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The Net Zero Litmus Test

Making energy efficiency a public and private infrastructure investment priority

Acknowledgements

This report was prepared by E3G with input from and review by fellow Energy Efficiency Infrastructure Group (EEIG) members. The EEIG is a growing and broad-based coalition of over 25 industry groups, NGOs, charities and businesses asking for rapid improvement in energy efficiency policy for UK homes and buildings. While it represents the views of the EEIG as a whole, this report does not necessarily represent the views of its individual members.

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Foreword

By Dr Rhian-Mari Thomas

CEO, Green Finance Institute

Decarbonising the UK economy to meet the Government's world-leading Net Zero greenhouse gas commitment by 2050, represents both an unprecedented challenge and an unrivalled opportunity for innovation and investment.

The imperative of net zero emissions, as attested by the latest science and now set out in legislation, will require the continued transition of the power sector and also the rapid decarbonisation of manufacturing, transport, agriculture and buildings.

Buildings are at the heart of the UK's decarbonisation and climate adaptation challenge. UK homes account for 20% of the UK's greenhouse gas emissions and comprise some of the oldest and least energy efficient housing stock in Europe, which is why an action plan consisting of clear steps and milestones for improving the energy efficiency of our homes and driving a step-change in the requisite investment is a priority.

This report, prepared by the Energy Efficiency Infrastructure Group (EEIG), provides such a roadmap. It comprises a frank and uncompromising assessment of Government policy to date, highlights the considerable risks of inaction and presents a bold vision for investing in a Buildings Energy Infrastructure Programme. As highlighted in this report, the multiple, quantifiable benefits of allocating capital to ensure no household is left behind in the transition to a zero carbon economy not only include lowering emissions, reducing power generation capacity, but also reducing households' energy bills, improving construction sector productivity, creating skilled employment opportunities. It will also deliver more comfortable and healthier indoor environments which in turn will lead to the avoidance of health conditions exacerbated by poor housing for some of our most vulnerable citizens.

Unlike some other sectors, where decarbonisation pathways are complex or require new technological advances, the solutions for domestic energy efficiency already exist and are ready to be deployed.

Meeting this opportunity, however, will require mobilising investment at pace and at scale. The EEIG presents the case for the Government to allocate £1 billion per year of additional public infrastructure capital to 2035, to support low-income households and incentivise a further £3.5 billion of private investment from landlords and those able to pay. This provides a compelling backdrop for the financial sector to develop the financial instruments both for renovation and for the construction of net zero carbon homes. Various mechanisms, combining initial public capital outlay have successfully led to significant private investment in energy efficiency in other jurisdictions, from which the UK can learn and further develop.

It is precisely in order to innovate and promote such solutions, that the newly formed Green Finance Institute, supported by seed funding from HM Treasury, the Department for Business, Energy and Industrial Strategy and the City of London Corporation has been launched. As the UK's principal forum for public private collaboration in green finance, the GFI is advancing the recommendations of the Government's Green Finance Taskforce and recent Green Finance Strategy, and has stated that one of its initial goals is to mobilise capital towards the energy efficiency of UK buildings.

This will clearly be a great challenge. However, as the EEIG sets outs in this practical and direct call for action, the opportunity to work with Government to build a commercially viable green investment market to decarbonise our housing stock and for the UK to realise the resulting economic and broader benefits, is so much greater.

Dr Rhian-Mari Thomas

Executive summary

Introduction

As the Energy Efficiency Infrastructure Group (EEIG), an alliance of businesses and non-governmental organisations, we are calling on the Government to make energy efficiency an infrastructure investment priority and allocate at least £1 billion per year of additional public infrastructure capital for home energy efficiency in the Spending Review. In this report we set out a bold vision for a Buildings Energy Infrastructure Programme to make all homes efficient, outline the huge benefits that would be achieved and assess Government progress.

In 2017 the Government announced a target to bring all homes up to Band C on an Energy Performance Certificate (EPC) by 2035. Since then, despite a plethora of analysis and consultations by Government, there have been few new policies and almost no investment announced to achieve it. The target is deliverable, but not yet matched by an infrastructure plan and capital funding to make it a reality.

Yet in a historic move, the UK Government has just introduced a legally binding target for net zero greenhouse gas emissions by 2050, making it the first major economy to do so. This new, more ambitious target can only be achieved cost-effectively if massive energy savings are secured. Ramping up energy efficiency is not optional for achieving net zero emissions, it has to be at the heart of the UK's net zero energy infrastructure delivery plan.

The opportunity of making energy efficiency an infrastructure priority

As part of our Buildings Energy Infrastructure Programme, we have assessed the economic, security, social and environmental benefits of bringing all homes up to at least EPC Band C by 2035 – a crucial staging post on the path to net zero emissions by 2050. These are set out below.

Net zero savings: Homes account for 20% of UK greenhouse gas emissions. Under the UK's new net zero target these emissions will have to be entirely eliminated. That means totally decarbonising the UK's 29 million homes. Bringing all homes up to a good level of energy efficiency by the 2030s is on the critical path to that goal, is essential for ensuring fuel poverty targets are met at the same time, and helps ensure the costs of the net zero transition are borne fairly while its benefits are enjoyed by all.

Household savings: Improved energy efficiency in buildings since 2004 now saves the typical dual fuel household over £500 per year[1]. Between 2004 and 2018, average household gas consumption fell 33% and electricity consumption fell 19%[2], despite a significant increase in the number of household appliances . These savings were driven substantially by energy efficiency improvements – including in lighting, appliances[3], heating systems and insulation[4].

Huge energy saving potential in UK homes remains untapped. Research by the UK Energy Research Centre found that cost-effective investments in residential energy efficiency and low carbon heating over the next 20 years, equivalent to getting all homes up to the Band C target, could reduce energy demand by 25%[5]. At current energy prices, this would reduce average household energy costs by £270 per year.

Under the net zero target all homes will need to move to zero carbon heating. Energy efficiency is key to making this transition affordable. In a typically sized home that is efficient, installation of a heat pump could be £1,000 cheaper than for a home that is

[1]CCC (2017) Energy Prices and Bills – impacts of meeting carbon budgets. Comparison with what household energy consumption and bills would have been without energy efficiency measures adopted in homes since 2004.

[2]BEIS (2019) Annual domestic energy bills, Tables 2.2.5 and 2.3.5. Temperature adjusted energy consumption. Average household electricity consumption based on households on standard electricity tariff. Equivalent data on households on Economy 7 does not go back further than 2010.

[3]BEIS (2019) Energy Consumption in the UK, Table 3.12

[4]BEIS (2019) Energy Consumption in the UK, Table 3.13, 3.19, 3.21-3.27

[5]Rosenow, R, Guertler, P, Sorrell, S & Eyre, N (2018) The remaining potential for energy savings in UK households.

[6]Heat pump sizing tested with Mitsubishi Electric's Ecodan selection tool;; marginal cost of larger heat pump derived from CCC (2019a) Net Zero Technical report

not[6] and running costs would be significantly lower. The transition to zero carbon heat is simply not affordable for UK households without UK Government support to make all homes energy efficient.

Economic returns: In total, bringing all homes up to at least EPC Band C and so cutting energy demand in homes by 25% represents an energy saving equivalent to the annual output of six power stations the size of Hinkley Point C. Appraisal based on HM Treasury's methodology for energy and climate policy finds that the net present value of this saving would be £7.5 billion. Appraised as an infrastructure investment, the net present value – to the economy, reduced power system investment needs and from improved health – amounts to an additional £47 billion[7].

It would reduce the need for costlier upgrades to the electricity grid and new power supply, with a present value of avoided electricity network investment of £4.3 billion[7]. Without energy efficiency, the costs of decarbonising heat to 2050 – ultimately borne by consumers – could be £6.2 billion higher per year[8]. It would enhance energy security, by reducing the need for gas imports, improving the balance of trade and boosting GDP in the process. As a result of greater energy efficiency investment, GDP could be 0.6% higher in 2030 – £13.9 billion – driven mainly by a 26% reduction in imports of natural gas by 2030[9].

In the long term the public investment pays for itself. The economic activity that would be driven by an energy efficiency infrastructure programme delivers tax revenue, cumulatively £51.1 billion by 2030. In present value terms, a return of £1.27 per £1 invested would be achieved over this time[9].

Ending fuel poverty and public spending savings: Statutory targets to tackle fuel poverty in England and elsewhere in the UK would be met. At current levels of investment, the 2030 target will not be achieved until the mid-2040s. On average there are 32,000 excess winter deaths every year, of which 9,700 are attributable to cold homes and 3,200 are linked directly to fuel poverty[10]. Making all homes energy efficient could create enormous savings in the long run. Welfare spending related to fuel poverty includes the Warm Home Discount (£320 million per year), Cold Weather Payments (£130 million per year) and the Winter Fuel Payment (£1.8 billion per year). This amounts to a typical annual total of around £2.3 billion of public spending every year to treat the symptoms of UK housing's poor energy efficiency.

It would deliver improved public health outcomes, by avoiding ill-health from cold homes through improved comfort. The cost to the NHS of health conditions made worse by poor housing is estimated to be between £1.4 and £2.0 billion each year in England alone[11], with the costs of productivity loss potentially far higher[12]. It would also improve outdoor air quality, the benefits of which carry a present value of £4.1 billion[5].

Increased productivity: It would improve construction sector productivity, adding value where energy efficiency upgrades are incorporated into broader renovation and maintenance works. It would improve national competitiveness, by enhancing energy productivity and staff productivity in the workplace[13]. Product and service innovation to build a market for low carbon and resilient buildings brings significant clean industrial growth opportunities, at home and abroad.

Jobs: It would create skilled employment opportunities, through the renovation and construction work needed, and the supply chains that support them. This means a net

[7]Rosenow et al. (2018) The remaining potential for energy savings in UK households

[8]Imperial College London (2018) Analysis of Alternative UK Heat Decarbonisation Pathways

[9]Cambridge Econometrics & Verco (2014) Building the Future: the economic and fiscal impacts of making homes energy efficient

[10]E3G & NEA (2018) Cold Homes and Excess Winter Deaths: a preventable public health epidemic

[11]BRE (2015) The cost of poor housing to the NHS

[12]Roys et al. (2016) The full cost of poor housing

[13]LBNL Indoor Environment Group (2016) Cost Effectiveness of Improving Indoor Environments to Increase Productivity

increase in annual employment of around 100,000 full-time equivalents over the period 2020-2030, with most jobs created in the services and the construction sectors[9].

Stalled progress

Despite its vast potential, energy efficiency's progress has stalled abruptly with changes to Government energy saving programmes in the UK, contributing to a 47% drop in the annual level of investment[14] and a 95% reduction in the number of insulation measures installed in homes per year between 2012 and 2017[15]. This is the result of the Government cutting the Energy Company Obligation in half and abandoning several flagship energy efficiency programmes such as Warm Front.

Where we are today

The Clean Growth Strategy introduced a goal for all UK homes to achieve an Energy Performance Certificate (EPC) rating of C by 2035. There are 19 million homes rated EPC D or worse. That means 1.2 million homes need to be renovated on average each year to the end of 2035. In 2017/18 across the UK, around 170,000 homes were renovated with significant energy efficiency improvements – just 14% of the rate required. This means the rate at which UK homes are upgraded needs to be increased by a factor of seven to meet the Government's target.

BEIS' latest energy and emissions projections, published in April and incorporating existing and currently planned policies, shows that household emissions are now rising and will continue to do so until 2035. Of all the major sectors, only homes' emissions are projected to rise.

