduce household costs related to heat and help deliver a better quality of life. Moreover, energy efficiency in particular provides clear system benefits such as permanent energy demand reduction (DECC 2012). If the avoided system costs of providing this

2 This is calculated using English Housing Survey (MHCLG 2020b) data on EPC by tenure and the total number of social rent households (MHCLG 2020a).

energy can be monetised, then households could be paid for providing this service to the power grid.

According to the CCC, for a new-build property, compared to current standards and gas heating, the combination of high energy efficiency standards and heat pumps is expected to generate savings of £85 per year across the life of the build, compared to £55 per year for high energy efficiency standards with gas boilers (CCC 2019b). The key challenge is that the upfront cost for retrofitting energy efficiency measures and heat pumps is significantly higher than integrating these technologies into the design stage of housebuilding (£26,300 compared to £4,800 (ibid)) as well as currently being more expensive than simply upgrading to a new gas boiler (BoilerGuide 2020). Consequently, while running costs of low-carbon heating systems like heat pumps combined with energy efficiency measures may well be cheaper than alternatives (as we discuss in chapter 7), developing policies to finance the upfront costs in a way that does not penalise the poorest households will be crucial to delivering a retrofitting programme that is both fair and sufficiently ambitious.

TACKLING FUEL POVERTY

Fuel poverty is a fact of life for 2.4 million households across England (BEIS 2019c). As a consequence, too many people are forced to make unacceptable choices between 'heating or eating' (BEIS 2020a). At its worst, fuel poverty can contribute to premature winter deaths – around 10,000 deaths in 2016-17 were related to cold homes (Emden et al 2018). Fuel poverty and its consequences are largely preventable through the right policy interventions, including action on energy prices, direct financial support to relevant households and energy efficiency schemes. However, it is through improving energy efficiency and deploying low-carbon heating systems that the most cost-effective and long-lasting difference could be made in reducing fuel poverty.

HEALTH

Low-carbon heating systems combined with high energy efficiency standards can make homes healthier to live in by making them warmer, reducing instances of damp and mould, and improving air quality. The health cost to the NHS of poor-quality housing has been estimated at £1.4-2 billion per year in England alone (CCC 2019a; Nicol et al 2015), caused by cardiovascular and respiratory diseases associated with cold, damp or moulding homes. Furthermore, across the UK, 1.9 million households use wood, coal or other solid fuels for their heating (Emden and Murphy 2018). These fuels are associated with high concentrations in the home of harmful pollutants like PM2.5 and PM10, and domestic housing accounts for the largest proportion of PM2.5 produced in the UK (ibid). Installing low-carbon heating in these homes could substantially improve air quality for both residents and their neighbours.

3. PRIORITISING THE SOCIAL RENTED SECTOR

Ensuring all homes can be decarbonised will require a strategic approach. Existing supply chains and installation services will need to be expanded before retrofit can be achieved at scale. While delivering retrofits for fuel-poor homes across all tenures must also be a priority, the social rented sector has a combination of existing good progress and the governance arrangements needed to support retrofit at scale. Starting retrofit efforts in the sector would provide an opportunity to help construction workers, electricians and other specialists to develop an understanding of new technologies and the skill sets needed to implement them, before expanding these at scale across other tenures. This would then make the roll-out of a nationwide retrofit programme across all tenures more manageable. This would bring additional benefits to housing providers, allowing them to develop their buildings and maintenance services around retrofit activity.

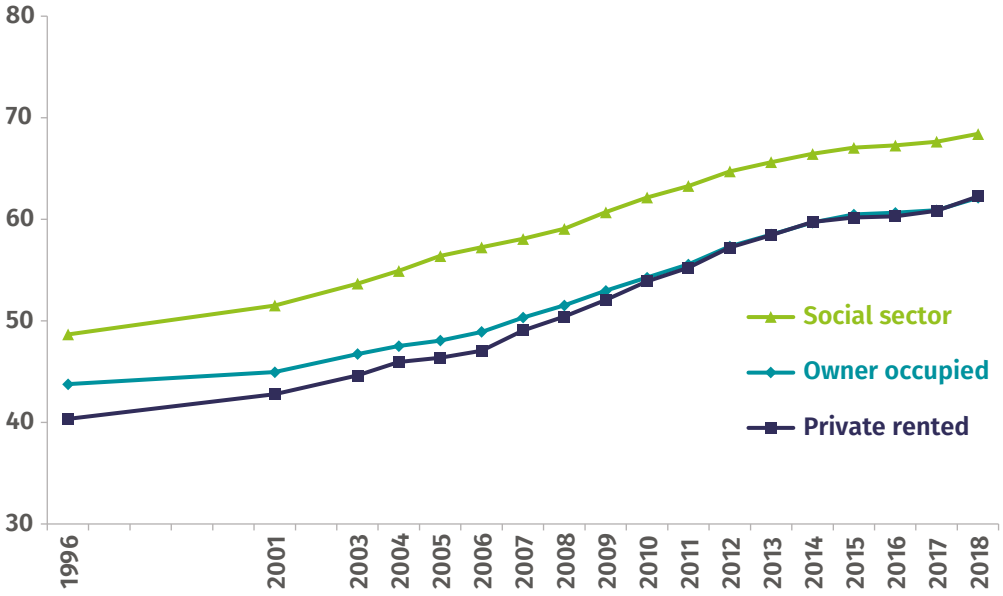
In this chapter, we highlight the current state of play in the social rented sector and discuss some of the challenges it still faces. We compare the social rented sector to performance in other tenures to demonstrate why the sector represents the best place to start with retrofit.

ENERGY EFFICIENCY ACROSS TENURES

Currently, there are two interrelated measures used to assess the energy efficiency of homes. The Standard Assessment Procedure (SAP) is used to assess and compare the energy performance and efficiency of a dwelling. A SAP score is used to calculate an Energy Performance Certificate (EPC), which categorises the energy performance of dwellings into different bands. These range from A to G in terms of energy performance. Current data shows that the social rented sector performs significantly better when compared to other tenures (figure 3.1).

FIGURE 3.1: DWELLINGS IN THE SOCIAL RENTED SECTOR ARE SIGNIFICANTLY MORE ENERGY EFFICIENT THAN THOSE IN OTHER TENURES

Mean SAP rating, by tenure, 1996 to 2018



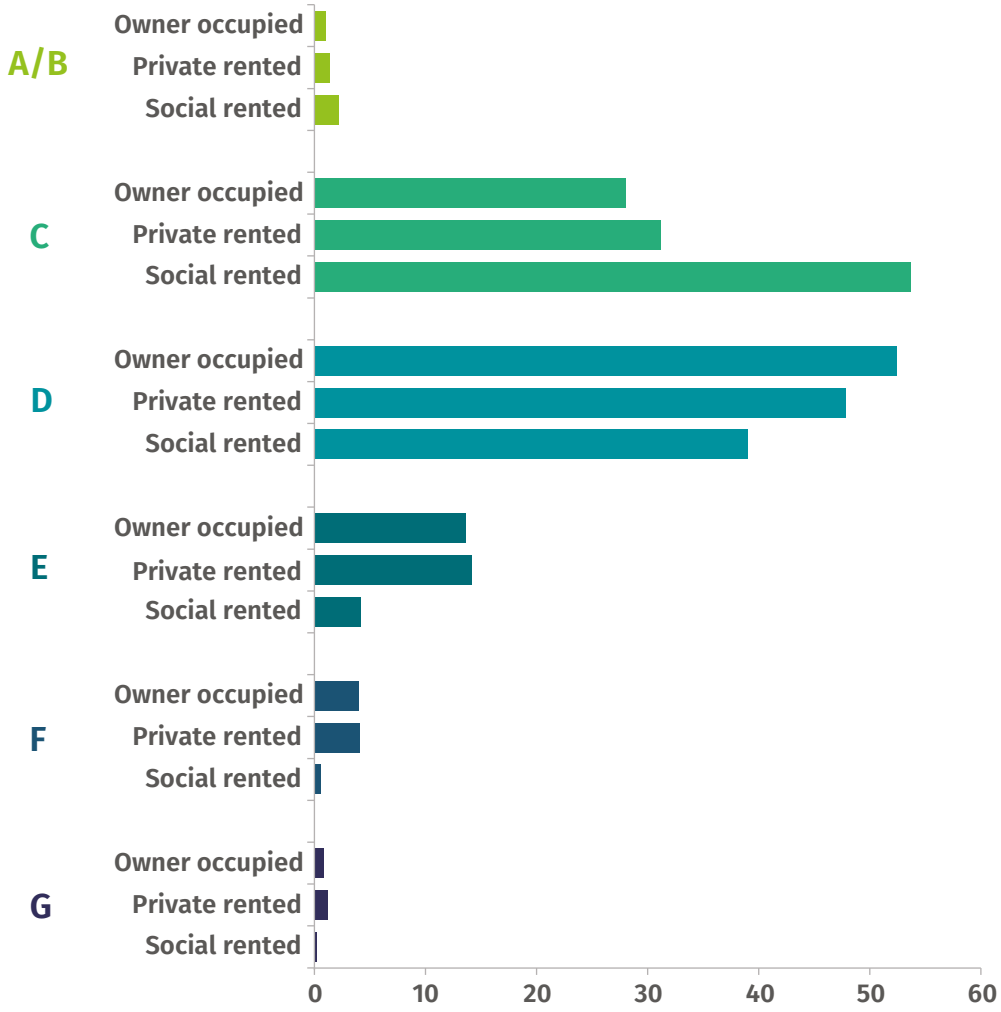
Source: English Housing Survey (MHCLG 2020b, 2020c)

The social rented sector has always outperformed other sectors, primarily due to the strong regulation and bespoke legislation that has encouraged the sector to deliver high-quality homes. For example, the Decent Homes Standard set out a clear set of standards that required all homes in the social rented sector to be efficient and free from associated hazards linked to inefficient and cold homes (CLGC 2010). This applied to both new and existing dwellings. It ensured that a minimum standard was met in terms of quality and energy efficiency measures where mandated and enforceable upon registered providers. The £40 billion invested through the Decent Homes Programme has had, in the words of the then Communities and Local Government Committee, 'a dramatic and positive effect' (CLGC 2010). Active investment to drive up standards has compelled the sector to be at the foreground of national efforts to decarbonise and modernise homes.

In terms of translating SAP rating into an EPC rating, the social rented sector has a much greater number of homes that meet high energy efficiency standards when compared to other tenures. Currently, the social rented sector has a higher proportion of housing stock that is rated at EPC C or above. However, more needs to be done to bring existing homes not just up to C but, where possible, the highest possible A/B standards.

FIGURE 3.2: THE MAJORITY OF HOMES IN THE SOCIAL RENTED SECTOR ARE RATED EPC C OR ABOVE. THIS PROPORTION IS SIGNIFICANTLY GREATER WHEN COMPARED TO OTHER TENURES

Energy efficiency rating bands, by tenure, 2018



Source: English Housing Survey (MHCLG 2020b, 2020c)

Compared to the social rented sector, which saw standards raised through the Decent Homes Standard, the private rented sector and owner-occupied sector have far fewer energy-efficient properties. Based on IPPR analysis of English Housing Survey data, across all tenures in England, 63.5 per cent of properties have an EPC rating below C, but 88.6 per cent of these homes are privately rented or owner-occupied (MHCLG 2020a).

This is because expectations on other tenures have been comparatively weak. In the private rented sector, the Minimum Energy Efficiency Standards only requires private landlords to ensure their property meets an EPC rating of E (EST 2019). Consequently, more privately rented homes are inefficient and, as of 2017, 19 per cent of households in the private rented sector were living with fuel poverty (BEIS 2019c).

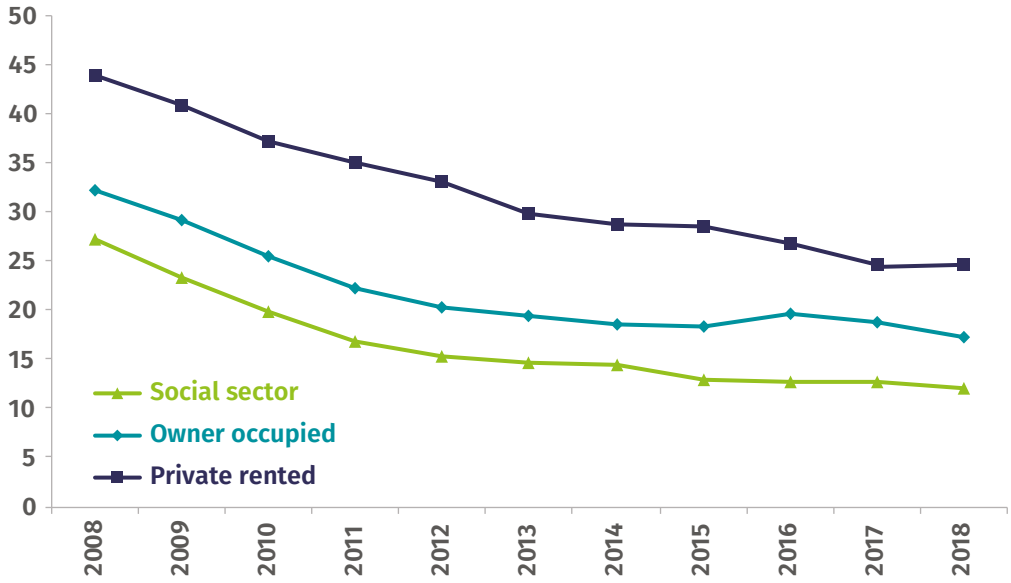
For those people who own their own home, there are no mandatory obligations to ensure their homes meet a minimum efficiency standard. Consequently, home improvements for energy efficiency have come largely at the discretion

of individual households, resulting in a lower proportion of homes meeting EPC C or above when compared to the social rented sector. 15 million households (64 per cent of all households) in England own their own home, which means that most households are not subject to any compulsory action or regulation designed to improve the energy performance of buildings (MHCLG 2020b).