Considering policies in place today, the Committee on Fuel Poverty estimated that the energy efficiency investment shortfall to meet England's statutory fuel poverty targets – that all fuel poor homes achieve a Fuel Poverty Energy Efficiency Rating of C (on a scale of A to G) by 2030 – amounts to £15.1 billion. Assuming Clean Growth Strategy proposals not adopted so far are implemented, there would still be a gap of £8.9 billion[16], with the interim fuel poverty milestones for 2020 and 2025 set to be missed as well.

The Building Energy Infrastructure Programme

To get the UK on track to net zero, to end fuel poverty and fulfil the huge economic potential, the EEIG is calling on the Government to adopt the Buildings Energy Infrastructure Programme[17]. This programme is designed to ensure that 19 million homes with an EPC rating of D or worse are renovated to an EPC rating of C by the end of 2035 at the latest and considers bringing the target forward to 2030. Newly built homes should not need to be upgraded.

Scotland has already made energy efficiency an infrastructure priority and continues to develop its world class programme. It should serve as the template for similar programmes in England, Wales and Northern Ireland. The key elements of the Programme are set out below alongside an assessment of Government progress so far.

Governance: Energy efficiency must be designated a national infrastructure priority. It must include the Government targets – all low-income homes to EPC C by 2030 and all other homes by 2035. It needs to be driven by a comprehensive and long-term investment programme with a dedicated delivery agency.

Rating: Amber
The Government has set the target to get all homes up to Band C by 2035 but not yet designated energy efficiency as an infrastructure priority, nor set up a dedicated agency to oversee the programme.

In light Parliament's declaration of a climate emergency and the adoption of the net zero target, consideration must now be given to bringing the target for all homes forward to 2030 and setting out a trajectory for continued improvement until all homes are decarbonised.	
Ring-fenced additional public capital investment averaging £1 billion per year to 2035, bringing the total investment funded from public budgets and household energy bills (via the Energy Company Obligation) to £1.7 billion, deployed to fully support low-income households and incentivise a further £3.5 billion of private investment from landlords and those able to pay. A total investment programme of £5.2 billion per year.	**Rating: Red** Almost no additional funding has been allocated to residential energy efficiency since public investment was halved compared to 2012.
Proper incentives for the 'able to pay' market to thrive and unlock the £3.5 billion of private investment needed. This should include a Stamp Duty incentive, zero interest loans and incentives to pump-prime demand for green mortgages as recommended by the Green Finance Taskforce.	**Rating: Red** No incentives have been introduced to help home-owners improve energy efficiency.
Using regulation to set minimum standards and reduce costs, by tightening rented sector regulation over time to an EPC rating of C by 2030, the eventual introduction of a mandatory minimum EPC rating for owner-occupied homes at point of sale, and ensuring newly built homes are net zero carbon across all energy uses in their operation and climate-resilient from 2030 at the latest.	**Rating: Amber** Government has confirmed regulation to prevent private rental of homes with EPC ratings of F or G and plans to raise ambition. There are no plans for minimum standards for owner-occupied homes. It has announced its intention to ensure new homes are supplied with low carbon heat from 2025.
A long-term, fair and local delivery programme similar to Scotland's – which places local authorities at the heart of delivery through area or locally-based renovation schemes, local heat and energy efficiency strategy development, local jobs and supply chains, localised and personalised advice services, and the development of an integrated approach to energy efficiency and heat that prioritises low-income households.	**Rating: Red** Government has not set out any plans to implement a local authority led delivery programme.
Local and long-term renovation advice, alongside full adoption of the of independent Each Home Counts review's recommendations to ensure informed consumer choice backed by the highest quality and safety standards.	**Rating: Red** The Government has ended the Energy Saving Advice Service, not set up any independent advice centres at local level and the Each Home Counts review's recommendations have not yet been rolled out.

Act Now

The Government's approach to energy efficiency is falling short of its own ambition and it has not yet put in place the policies and investment required to get the UK on track to meet its carbon budgets or tackle fuel poverty at the scale and speed required to meet legally binding targets. Delay implies more carbon emissions, higher energy bills and unnecessarily cold homes.

To meet the net zero challenge and make the transition affordable, the Government must make energy efficiency an infrastructure priority and adopt this programme in full, by placing it at the heart of the UK's infrastructure plans and allocating at least £1 billion extra per year to underpin and drive energy efficiency investment. The co-benefits, healthier homes and the elimination of fuel poverty, represent a major prize. And the huge economic benefits mean that there is a strong case to make this the UK's number one infrastructure priority. No other infrastructure investment can do so much for so many.

[14]E3G (2018e) Home energy performance investment gap

[15]CCC (2019c) UK housing: Fit for the future?, p. 28

[16]Committee on Fuel Poverty (2018) Third Annual Report

[17]Frontier Economics & EEIG (2017) Affordable Warmth, Clean Growth

1 Introduction

1.1 Why energy efficiency?

The Intergovernmental Panel on Climate Change[18], the European Commission[19] and the UK's Committee on Climate Change[20] have in recent months set out the urgency and scale of action required to avoid dangerous global warming in line with the Paris Agreement. Each made clear the central and early importance of energy efficiency in achieving the deep greenhouse gas reductions required. The UK has since passed a net zero greenhouse gas emissions target for 2050 onto the statute book. Without a huge uplift in the elimination of energy waste, targets commensurate with limiting warming to 1.5˚C cannot be met.

Improved energy efficiency in buildings since 2004 has strengthened UK energy security, reduced energy supply infrastructure costs, and now saves the typical dual fuel household over £500 per year[21]. Between 2004 and 2018, average household gas consumption fell 33% and electricity consumption fell 19%[22], despite a significant increase in the number of household appliances[23]. These savings were driven substantially by energy efficiency improvements – including in lighting, appliances, heating systems and insulation[24]. Direct greenhouse gas emissions from homes have fallen by 25% since 2004[25], mostly due to energy efficiency[26].

Huge energy saving potential in UK homes remains untapped. Research by the Regulatory Assistance Project, E3G, Sussex and Oxford Universities found that the technical potential for energy saving with today's readily available technologies could halve energy demand in the housing stock. Investments in residential energy efficiency and low carbon heating that are immediately cost-effective could over the next 15 years reduce energy demand by 25%[27]. At current energy prices, this would reduce average household energy costs by £270 per year. In total, this represents an energy saving equivalent to the annual output of six nuclear power stations the size of Hinkley Point C.

Appraisal based on HM Treasury's methodology for energy and climate policy finds that the net benefit of this saving would be £7.5 billion. Appraised as an infrastructure investment, the net financial benefits – to the economy, reduced power system investment needs and from improved health – amount to £47 billion more[27].

1.1 Why this report?

Despite its vast potential, energy efficiency's progress has stalled abruptly with changes to Government energy saving programmes in the UK contributing to a 47% drop in the annual level of investment[28] and a 95% reduction in the number of insulation measures installed in homes per year between 2012 and 2017[29].

The Clean Growth Strategy introduced a goal for all UK homes to achieve an Energy Performance Certificate (EPC) rating of C by 2035. The Committee on Climate Change has assessed that this level of ambition is commensurate with meeting medium term greenhouse gas targets, and achievable. There are 19 million homes rated EPC D or worse – that means 1.2 million properties need to be renovated on average each year to the end of 2035. In 2017/18 across the UK, around 170,000 homes were renovated with significant energy efficiency improvements – just 14% of the rate at which homes need to be improved. Current Government plans are not set to shift this dial anywhere near enough. A step-change in energy efficiency framing, policy and investment is desperately needed.

This Energy Efficiency Infrastructure Group (EEIG) report sets out the benefits of action on energy efficiency and clarifies the risks to the Government and the UK if a step-

[18]IPCC (2018) Global Warming of 1.5˚C

[19]COM (2018) A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy

[20]CCC (2019b) Net Zero: The UK's contribution to stopping global warming

[21]CCC (2017) Energy Prices and Bills – impacts of meeting carbon budgets. Comparison with what household energy consumption and bills would have been without energy efficiency measures adopted in homes since 2004.

[22]BEIS (2019a) Annual domestic energy bills, Tables 2.2.5 and 2.3.5. Temperature adjusted energy consumption. Average household electricity consumption based on households on standard electricity tariff. Equivalent data on households on Economy 7 does not go back further than 2010.

[23]BEIS (2019b) Energy Consumption in the UK, Table 3.12

[24]BEIS (2019b) Energy Consumption in the UK, Table 3.13, 3.19, 3.21-3.27

[25]BEIS (2019c) Updated energy and emissions projections 2018, Annex A

[26]Carbon Brief (2019b) Analysis: Why the UK's CO_2 emissions have fallen 38% since 1990

[27]Rosenow et al. (2018) The remaining potential for energy savings in UK households

[28]E3G (2018e) Home energy performance investment gap

[29]CCC (2019c) UK housing: Fit for the future?, p. 28

change in energy efficiency investment is not achieved. It builds directly on the EEIG's 2017 report prepared with Frontier Economics, by setting out a clear action plan for establishing a comprehensive UK Buildings Energy Infrastructure Programme designed to achieve the EPC C goal by 2035. The Programme's structure is sufficiently robust and flexible to achieve the target more quickly if deemed necessary, as well as to achieve subsequent targets on the path to net zero greenhouse gas emissions. It updates on the policy progress made since 2017, identifies the gaps in policy that remain, and it sets out the near-term opportunities for the Government to close these gaps.

This report makes clear that energy efficiency's impacts are much broader than greenhouse gas reductions and sets out the benefits that energy efficiency investment will bring to housing and other policy objectives within and across numerous departmental remits. While the focus of this report is on housing, the Programme must ultimately cover energy performance and efficiency in all buildings, including commercial and public buildings. Unless energy efficiency is put at the heart of the UK's infrastructure plan and into departmental spending plans for the coming decade – for which HM Treasury support during the next Spending Review will be critical – the most beneficial path to a net zero economy will be lost and UK households and businesses will be the poorer for it.

Energy efficiency as an infrastructure investment priority means that its economy-wide benefits can be properly acknowledged and realised, while the Government can avoid non-compliance with its legal obligations, minimise wasteful spending and avert reputation and credibility loss. It can help the Government ensure that fuel poverty targets are met while the costs and benefits of the net zero transition are borne fairly. With this report, the EEIG affirms its commitment to work closely with the Government on making the UK's buildings fit for the net zero future.

2 Energy efficiency as a national infrastructure priority

2.1 The opportunity: energy efficiency delivers public benefits

The Clean Growth Strategy's overarching goal for all housing to achieve an Energy Performance Certificate (EPC) rating of C by 2035 was welcome. It reflected the central and crucial role energy efficiency plays in keeping the cost of decarbonisation down.

As energy efficiency delivers not only private benefits, but also a wide range of public goods outlined below, public policy intervention and especially public investment is not only necessary, but thoroughly justified. The fact that its benefits accrue across a wide range of public policy priorities speaks to the need for cross-departmental coordination – something that would be bolstered by designating energy efficiency investment as a national infrastructure priority. The EEIG's proposals for a Buildings Energy Infrastructure Programme can deliver the following public and private benefits.

[30] Rosenow et al. (2018) The remaining potential for energy savings in UK households

[31] Cambridge Econometrics & Verco (2014) Building the Future: the economic and fiscal impacts of making homes energy efficient

[32] See section 2.2.