In comparison to other tenures, the regulatory framework governing social housing and the experience of the Decent Homes Standard has given registered providers a much more comprehensive understanding of the relationship between energy efficiency and housing quality. The majority of the 18 per cent of homes that contain defects that result in them being classed as non-decent are in the private rented sector (MHCLG 2020b).

FIGURE 3.3: HOMES THAT ARE NOT ENERGY EFFICIENT ARE FAR MORE LIKELY TO BE CLASSED AS NON-DECENT DUE TO THE PRESENCE OF HEALTH AND SAFETY HAZARDS LINKED TO INEFFICIENT HEATING. THE PROPORTION OF STOCK IN THE SOCIAL RENTED SECTOR CLASSED AS NON-DECENT IS SIGNIFICANTLY LESS THAN OTHER TENURES

Percentage of homes classed as non-decent by tenure



Source: English Housing Survey (MHCLG 2020b, 2020c)

BUILDING ON PROGRESS IN THE SOCIAL RENTED SECTOR

Higher standards in the social rented sector are also a function of the sector's inherent characteristics and obligations to look after tenants, as well as greater regulation governing minimum standards. Indeed, some of the main reasons why progress has been made include:

- The goodwill of social landlords.
- The Decent Homes Standard and Programme.
- A better understanding of legal obligations under the Housing Act 2004 and higher standards outlined in the Decent Homes Standard and Homes (Fitness for Human habitation) Act 2018.
- Greater uniformity of stock and ownership of large concentrations of housing (which isn't typically the case for private landlords).
- A greater degree of professionalism and collective organisation when compared to other tenures.

While the sector has clearly performed well when compared to other tenures, the scale of the challenge is still substantial. Overall, 44 per cent of all social rented homes (1.7 million homes) still fail to meet an EPC C rating (MHCLG 2020b). This represents a significant amount of social housing stock in England, much of which will be hard to treat – requiring more intensive resources and technologies. While all housing providers will need to decarbonise their stock, the scale of the challenge varies significantly both in terms of geography and across the housing stock of individual providers. For instance, providers with newer stock or stock concentrated in one geographical area might find it easier to meet the retrofit challenge than providers who hold stock of varying quality across different regions.

One housing association operating in London and the South East suggested that retrofit work would cost nearly £20,000 per home, while Greenwich Council have suggested it would cost nearly £1 billion to decarbonise its homes by 2030 (Hollander 2020). These high costs will be coupled in some cases with practical questions about how older stock should be treated. In cases where stock is particularly poor and hard to treat, replacing old homes with new homes may be necessary. Despite the scale of the challenge, when compared to other tenures, the social rented sector has the sufficient regulation and maintenance services needed to build towards retrofit at scale.

LESSONS FROM THE DEVOLVED NATIONS

Achieving zero-carbon homes will require comprehensive support from both the UK and devolved governments. There is noticeable variation across the UK in the policy support that providers can draw upon. In Scotland and Wales, housing decarbonisation has been prioritised. The Scottish Government has for example recently announced a £30 million investment to ensure new homes in Scotland have renewable or low-carbon heating (Scottish Government 2019).

In Wales, the Welsh Government's Prosperity For All low-carbon strategy outlines how a suite of measures, ranging from supporting innovation around energy systems planning to providing the workforce with the skills it needs to undertake retrofit, has allowed the Welsh Government to put in place an ambitious decarbonisation strategy that Welsh housing associations can draw upon, while at the same time providing a blueprint for how the transition can be maximised (Welsh Government 2019).

In both cases these programmes will need to be scaled up but in comparison, the policies offered by the UK government do not offer the same scale of support to allow English providers to meet the climate challenge.

Given the strong progress to date and with the existing regulatory framework and maintenance services needed to help deliver retrofit on a much larger scale than other tenures, it is unsurprising that the Business, Energy and Industrial Strategy Committee have called for social housing tenure to be treated as a 'flag bearer' for energy efficiency (HC 2019). This long-term strategy will not be possible however until the technological solutions needed are agreed upon, the net-zero workforce created and the policy architecture put in place to ensure that registered providers have the funds and governance they need to deliver housing retrofit at scale. As such, while the sector represents the best place to start, more needs to be done to enable it to achieve its full retrofit potential. The technological solutions, financing options and policy framework needed to help the sector deliver are outlined in the subsequent chapters of this report.

4. CHOOSING THE RIGHT TECHNOLOGY PATHWAY

While some progress has been made on energy efficiency upgrades in the social rented sector, energy efficiency upgrades across other tenures, and deployment of low-carbon heating technologies for all tenures, has been far slower. Successive governments have continuously delayed the implementation of a coordinated, fully funded low-carbon heat strategy and have yet to decide which heating technologies should be preferred. Currently only 4.5 per cent of all heating is considered to come from low-carbon sources, the vast majority (82 per cent) of which comes from biomass, which would not be possible to scale up sustainably to match its current market share (CCC 2019a).

In an effort to steer government, in its net-zero report, the Committee on Climate Change (CCC)'s Further Ambition Scenario explores three main technology pathways for the decarbonisation of heat:[3] hydrogen, heat pumps and hybrid heat pumps (where heat pumps are combined with a gas boiler that tops up heat demand). The CCC finds that each of these scenarios has similar costs (including, crucially, system costs such as the need for network upgrades and energy storage) and each one includes technologies that will be needed regardless of the scenario (Strbac et al 2018). These include heat networks, energy efficiency upgrades[4] to homes (such as wall and loft insulation), and a small role for electric heaters.

However, while the scenarios have similar costs, the CCC leans more towards a scenario where heat pumps are the dominant technology (see table 4.1). Below, we briefly discuss why other technology pathways face challenges to deliver a genuinely net-zero heat sector.

TABLE 4.1: THE SCALE OF DEPLOYMENT OF LOW-CARBON HEATING TECHNOLOGIES IS SUBSTANTIAL

Number and type of technologies required to meet net-zero targets by 2050 in domestic buildings under the CCC Further Ambition Scenario (high electrification pathway)

Scenario	Number of heat pumps installed	Homes using heat networks	Energy efficiency measures (heat)	Bioenergy	Electric storage heaters
High electrification	19 million (of which up to 10 million could be hybrid heat pumps by 2035)	5 million	6 million solid wall upgrades 6 million cavity wall upgrades At least 9 million loft insulation upgrades	A small role for bio-based fuels as part of hybrid heat pumps for off-grid properties	460,000

Source: CCC (2019a)

3 Which includes non-residential buildings and industrial demand.

4 In this report we use figures from the CCC for solid wall insulation, cavity wall insulation and loft insulation but recognise that in some cases other measures will also be important to ensure maximum efficiency.

CHALLENGES FACING A HYDROGEN-DOMINANT SCENARIO

A hydrogen-dominant scenario would require a substantial scale-up of infrastructure. Deploying the technologies to produce hydrogen through a process known as Steam-Methane Reformation (SMR) combined with Carbon Capture and Storage (CCS)[5] would require a large-scale industrial programme as well as additional hydrogen storage sites. By contrast, heat pumps are already commercially available. Additionally, the CCS technology deployed would need to demonstrate very high (at least 90 per cent) CO2 capture rates (CCC 2018a; CCC 2019a), whereas heat pumps provide more immediate emissions reductions (CCC 2018a).

Imports also present a challenge for a hydrogen-dominant scenario. Hydrogen produced through SMR and CCS will require an estimated 60 per cent increase in natural gas imports,[6] for which future prices could be uncertain (ibid). This means that, while the upfront cost of a hydrogen boiler is expected to be cheaper than that of a heat pump, the running costs will be linked to gas and are likely to be higher as heat pumps benefit from increasingly cheap renewable energy (ibid). This is particularly important as, where upfront costs can be addressed with ambitious policy under which the poorest homes do not pay anything, running costs are arguably more important for people's everyday experience of their low-carbon heating systems.

In addition, the increased demand for gas would put pressure on existing trends. In 2017, the UK already imported 60 per cent of the natural gas consumed and domestic oil and gas production from the North Sea is expected to continue to decline in future (ibid). Lastly, it is important to consider the ethics of increasing gas imports, as this will increase emissions associated with natural gas extraction abroad but will not be counted in the UK's territorial net-zero target.

In a scenario where new technologies such as Auto Thermal Reformers replace the SMR process of producing hydrogen, both upfront costs and CO2 capture rates can be substantially improved (Strbac et al 2018). However, currently this technology is not mature and consequently not considered by the CCC. Furthermore, while a small role is envisaged for hydrogen produced via electrolysis in 2050 to become the main method of producing hydrogen, it would require both high upfront costs and an unmanageably high annual rate of deployment of new renewable energy projects to supply electricity for the electrolysis process (CCC 2019a).

CHALLENGES FACING A HYBRID HEAT PUMP SCENARIO

For a hybrid heat pump scenario, while the CCC states that a high level of uptake of hybrid heat pumps could be feasible by 2035, this pathway still faces similar, though less severe, challenges to the hydrogen pathway. For example, while natural gas imports for hydrogen production would not increase in a hybrid scenario, they would broadly stay the same as natural gas imports in 2017. Furthermore, while hybrid heat pumps combined with gas boilers could provide an interim solution that offers relatively low running costs, when heat pumps are paired with high energy efficiency standards, the combination is likely to have lower running costs for consumers (Foster et al 2017). Finally, the CCC's scenarios limit the use of boilers supplied by biofuels such as biomethane to off-grid properties, since the quantity of sustainable biomass that can be supplied is relatively small and will require rigorous monitoring (CCC 2018b; CCC 2019a).

5 The main method of producing hydrogen envisaged by the CCC.

6 As at 2017, IPPR calculations of CCC 2018a.

HEAT PUMPS – LOW-CARBON CREDENTIALS

The primary challenge facing a large-scale deployment of heat pumps is the speed at which additional renewable generation can be provided to accommodate increased electricity demand from heat pumps. However, the CCC suggests that the build rates needed are achievable, thanks to the existing policy progress in decarbonising the power sector. By contrast, the other technology pathways considered face more severe barriers (CCC 2018a), making a net-zero target more difficult (though not impossible) to reach. For this reason, for the remainder of the report, our discussion focusses on the barriers facing heat pump installation along with no-regrets technologies such as energy efficiency and heat networks.

5. SCALING-UP

Government policy stands at a critical moment. The response to Covid-19 has demonstrated that the government has the capacity to develop both rapid and far-reaching policy. As the government turns its attention to rebooting the economy, a similarly ambitious housing retrofit programme, with all the benefits that would bring, would offer an ideal flagship policy to lead the recovery.

However, such a programme needs to recognise the scale of ambition and financing that will be required and the gaps that exist in current initiatives. In this chapter, we highlight the lack of scale in policymaking, the unfair distribution of costs and how, in the absence of sufficient policy, households face many barriers to funding retrofits themselves.

INCREASING THE PACE AND SCALE OF HEAT DECARBONISATION

The scale of the delivery challenge facing the decarbonisation of housing is substantial. Across the UK, at least 21 million separate energy efficiency measures[7] and 19 million heat pumps will need to be installed in the next 30 years along with the connection of five million homes to heat networks (CCC 2019a). Currently, however, government policy (or even the proposed Clean Heat Grant) severely underestimates the scale of investment needed to achieve this level of deployment. It is worth reiterating that any delay in uptake would decrease the likelihood of meeting the net-zero emissions target in the UK by 2050.

THE ENERGY COMPANY OBLIGATION (ECO)

In the case of energy efficiency, the government's flagship programme to tackle fuel poverty – the Energy Company Obligation (ECO) – is underfunded, bad at targeting fuel-poor homes and far too slow. Indeed, according to IPPR analysis in 2018, even since changes to the programme to focus solely on fuel-poor homes, the rate of installation meant that the 2.55 million fuel-poor homes in England are not likely to achieve an Energy Performance Certificate (EPC) of C until 2091, missing the government's target in its Fuel Poverty Strategy of 2030 (Emden et al 2018; CFP 2018; HM Government 2015). Since this research was conducted, the pace of change has largely remained unchanged and 2.4 million homes remain in fuel poverty (BEIS 2019a).

As well as failing fuel-poor homes specifically, in the context of reducing household carbon emissions (as table 5.1 shows), across the entirety of ECO's lifetime, the number of energy efficiency upgrades installed per year is far behind what has been set out by the CCC.

7 Six million solid wall insulation, six million cavity wall insulation and at least nine million loft insulation measures.

TABLE 5.1: THE NUMBER OF ENERGY EFFICIENCY MEASURES INSTALLED UNDER THE ECO SCHEME IS FAR BEHIND THE AVERAGE YEARLY NUMBER REQUIRED TO MEET NET-ZERO BY 2050 FOR THE HOUSING SECTOR

Comparison of average yearly installations under ECO and implied average required to meet net-zero by 2050 in the housing sector

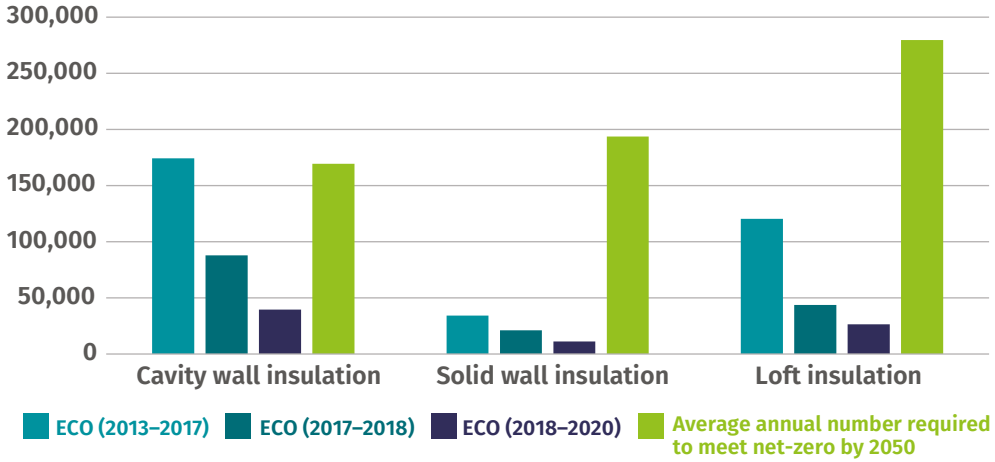
Energy efficiency measure	Number installed to date since beginning of ECO in 2013	Average installations per year[8]	Implied average number of yearly installations required to meet net-zero by 2050
Cavity wall insulation	918,166	131,167	169,394
Solid wall insulation	189,943	27,135	193,669
Loft insulation	608,771	89,967	279,708

Sources: IPPR analysis of BEIS (2020b); CCC (2019a)

It also worth pointing out, as figure 5.1 shows, that the vast majority of these installations came during previous iterations of ECO, which were generally better funded. Since then, as funding has been cut, the number of yearly installations has declined significantly.

FIGURE 5.1: THE NUMBER OF ECO INSTALLATIONS HAS DECREASED OVER TIME AND IS NOW FAR LOWER THAN THE ANNUAL NUMBER OF INSTALLATIONS REQUIRED TO MEET NET-ZERO BY 2050

Average annual number of energy efficiency installations over the lifetime of ECO compared to the number required to meet net-zero by 2050 in the housing sector



Source: IPPR analysis of BEIS (2020b)

THE RENEWABLE HEAT INCENTIVE (RHI)

From April 2014 to January 2020, only 77,000 low-carbon heating measures had been installed, of which approximately 55,400 were heat pumps (BEIS 2020c). Across the UK, this equates to an average annual number of heat pumps being installed of 9,233.[9] This is just 1.5 per cent of the annual average 628,000 heat pumps that will need to be installed to reach 19 million heat pump installations by 2050.[10] In a

8 Average installation rates based on a variety of sources providing different time periods.
9 IPPR analysis of BEIS 2020c.
10 IPPR analysis of CCC 2019a. Figure includes heat pumps already installed.

hypothetical net-zero scenario for 2030, the implied annual installation rate jumps to 1.88 million heat pumps per year.[11]

At the same time, government guidance continues to be orientated to increasingly antiquated heating solutions. For example, while the CCC envisages a small role for electric storage heaters, government guidance still prioritises this technology over more modern and efficient heat pumps for electric-only properties – of which there are 8.3 per cent in the social rented sector (MHCLG 2020c).

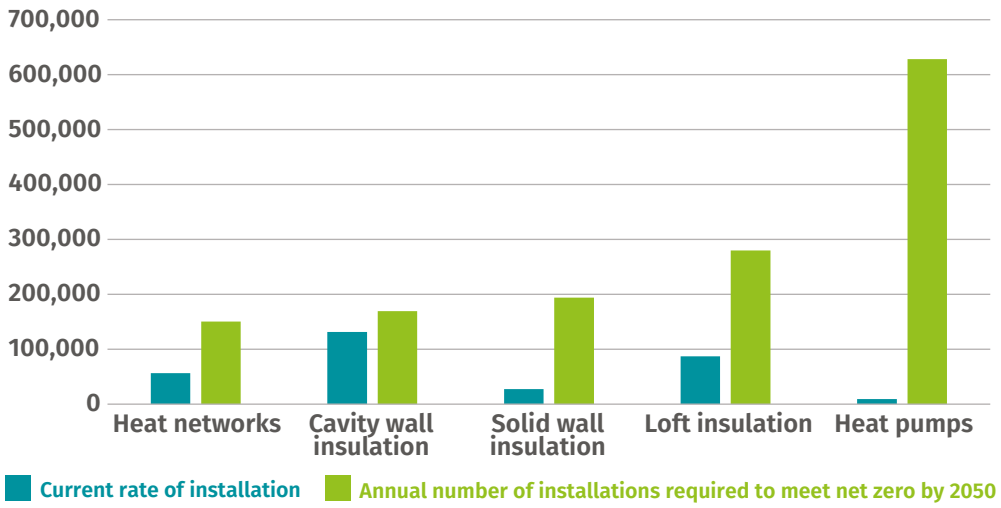
HEAT NETWORKS

Though progress has been made on ramping up heat network projects, the pace of delivery still needs to increase. Through the government's Heat Network Investment Programme and the support of the national coordinating body, the Heat Network Delivery Unit (Emden et al 2017), the government has committed £320 million to 2021 to help develop heat networks projects that are expected to leverage £2 billion in private finance (de Rochefort 2018). The Scottish Government has also committed to connecting 40,000 homes to heat networks by the end of 2020, representing 1.5TWh of heat demand (Scottish Government 2018). From 2013 to January 2018, the number of homes supplied by heat networks increased from 211,000 to 491,898, an average rate of 56,180 homes per year across five years (ibid). However, to reach five million homes by 2050 (CCC 2019a), this rate will need to increase to an average of 150,270 homes connected to heat networks each year.

Figure 5.2 illustrates how the number of installations for energy efficiency upgrades, heat networks and heat pumps[12] are all far behind the average annual number of installations required to meet a net-zero target by 2050.

FIGURE 5.2: THE AVERAGE ANNUAL NUMBER OF INSTALLATIONS ACROSS ALL LOW-CARBON HEATING TECHNOLOGIES IS FAR BELOW THE LEVEL NEEDED TO MEET NET-ZERO TARGETS BY 2050

Average annual number of installations across low-carbon heating technologies compared to the number required to meet net-zero by 2050 in the housing sector



Sources: IPPR analysis of CCC (2019a); de Rochefort (2018); BEIS (2020b); BEIS (2020c)[13]

11 Figure includes heat pumps already installed.

12 Averages calculated across different time periods using most recent available data.

13 Note: the Scottish Government has its own programmes that combine ECO money with other funding streams (Scottish Government 2020), meaning installations may be slightly higher than the total ECO measures recorded by BEIS. These figures only refer to energy efficiency measures and do not include other important considerations to help manage energy bills such as advice services and tariff management provided by Scotland and the Welsh Government's Nest scheme (Welsh Government 2020).

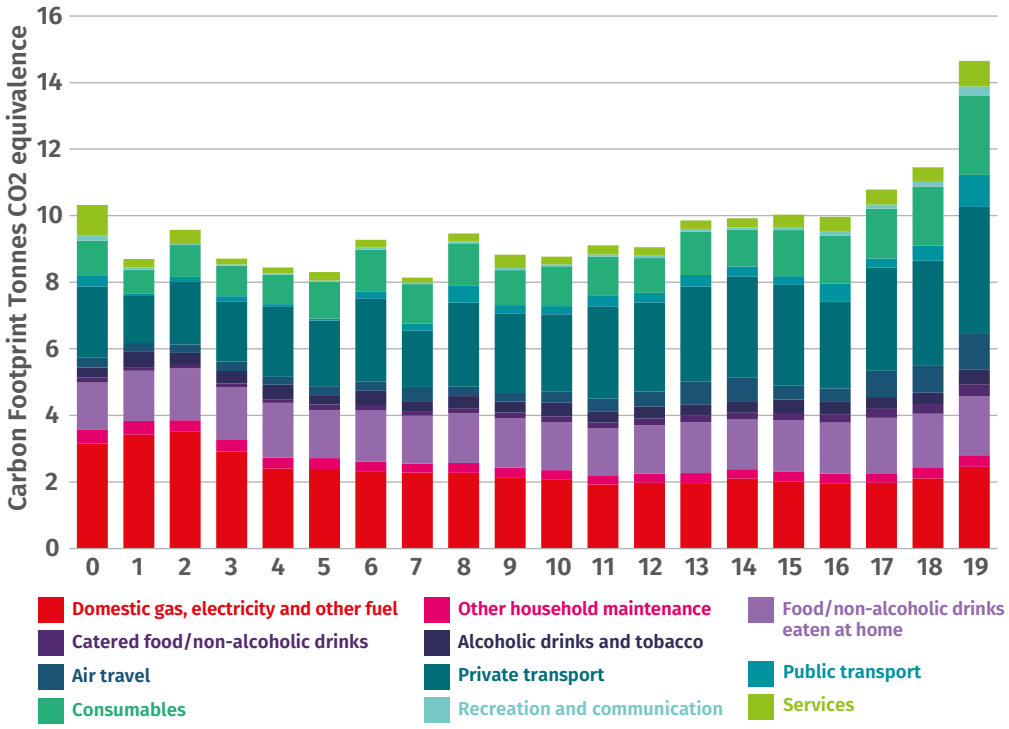
ENSURING COSTS ARE DISTRIBUTED FAIRLY

The cost-effective delivery of low-carbon heat remains a priority, however the three technology pathways presented by the CCC incur similar costs (CCC 2019a) so what matters more is how fairly those costs are distributed, and whether the pace and scale of policy initiatives match the number of homes that need to be retrofitted.

Those who are least responsible for emissions from the sector must not pay disproportionately for the cost of the transition. As IPPR's interim report for the Environment Justice Commission has found, the poorest households also have the lowest carbon footprints. As figure 5.3 shows, the highest earners have a 42 per cent higher carbon footprint than the lowest earners. Were it not for the poorest households having the least energy-efficient properties, their carbon footprints would be even lower.

FIGURE 5.3: POORER PEOPLE IN THE UK HAVE A LOWER CARBON FOOTPRINT THAN THE RICHEST[14]

Consumption emissions (CO2eq) per capita split by income across 20 quantiles and by activity (2016 data)



Source: University of Leeds Sustainability Research Institute (2019)

However, under current and proposed policy, the two most prominent home retrofitting initiatives – the Energy Company Obligation (ECO) and the Clean Heat Grant – are funded through on-bill financing and consumer-driven applications for grants respectively, neither of which distributes costs fairly.

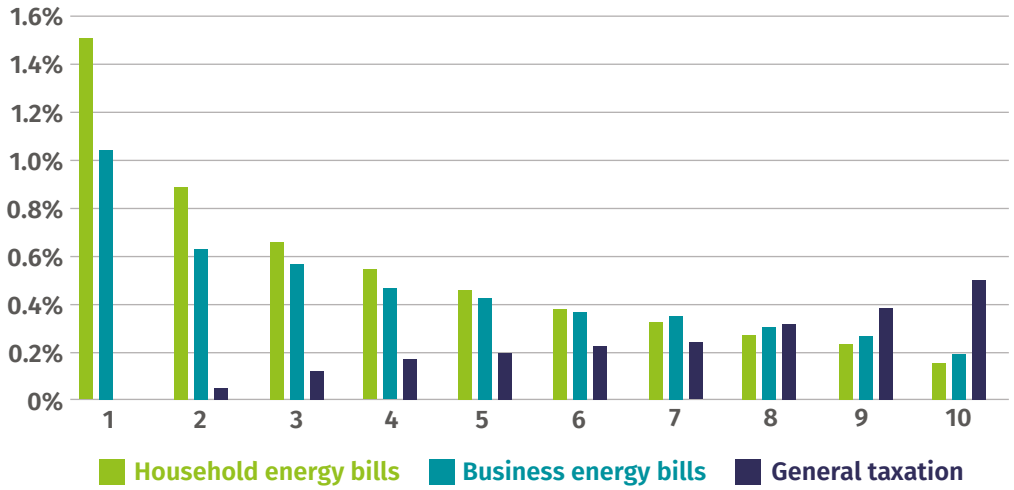
14 Data table for graph available on request – underlying data from licensed UK Data Archive.

ON-BILL FINANCING

Even though funding is drawn from all consumer bills to focus on delivering measures for fuel-poor homes, as figure 5.4 shows, with on-bill financing, poorer consumers end up paying more as a proportion of their income compared to alternative financing methods. While it is to be expected that lower-earning groups spend a larger proportion of their income on energy bills, and therefore on energy levies, the trend is exaggerated because many low-income households actually pay a higher rate for their energy, due to their exclusion from the lowest available energy tariffs (Garman and Aldridge 2015). The poorest households are also more likely to have energy-inefficient homes that further increases the cost of heating their homes (NEA 2018).

FIGURE 5.4: POORER HOUSEHOLDS PAY MORE FOR ENERGY EFFICIENCY UPGRADES AS A PROPORTION OF THEIR INCOME UNDER ON-BILL FINANCING FROM THE ECO SCHEME

Proportion of household income required to meet different energy policy funding approaches



Source: Barrett et al (2018)

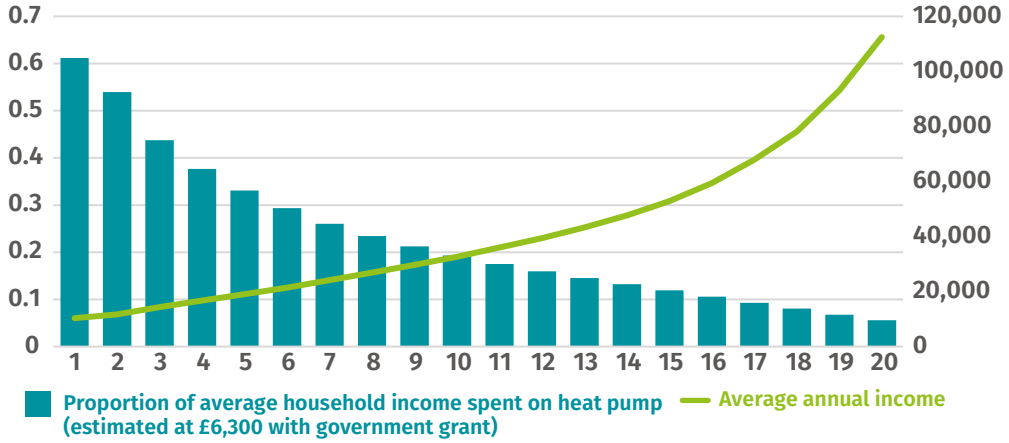
GRANTS AND SUBSIDIES

As mentioned above, the Renewable Heat Incentive has seen very little uptake of low-carbon heating technologies like heat pumps and it is due to end in March 2021. The UK government is currently consulting on a new low-carbon heat scheme to replace this. This scheme will complement a wider £9 billon investment for energy efficiency measures planned over the next decade (BEIS 2020d). This proposal outlines investment in green gas through biomethane injection, as well as a new Clean Heat Grant scheme that will offer households cash grants of £4,000 towards upfront installation costs of heat pumps (ibid).