Cross-departmental benefits for:	Details	Relevant for:
Energy bills	Households' energy bills would be permanently reduced – on average by a quarter or £270 a year at today's prices[30], and by significantly more in the least efficient homes – amounting to £7.2 to £8.6 billion per annum in total energy bill savings across the housing stock once comfort taking has been accounted for[24 31]. This is money that households can save or spend in more productive parts of the economy.	HMT, BEIS
Fuel poverty	Statutory targets to tackle fuel poverty in England and elsewhere in the UK would be met. This could create enormous savings in the long run. Welfare spending to stem the worst effects of fuel poverty includes the Warm Home Discount (£320 million per year), Cold Weather Payments (£130 million per year) and the Winter Fuel Payment (£1.8 billion per year). This amounts to a total of £2.25 billion of public spending every year due in large part to the poor energy efficiency of the UK housing stock.	DWP, BEIS
Carbon emissions	Achieving a good level of energy efficiency for all homes by 2035 is consistent with the least-cost approach to meeting the fourth and fifth carbon budgets[32], and a critical staging post for achieving zero carbon homes and net zero emissions in the UK. Government investment in energy efficiency reduces the costs of decarbonisation for all households – heat decarbonisation could cost £6.2 billion less per year to 2050[33] – and decreases the overall level of public subsidy needed.	BEIS
Productivity and competitiveness	It would improve construction sector productivity where energy efficiency upgrades are incorporated into broader renovation and maintenance works and the added value exceeds the marginal cost. It would improve national competitiveness, by enhancing energy productivity and staff productivity in the workplace[34]. Product and service innovation to build a market for low carbon and resilient buildings brings significant clean industrial growth opportunities, at home and abroad.	HMT, MHCLG, BEIS

Cross-departmental benefits for:	Details	Relevant for:
Employment	It would create skilled employment opportunities, through the renovation and construction work needed, and the supply chains around them. This means a net increase in annual employment of around 100,000 full-time equivalents over the period 2020-2030, with most jobs created in the services and the construction sectors[31].	HMT, BEIS, MHCLG
Infrastructure investment	It would, through robust new build standards, avoid the need to renovate new homes for net zero at a later date, saving household energy costs from the outset, and harness the opportunity to make newly-built homes resilient to hot weather, floods and water scarcity. For a typical new home, retrofitting for zero emissions and resilience can cost £33,000 more than building it that way[35]. More broadly, a Buildings Energy Infrastructure Programme would reduce the need for costlier upgrades to the electricity grid, new power supply and low carbon heat supply, with a present value of avoided electricity network investment of £4.3 billion[30] and avoided annual costs of decarbonised heat to 2050 of up to £6.2 billion[36].	MHCLG, HMT, BEIS
Health impacts of homes and outdoor air quality	It would deliver improved public health outcomes, by avoiding ill-health from cold homes through improved comfort. The cost to the NHS of health conditions made worse by poor housing is estimated to be between £1.4 and £2.0 billion each year in England alone[37] with the costs of productivity loss potentially far higher[38]. It would also improve outdoor air quality, with a present value of £4.1 billion[30].	DHSC, DEFRA
Energy security	It would enhance energy security, by reducing the need for gas imports, improving the balance of trade and boosting GDP in the process. As a result of greater energy efficiency investment, GDP could be 0.6% higher in 2030 (£13.9 billion), driven by a 26% reduction in imports of natural gas by 2030[31].	HMT, BEIS
Fiscal position	In the long term the public investment pays for itself. The economic activity that would be driven by an energy efficiency infrastructure programme delivers tax revenue, cumulatively £51.1 billion by 2030. In present value terms, a return of £1.27 per £1 invested would be achieved over this time[31].	HMT

Including the indirect emissions from the electricity they use, homes account for 20% of the UK's greenhouse gas emissions. Making our housing stock energy efficient is inextricably linked to decarbonising the UK economy.

More broadly, it is now recognised as an intrinsic part of delivering high quality, safe, healthy and affordable homes for all. Having an energy efficient housing stock means homes are not cold and damp, and do not result in a burden on the NHS and the welfare system; they are well-adapted to a warming world and cheaper to insure; they are more affordable to run, easier to maintain and comfortable to live in – whether as a young family or in old age.

[33]Imperial College London (2018) Analysis of Alternative UK Heat Decarbonisation Pathways

[34]LBNL Indoor Environment Group (2016) Cost Effectiveness of Improving Indoor Environments to Increase Productivity

[35]CCC (2019c) UK housing: Fit for the future?, p. 42

[36]Imperial College London (2018) Analysis of Alternative UK Heat Decarbonisation Pathways

[37]BRE (2015) The cost of poor housing to the NHS

[38]Roys et al. (2016) The full cost of poor housing

Where energy efficient homes are rented out, they are of a decent standard and see better, longer tenancies[39]; where bought and sold they have better value[40 41]; their low energy bills decrease the likelihood of defaulting on mortgage payments[42] and should make it easier to get on and stay on the housing ladder[43]. Where newly built, they are fit for the future in all these respects.

The vision for the UK's homes must be that they do not exacerbate inequalities – they should serve as a secure foundation for getting on in life and achieving one's aspirations. Transforming the energy efficiency of our homes helps to achieve that.

2.2 The threat: failure to comply with legal obligations and unnecessary cost

Without a policy and investment step-change on energy efficiency, the Government will (avoidably) fail to meet its statutory climate and fuel poverty targets, put net zero emissions out of reach, and incur unnecessary costs on public and private budgets.

Government will not comply with the fourth and fifth carbon budgets and the UK cannot achieve net zero greenhouse gas emissions

The Committee on Climate Change has made clear that the Government's 2035 target for existing homes, if met, is consistent with the least cost pathway to achieving the UK's fifth carbon budget[44] and therefore the current 2050 greenhouse gas target.

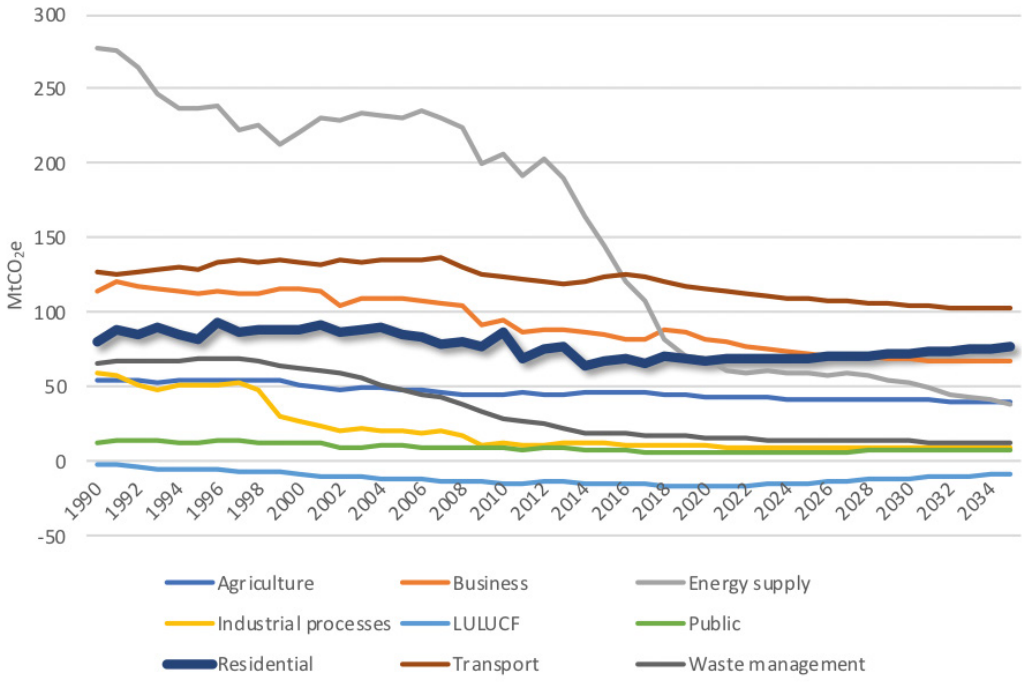

Figure 1: Progress to date and central projections for greenhouse gas emissions based on current and planned policies[45]

[39]Sustainable Homes (2016) Touching the Voids: the impact of energy efficiency on social landlord income and business plans

[40]Brocklehurst (2017) What will you pay for an "A"? – a review of the impact of building energy efficiency labelling on building value

[41]Money Super Market (2018) Improving your home value through energy efficiency

[42]UNC Center for Community Capital & Institute for Market Transformation (2013) Home Energy Efficiency and Mortgage Risks

[43]The Welsh Government has recognised this, offering to lend more through its Help to Buy shared equity loans the more efficient the property being purchased is; Welsh Government (2018b) Help to Buy-Wales homebuyers will see energy efficiency loan benefit

[44]The CCC says that "The Government's commitments on energy efficiency have the potential to deliver the ambition in our central scenario for meeting the fifth carbon budget, provided that the limitations of 'practical' and 'affordable' do not significantly limit cost-effective uptake."; CCC (2018) An independent assessment of the UK's Clean Growth Strategy – From ambition to action

However, BEIS' latest energy and emissions projections, published in April and incorporating existing and currently planned policies, shows that household emissions are now rising and will continue to do so until the mid-point of the sixth carbon budget period in 2035. This is shown in dark blue in Figure 1.

As things stand, out of all these sectors, only residential sector emissions are projected to rise. This is due to new homes being built to weak energy efficiency and carbon standards, and the collapse in support for making UK existing homes energy efficient. For achieving net zero emissions, this is untenable. The main driver of greenhouse gas emissions reductions in the UK has been the decarbonisation of power as the use of coal has waned and renewables ascended. This is progressing ahead of schedule, with the target for grid carbon intensity of 100gCO_2 per kWh projected to be met years ahead of the 2030 target date[46]. For net zero emissions, similarly rapid progress must be achieved in the other sectors too. Figure 2 contrasts the Government's projections for the residential sector with the CCC's least cost pathway to meeting the fifth carbon budget – which may need to decline more steeply for net zero emissions. It shows how the Government's projection for residential sector emissions increasingly veers off the least cost route as we head towards 2035.

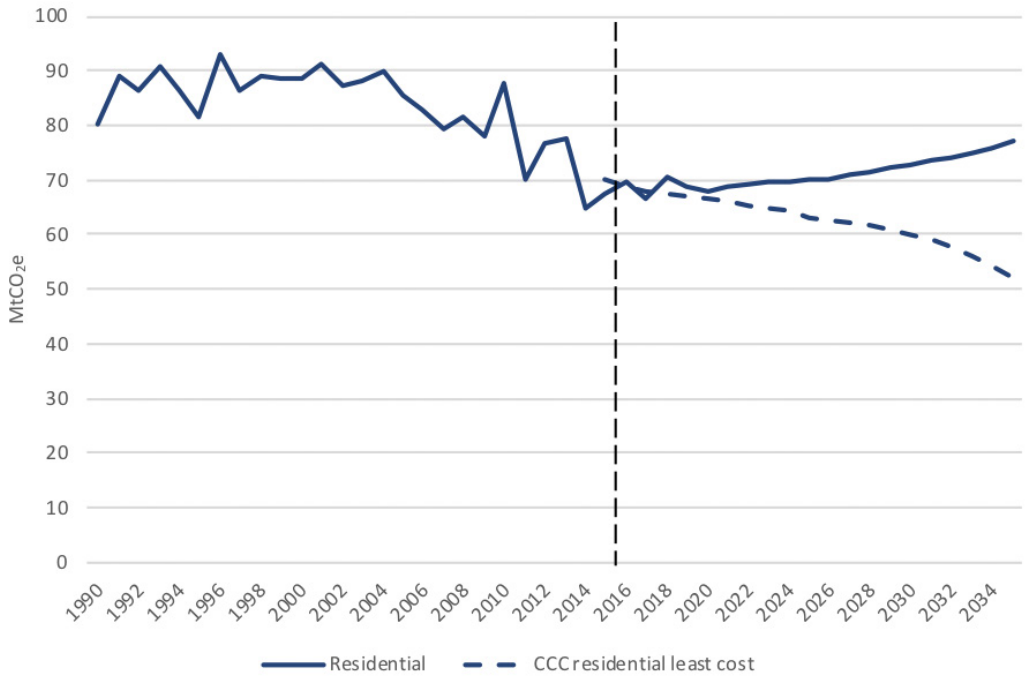

Figure 2: Progress to date and central projection for residential greenhouse gas emissions[45], compared to CCC least-cost emissions reduction pathway for the residential sector[47]

[45]BEIS (2019) Updated energy and emissions projections 2018, Annex A

[46]Carbon Brief (2019) Analysis: Half of UK's electricity to be renewable by 2025

[47]CCC (2016) Fifth Carbon Budget Dataset

Despite progress in power decarbonisation and projected emissions reductions in other sectors, the fourth and fifth carbon budgets will not be met. The residential sector is projected to contribute a significant and growing share of the shortfall – amounting to 39% for the fifth carbon budget – as shown in Figure 3.

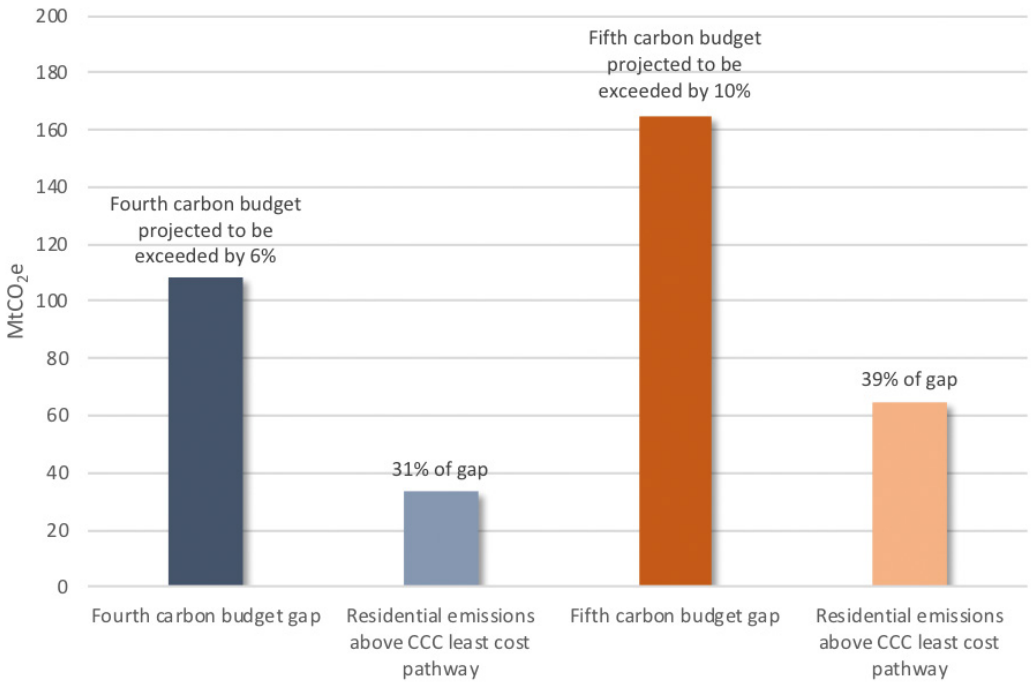

Figure 3: Central projection of emissions in excess over the 5-year fourth and fifth carbon budgets, compared to residential emissions in excess of the CCC's least cost pathway to meeting the fifth carbon budget[45 47]

It is important to note that the impact of some policies announced in the Clean Growth Strategy have not been included in BEIS' projections yet as they are insufficiently developed. Among these is the commitment to energy efficiency for low-income households at the same level of funding as the current Energy Company Obligation from 2022 to 2028, the intention to regulate to ensure rented housing achieves an EPC rating of C by 2030, and a review of standards for newly built homes.

In addition, the Clean Growth Strategy announced a process for assessing future heat decarbonisation policy, but made no commitment to implementing a successor to the Renewable Heat Incentive. Subsequent announcements not included in the projections include the possible impacts of the 2030 Buildings Mission[48] of the Transforming Construction Challenge[49] and the Future Homes Standard.

However, none of these policies are likely to meaningfully impact the fourth carbon budget gap, and are likely to have only a modest effect on closing the fifth carbon budget gap as they are insufficient to meet the Government's 2035 target for homes. Now that the Government has chosen to adopt a net zero greenhouse gas emissions target, the required step-change in energy efficiency investment has become mission-critical.

[48]To halve the total energy use of new buildings by 2030 compared to today's new build standards, and halve the cost of retrofitting buildings to a similar level of performance.

[49]The Buildings Mission is supported by the Transforming Construction Industrial Strategy Challenge Fund, which has £170m of public funding, matched by £250m of private investment, for construction sector innovation. Under the fund, a £10 million competition was announced in July to support the Mission's aim to reduce the cost of retrofitting buildings.

Statutory fuel poverty targets will not be met

The Committee on Fuel Poverty estimates that energy efficiency investment to meet England's statutory fuel poverty targets – that all fuel poor homes achieve a Fuel Poverty Energy Efficiency Rating of C (on a scale of A (best) to G (worst)) by 2030 – amounted to at least £19.8 billion in total from 2016. Taking into account policies approved and in place since the Clean Growth Strategy was published – the current phase of the Energy Company Obligation to 2022 and the amended Minimum Energy Efficiency Standard for the private-rented sector – the investment shortfall presently stands at £15.1 billion.

Policies proposed in the Clean Growth Strategy but not yet implemented could close some of this gap. Regulating to ensure rented homes achieve an EPC C rating by 2030 could drive £2.7 billion of investment in the private-rented and £1.4 billion in the social housing sector respectively; and the extension of support for low-income households to 2028 at the same level as the current Energy Company Obligation could see £2.1 billion of further investment[50].

The Committee on Fuel Poverty concluded in its latest annual report at the end of 2018 that if the above proposals are implemented in full, an investment gap of £8.9 billion would still remain, amounting to an average £740 million per year over the 12 years to the end of 2030. This reduced shortfall would still mean that the interim fuel poverty milestones for 2020 and 2025[51] will be missed. The Committee recommended that in the near term, £1 billion of additional funding needed to be allocated by HM Treasury over 2019-2021 to meet the 2020 interim fuel poverty milestone, and that for the 2025 milestone an additional £1.8 billion is required over 2022-2025.

At the current level of investment, it would take until the mid-2040s to meet the fuel poverty target. Leaving households languishing in fuel poverty after 2030 will not only mean that the Government is in breach of the law. The cost to the NHS of health conditions made worse by poor housing is estimated to be between £1.4 and £2.0 billion each year in England alone[52]. If the full cost to society included medical costs plus, for example, lost education and employment opportunities, the true figure could be as high as £18.6bn[53]. Most starkly, there are on average 32,000 excess winter deaths every year, of which 9,700 are attributable to cold homes and 3,200 are linked directly to fuel poverty[54].

Existing and emerging fuel poverty commitments in Northern Ireland, Scotland and Wales also need to be met by the devolved governments. If low-income and vulnerable households are unable to share in the benefits of decarbonisation, it severely risks precipitating the loss of public support and good will for tackling climate change

The costs of decarbonising our heat supply, and therefore the wider economy, will rise

Failure to achieve a step-change in energy efficiency investment will make the significant challenge of decarbonising the UK's heat supply more difficult and costly – regardless of the avenues pursued (e.g. heat pumps, hybrid systems, district heating, hydrogen) to do this. Analysis for the Committee on Climate Change by Imperial College London estimates that energy efficiency can reduce the total system costs of heat decarbonisation by as much as £6.2 billion per year to 2050[55].

[50]Committee on Fuel Poverty (2018) Third Annual Report

[51]For all fuel poor households in England to achieve a Fuel Poverty Energy Efficiency rating of E by 2020 and D by 2025.

[52]BRE (2015) The cost of poor housing to the NHS

[53]Roys et al. (2016) The full cost of poor housing

[54]E3G & NEA (2018) Cold Homes and Excess Winter Deaths: a preventable public health epidemic

[54]Imperial College London (2018) Analysis of Alternative UK Heat Decarbonisation Pathways

Without a step-change in energy efficiency investment, such costs will be incurred and ultimately borne by households and businesses. Some of the dynamics are set out below, and speak to the urgency of ensuring that energy efficiency and heat decarbonisation programmes are deeply integrated.

Table 1: The negative impacts of low energy efficiency investment

Energy bills will be higher because we consume more energy	It would cost households and businesses more to heat their buildings to the same level as more units of heat are required.
Heating equipment won't operate as efficiently as it could	In the case of heat pumps, they do not run as efficiently in a home that loses heat quickly: which means that for every unit of heat that they produce, they need more units of electricity to produce it. Should hydrogen boilers become the dominant route to decarbonising heat, then inefficient homes would require more natural gas to be sourced to produce additional hydrogen.
Heating system replacements will be more expensive	The more efficient a property is, the smaller the capacity of the heating system it needs. Larger heat pump and boiler sizes are more costly to buy and to run. For example, in a typically sized home that is not properly efficient, an unnecessarily large heat pump could cost £1,000 more[56].
More power plant and more grid reinforcement would be needed than is necessary	As a result of needing to inefficiently produce more heat for homes, more electricity generation, transmission and distribution capacity and hydrogen production capacity would be required, which consumers ultimately pay for through energy bills.
The balance of trade would worsen	Needing more energy to heat our buildings means we need to import more gas and electricity than we otherwise would. This exacerbates energy security risks but it also means GDP is lowered by the same amount as the value of additional imported energy.
We would have to pursue more costly decarbonisation options elsewhere	The least cost path to meeting current climate targets, according to the CCC, requires near full decarbonisation of buildings (i.e. heat as they treat power decarbonisation separately). Therefore, not fully decarbonising heat means meeting our targets in another, costlier, way.
Fuel poverty would persist	This would continue the social blight of fuel poverty and unnecessarily burden the welfare system – including, but not limited to the ongoing need for Warm Home Discount, Cold Weather and Winter Fuel Payments – imposing unnecessary costs on the NHS and wider society.

[56]A heat pump in a poorly insulated home would typically need to be 50% larger in terms of heat output compared to an appropriately sized heat pump for a well-insulated home. For a typically-sized three-bedroom semi-detached house, this can amount to an extra £1,000 on the installed cost. (Heat pump sizing tested with Mitsubishi Electric's Ecodan selection tool; marginal cost of larger heat pump derived from CCC (2019) Net Zero Technical report)

3 The actions needed to achieve the 2035 EPC C target are clear

The *Affordable Warmth, Clean Growth* report produced by Frontier Economics for the EEIG set out an action plan for delivering a coherent, comprehensive and long-term Buildings Energy Infrastructure Programme[57], designed to ensure that 19 million homes with an EPC rating of D or worse are renovated to at least an EPC rating of C by the end of 2035, and that newly built homes do not need to be upgraded.

Achieving the EPC C target means undertaking significant energy improvements for 1.2 million homes each year. At present, 170,000 homes undertake meaningful energy efficiency upgrades each year, a rate which will not be meaningfully increased by presently planned policies. There is a vast gap between where we are and where we need to be – although this varies considerably from place to place across the United Kingdom, as shown in Figure 4.