While this Clean Heat Grant is a step in the right direction and identifies heat pumps as a key technology, the upfront costs are still likely to be prohibitive for many homes and will inherently favour higher-earning households. Even with cash grants of £4,000, households must still pay approximately £6,300 to have a heat pump installed in their home (BEIS 2020d). The government's rationale for this is that, below £7,000, consumer acceptability begins to rapidly increase uptake (ibid). However, for many, this is simply unrealistic. As figure 5.5 shows, the cost of a heat pump with government grants would still be as much as 61 per cent of the annual household income for the poorest homes.

FIGURE 5.5: EVEN WITH A £4,000 CASH GRANT, THE COST OF A HEAT PUMP IS UNAFFORDABLE FOR MANY HOUSEHOLDS AND INHERENTLY FAVOURS WEALTHIER HOMES

Cost of a heat pump with government grant as a proportion of household income



Source: IPPR analysis of BEIS (2020d); University of Leeds Sustainability Research Institute (2019)

Furthermore, in order to optimise heat pump performance (CCC 2019a), reduce disruption and ensure that household energy bills are minimised or reduced, it is highly likely that many properties will need to receive energy efficiency retrofits in addition to heat pumps. These additional measures could add several thousand pounds onto the cost of retrofitting a home, making applications for grants or incentives even less likely or heat pump performance less effective. Finally, to even make applications, households need to be aware of what heat pumps actually are. A recent BEIS survey suggested that only a third of people were 'aware' of ground source heat pumps and just over a quarter were aware of air source heat pumps (BEIS 2019b).

ENSURING ACCESS TO CAPITAL

In the absence of sufficiently ambitious, or fairly distributed, programmes and incentives, households across all tenures will struggle to retrofit homes on their own. Table 5.2 shows how the same challenge manifests differently across each tenure type.

TABLE 5.2: THOUGH EVERY TENURE TYPE FACES SPECIFIC CHALLENGES, THEY ALL INVOLVE BEING UNABLE TO ACCESS AND RELEASE CAPITAL

Financial barriers by tenure type

Owner-occupied	Private rented	Social rented
Prohibitive upfront costs and lack of access to capital support Doubt over whether upgrades will add value and/or reduce energy bills Payback period of upfront cost may not be long enough for the time the homeowners plan to live there	Prohibitive upfront costs and lack of access to capital support No incentive for landlords as they do not pay the energy bills that would benefit from low-carbon heating and energy efficiency upgrades – it is only a cost for them	Prohibitive upfront costs and lack of access to capital support Funding programmes can take a long time to be approved Short-term government grants may not fit with longer-term investment plans Housing associations face higher borrowing interest rates than local councils

Source: GFI (2020)

6. OVERCOMING HURDLES TO IMPLEMENTATION

Even if the scale of the funding challenge is recognised by a substantial increase in investment, the costs of a retrofitting programme are distributed fairly and capital is accessible to all, there are still several, key, non-financial barriers that could threaten the implementation of any scheme.

DISRUPTION TO HOUSEHOLDS

Delivering low-carbon heating systems and energy efficiency upgrades to the majority of the UK's existing housing stock will be very disruptive both for households and for local infrastructure. For example, developing heat networks in urban areas will lead to extensive roadworks while new pipes are laid (Emden et al 2017). Installing heat pumps, energy efficiency upgrades and, where necessary, additional water tanks will also be disruptive for many households directly. The increased electricity demand from heat pumps on local electricity networks may also require network operators to deploy more cabling that, as with heat networks, may lead to increased roadworks and disruption to daily commuting.

As such, awareness-raising and early communication will be crucial in allowing people to make preparations for their homes to be retrofitted, particularly in cases where residents may have special requirements, such as being a primary carer or having disability needs. In addition, as we discuss in chapter 8, a 'whole-house approach' could be an important installation method to ensure that households experience maximum performance and minimal disruption as opposed to a series of installations over a number of years.

TENURE TYPE

Housing tenure types can also hinder the pace of deployment even if applying for a low-carbon heating grant would be desirable to homeowners or tenants. For example, currently private renters need to approach landlords and ask them for either new heating systems or energy efficiency upgrades. Depending on the technology being installed, even owners of flats on leasehold may require consent from the freeholder of the land. This could prove complex in areas where there are mixed estates of market and sub-market housing (Bright et al 2019). Finally, the nature of social housing means that many tenants will be reliant on their providers to undertake retrofit. This will give them less control over the process and may exacerbate a feeling of disruption to their lives.

HOUSEHOLD SUITABILITY

The CCC highlights that for a sizeable minority of homes, heat pumps will be difficult or impossible to install due to concerns around building safety, space constraints or the heritage nature of some homes – approximately 1.3 million fall into this category in the UK (CCC 2019a). This is particularly true for rural and off-grid communities where the archetypes and housing stock can be less well known (FREE 2013). While low-carbon heat can be provided to these homes by alternative technologies, the disruption experienced to these homes is still likely to be

substantial, making residents unlikely to apply for upgrades of their own volition. Some homes may also require additional measures such as passive cooling to make homes comfortable in all weather conditions.

Suitability is a particularly challenging issue for social landlords. Retrofitting all homes in the social rented sector will require navigating the significant variations in the geography and stock quality of different providers. While some providers with newer and more uniform stock can undertake retrofit work more cost effectively and quickly, other providers will need time and support to improve their housing stock. There is currently a lack of support to help providers who most need it and support is not currently based on the capacity and need of the provider.

LOCAL CAPACITY

Local stakeholders, whether councils, combined authorities, city regions or housing associations, are best placed to deliver low-carbon heating systems and energy efficiency upgrades. In part, this is because local government is consistently more trusted than national government, even while experiencing severe budget cuts that limit the services that it can provide (LGA 2018). However, this is also because local government has a better understanding of where the poorest households are in its wards and therefore who to prioritise (Marsh 2019), particularly for energy efficiency upgrades that can reduce energy bills (Emden et al 2018). Furthermore, in the case of the social rented sector, as discussed in chapter 3, many social landlords have a good track record of maintaining and improving the living standards of their tenants. Finally, many local councils have declared a climate emergency and are already developing high-quality plans for the action they need to take.

Currently however, many councils have had their budgets cut in real terms by nearly 50 per cent between 2010 and 2018 (NAO 2018). This has severely limited their ability to identify priority households, develop capacity to produce clear procurement guidelines and tenders, and oversee programmes. This could also result in a 'postcode lottery', where some local authorities that have not experienced such deep cuts are able to deliver a more comprehensive approach, while others struggle to fulfil even their core competencies (Platt et al 2013; ACE et al 2015; Citizens Advice 2016; CFP 2017). Finally, councils lacking the capacity to deliver a scheme may be more likely to outsource responsibility for the management of delivery. If not done effectively, this could result in less transparent quality control.

For the social rented sector specifically, there is a significant shortfall in financial support available to providers that limits the purchasing of the technologies themselves and may limit the internal capacity to even consider them, despite a willingness to do so. It is therefore unrealistic to expect housing associations to retrofit existing stock through their own finances given the scale of the challenge.

AVAILABILITY OF SKILLED INSTALLERS

The demand for jobs in the low-carbon heating sector is likely to be substantial in the coming decade. However, this demand will also require rapid upskilling, reskilling and training to ensure required installation rates are met. However, a survey of the installer industry showed that 43 per cent of installers had no experience at all in fitting heat pumps and only 42 per cent said they would be confident installing one (HPA 2019). This also does not reflect that to ensure optimum performance, energy efficiency measures would also need to be installed, meaning that installers may also need to have experience of whole-house retrofitting.

This new demand comes at a time when the skills system as a whole is already struggling to prepare for future skills demands across the low-carbon energy sector. These challenges include but are not limited to:

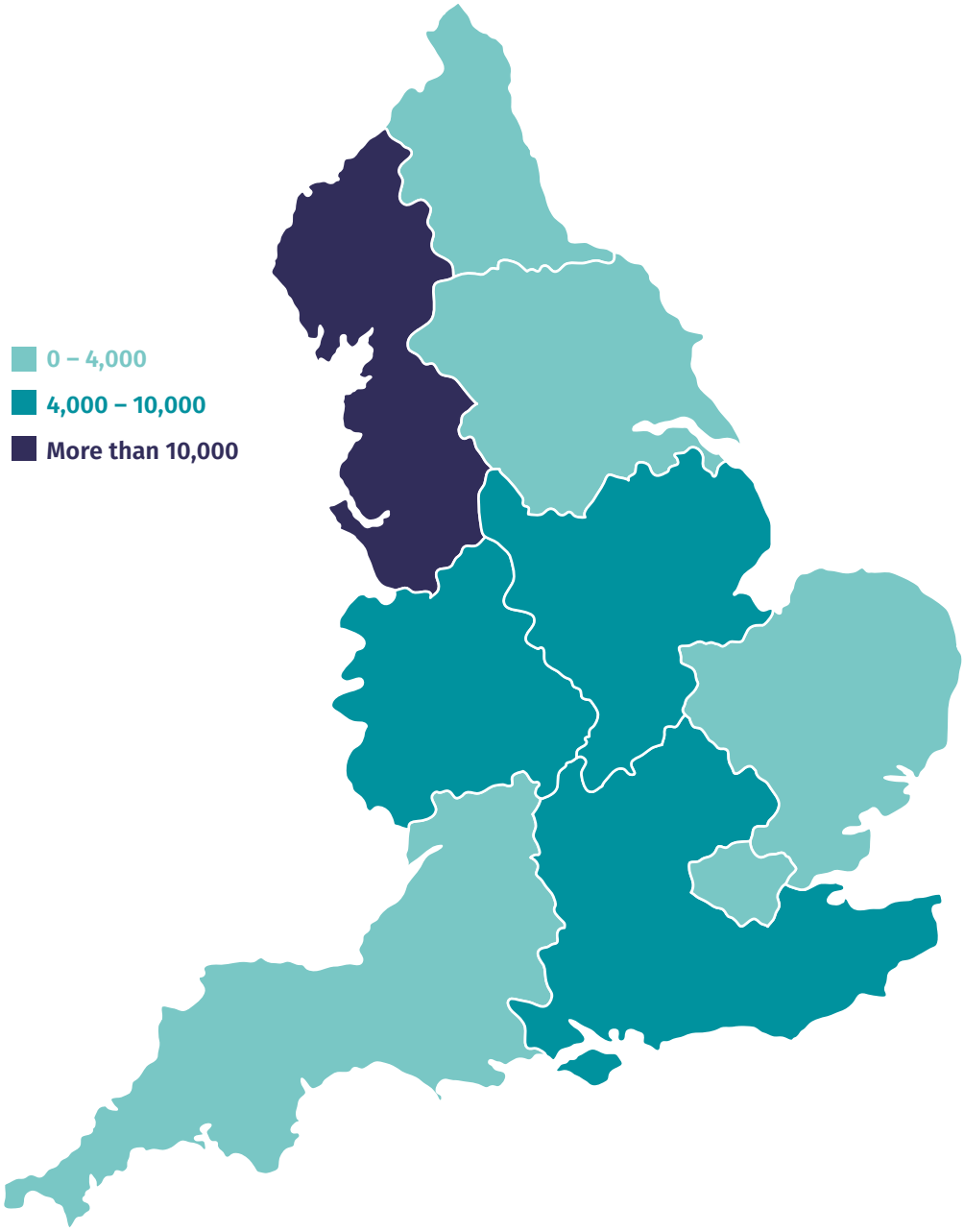
- **Insufficient funding for adult retraining:** The provision of adult retraining in the UK is particularly poor. As IPPR's Skills 2030 report finds, the UK lags behind other developed economies when it comes to adult skills, with funding for adult skills training expected to be cut in half from 2009/10 to 2020/21 (Dromey and McNeil 2017).
- **Limited skills devolution for local economies:** Though the Adult Education Budget has been devolved, not only has the overall funding pot been reduced, but the vast majority of local budgets must be spent on nationally defined obligations rather than providing regional authorities with the flexibility to invest according to local needs (Round 2016).
- **Lack of appropriate training:** To some extent, a lack of appropriate training is a product of policy uncertainty as businesses are less likely to provide training if they do not know what the direction of the market will be. However, it has also been found that a limited number of training courses are being offered with technical skills and knowledge that are specific to the low-carbon energy sector which limits existing technicians' ability to upskill (Brennan and Limmer 2015).
- **Lack of commonly recognised accreditation across the industry:** Given previous findings by the Bonfield Review that up to 10 per cent of energy efficiency measures under the Energy Company Obligation were poorly installed (Bonfield 2016), a common quality assurance standard will be crucial to ensuring effective delivery and people's trust.

JUST TRANSITION SUPPORT

It is important to recognise that there will also be job losses in the low-carbon heat transition. According to IPPR analysis, as figure 6.1 shows, up to 30,000 jobs in the production of gas for heating could be at risk in England.

FIGURE 6.1: A SIGNIFICANT NUMBER OF JOBS IN ENGLAND, PRIMARILY CONCENTRATED IN THE NORTH WEST, ARE AT RISK WITH THE MOVE AWAY FROM GAS

Number of jobs at risk by English region



Source: IPPR analysis of BRES (2020)

Some workers in gas mains roles will still be needed to supply industries with hydrogen in a net-zero future. In addition, more workers will be needed in the gas industry if hybrid heat pumps topped up by hydrogen boilers become a commercially viable and preferred technology pathway (CCC 2019a). Nevertheless, it is likely that some degree of scaling-down will be experienced.

7. HOW TO PAY FOR IT

The CCC estimates that £15 billion will be required each year to reduce all emissions from buildings by 2050 (including domestic and non-domestic) (CCC 2019a). Using English Housing Survey data, we estimate that retrofitting the majority (12 million) of homes below and EPC band of C in England with heat pumps and high energy efficiency standards will require significant investment at approximately £10.6 billion per year through to 2030, reducing to £7 billion per year from 2030 to 2050 (MHCLG 2020b).[15] For the 1.76 million social-rented homes below an EPC of band C social-rented sector, this would require at least £3.6 billion per year to reach this target by 2030 or £1.2 billion per year by 2050. This chapter discusses a variety of financing options and ultimately concludes that the cost of retrofitting should be divided evenly, taking a blended approach of public and private financing options.

PUBLIC PROVISION OF FINANCE

Public sector money can be injected in two ways: investment spending as part of a debt-financed recovery package and spending on low-emission housing funded through concurrent tax increases.

Public investment spending

The current economic outlook for the UK shows an unprecedented retraction of the economy in 2020. Under such circumstances, a debt-financed fiscal recovery package will be essential to replace lost demand and support struggling industries. By increasing borrowing to invest in job preservation and further job creation, the government can ensure that tax revenues increase due to more people being employed. This will ensure that increased debt is serviced through higher levels of employment, rather than through increases in tax rates (although, as we discuss below, small increases could be considered in future). It is also a particularly attractive time to borrow due to record low interest rates, with some recent bonds even trading at negative yields as a result of the market being highly risk averse (Thorpe 2020). Consequently, from a purely macroeconomic perspective, it makes sense to borrow to invest in retrofitting homes with low-carbon heating and energy efficiency given the benefits outlined in chapter 2.

Public spending funded by taxation

Investing in home retrofitting will require sustained investment over 30 years. Therefore, to balance against more immediate increased borrowing and to hedge against the possibility of the cost of borrowing increasing in future, alternative public funding options could be explored. One of the fairest ways to fund these types of investments could be through general taxation. As discussed in chapter 5, current policy is neither ambitious enough, nor does it distribute costs fairly. Indeed, even under proposals for a Clean Heat Grant, it is very unlikely that a cash grant scheme would be able to deliver the number of heat pump installations required by 2050 due to the financial barriers that many homes would still face.

15 Figures are calculated for England only and costs are not calculated for heat networks in this report, but their uptake is taken into account. Population density is higher in England meaning numbers are adjusted to allocate more heat networks to this region. In the absence of more granular data, we assume the ratio of heat pumps to heat networks is the same across all housing tenure types.

By comparison, general taxation is a far more equitable solution for raising funds and is starting to gain more attention as a viable financing option. For example, the CCC's most recent progress report to parliament has recommended a tax on gas heating as a means of funding retrofits and incentivising change while protecting vulnerable customers (CCC 2020). An alternative approach could be a progressive increase in income tax. According to analysis from IPPR's Tax Benefit Model (see table 7.1), in comparison to the government's Clean Heat Grant where the poorest households would pay over 60 per cent for the upfront cost, a taxation approach would mean these homes pay nothing or very little.

Our analysis presents two taxation approaches. The first option proposes no increase to the basic rate of wage-based income tax, a 1 percentage point increase to the higher rate and 1.5 percentage point increase to the additional rate. The funds raised through this method are equivalent (approximately £2.5 billion) to the average annual cost of the government grant scheme in a scenario where it delivered on average 628,000 heat pump installations per year (the number required to meet net-zero targets by 2050).

By way of comparison, in the second scenario, we apply a 0.5 percentage point increase on the basic rate of income tax, a 1.25 percentage point increase on the higher rate and a 2.75 percentage point increase on the additional rate. This hypothetical scenario would raise almost all the funds (just over £6 billion per year over 30 years) to pay for the full cost of heat pumps[16] at the same rate of installation as the first scenario. While we do not advocate for these tax increases, they are illustrative of how large sums of money could be raised to pay for heat pumps while still being progressive and costing most households very little.

TABLE 7.1:[17] A TAXATION APPROACH TO FUNDING HEAT PUMPS COULD RAISE THE SAME MONEY AS A GOVERNMENT GRANT SCHEME BUT FAR MORE FAIRLY

Table showing funds raised based on given increases to each tax band according to IPPR Tax Benefit Model analysis

	Low-tax scenario	High-tax scenario
Funds raised		
£bn (2019/20)	2.6	6.3
Percentage point increase in tax (%)		
Basic	0	0.5
High	1	1.25
Additional	1.5	2.75

Source: IPPR Tax Benefit Model (2020)

It is important to note that this scenario for increases to taxation has only been explored for the delivery of heat pumps, primarily because, as shown in chapter 5, this technology has the biggest gap in the current number of annual installations compared to what is required to meet net-zero targets. However, as also discussed energy efficiency also requires a significant ramp-up in the scale of funding and, as IPPR has previously called for, this could also be funded through general taxation rather than the regressive method of on-bill financing (Emden et al 2018) (see figure 5.4 in chapter 5).

16 Assumed to be £10,300 and assuming no cost reductions. In reality, as we discuss below, cost reductions of 20 per cent are realistic and tax could be reduced over time to account for this.

17 Taxation scenario based on 2019/20 tax year to illustrate fairer distribution. Revenues for 2020/21 will likely be lower due to the Covid-19 pandemic. Includes Scotland income tax rates where increases to UK basic rate are equivalent to increases in starter, basic and intermediate rates in Scotland.

Additionally, by prioritising borrowing as the primary financing option, any future increases in tax may not be required as the cost of manufacturing heat pumps comes down over time. The modularity of heat pumps makes them an attractive candidate for fast cost reductions if they can be deployed at scale, as has been the case for technologies like solar panels and batteries (Ralon et al 2017). The CCC, for example, has estimated that the cost of heat pumps could be reduced by 20 per cent by 2030 (CCC 2019a) if a rapid scale-up of hundreds of thousands of units can be achieved (Foster et al 2017).

PRIVATE PROVISION OF FINANCE

In any scenario, a sizeable proportion of the funding will still need to come from the private sector. In this sense, government funding should be used to 'crowd in' private capital, for instance guaranteeing individual or bundles of loans provided to homeowners, to make them more attractive for private financial institutions. This could also be targeted to fund additional retrofit activity in the social rented sector and across other tenures. This approach would balance ensuring the poorest homes do not face regressive increases to their energy bills with providing decent rates of return for private investors.

This scenario would require an exploration of different financial models to attract private finance. An example of how such a model could function is provided below (Retallack et al 2017):

1. **Aggregate:** Local government selects and packages together clusters of candidate homes on a large enough scale to attract private investment.
2. **Securitise:** Securitise the investment into technologies being retrofitted to the aggregated pool of homes to increase market liquidity. In addition, the government could own the most junior tranche of zero-carbon home securities, leaving it to private investors to own the less risky tranches.
3. **Procurement tenders:** Local government issues competitive tenders to procure whole-house low-carbon heating and energy efficiency retrofits for the pooled properties.
4. **On-bill repayments:** Once retrofits are complete, a proportion of the energy bill payments from the pooled properties are paid back to the private investors. Crucially, any indirect payments to investors through energy bills would have to be more than offset by reductions in energy bills due to lower running costs for homes with the new low-carbon heating systems and energy efficiency upgrades.

Developing these private finance channels can be further encouraged through other green finance schemes (see box below). Ensuring that lenders offer attractive rates for housing retrofit will require action from other financial institutions and a change in monetary policy from the Bank of England towards green investment. This will require hardwiring action on climate change into the UK's financial policy framework, if green finance is to take off at scale. Ensuring green finance is incentivised will also require other actions to grow the size of the green bond market and disincentivise funding for carbon-intensive technologies.

One option for lowering the cost of financing to consumers and to incentivise private investment might be the use of the government's UK Guarantees Scheme.[18] As argued by Hall and Caldecott (2016), comparable schemes in France and Germany provide similar cheap financing for green initiatives.

18 See: https://www.gov.uk/guidance/uk-guarantees-scheme#:~:text=The%20UK%20Guarantees%20Scheme%20(%20UKGS,finance%20in%20the%20financial%20markets.

GREEN FINANCE

Green finance initiatives require linking housing assets to environmental criteria such as discounted interest rates on mortgages for more energy-efficient homes. Currently, however, such schemes only apply to new-build homes (Black 2018). A similar model could be operated for homeowners and landlords wishing to re-mortgage. Furthermore, for the social rented sector, private lenders who invest in housing associations could offer a more substantive range of products that are linked to energy efficiency in order to incentivise providers to undertake retrofit work.

Despite relevance across all tenures, this financing scenario recognises that solutions will also need to be tailored. Whereas small private landlords or homeowners may be able to benefit from personal loans, housing associations typically finance their activity through much more expansive borrowing streams. However, at the moment, housing associations face higher borrowing costs than local authorities, yet retain the majority of social rented stock. Parity will need to be achieved between these borrowing rates to accelerate housing retrofit.

Finally, Government Guaranteed Social Housing Finance could further develop the supply chain across all tenures by providing a guarantee mechanism to support retrofit in the social rented sector. This could stimulate demand and drive growth in the supply chain by altering the risk profile of housing retrofit, positively impacting the availability and costs of capital from private sector sources.

Source: GFI (2020)

THE ROLE FOR DNOS

Distributed Network Operators (DNOs) will have a critical role in managing local electricity demand and the physical cables that connect the electricity grid to our households. As heat pumps that use electricity are installed at scale, local energy demand will require more careful balancing and, where necessary, laying more cables to support additional demand.

In specific circumstances, DNOs may have a role to play in the delivery of heating upgrades as well. Given that they have responsibility for managing energy demand on these local grids, there are clear system benefits to DNOs if they are delivering energy efficiency and low-carbon heating upgrades. DNOs can therefore contribute to the financing of retrofit activity. One option could be a scheme that is funded by DNOs through the RIIO price framework – the Returns = Incentives + Innovation + Outputs model under which these networks operate (ACE et al 2015). This is because this framework is designed to ensure that the network cost portion of the bill stays as low as possible and, if possible, results in bill reductions due to profits being shared between DNOs and consumers (ENA 2017).

However, this proposition faces two major challenges. First, DNOs do not have specific expertise in building energy efficiency or low-carbon heating systems and would therefore be just as reliant on local authorities supporting them and equally likely to subcontract to third parties, thereby reducing transparency. Second, while it is possible under the RIIO framework for savings from energy efficiency upgrades to be shared with customers (National Grid 2018), the actual raising of funds would still be a de facto regressive levy on bills. It would therefore face the same problem of disproportionately penalising the poorest consumers. Consequently, our preferred extent of involvement from DNOs would be for them to provide investment where there were obvious energy savings to be made, which

would help them to defer the cost of upgrading the network and make savings for themselves and consumers.

SUMMARY OF FUNDRAISING PATHWAYS

Having assessed the various ways in which an ambitious retrofit programme could be financed, we conclude that a blended approach that divides the cost of retrofitting evenly – drawing on government borrowing at record low interest rates combined with private finance – represents the most effective, fair and sustainable way in the short term of funding the retrofit of homes in the social rented sector and across other tenures. The government may wish to consider a different blend of options in the medium to long term, depending on economic conditions.

8. DELIVERY OPTIONS

Regardless of which means of financing is chosen (public, private or a blend), there will need to be a substantial increase in local and national government capacity, governance arrangements and supporting policy (for example, in skills and securing a just transition) to actually deliver a cohesive and ambitious low-carbon heating plan. This chapter outlines three possible options for designing a policy framework to deliver retrofit. It provides an overview of these options and offers conclusions on why we believe option 2 is the most appropriate path. Fundamental to the decision on which delivery pathway to adopt is the tension between consumer choice and the pace of change. A summary of the delivery options is shown in table 8.1.

TABLE 8.1: POSSIBLE DELIVERY OPTIONS FOR ENCOURAGING THE UPTAKE OF LOW-CARBON HEAT SOLUTIONS

Option 1	Social tenants	Private rented sector	Homeowners
Main body for coordinating retrofit	Local government in collaboration with registered providers	Local government in collaboration with landlords	Local government in collaboration with homeowners
Summary of policy framework	Investment delivered directly to local government to undertake retrofit work across all tenures, prioritising fuel poor homes	Investment delivered directly to local government to undertake retrofit work across all tenures, prioritising fuel poor homes	Investment delivered directly to local government to undertake retrofit work across all tenures, prioritising fuel poor homes
Level of consumer choice for households	Low	Low	Low
Pace of change	High	High	High

Option 2	Social tenants	Private rented sector	Homeowners
Main body for coordinating retrofit	Local government in collaboration with registered providers, prioritising fuel poor homes	Landlords (can opt-in to a scheme coordinated by local government achieving lower costs through aggregation and economies of scale). Local government works with landlords to identify and prioritise fuel poor homes	Homeowners (can opt-in to a scheme coordinated by local government achieving lower costs through aggregation and economies of scale). Local government identifies and advertises to fuel poor homes
Summary of policy framework	Disbursement of support through Social Housing Decarbonisation Fund and proliferation of private finance initiatives to providers and local authorities. Enforcement by Regulator of Social Housing	Low-costs loans made available to landlords. Improved MEES standards to ensure compliance with similar standards to those enforced in social rented sector. MEES gradually brought up to a minimum of B, with an exception of C for hard-to-treat stock by 2030. MEES also applied at point of sale or when other renovations are carried out. The target standards could be increased over time. Exemptions for certain households and properties.	Grant to cover at least half the cost of installing a heat pump. Means-tested grants for homeowners who need further financial assistance. Link established between property value and energy efficiency through reforms to council tax and/or stamp duty to incentivise uptake of retrofit work. MEES introduced for all private residential properties applied at point of sale or when other renovations are carried out. The target standards could be increased over time. Exemptions for certain households and properties.
Level of consumer choice for households	Low	Medium	Medium
Pace of change	High	High	Medium

Option 3	Social tenants	Private rented sector	Homeowners
Main body for coordinating retrofit	Local government in collaboration with registered providers	Landlords	Homeowners
Summary of policy framework	Disbursement of support through Social Housing Decarbonisation Fund. Emphasis on private finance as primary instrument for supporting decarbonisation work. Enforcement by Regulator of Social Housing	Low-cost loans available for energy efficiency and heat pumps. Improved MEES standards. Continuation of ECO for fuel-poor homes in the sector.	Grant of £4,000 towards the cost of installing heat pump and voucher scheme for energy efficiency. Low-cost loans also available for energy efficiency and heat pumps. Continuation of ECO for fuel-poor homes in the sector
Level of consumer choice for households	Low	Medium	High
Pace of change	High	Medium	Low

Source: Authors' analysis

OPTION 1: STRONG GOVERNMENT INTERVENTION TO MAXIMISE THE PACE OF CHANGE

A policy pathway that seeks to achieve retrofit as fast as possible across all tenures driven by national and local government, both in terms of finance and delivery. This pathway would primarily be led by local authorities, with coordinating support from national government. Delivery and financing by the local authority would be mandatory for all properties in all tenures, with the local authority carrying out assessments and deciding the timing and extent of any works. An area-based approach (see box) would be adopted, which makes extensive use of heat zoning. Heat zoning would involve creating a map of heat demand in a given area to identify and prioritise homes that need upgrades the most. This approach would achieve whole-house retrofit across tenures under this model to minimise disruption and maximise delivery speed.