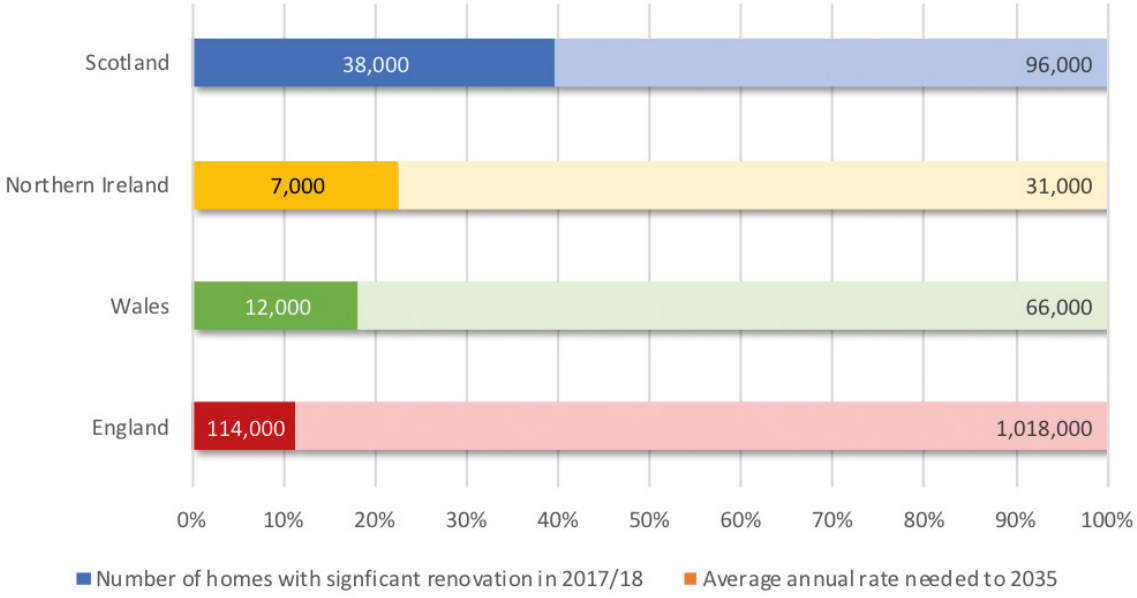

Figure 4: Rate of significant energy efficiency improvements in UK homes in 2017/18 shown as share of average annual rate need to 2035[58]

The EEIG's proposals for a Buildings Energy Infrastructure Programme are therefore designed to deliver 19 million high quality home renovations to 2035. Given Parliament's declaration of a climate emergency and the UK's new net zero greenhouse gas target, serious consideration now needs to be given to bringing this target forward to 2030. The Programme's recommendations – quantified in relation to 2035 but adaptable to a new 2030 target – can be summarised in six interlocking points:

1) A need for **clear governance** combined with practical and achievable targets – principally all low-income homes to EPC C by 2030 and all other homes by 2035 – and as in Scotland and Wales **designating energy efficiency as a national infrastructure priority** to secure cross-government buy-in, to be driven by a comprehensive and long-term investment programme with a dedicated delivery agency.

2) Ring-fenced additional public capital investment averaging £1 billion per year to 2035, bringing the total investment funded from public budgets and household

[57] Frontier Economics & EEIG (2017) Affordable Warmth, Clean Growth

[58] 2019 analysis by E3G for the EEIG.

energy bills (via the Energy Company Obligation) to £1.7 billion, deployed to fully support low-income households and incentivise a further £3.5 billion of private investment from landlords and those able to pay.

3) Proper incentives for the 'able to pay' market to thrive and unlock the £3.5 billion of private investment needed – starting right away with a demonstration programme to test and refine a Stamp Duty incentive, zero interest loans and incentives to pump-prime demand for green mortgages as recommended by the Green Finance Taskforce.

4) Using regulation to help frame individual choices, minimise costs and drive private investment, by tightening rented sector regulation over time to an EPC rating of C by 2030, the eventual introduction of a mandatory minimum EPC rating for owner-occupied homes at point of sale, and ensuring newly built homes are net zero carbon across all energy uses in their operation and climate-resilient from 2030 at the latest.

5) A long-term, fair and local delivery programme similar to the ones guiding energy efficiency investment in other countries, in particular Scotland – which places local authorities at the heart of delivery through area or locally-based renovation schemes, local heat and energy efficiency strategy development, local jobs and supply chains, localised and personalised advice services, and the development of an integrated approach to energy efficiency and heat, residential and non-residential sectors, fuel poor households and those more able to pay.

6) Nationally framed, locally salient and forward-looking renovation advice provision, alongside full adoption of the independent Each Home Counts review's recommendations, to ensure informed consumer choice backed by the highest quality and safety standards.

The following sub-sections examine the Government's progress towards, and the case for, each of the recommendations. It considers concrete opportunities for the Government to take the recommendations forward, going with the grain of policy development processes already underway, and maps these out. The Energy White Paper (absorbing the originally planned Energy Efficiency Action Plan), the England Fuel Poverty Strategy Review, the Review of Parts L and F of the Building Regulations for 2020 and the National Infrastructure Strategy are also considered.

3.1 Clear governance arrangements and national infrastructure priority

A programme to upgrade the UK's residential energy efficiency infrastructure needs clear governance arrangements combined with practical and achievable targets – principally all low-income and rented homes to EPC C by 2030 and all other homes by 2035 – and as in Scotland and Wales designating energy efficiency as a national infrastructure priority to secure cross-government buy-in, to be driven by a comprehensive and long-term investment programme with a dedicated delivery agency.

The Government has taken the initial step of setting clear targets for energy efficiency in homes in the Clean Growth Strategy. Given the wide range of public goods and policy priorities to which energy efficiency investment contributes, significant cross-departmental coordination is needed to ensure a comprehensive energy efficiency infrastructure programme can be delivered well. The EEIG believes the designation of energy efficiency as a national infrastructure priority is key to driving the coordination and focus required from departments over the long term, and sees a dedicated delivery

EEIG RECOMMENDATION	PROGRESS
Set clear targets	2017 Clean Growth Strategy set out goal to improve all homes to energy rating of C by 2035 where 'practical, cost-effective and affordable', with goals for the rented sectors for 2030, complementing England fuel poverty target.
Designate energy efficiency a national infrastructure priority	The National Infrastructure Commission, it its first Infrastructure Assessment, identified energy efficiency as an investment priority, but did not recommend enough action or public capital to meet the Band C 2035 target. Government has taken no action so far.
Establish dedicated delivery agency to manage cross-departmental coordination and effective delivery	No action taken so far.

unit or agency as central to maintaining momentum, coordination and investment to meet the targets.

The UK Government has already embarked on an analogous, albeit smaller scale and shorter-term approach to deliver district heating investment as an infrastructure programme with dedicated coordinating capacity. Backed by £320 million of public infrastructure capital over three years, the Heat Networks Investment Project aims to leverage £1 billion of private and other capital. Its deployment is enabled, guided and assisted by BEIS' Heat Networks Delivery Unit working alongside a specialist delivery partner dedicated to raising the additional capital.

Germany's ambitious programme for deep energy efficiency renovations has been assigned to its national infrastructure bank, which coordinates the deployment of low interest loans, subsidies and application of energy performance standards. The Kreditanstalt für Wiederaufbau (KfW) has established a formidable track record in unlocking private investment for energy efficiency (see section 3.3).

Within the UK, Scotland takes the clear lead – its Government designated energy efficiency as a national infrastructure priority and this has underpinned the comprehensive programme now being delivered across Scotland. It has recently been brought together under the umbrella of the Energy Efficient Scotland (EES) route-map[59]. EES is the combined result of a long track record in devolved energy efficiency and fuel poverty policy, a coordinated set of continuing pilot schemes, an ongoing consultative process and an evaluation framework allied with long-term funding commitments. It outlines a 20-year programme for all homes to achieve an EPC of C by 2040, with rented housing and fuel poor households to achieve this standard at earlier dates – and decarbonise their heat supply. In March, the Scottish Government launched a consultation on the further development of EES which explores bringing the EPC target forward to 2030[60]. EES also encompasses commercial and public buildings, which a UK-wide Buildings Energy Infrastructure Programme ultimately needs to cover to reduce emissions to zero across the entire building stock.

This goes to show that in the complex and often fragmented world of energy efficiency, the clarity of positioning it as a national priority is more than just words – it is key to securing and sustaining good governance, long-term funding and private investment. The Government should apply the lessons from Scotland's successful model and use it to build a comprehensive and practical UK-wide programme along similar lines.

[59]Scottish Government (2018) Energy Efficient Scotland: route map

[60]Scottish Government (2019a) Energy Efficient Scotland: consultation on further development of the programme

CURRENT GOVERNMENT OPPORTUNITIES TO TAKE THIS FORWARD	
2019 BEIS Energy White Paper / Energy Efficiency Action Plan	• Establish clear framework for governing able-to-pay sector progress towards Clean Growth Strategy 2035 target • Set out consultative process and timetable for developing and publishing a National Capital Raising Plan for climate compatible infrastructure. Initiate process for establishing a covenant between government and finance providers for driving energy efficiency investment • Ensure that the 'energy efficiency first' principle is operationalised, by instituting energy planning requirements that prioritise energy efficiency investment where more economical
2019 BEIS England Fuel Poverty Strategy Review	• Include all low-income households living in homes below EPC C in the measurement of fuel poverty. Issue new fuel poverty action plan with clear roles and responsibilities for actors under reviewed strategic framework
2019 HMT National Infrastructure Plan	• Establish energy efficiency as a national infrastructure investment priority with a capital-raising plan, consistent with a National Capital Raising Plan for climate compatible infrastructure, with progress tracked by HMT
2019 Budget and 2020 Government Spending Review	• Align departmental spending with climate targets, and therefore allocate public infrastructure capital to energy efficiency investment over this and the next Spending Review period as the foundation for longer term investment

3.2 Ring-fenced additional public capital investment of £1bn per year to 2035

Additional public capital investment averaging £1 billion per year to 2035 needs to be allocated, starting with the Spending Review. This would bring total investment funded from public budgets and household energy bills (via the Energy Company Obligation) to £1.7 billion; the increase needs to come from public infrastructure funds to ensure the regressive impacts of funding via energy bills are not added to. This should be deployed to fully support low-income households and designed to incentivise – alongside regulation – a further £3.5 billion of private investment from landlords and those able to pay. Without additional public investment, private contributions will not reach the necessary scale.

EEIG RECOMMENDATION	PROGRESS
Ring-fenced additional public capital investment of £1 billion per year to 2035, suitably deployed.	The National Infrastructure Commission recommended £3.8 billion of infrastructure funds be allocated to energy efficiency improvements in social housing over 10 years, which is not sufficient. No action to allocate public capital investment yet taken by Government.

Figure 5 shows the current level of investment from public budgets and the Energy Company Obligation at £0.7 billion, how the increase to £1.7 billion a year needs to be configured, and the overall amount and sources of private investment - £3.5 billion – it must be designed to unlock. For context and scale, the UK's housing repair and maintenance market was worth £27.6 billion in 2016[61]. Separately, infrastructure investment in the UK amounts to around £60 billion per year from 2018/19 to 2020/21, of which around £30 billion is from public capital budgets[62].

Out of the £1.7 billion public investment required (shown in the middle of Figure 5), £0.6 billion is needed to support incentives for able-to-pay owner-occupiers[63] each year.

[61] ONS (2019) Output in the construction industry

[62] Infrastructure and Projects Authority (2018) Analysis of the National Infrastructure and Construction Pipeline

[63] More on this in section 3.3.