A strong role for local government

As discussed in chapter 6, local government and local housing providers are more aware of the different types of housing stock in their areas and more attuned to the needs of residents than non-local organisations and national government (Marsh 2019).

To deliver the decarbonisation of heat at sufficient scale, a lot will be asked of local government. Roles and responsibilities would include (Emden et al 2018):

- Developing heat maps of local areas to inform an area-based approach that determines which technologies are most suitable, how homes should be clustered together to make installation as efficient as possible and which (ie fuel poor) homes should be prioritised.
- Using councils' heat maps – where private finance is involved – to cluster properties into an aggregated package, calculate the expected returns through energy bills and offer these packages to private finance through issuing bonds.
- Issuing competitive tenders to installers with clear, high-quality procurement guidelines.
- Overseeing and monitoring delivery.
- Informing and communicating with households about the need to have their homes retrofitted and the benefits associated with this.
- Providing advice to households and coordinating with national advice services to deliver a consistent message. This will involve advice on how the new heating systems operate and energy-saving advice once the systems are installed.

DELIVERING RETROFIT THROUGH AREA-BASED APPROACHES

Under this option, England would follow Scotland's and Wales's examples by adopting an area-based approach led by local authorities to deliver a low-carbon heating and energy efficiency programme. An area-based approach would be more effective than targeting individual households for several reasons (Howard 2015).

First, where fuel-poor and non-fuel-poor households are located in the same place, local authorities would be able to upgrade all households together on a street-by-street basis. While this would lead to some leakage of spending on non-fuel-poor consumers, it has the potential to be offset by the cost effectiveness of upgrading multiple properties at the same time (ACE et al 2015). Second, it would avoid a piecemeal delivery of solid wall insulation, which may result in unnecessary heat loss, disruption to neighbours and the stigmatisation of individual households (ibid). Finally, identifying specific areas that should receive energy efficiency upgrades can be an effective way of identifying and addressing synergies with other local authority priorities at the same time, such as regeneration and health and wellbeing (ACE et al 2015).

Many councils in the UK have already declared a climate emergency and many have set out plans that detail how they will approach the challenge (CACC 2020). As recent studies have shown, just under 40 per cent of local councils are undertaking multiple low-carbon energy projects already (EEIG 2020). However, as discussed in chapter 6, many local councils still lack the resources and capacity to deliver on ambitions without increased government support.

To resolve the challenges, the simplest and most effective answer would be to fund all local government properly. IPPR has previously estimated that an investment of £40 million in recruitment, training, data analysis and research could secure a net benefit of £90 million in energy efficiency schemes alone (Platt et al 2013).

Coordinating body at national level

While delivery will need to be local, coordination and support will be needed at a national level. As an example of positive national coordination, the Heat Networks Delivery Unit has been successful in supporting local councils to develop heat mapping in their local area to inform which homes are most suitable for heat networks, how homes should be grouped together during installation and which areas should be prioritised.

Decarbonising the whole residential sector will be much more complex, as local authorities will have to choose which technologies are most appropriate between heat networks, heat pumps and, in some cases, other technologies like electric storage heaters or hydrogen or biomethane boilers. In all cases, taking a whole-house approach will require energy efficiency measures being installed regardless of the heating system chosen. Supporting local government through a national coordinating body of experts will therefore be critical in helping them to decide between technologies and set out consistent procurement guidelines. A national coordinating body would have the following roles and responsibilities:

- Supporting local authorities in developing heat zoning of their local area.
- Supporting local authorities with advice and clear guidelines on how to decide technologies.
- Working with industry to develop, monitor and verify consistent training standards.

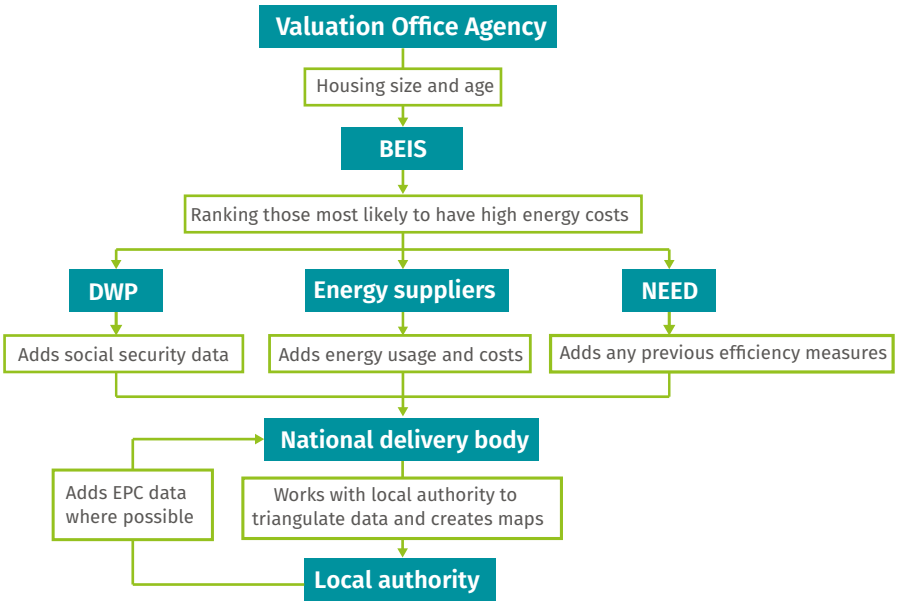
Greater data-sharing

To conduct heat mapping effectively and prioritise upgrades – particularly energy efficiency measures for fuel-poor consumers – local government needs to know where the poorest households are and understand how much energy they are using. While local authorities are generally better placed than national government to understand this, data-sharing between institutions and government departments could substantially improve identification, prioritisation and targeting.

In figure 8.1, we propose a data-sharing approach which could achieve these objectives. With the relevant organisations working together to share data, this should give local authorities a clearer picture of households' energy efficiency, their income, existing social security arrangements and their energy usage.

FIGURE 8.1: DATA-SHARING BETWEEN MULTIPLE NATIONAL AND LOCAL GOVERNMENTAL ORGANISATIONS WILL BE CRUCIAL TO IDENTIFYING HOMES MOST IN NEED OF COST-SAVING UPGRADES

How data can be shared between governmental organisations



Source: Adapted from Emden et al (2018)

The role for regulation

Current attempts to meet EPC targets are frustrated by lack of strong and consistent regulation. To date, much of the social rented sector's success is a result of the sector's determination to meet high housing standards and the impact of the Decent Homes Standard and Decent Homes Programme. Under this delivery option, new regulation would set high energy efficiency standards above EPC C. As responsibility for carrying out retrofit would rest with local government, the main responsibility on homeowners and landlords would be to guarantee access to properties to ensure retrofit work could take place. Local authorities would need to use existing powers related to entry of properties (such as those contained under the Building Act 1984) to ensure work could take place under this pathway.

Financing

Under this pathway, the costs of retrofits would be borne by national government. The degree of compulsion required, with local authorities coordinating and delivering improvements, would require that the state pay for the full costs for all tenures.

OPTION 2: ACCELERATED ACTION AND ENHANCED CONSUMER CHOICE

This pathway would involve local government playing a key role in coordination efforts across local authority areas, with the support of national government. Much of the policy architecture proposed in option 1 (such as an area-based approach, heat zoning and data-sharing) would be retained but on a smaller scale. In the case of the social rented sector and fuel-poor homes, this heat zoning would give housing providers, landlords of fuel poor properties and fuel poor homeowners guidance on the improvements they need to make, and local authorities would work closely with the Regulator of Social Housing to ensure compliance.

In the case of other tenures, homeowners and private landlords would have the option of opting-in to the area-by-area scheme being delivered by local authorities and would be encouraged to do so in the case of fuel poor homes (similar to that described in option 1). Homeowners and private landlords would gain through the cost savings achieved as a consequence of aggregation and delivering at scale. Extensive financial support would be made available in the form of means tested grants for homeowners, low cost green finance loans for homeowners and landlords and the roll-out of valuation options to help homeowners and landlords pay for retrofit work if their income or savings are limited.

A mix of government subsidy and private finance mechanisms

The government would provide enhanced support to lower income households to ensure retrofit work can be undertaken. For social rented tenants, the work would be undertaken by housing providers on the tenants' behalf at no upfront cost to the households. For homeowners, support would take the form of means-tested grants topped up with low-cost loans. Private landlords would be able to apply for low-cost loans if they could not afford to undertake retrofit work from their income or savings.

An effective means for delivering this support for the social rented sector would be the proposed Social Housing Decarbonisation Fund (Cross 2019). However, this fund will need to deliver far more than the government's proposed £380 million per year over 10 years (£3.8 billion total) if the social rented sector is to meet its retrofit ambitions. For example, based on our calculations in chapter 7, even covering half the cost of retrofitting homes in the social rented sector would require £1.8 billion per year over the same period of time.

Under this option, the money given to the sector through the Decarbonisation Fund would be matched with private finance through models like Energiesprong (Energiesprong 2019; Energiesprong 2020). Attractive borrowing rates would need to be offered to the social rented sector to ensure retrofit can be delivered at scale. Social landlords would need to play a crucial role in developing their business plans around retrofit and ensure they are working to secure private finance.

A means-tested grant-funding model could help support retrofit activity for homeowners. Under this model, different levels of support would be offered to households based on either their income or property value, or a combination of both. This approach would ensure that those who need more financial support to retrofit their homes would benefit from larger grants, whereas those households who could afford to retrofit their homes would receive less support on the basis that they can fund large parts of the work themselves. In all cases, grants would cover at least half the cost of installing a heat pump and energy efficiency upgrades, with the remaining 50 per cent subject to means testing. For landlords, low-cost loans should be made available, which would also be available to homeowners whose costs are not fully covered by the means-tested grants.

Current energy efficiency schemes such as ECO are already means tested. However, as discussed in chapter 5, ECO is poorly targeted towards fuel-poor homes and these homes still pay through their energy bills (Emden et al 2018). Effective means-tested support on the other hand should account for the full cost of upgrades and comprehensively identify those who need it. Furthermore, assessing household income alongside the quality and efficiency of a household's property can be used to determine how much support a household will need to carry out retrofit work.

There are practical considerations which may reduce the effectiveness of means-tested approaches. Current grant schemes have been taken up by those who understand energy efficiency measures, as well as the money to support other

energy efficiency measures not covered by grant schemes (Hamilton et al 2014). For those people who have less awareness or understanding to think about the energy performance of their home, uptake might be limited, even if grants are offered. For private landlords in particular, there may be little incentive to apply for low-cost loans when the bill savings do not accrue to them.

Ensuring that better-off households contribute more of their own income towards the cost of retrofit, while fair in principle, could adversely affect uptake. One solution would be to match incentives with new regulation and enforcement actions to ensure compliance. While the framework exists for doing this in the private rented sector through the Minimum Energy Efficiency Standard (MEES), this is not ambitious enough and does not apply to homeowners (BEIS 2020e). As such, means-tested grants and low-cost loans need to be matched with sufficient regulation and other incentives to ensure uptake.

Valuation options for property owners

Currently, property values do not consider energy efficiency. While some buyers might be less willing to buy a home that is not energy-efficient, the impact energy efficiency has on the price of a property is subjective and negotiable. Two valuation options exist for incentivising homeowners to improve the efficiency of their homes: variable council tax and rebates, and variable stamp duty.

Modifying council tax so that less efficient homes pay an added premium could encourage homeowners to improve the efficiency of their homes. In the case of the private rented sector, private landlords should bear any additional costs linked to poor efficiency as the impetus for upgrading their properties lies with them. A council tax rebate or discount for homes that install energy efficiency measures would provide significant discounts for households that retrofit their homes. This sort of scheme would be popular with consumers but would be a significant financial burden to local councils, who would potentially see reductions in the amount of council tax they receive (UKGBC 2013).