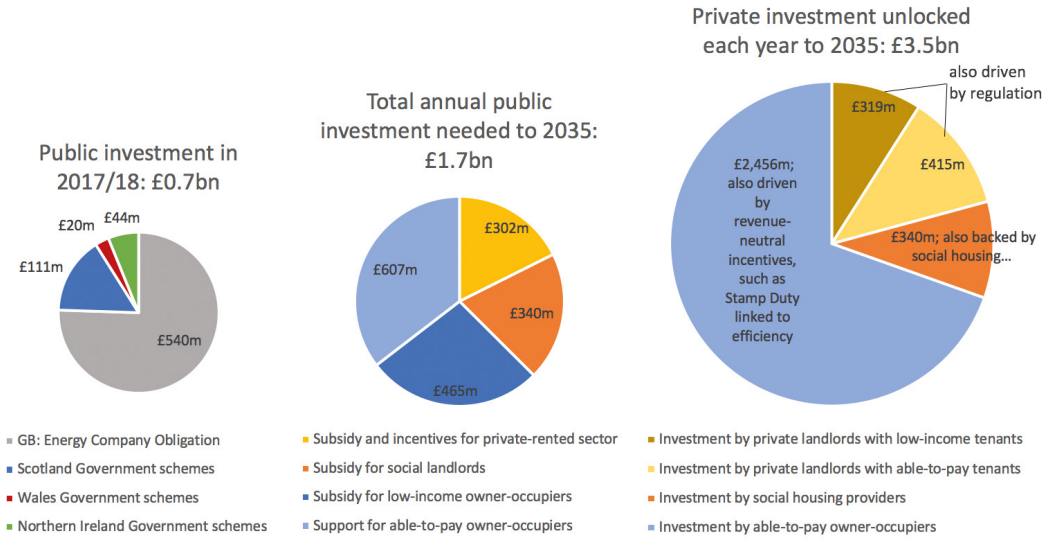

Figure 5: Current public investment, public investment needed to meet an energy rating of C by 2035 and the private investment it can unlock [capital only, excludes admin costs; annual averages][64] [65]

This should be designed to leverage £2.4 billion of private investment – a ratio of 1 to 4. Low-income owner-occupiers need to be 100% supported with energy efficiency measures through public investment. Regulation needs to be a major driver in rented housing alongside public investment: private landlords need to contribute 70% of the investment needed to get their properties to a C rating by 2030, and social landlords need to contribute 50%.

Deployed the right way, public investment can leverage the private investment needed. France's zero interest loan for home energy improvements is costing €40 million in interest rate subsidy over the lifetime of loans issued in 2016 and has supported €400 million of private investment: a ratio of 1 to 10. France issued tax credits for 'eco renovations' worth €1.6 billion which drove €5.8 billion worth of renovation in 2016, a ratio of 2 to 7[66]. In Germany in 2016, the federal cost of interest rate subsidy for renovation loans issued through the KfW bank and associated capital subsidies amounted to €1.7 billion and drove €10.1 billion in energy renovation that year – a ratio of 1 in 6. The VAT revenues alone, at €1.6 billion, nearly recouped the federal government's outlay[67] [68].

These examples of the UK's most comparable European neighbours make clear that first, major economies recognise that large-scale public investment is essential to drive significant energy efficiency improvements in housing and that it is economically sensible and viable to do so, and second, that the ratios of public to private investment that the Energy Efficiency Infrastructure Group proposes are highly achievable.

CURRENT GOVERNMENT OPPORTUNITIES TO TAKE THIS FORWARD	
2019 BEIS Energy White Paper / Energy Efficiency Action Plan	• Set out national energy efficiency investment requirement in able-to-pay households to 2035 and beyond
2019 BEIS England Fuel Poverty Strategy Review	• Set out how investment gap of at least £8.9 billion to 2030 identified by Committee on Fuel Poverty will be closed
2019 HMT National Infrastructure Plan	• Set out how overall energy efficiency investment gap of £5.2 billion per year to 2035 will be closed
2019 Budget and 2020 Government Spending Review	• Ring-fence additional public capital investment of £1 billion per year for residential energy efficiency, bringing UK total to £1.7 billion

[64] Frontier Economics & EEIG (2017) Affordable Warmth, Clean Growth

[65] E3G (2018e) Home energy performance investment gap

[66] Ministère de l'Environnement, de l'Energie et de la Mer (2017) National Energy Efficiency Action Plan

[67] Institut Wohnen und Umwelt & Fraunhofer Institut (2018) Monitoring der KfW-Programme „Energieeffizient Sanieren" und „Energieeffizient Bauen" 2016

[68] Bundesministerium der Finanzen (2016) Haushaltsgesetz 2016

3.3 Proper incentives for the 'able to pay' market

Proper incentives are critical for the 'able to pay' market to thrive and unlock the £3.5 billion of private investment needed every year. Without such incentives this will simply not happen. It is viable to start right away with a demonstration programme to test and refine a Stamp Duty incentive, zero interest loans and incentives to pump-prime demand for green mortgages as recommended by the Green Finance Taskforce[69]. Alongside a potentially revenue-neutral incentive such as Stamp Duty linked to the Energy Performance Certificate (EPC). The EEIG recommends that an annual £0.6 billion be allocated to supporting the able-to-pay market, geared towards unlocking £2.4 billion of household contributions each year.

EEIG RECOMMENDATION	PROGRESS
Introduce a revenue-neutral Stamp Duty-based incentive, linking level of Stamp Duty paid to energy performance of the property.	Whilst a trial was explored in BEIS' call for evidence on building the market for energy efficiency, and recommended by the Green Finance Taskforce, no action to establish a trial has been taken.
Demonstrate at scale options for low-cost finance, income tax relief and partial grants for energy efficiency and roll out the most effective approaches.	The Green Finance Taskforce recommended such drivers of demand for energy efficiency be introduced to incentivise mortgage lenders and retail banks to introduce financial products to support home energy renovation. The £5 million Green Home Finance Fund to help pilot new financial products, announced in the Green Finance Strategy, is too small in relation to the challenge. Plans to consult on the merits of setting requirements for lenders to improve the energy performance of homes they lend to have potential, but a decision on them would appear to be a long way off.

The Green Finance Taskforce was crystal clear that mortgage providers would not see take-up of 'green' mortgages to support home energy renovation without Government incentives and regulation to drive demand. The Committee on Climate Change agreed and called on the Government to implement the Taskforce's recommendations in its Housing Fit for the Future report. The lack of demand drivers for Green Deal finance played a large part, compounded by its high interest rate, in its complete failure to be transformational. With demand drivers in place, industry investment in bringing the energy efficiency market to scale will grow, innovation will flourish, costs will fall and performance will improve – along with a boost to skills, jobs and export opportunity.

It is only the combination of a variety of government-backed incentives, private finance deals and technological solutions from the construction sector that can ensure there is a suitable and attractive offer for every household to improve their home. Experience in France, Germany, the Netherlands and Scotland bears this out. For example, France combines tax credits with zero interest finance[70], Germany links the level of subsidy, which can be combined with low cost finance, to KfW bank-defined whole house energy performance standards[71]. The Netherlands offers subsidies combined with rules that require mortgage lenders to lend more to property owners whose homes achieve a net zero energy standard[72]. And Scotland offers 'stackable' subsidies for individual energy efficiency measures in combination with zero interest loans[73].

[69] Green Finance Taskforce (2018) Accelerating Green Finance

[70] E3G (2018a) Country case study: France

[71] E3G (2018b) Country case study: Germany

[72] E3G (2018c) Country case study: Netherlands

[73] E3G (2018d) Country case study: Scotland

CURRENT GOVERNMENT OPPORTUNITIES TO TAKE THIS FORWARD	
BEIS Energy White Paper / Energy Efficiency Action Plan	• Build on actions planned in Green Finance Strategy to design and launch programme of demonstrations of incentives that leverage investment from able-to-pay households and incentivise mortgagelenders and retail finance providers to provide financial products
2019 Budget and 2020 Government Spending Review	• Tweak Stamp Duty to reflect energy performance of properties. Allocate £0.6 billion per year for rollout of incentives and low-cost finance, preceded and informed by demonstrations of able-to-pay incentive schemes

These countries see far higher renovation rates than the UK as a result of households being able to combine different types of subsidy for a variety of technologies – or technology-neutral subsidies linked to achieving high energy performance outcomes for the home – with a variety of finance offers: be they government subsidised interest rates on personal loans, equity loans, regulated additional mortgage borrowing or entirely private offers. The key has been for governments to provide incentives designed to drive demand, creating space for finance offers that enable households to act on that demand.

3.4 Regulation to help frame choices and guarantee outcomes

It is essential to use regulation, especially new-build standards and mandatory minimum energy efficiency standards (MEES) for existing homes, to help frame individual choices and drive private investment. To maximise the chance of reaching the Government's targets, regulation can play a major role in reducing costs for consumers and driving individual decisions, market development and private investment by households and businesses, whilst optimising the use of infrastructure capital for new homes. For the Energy Efficiency Infrastructure Group, this means tightening rented sector regulation over time to an EPC rating of C by 2030, the eventual introduction of a mandatory minimum EPC rating for owner-occupied homes at point of sale, and ensuring newly built homes are net zero carbon across all energy uses in their operation and climate-resilient from 2030 at the latest.

EEIG RECOMMENDATION	PROGRESS
Signal intention to tighten standards in the private rented sector and review need for standards in social rented sector. Introduce incentives for landlords who go further.	Intention signalled in Clean Growth Strategy for strengthened rented housing standard of a C rating from 2030, but this has not yet been confirmed. No action taken on landlord incentives, but private landlord investment requirement per property for meeting current MEES raised from £1,500 to £3,500 – should have been raised to £5,000.
Signal intention introduce a minimum standard from 2025 in owner occupied homes at point of sale or major renovation.	No action taken.
Require that all new dwellings built from 2020 meet at the very least the 'Zero Carbon Homes' standard previously proposed by the Zero Carbon Hub; from 2025 no longer connected to the gas grid, climate resilient and highly energy efficient, covering cooling, lighting and hot water in addition to heating; from 2030 net zero carbon in operation, covering all energy uses.	Spring Statement 2019 announced the introduction of a Future Homes Standard for ensuring low carbon heat supply by 2025 (consultation launched on interim standard for 2020). Previous Prime Ministerial announcement of Buildings Mission with aim of at least halving all energy consumption in new buildings compared to homes built today by 2030.

The Government has recognised the importance of regulation in improving the energy efficiency of UK homes by setting out the intention in its Clean Growth Strategy to drive the private and social-rented sectors to an EPC rating of C by 2030 through regulation, building on the MEES standard of EPC E currently in place. It is now critical that landlords get early certainty that an EPC rating of C by 2030 will be a legal requirement for a property to be lettable. This will enable them to plan investments, and for the energy advice, finance and construction sectors to come forward with products and services to make it easy and attractive to do so.

However, regulation for the owner-occupier sector has not yet been considered by Government. While incentives for the owner-occupier market are key to driving progress in that sector, regulatory backups that ensure a minimum acceptable level of energy performance may be necessary too and would have positive effects on homeowners' decisions.

Scotland is set to consult on MEES for owner-occupied homes[74]. If introduced with a long lead-in time, MEES for the owner-occupied sector, which could apply at the point of sale and/or major renovation or extension, would move many home-owners to adopt a proactive stance towards home energy performance renovations – for example towards incorporating energy efficiency measures into renovation works when they next improve their home's loft, kitchen or bathroom – and including energy efficiency in forward planning. With proper incentives and finance offers in place alongside such regulatory requirements (with reasonable exemptions), households would be empowered to do so, supported by businesses that have geared up to offer products and services to help homeowners comply.

The urgency of improving the standards to which new homes are built has been made much greater by the combination of the UK's new net zero target and the high ambitions for the volumes of new homes to be built in the coming years. 1.5 million new homes are to have been built by 2022[75], while millions more additional homes can be expected to be built to 2050.

It is critical to ensure these new homes do not add to the challenge of decarbonising our housing. The current challenges of upgrading and renovating the existing housing stock should be a valuable lesson that ensures all homes built today must perform to a very high energy performance standard, and be resilient to heat, flooding and water scarcity pressures of the future – therefore negating the need for retrofits to be climate resilient and meeting the requirements of net zero greenhouse gas emissions by 2050.

The CCC has highlighted how a home built to today's standards is not fit for the future, and could cost as much as £33,000 more to renovate with a low carbon heating system, efficiency measures and resilience features than it would cost to include at construction stage[76]. Higher energy consumption will also incur unnecessary costs for the occupants, with the Energy & Climate Intelligence Unit estimating that energy bills for people moving into new homes built since 2016 are £200 higher each year because Zero Carbon Home standards originally slated for 2016 were not implemented[77]. Given the UK's housebuilding ambitions, the speed with which better building regulations can be adopted and implemented is key to keeping down the costs of decarbonisation and minimising fuel poverty risk.