A second council tax option would involve changing council tax rates to match energy efficiency. This would see a new system of valuation attached to properties, with more efficient properties paying less than inefficient properties. This could be constructed in such a way to ensure the approach is revenue neutral, with discounts being balanced against increases (ibid). In some cases, council tax is already highly regressive and there is a risk that households currently paying unaffordable levels of council tax are penalised further for not being able to improve their homes (Murphy and Snelling 2019). Any council tax option will therefore need to be properly evaluated to ensure it does not punish lower income households who cannot afford to retrofit their properties. One way this might be achieved is by councils identifying lower income households and providing them with access to means-tested grants. This would ensure these households can cover the full costs of retrofit and avoid any increases in council tax that they cannot afford.

Another option would be variable stamp duty. Ensuring that homebuyers get a reduced discount on the amount of stamp duty they pay if they commit to undertaking retrofit work on newly purchased properties could prove to be a strong incentive. Under this scenario, Standard Assessment Procedure (SAP) scoring could be used to calculate a discount for people buying an energy-efficient property. For those buying an inefficient property, the ability to apply for a stamp duty rebate after purchase would be offered on the basis that they have undertaken retrofit work within a set amount of time after moving into the property (UKGBC 2013).

Higher standards for private properties

For the private sector, regulation will be crucial for ensuring retrofit takes place without more direct government involvement. In the private rented sector current Minimum Energy Efficiency Standards (MEES) do not go far enough in mandating an EPC E. Under this pathway, MEES would gradually be brought up to a minimum of B, with an exception of C for hard-to-treat stock. Enforcement action for non-compliance will continue to be taken by local authorities and there would be an expectation that the private rented sector would start meeting these standards by 2030.

These MEES standards could also be applied across all private residential properties, including for owner-occupied properties, at the point of sale or when other renovations are carried out. The target standards could be increased over time. There will need to be exemptions for certain households and properties.

OPTION 3: A LIMITED ROLE FOR GOVERNMENT THAT MAXIMISES CONSUMER CHOICE

A third option for delivering retrofit would operate in line with an incentive-based approach. This would see the role of local and national government limited to information-sharing and the provision of government grants, up to the value of £4,000 per home as set out in the Clean Heat consultation (BEIS 2020d) and the recent vouchers announced by government for energy efficiency. Under this pathway, the Social Housing Decarbonisation Fund would retain a significant role in delivering funding so that retrofit can take place across all social rented stock. Like option 2, private finance would play a similar role in supporting the social rented sector.

For homeowners who need further support, some additional means-tested support would be made available, as would other private finance due to the expansion of green finance. For private landlords, some low-cost loans would also be made available. This would require lenders to expand their offering of green loans and mortgages to private landlords and homeowners, while communicating to these tenures the financing options available to them. Under this option, support from government grants, combined with access to other private financing options, such as loans to cover the cost of installing heat pumps and energy efficiency measures, would act as incentives to ensure uptake.

New standards for private landlords and advice for homeowners

Under this option, national government would retain a key role in setting new standards around energy efficiency. It would also oversee the delivery of grant-funding offered through its low-carbon heat scheme. Local councils would have a role in upholding these standards, particularly in the private rented sector through the enforcement of MEES. MEES should be raised in line with the EPC ambitions outlined, with the expectation that homes meet a B standard or, if that is not possible, a minimum C standard.

An emphasis on information to households

The primary mechanism for encouraging retrofit among homeowners would be the provision of information to households and clear signposting towards available financing options. These information services would need to be offered in the delivery pathways outlined in Option 1 and Option 2 (see below for what wider policy support is needed). However, under this option, they would constitute a much more important mechanism for delivering retrofit in the absence of more substantive regulation for homeowners. The absence of more stringent policies to encourage uptake means that this option would maximise consumer choice but provide the weakest policy framework. Ultimately, this option is the least likely to encourage retrofit at the required pace and scale.

WIDER POLICY SUPPORT NEEDED

Regardless of which delivery option policymakers pursue, a wider set of policy measures will be needed to support retrofit activity. These include policies to support consumers and wider support to industry.

A unified policy approach

Administration of different schemes, for example, one for low-carbon heat and one for insulation upgrades, may prove confusing or cumbersome for households. A single retrofit scheme would be more effective as it would prevent piecemeal retrofit work taking place. This will require coordination within offices in the Department for Business, Energy & Industrial Strategy (BEIS) but also between departments, including BEIS, Ministry of Housing, Communities & Local Government (MHCLG), Department for Work & Pensions (DWP) and the Treasury, to ensure the delivery of a cohesive and streamlined zero-carbon heating programme.

Consistent and accessible advice

Policy in England will need to follow the examples set by Scotland and Wales and offer clear, consistent advice that can be accessed through multiple communication channels including text, letter, telephone, email or online.

While the Simple Energy Advice website and freephone helpline exists in England, it is not widely advertised and will need far more resources knowing the scale of the change and disruption that many households will be facing. This will be particularly important given that heat pumps operate differently from gas boilers. As such, households will not only need upfront advice from heat engineers during installation, they will also need readily accessible advice that can help them to acclimatise to these new technologies and facilitate any behaviour changes due to the way heat pumps operate.

Low or no administrative burden

As discussed in chapter 6, one of the major hurdles that households have faced in the past, and risk continuing to face, is the hassle of applying for incentives and grants. In the government's most recent renewable heat consultation, there are welcome proposals to ensure that technical information is largely handled by the installation company delivering upgrades. However, for many households, even the need to apply may limit the scale of uptake such that it falls behind the required installation rates to meet net-zero targets. For the social rented sector, this is likely to be less of a hurdle since social landlords can apply on their tenants' behalf. Minimising administrative burden, or, in the case of delivery option 1, removing it all together, will therefore be critical to uptake at sufficient pace and scale.

Skills system reforms

Heat engineers will be crucial to the competent delivery of the heating systems themselves, as well as the clear, professional and friendly advice to residents to teach them how the new systems work. For the few households that already have these systems, heat engineers are seen to be a reliable source of information, with 79 per cent of those surveyed saying they trusted their advice (BEIS 2019b). However, delivery of low-carbon heating systems at a national scale will require upskilling a workforce which, as discussed in chapter 6, does not have enough installers with the knowledge of how to fit heat pumps or energy efficiency measures.

Consequently, high-quality rigorous training standards must be put in place. Financial support should be provided to workers to undertake this training as an incentive and to alleviate the pressure on industries, particularly small and medium-sized enterprises, to pay for their workers to undertake it. The development of a Heat Engineer Accreditation Training (HEAT) scheme could rapidly upskill thousands of workers to an industry-recognised standard that ensures fast but high-quality installations. The guidance and specifications for

this would be developed nationally but the powers and funding to deliver it should be devolved to a local level.

Just transition support

While job creation is a major opportunity for low-carbon heat and energy efficiency, as discussed in chapter 6, a high electrification pathway also implies a reduction in gas demand for heating, which could impact jobs in the gas sector. Consequently, it will be critical to provide transition support to ensure that those workers who may be moving out of the gas sector can expect similar or better job quality. For this to happen, trade unions will need to be a crucial social partner that must have access to all new businesses providing heating technologies or energy efficiency upgrades. As IPPR research has previously shown, trade unions have a good track record of securing higher levels of pay for members along with higher-quality working environments (Dromey 2018).

The government should take two key actions. First, it must internalise the principles of a just transition into its policymaking. Second, it must provide comprehensive support for workers. This could comprise many different measures, but should at the very least explore what a reasonable income guarantee would be, a right (and financial support) to retrain, additional support such as travel assistance, and access to careers services and mental health and wellbeing services. At an economy level, support should be explored in the form of greater inward investment in local economies, developing low-carbon clusters and repurposing existing high-carbon assets (Emden and Murphy 2019).

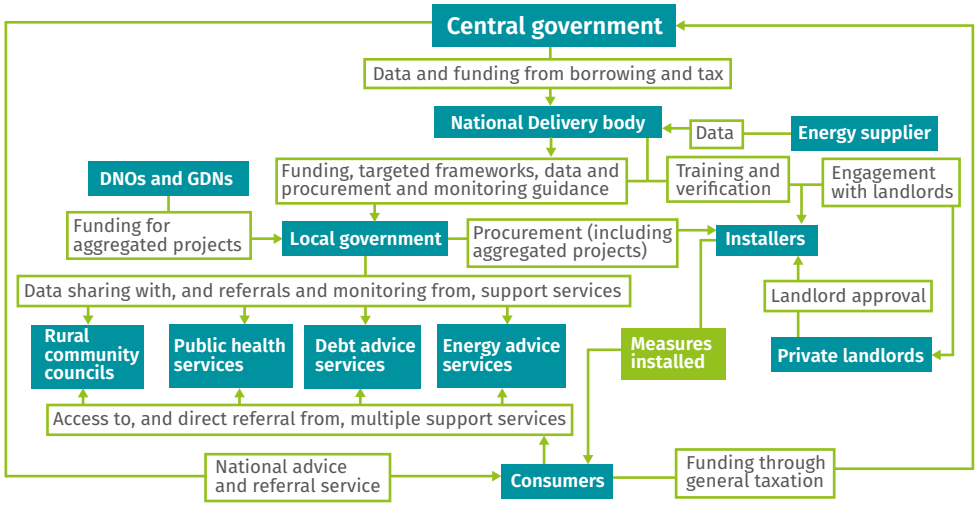
9. RECOMMENDATIONS

This chapter outlines our recommendations for a new **'Home Improvement Plan'**. Our analysis of the different technological pathways, financing scenarios and delivery options leads us to conclude that the prioritisation of the use of electric heat pumps is the most viable way to meet net-zero targets for the majority of the housing sector, with heat networks being deployed in dense urban areas and energy efficiency measures being required across the majority of properties regardless of heating system deployed. A blended financing approach represents the best means to ensure the roll-out of these technologies. Collaboration between local government and housing providers, coupled with incentives for other tenures and new regulation on efficiency standards, represents the best approach for delivering retrofit at scale. This approach strikes a balance between consumer choice, the need to prioritise fuel-poor homes and the social rented sector, and the pace of change.

Figure 9.1 summarises how we envisage all relevant stakeholders interact with each other where households have maximum access to information about the scheme and minimum hassle of applying.

FIGURE 9.1: MULTIPLE STAKEHOLDERS WILL HAVE A ROLE TO PLAY IN THE DELIVERY OF A LOW-CARBON HEATING SCHEME, MOST OF WHICH THE CONSUMER SHOULD NOT BE EXPECTED TO ENGAGE WITH

Summary of policy architecture for low-carbon heating and energy efficiency scheme



Source: Adapted from Emden et al (2018)

A CLEAR TECHNOLOGICAL PATHWAY

A high electrification pathway that is focussed primarily on the delivery of electric heat pumps, heat networks and energy efficiency measures is the best solution for providing low-carbon heating at scale. We recognise that in circumstances where the installation of a heat pump would not be possible or appropriate, hydrogen boilers and high heat retention storage heaters can ensure housing is decarbonised.

Recommendation 1: We call on the UK government to ensure that electric heat pumps, heat networks and energy efficiency upgrades are prioritised as the main technologies for retrofitting homes. These technologies should be the primary focus of government and private financing, with the majority of government funding supporting the installation and deployment of these technologies.

Recommendation 2: In some cases, the installation of heat pumps will not be possible, for example in high-rise buildings with little outdoor space or developments of mixed tenure. In these cases, the use of hydrogen boilers and high heat retention storage heaters should be considered and accounted for in SAP assessments.

Recommendation 3: To ensure that we meet our decarbonisation objectives as quickly as possible and to ensure money is diverted into zero-carbon technologies today, we need to ensure that housing is no longer heated by gas. We recommend that households in need of boiler replacements should be signposted towards alternative low-carbon heat solutions.

A STRATEGY FOR FINANCING RETROFIT

The main barrier to achieving retrofit at scale is the cost. The social rented sector does not have the resources to achieve the decarbonisation of its housing stock without support from the UK government. We recommend a blended approach for financing housing retrofit, focussing on improving the amount of government support while also encouraging private finance to invest in decarbonisation activity. Taking a balanced approach, we propose that government and private investors will each need to fund half of the total cost, while recognising that other splits would be possible.

Our analysis estimates that, after accounting for heat network upgrades, it will cost approximately £10.6 billion per year through to 2030, reducing to £7 billion per year from 2030 to 2050, to retrofit all homes in England below an EPC standard of C with heat pumps and to high energy efficiency standards. The government has recently announced a £3 billion investment, with £2 billion in vouchers for home owners to pay for retrofits that include energy efficiency measures like insulation and £1 billion to upgrade public buildings. This forms part of the £9.2 billion of investment committed to in the Conservative manifesto for energy efficiency of homes, hospitals and schools.

Recommendation 4: To maximise the chance of meeting net-zero targets and reducing energy bills for households, we recommend that the UK government creates a Retrofit Fund for England that commits to spending £5.3 billion per year (ie half the cost of upgrading homes below an EPC of C) to meet domestic net-zero targets through to 2050, reducing to £3.5 billion per year from 2030. Its focus would be on funding heat pumps and high energy efficiency standards. Of the £5.3 billion up until 2030, £1.8 billion should be committed to the Social Housing Decarbonisation Fund every year, increasing the £380 million committed to this fund in the Conservative's manifesto over the next decade. The remainder should be used to fund grants and low-cost loans for homeowners, to be accompanied by low-cost loans for homeowners and private landlords (see below).

Recommendation 5: We recommend in the short term that the government takes advantage of record low interest rates and supports a green economic stimulus. This will allow large-scale infrastructure projects like retrofit to benefit from government support. This will deliver warmer, healthier homes and create over 275,000 jobs by 2035 across every region in England.

Recommendation 6: In the long run, if the cost of borrowing increases, the UK government should shift the cost of housing retrofit from regressive on-bill financing to a more progressive taxation and explore how marginal increases in taxation can help fund housing retrofit. This will reduce the long-term reliance on borrowing to fund retrofit and create a sustainable funding option beyond the initial stimulus.