In this context, the intention announced at Spring Statement 2019 to introduce a Future Homes Standard focused on ensuring low carbon heat supply in new homes by 2025 is

[74]Scottish Government (2019a) Energy Efficient Scotland: consultation on further development of the programme

[75]BEIS (2018a) Industrial Strategy – Construction Sector Deal

[76]CCC (2019c) UK housing: Fit for the future?, p. 42

[77]ECIU (2019) Zero Carbon Homes

welcome, but details of what that Standard entails for energy efficiency levels are scant and under current practices it will come too late. Transitional arrangements currently in place allow homes to be built to earlier standards that applied to the whole of a development site at the point work first commenced – there are still new homes being sold today that only meet the 2006 Building Regulations in England and are therefore not fit for the future. In addition, too many homes fall short of the standards to which they are supposedly being built. Inspection and compliance must be made more robust, accurate and trustworthy.

For the Future Homes Standard, and the forthcoming review of Parts L and F of the Building Regulations for 2020 to have a meaningful impact on the hundreds of thousands of homes to be built in the next few years, loopholes allowing construction to historical standards need to be closed, and the inspection and compliance regime strengthened. In addition, the next review of Parts L and F must urgently set out a clear trajectory for improving Building Regulations so that all new buildings achieve net zero carbon (for both regulated and currently unregulated energy uses, and actual performance) and resilience by 2030, and establish a mechanism to govern the interactions between the development of future standards and industry leadership in thought and practice – such as the Advancing Net Zero project[78] and the Government-supported 2030 Buildings Mission. This will help to ensure that the entire supply chain is well-prepared to deliver new homes fit for the future.

CURRENT GOVERNMENT OPPORTUNITIES TO TAKE THIS FORWARD	
BEIS Energy White Paper / Energy Efficiency Action Plan	• Establish clear timetable for rented sector regulation. Set out intention to regulate for minimum energy efficiency standard of E from 2025 at point of sale or major renovation of property • Set out timetable for replacing Energy Performance Certificates with renovation roadmaps
2019 BEIS England Fuel Poverty Strategy Review	• Set out proposals for assisting low-income owner occupiers who may be affected by regulation in future
2019 MHCLG consultation on Parts L and F of the Building Regulations for 2020	• Adopt from 2020 a standard that is at least as good as the 'zero carbon homes' standard previously proposed by the Zero Carbon Hub • Ensure this is compatible with, and set out, a clear trajectory for strengthening Parts L and F for 2025 and 2030 to broaden regulated energy uses, address climate resilience and move towards operational net zero carbon for all energy use in 2030 • Establish clear mechanism for governing links between Transforming Construction Challenge, industry leadership in developing new standards and future reviews of Parts L and F
2019 Budget and 2020 Government Spending Review	• Launch fiscal incentives for private and social landlords who renovate to higher standards than minimum requirements • Commit to timetable for faster adoption and implementation of Future Homes Standard

[78] UKGBC (2019) Net Zero Carbon Buildings: A Framework Definition

3.5 Long-term, balanced and local delivery

A long-term delivery programme, backed by clear and strong governance arrangements similar to the ones guiding energy efficiency investment in other places, in particular Scotland, needs to be established. In Scotland, local authorities are placed at the heart of delivery through street-by-street or locally-based renovation schemes, local heat and energy efficiency strategy development, local jobs and supply chains, localised and personalised advice services, and the development of an integrated approach to energy efficiency and heat, residential and non-residential sectors, fuel poor households and those more able to pay.

Scottish Government funding for local authorities to deliver area-based energy efficiency schemes for low-income households has been in place for ten years now, and has built the foundation for the expanding role Scottish local authorities are expected to play. It has also ensured that delivery of energy efficiency in Scotland is much more evenly distributed based on local needs, and enabled Scotland to attract more than its proportionate share of Energy Company Obligation (ECO) funding, owing to the foundations for delivery laid by local authorities.

EEIG RECOMMENDATION	PROGRESS
Require England's local authorities to publish local energy efficiency and fuel poverty plans and allocate capital funding to them based on need so that local schemes can be delivered.	No action taken.
Establish a national grant scheme for low-income households in England to complement local schemes and ECO delivery, as well as to ensure households unable to access the latter two routes can get help.	No action taken.
Provide long-term non-capital support to local authorities for drawing up local plans and helping them to raise additional capital.	The Local Energy Programme is supporting Local Enterprise Partnerships with £10 million to develop local energy strategies, and for five regional energy hubs to produce a pipeline of clean energy projects. Unlike the support available from BEIS' Heat Networks Delivery Unit for local authorities pursuing heat networks projects, there is no public capital to pump-prime investment.

Public investment in home energy efficiency improvements (including Energy Company Obligation spending) has been cut by 58% in England since 2012. Wales, Northern Ireland and Scotland now spend respectively two, three and four times as much per citizen on home energy efficiency programmes than is spent in England, a wider disparity than in 2012, as shown in Table 2. Investment in England is now almost entirely driven by the Energy Company Obligation, while the devolved nations have significant publicly funded energy efficiency programmes – in the case of Scotland and Wales additional to the ECO.

Table 2: Public investment (including ECO spending) in energy efficiency per capita across UK nations, 2012 and 2017[79]

[79] E3G analysis of UK and Devolved Administration data. For sources see E3G (2018e) Home energy performance investment gap, slide 29 onwards

Country	Population	IN 2012		IN 2017		Change since 2012
		Public investment in energy efficiency	Per head of population	Public investment in energy efficiency	Per head of population	
England	55.6m	£1,022m	£18	£425m	£8	-58%
N. Ireland	1.9m	£52m	£27	£44m	£23	-16%
Scotland	5.5m	£190m	£35	£192m	£35	+1%
Wales	3.1m	£93m	£30	£54m	£17	-42%

Scotland is not spending four times more than England because its housing stock is less efficient. The latest available housing survey data for the two countries shows that homes in Scotland had considerably higher levels of insulation in 2012 and have made more progress than in England since then – as shown in Figure 6.

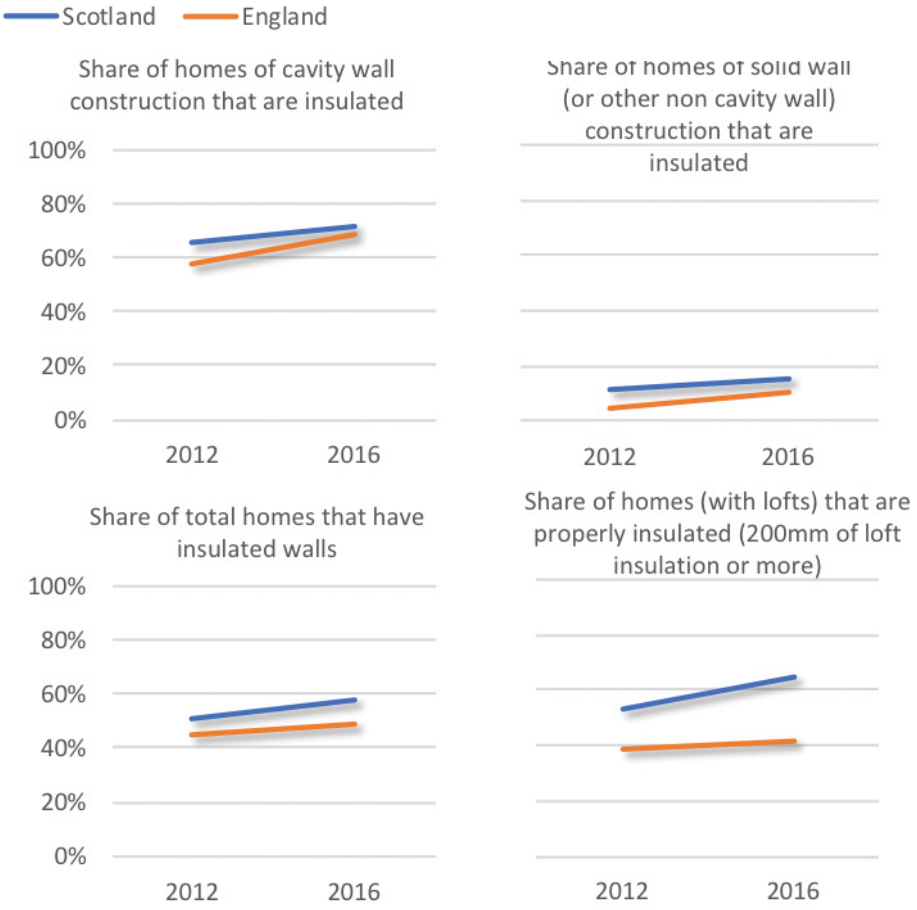

Figure 6: Share of homes with insulation, England and Scotland, 2012 and 2016[80]

This difference is also reflected in the distribution of Energy Performance Certificate ratings. Scotland has fewer poorly rated (E, F or G) properties and a higher share of highly-rated properties (A, B or C) than England, as shown in Table 3.

Table 3: Share of homes with different EPC ratings, England and Scotland, 2016[80]

2016	NUMBER OF HOMES		PERCENTAGE OF HOMES	
	England	Scotland	England	Scotland
Poorly insulated (rated E, F or G)	4,888,000	422,000	21%	18%
Well insulated (rated A, B or C)	7,049,000	963,000	30%	39%
'Middling' homes (rated D)	11,796,000	1,068,000	49%	43%

[80]MHCLG (2019) English Housing Surveys and Scottish Government (2019c) Scottish House Condition Surveys, 2012-13 and 2016-17

In addition to the large fuel poverty investment gap in England identified by the Committee on Fuel Poverty, targeting is an issue. While it has improved over the years, targeting by ECO of households in receipt of certain benefits means many fuel poor households miss out on support. Of 6.4 million households in receipt of benefits in England, 1.35 million are estimated to be in fuel poverty[81], meaning that 47% of fuel poor households – 1.2 million – will definitely miss out on standard ECO support. This means that almost half of all fuel poor households are not eligible for subsidised energy efficiency measures in England.

ECO support could in theory be accessed by such households via the mechanism known as local authority flexibility, whereby local authorities propose groups of households they think should get energy efficiency help. However, energy suppliers do not have to use the mechanism and many local authorities do not have the capability or capacity to assess who needs support in their area. Nevertheless, local authority proposals exceed the cap of 25% of the Obligation energy suppliers are permitted to deliver this way.

The map in Figure 7 below shows ECO measures per 1,000 households delivered to September 2018 since the programme commenced in 2013. What it shows is a very uneven depth of delivery, characterised by concentrations that are considerably higher in Scotland, Wales, the areas around Greater Manchester, Birmingham and the North East than in other parts of the country. To varying extents contributing factors to this pattern are:

- The presence of other energy efficiency programmes that complement ECO – true of Scotland and Wales
- The capabilities of local authorities to support identification of ECO-eligible households, and local political support for energy efficiency/tackling fuel poverty – true of Greater Manchester and Birmingham
- Delivery costs, the maturity of supply chains and contractors' ability to find leads – which bear positively on the results in the North East of England

The presence of eligible households is a factor that has become more important in recent years as ECO evolved into exclusively supporting low-income households. However, the mapped data covers ECO since it commenced, including the first four and a half years that up to half of ECO delivery was not constrained by eligibility criteria.