The cost of retrofit should not lie solely on the government's books. Private finance can also play a positive role in funding retrofit activity. According to our proposals, the sector will need to access £5.3 billion per year through to 2030 (the second half of the total £10.6 billion annual cost of retrofitting), reducing to £3.5 billion from 2030 to 2050. However, their current involvement is limited by a system that disincentivises investment in retrofit work because it is seen as a high-risk, low-return activity. Consequently, to facilitate a large increase in capital investment, reforms are needed to ensure private finance can play its role in supporting the decarbonisation of the housing sector.

Recommendation 7: We recommend that the Bank of England works with financial institutions to ensure that the risk profile of retrofit activity is reduced, reflecting the long-term environmental benefits it brings. The environmental credentials of public works, which would include the retrofit of activities of social housing providers, should become a key lending criteria. The government could also play a role in securing low interest rates for the loans by using the UK Guarantees Scheme.

Recommendation 8: We expect that local councils and housing providers will play a key role in driving retrofit, within both the social rented sector and other tenures. At the moment, these public bodies struggle to access public finance. In tandem with work being carried out by the Green Finance Institute, we recommend a new framework be developed that helps these bodies aggregate areas of homes and then securitise the investment in low-carbon heat technologies as a means of attracting private finance. This would allow housing providers to undertake retrofit activity and further develop the supply chains connected to retrofit activity.

A FRAMEWORK FOR POLICY AND INCENTIVES

The current governance and institutions required to deliver retrofit at scale are either missing or inadequate. Without a new policy framework, the UK is unlikely to meet its retrofit ambitions. The social rented sector has a key role to play in leading the decarbonisation effort but cannot do so without the right policy framework.

Progress to decarbonise the housing stock has varied significantly across tenure. Well over half of all social rented homes meet an EPC C target. This number will increase significantly in the next decade. Even with limited support, the social rented sector is already meeting ambitious targets. There is, however, scope to go further and faster.

Recommendation 9: In the social rented sector, providers should set themselves the ambition of ensuring that all retrofit activity brings homes to EPC B standard or higher by 2030. In cases where this is not possible, EPC C should be the minimum target. Under this option, the money given to the sector through the Decarbonisation Fund would be matched with private finance through models like Energiesprong. Attractive borrowing rates would need to be offered to the social rented sector to ensure retrofit can be delivered at scale. The use of the UK

Guarantees scheme currently used to lower interest rates for large infrastructure projects could be used to secure attractive borrowing rates.

Recommendation 10: The government should offer means-tested grants and low-cost loans for homeowners and low-cost loans for private landlords. Grants would cover at least half the cost of installing a heat pump and energy efficiency measures, with the remaining 50 per cent subject to means testing. The government should consider a range of taxation options on council tax and stamp duty. In the case of council tax, consideration should be given to linking council tax rates to energy efficiency, modifying them so that less efficient homes pay an added premium or matching them to energy efficiency. Another option would be variable stamp duty, with a higher rate charged for energy-inefficient properties and vice versa.

Recommendation 11: Incentives should be matched with new regulation and enforcement actions to ensure compliance. For the private rented sector, Minimum Energy Efficiency Standards (MEES) should be gradually brought up to at least B by 2030, with an exception of C for hard-to-treat stock. These MEES standards should also be applied across all private residential properties, including for owner-occupied properties, at the point of sale or when other renovations are carried out. The target standards could be increased over time. There will need to be exemptions for certain households and properties.

A BLUEPRINT FOR DELIVERY

Having evaluated the various options available we believe that a local government-led approach, with significant input from housing providers and democratic engagement with residents' associations, is crucial for delivering retrofit. The development of new policy tools and the introduction of new mechanisms to support retrofit work will be needed to ensure this approach is implemented. While this approach should first be implemented in the social rented sector and fuel poor homes, we recommend that the government quickly scale up the policy architecture and apply it across other housing tenures.

Recommendation 12: Retrofit needs and requirements will be fundamentally different across the country. Given the disruptive nature of retrofit and the varying quality of housing stock, any approach must be grounded in local communities. We recommend the UK government develops an area-based approach to housing retrofit, incorporating a local plan for retrofit which will take place on a street-by-street basis. This work will be led by local government, with further support given from the UK government provided to help develop the capacity of local authorities to deliver this approach. Crucially, these plans will need to identify and prioritise fuel-poor homes across tenures and all homes in the social rented sector.

Recommendation 13: We envisage that under this plan, local authorities will play a key role in identifying where improvements need to be made. Local authorities should act as the main body responsible for auditing stock and monitoring retrofit activity. In the social rented sector, a close working relationship should be developed between councils and housing providers. Housing providers should work with local councils to generate costings and tenders to undertake retrofit work in the social rented sector. Under this approach, the Social Housing Decarbonisation Fund would be substantially increased from £380 million to £1.8 billion every year for the next 10 years and would play a crucial role as the main instrument for distributing government subsidy that supports retrofit activity in the social rented sector. This fund should be readily accessible to councils coordinating retrofit activity and housing providers who need to draw down funds to support retrofit activity.

Recommendation 14: To identify where heat pumps and heat networks will be needed and to understand where alternative technologies will be necessary, we need to better understand our housing stock. Resources should be allocated to carry on conducting heat zoning to determine the most appropriate heat technologies for different areas. This will identify where other technologies like heat networks are useful and the circumstances in which hydrogen boilers would need to be used as an alternative to heat pumps.

Recommendation 15: As part of this plan, local councils and providers should liaise frequently with the Regulator of Social Housing. The Regulator will need to assume a key role and work with local councils to share information on compliance with new standards and regulation designed to improve the efficiency standards of properties. The Regulator should be given expanded enforcement powers to ensure all registered providers are making clear progress in retrofitting their stock to the required standards.

Recommendation 16: Low-carbon heat policy is currently not well connected with other aspects of the government's energy efficiency policy. As a result, where progress has been made, it is often the low-hanging fruit of efficiency measures. New low-carbon heat solutions will only work in well-insulated properties. We recommend the UK government evaluates its current insulation initiatives to ensure it supports its low-carbon heat strategy. Practically speaking, this should mean any low-carbon heating assessment is matched with a corresponding insulation survey. Households should be signposted to the appropriate government support schemes and given information on insulation installation when a heat pump cannot be installed due to low levels of thermal efficiency in buildings.

Recommendation 17: For the purposes of achieving heat decarbonisation at sufficient pace and scale, we recommend that the government examines replicating delivery at local level by local government on behalf of all residents in a local area even if they are not in the social rented sector. However, in recognition of the fact that this may limit a degree of consumer choices, other initiatives could be provided to incentivise uptake. For homeowners and private landlords, local government should work with these tenures to identify and advertise to fuel poor homes and the government should provide means-tested grants and low-cost loans respectively, incentives that link energy efficiency to stamp duty, mortgages and council tax, and, for private residential properties, stricter minimum energy efficiency standards.

Recommendation 18: Clear guidance needs to be offered to households and consumers on how low-carbon heat solutions work. For the other tenures beyond the social rented sector, guidance on funding opportunities to carry out retrofit work will need to be identified. As is already the case in Scotland and Wales, clear and consistent advice should be given to households in England. We recommend the UK government scales up existing support and creates a widely accessible dedicated advice service to support households with the operation of their low-carbon heating systems, which can be accessed via text, letter, telephone, email or online.

Recommendation 19: In addition, to promote awareness among households and familiarise people with the technologies, we recommend government invests in a national advertising campaign around the benefits of heat networks, heat pumps and energy efficiency measures. This will help generate awareness and, for those households not having upgrades installed for them, will help to improve the uptake of measures.

SUPPORTING INDUSTRY TRANSITION THROUGH RETRAINING, RESKILLING AND UPSKILLING

We do not have industry capacity to currently deliver retrofit at scale. Across low-carbon heating systems, we lack the necessary number of technicians and installers but also face threats from the scaling-down of high-carbon heating. But this is also an opportunity to rapidly scale up retraining, reskilling and upskilling thousands of locally based workers, to develop a skilled zero-carbon workforce and to provide at-risk workers and communities with the support, time and information to make decisions about their future careers and local areas.

Recommendation 20: The government should invest in a large-scale training and retraining programme for installers: the Heat Engineer Accreditation Training (HEAT) scheme. This will help provide the capacity needed to install heat pumps at scale. This can offer hundreds of thousands of new jobs and provide opportunities for young people through appropriate apprenticeship schemes.

Recommendation 21: The government should invest in a Just Transition Fund. In IPPR's interim report for the Environmental Justice Commission, we recommended that an initial down-payment of £5 billion should be made for a Just Transition Fund to support workers who may be at risk in high-carbon sectors (IPPR 2020).

TABLE 9.1: SUMMARY OF GOVERNMENT POLICIES AND SPENDING PLANS COMPARED TO IPPR PROPOSALS OUTLINED IN THIS CHAPTER

	Targets	Annual number of homes retrofitted	Investment	Coordinating body	Consumer offer
Current government activities	EPC of C for 2.4 million fuel poor homes by 2030. Non-fuel poor homes to EPC of C by 2035 where cost-effective. No targets for heat pumps.	72,632 homes with energy efficiency measures per year through to 2028 from latest iteration of Energy Company Obligation (ECO3). Note: there is no guarantee these measures will reach an EPC of C as EPC data is not linked to energy efficiency upgrade data. 9,233 heat pumps per year from Renewable Heat Incentive (RHI) from 2016 to the beginning of 2020.	ECO3: Average committed spend of £700 million per year (actual spend in 2019 was £417 million) through to 2028. Domestic RHI: Average committed spend of £118 million from 2016/17 to 2020/21 (£140 million committed in 2020/21.	None	ECO: Regressive payment through energy bills. RHI: Feed-in tariff of 21.16p/kWh for a ground source heat pump and 10.85p/kWh for an air source heat pump both for seven years.
New funding and upcoming commitments (adjusted for England only)	EPC of C for fuel poor homes by 2030. Non-fuel poor homes to EPC of C by 2035 where cost-effective. No target for heat pumps.	306,390 homes[19] (including 7,449 social homes) this year. **Note:** there is no guarantee that even maximum funding will achieve an EPC of C as some properties may require multiple measures. 14,825 homes per year could be retrofitted with heat pumps between 2020-2022 under the RHI.[20]	£2.05 billion for energy efficiency (of which £50 million for social homes) this year. The Conservative manifesto has pledged £9.2 billion over the next ten years in total, including £3.8 billion for a Social Housing Decarbonisation fund over 10 years. Of this amount, only £50 million has been committed for social homes at the time of writing. RHI has been extended until 2021/22, after which, consultation is underway to replace it with a Clean Heat Grant, for which approximately £15 million could be available for heat pumps in homes in 2022/23 and 2023/24.[21]	None	Vouchers of up to £5,000 for energy efficiency upgrades to property and up to £10,000 for fuel poor homes. Distribution of funds for the Social Housing Decarbonisation Fund yet to be decided. Grants of up to £4,000 for the cost of heat pumps are being considered.
IPPR's Home Improvement Plan for England	EPC of at least B with heat pump installed with priority given to fuel poor homes and the social rented sector.	495,716 homes (including 137,670 social homes) per year through to 2030 fitted with highly energy efficient retrofits and heat pumps. 358,046 homes fitted per year from 2030-2050 fitted with highly energy efficient retrofits and heat pumps.	To meet net-zero targets and maximise potential for bill savings to households, the government will need to increase funding in both energy efficiency and low-carbon heating. Even if all £9.2 billion per year is committed over the next ten years, this equates to a funding gap of £4.38 billion per year.[22] **Public sector:** An increase to £5.3 billion per year until 2030 (of which £1.8 billion per year to social rented sector), thereafter £3.5 billion to 2050. **Private sector:** An increase to £5.3 billion per year through to 2030 (of which £1.8 billion to social rented sector), £3.5 billion to 2050 thereafter. Possible use of the government's UK Guarantees Scheme to secure low interest rates.	Local authorities play a key role for social rented sector and fuel poor homes in collaboration with social landlords. Owner-occupiers and private landlords can also opt-in to local authority scheme.	The cost of installing a heat pump and high energy efficiency standards is approximately £26,300 per household (CCC 2019a).[23] The offer to consumers will differ according to tenure type as detailed below. **Social renters and fuel poor homes:** Our Home Improvement Plan will cover the full cost of upgrades through a combination of public and private finance and for the social rented sector, housing providers and local authorities will install upgrades on tenants' behalf. For fuel poor homes, local government will work closely with homeowners and private landlords to identify and encourage uptake. **Homeowners** (can opt-in to a scheme coordinated by local government achieving lower costs through aggregation and economies of scale): Grant to cover at least half the cost (£13,150) of installing a heat pump and high energy efficiency standards. Means-tested grants for homeowners who need further financial assistance. **Private landlords:** Low-costs loans for up to the full cost of heat pumps and energy efficiency installations made available to landlords. Improved MEES standards to ensure compliance with similar standards to those enforced in social rented sector. MEES gradually brought up to a minimum of B, with an exception of C for hard-to-treat stock by 2030. **All private properties:** Link established between property value and energy efficiency through reforms to council tax and/or stamp duty to incentivise uptake of retrofit work. MEES also introduced for all private residential properties applied at point of sale or when other renovations are carried out. The target standards could be increased over time. Exemptions for certain households and properties.

Source: HC 2019; BEIS 2020b; Currie & Brown 2019; CCC 2019a; CCC 2019b; MHCLG 2020c; Conservative and Unionist Party 2019; Vattenfall 2020

19 Calculations adjusted for England. Calculations adjusted according to proportion of fuel poor homes in England and social homes in England.
20 Based on existing committed spending in (BEIS 2020f) and extrapolation for 2021/22.
21 Based on extrapolation from (BEIS 2020f).
22 For simplicity, though the £9.2 billion contains different timeframes for spending funds, we average the total across 10 years. This includes the £2.05 billion already committed and the £15 million for domestic heat pumps spread in the latest budget spread across 10 years.
23 In this calculation we assume this cost for all households but acknowledge that some households will face constraints which may increase costs or limit what measures can be installed.

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