[81] BEIS (2018b) Fuel poverty detailed tables 2018

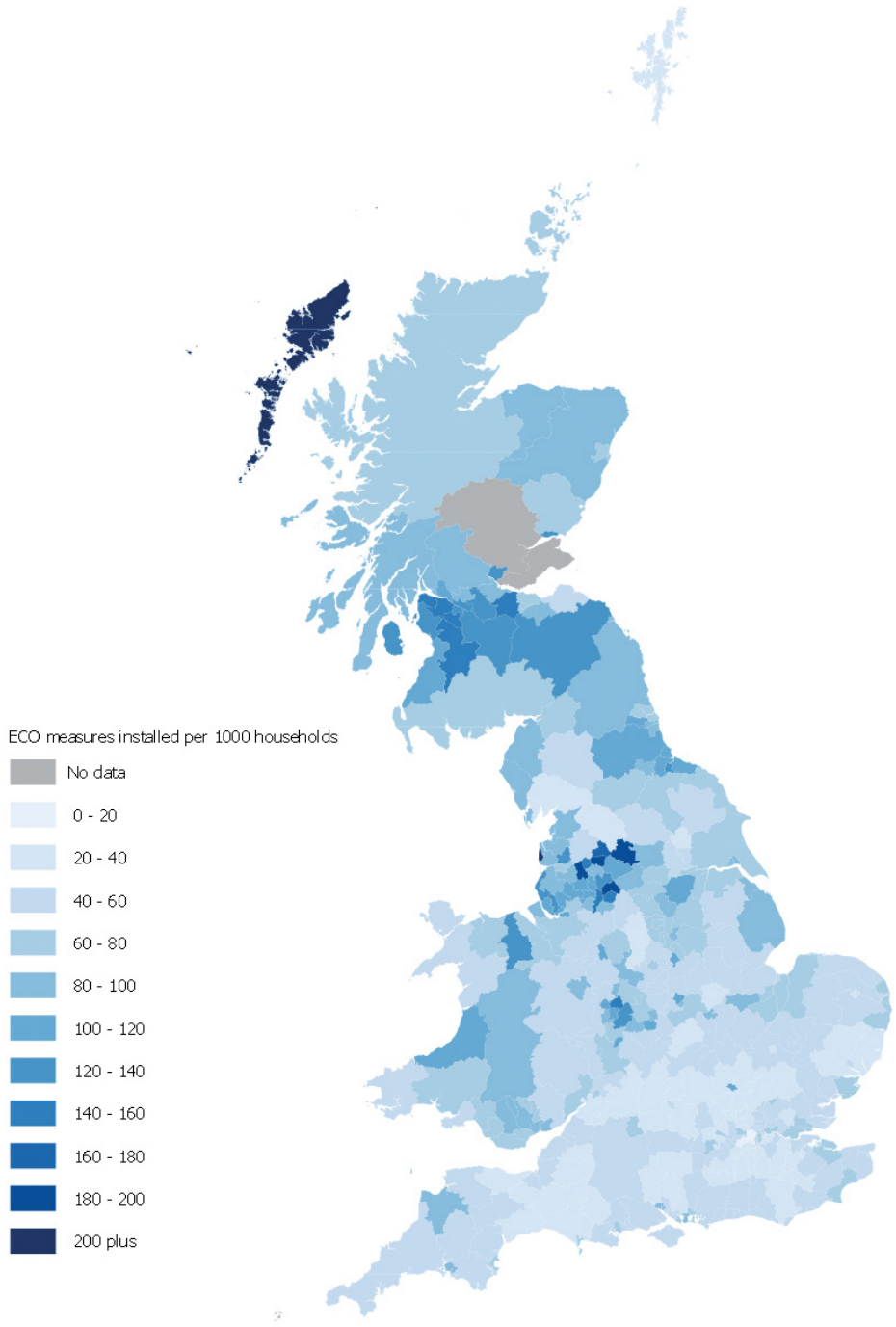

Figure 7: ECO measures installed per 1,000 households, by local authority in Britain, to September 2018[82]

As can be seen in Figure 8, there is a clear disparity in the level of delivery between rural and urban areas in favour of the latter. Amongst urban areas, cities and towns have seen less delivery than their suburban counterparts.

[82]Mapped with QGIS using BEIS (2018b) Household Energy Efficiency National Statistics, headline release December 2018

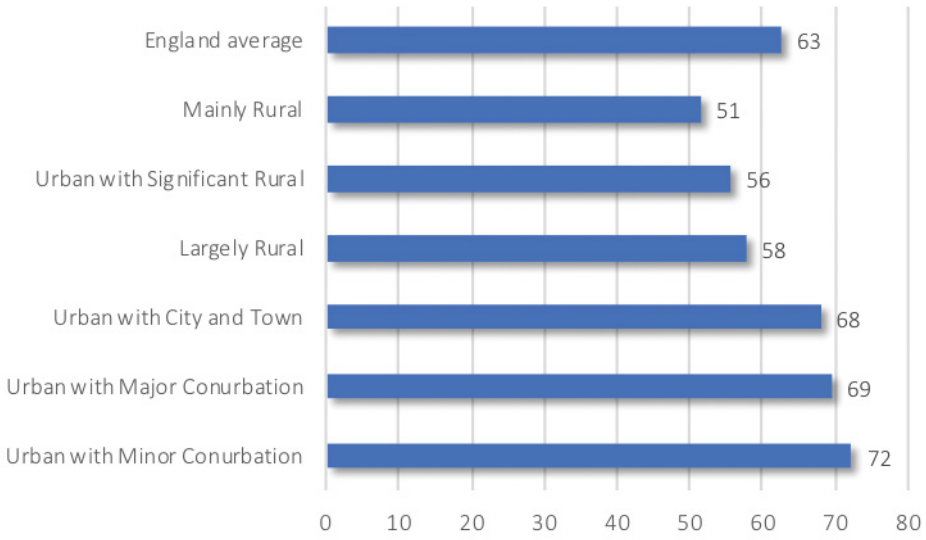

Figure 8: ECO measures delivered per 1,000 households by urban/rural classification in England[83]

Judging by the distribution of properties with an EPC rating that is lower than C, shown in Figure 9, inefficient properties and the potential to install energy efficiency improvements is possibly a factor in higher ECO delivery in Wales, the North East and North West of England. However, the geographical distribution of properties rated lower than C is far more even than the pattern of ECO delivery. In addition, the efficiency of homes in Scotland is considerably higher than in England (as shown in Figure 6 and Table 3), and yet it continues to attract more ECO delivery.

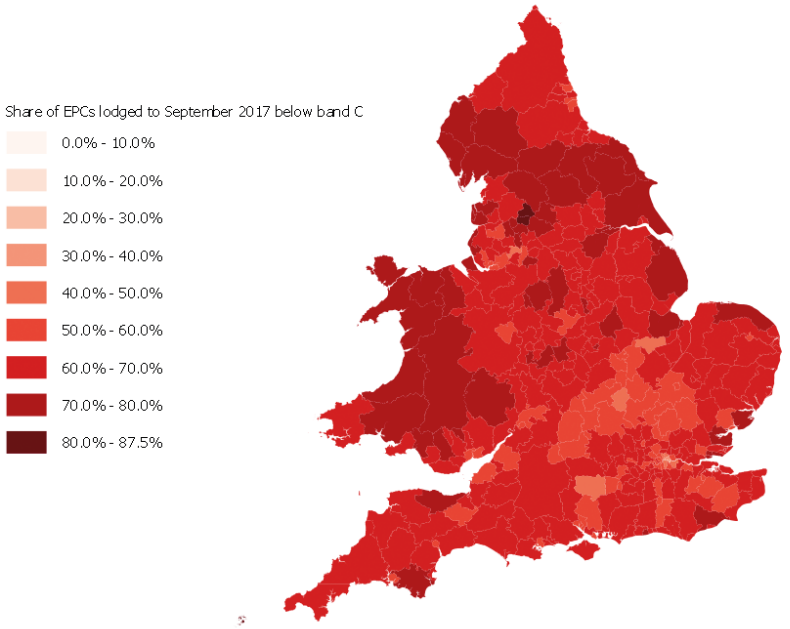

Figure 9: Share of EPCs lodged below band C, by local authority in England and Wales, to September 2017[84]

[83]BEIS (2018b) Household Energy Efficiency National Statistics, headline release December 2018

[84]Mapped with QGIS using MHCLG (2018) Table LA1: domestic Energy Performance Certificates for all dwellings in each local authority, by energy efficiency rating. Mapping of MHCLG EPC lodgement data; not representative and likely to underestimate presence of inefficient homes due to overrepresentation of newer construction.

This highlights the clear need there is to empower and fund local authorities to lead delivery of fuel poverty schemes in their area. They should bear responsibility for delivery and accountability for results, but be free to partner with the private, public and third sectors as appropriate. Scotland does so via its 'Home Energy Efficiency Programmes Scotland: Area-Based Scheme', with central government funding allocated to councils on the basis of need and support provided centrally to set up schemes[85]. Wales delivers on an area basis through its Arbed programme[86], principally funded by the European Regional Development Fund. And Northern Ireland does so through its Affordable Warmth Scheme[87]. In each case, there is also a nationally available grant scheme for fuel poor households who can't benefit from area-based schemes[88], akin to what Warm Front used to offer in England; and Scotland and Wales can of course access ECO funding as well.

Therefore, the tried and tested route to overcoming ECO's inadequacy for meeting the fuel poverty target, and overcoming the at least £8.9 billion investment gap towards meeting England's fuel poverty targets, is to complement it with parallel, Exchequer-funded programmes for locally-led delivery and a national fuel poverty grant scheme.

CURRENT GOVERNMENT OPPORTUNITIES TO TAKE THIS FORWARD	
BEIS Energy White Paper / Energy Efficiency Action Plan	• Require local authorities to develop and publish local energy efficiency investment plans. Provide expanded support for plan development and raising capital, analogous to Heat Networks Delivery Unit
2019 BEIS England Fuel Poverty Strategy Review	• Establish role for local authorities in deploying missing capital investment
2019 HMT National Infrastructure Plan	• Establish role for local authorities in deploying missing capital investment. Implement National Infrastructure Commission's social housing recommendations
2019 Budget and 2020 Government Spending Review	• Establish national grant scheme for fuel poor households. Set out a statutory duty for local authorities to lead on energy efficiency, accompanied by funding for developing plans and tackling fuel poverty, allocated on the basis of need

3.6 Quality advice, installation and aftercare

Cornerstones of an energy efficiency infrastructure investment programme include nationally framed and locally salient renovation advice provision, alongside full adoption of the of independent Each Home Counts review's recommendations to ensure informed consumer choice backed by the highest quality and safety standards. The framework for advice, quality and safety will be key to crafting the national identity and purpose of the programme from the consumer's perspective, making it critical to success.

EEIG RECOMMENDATION	PROGRESS
Establishment of a national network of locally tailored advice centres	No action taken. A new website with phone-assisted support has been launched, but the Energy Saving Advice Service has been ended.
Introduction of a renovation roadmap methodology to replace recommendations made on Energy Performance Certificates	Recommended by Green Finance Taskforce. No action taken.
Full and swift implementation of the Each Home Counts review's recommendations	BEIS policy intent is for the Each Home Counts Quality Mark to become part of the Energy Company Obligation 3 (2018-2022) installations 'at a later date'. Safety standards are under rigorous review.

[85] Scottish Government (2019b) Home Energy Efficiency Programmes for Scotland: area-based schemes

[86] Welsh Government (2018a) Arbed programme

[87] NIHE (2019a) Affordable Warmth Scheme

[88] NIHE (2019b) Northern Ireland Boiler Replacement Allowance; Greener Scotland (2019) Warmer Homes Scotland; Welsh Government (2019) Nest Wales

Quality advice provision will be critical to the growth and staying power of a Buildings Energy Infrastructure Programme over the long term, both to ensure that Government funds are well invested and to grow the market outside Government support by building consumer confidence. To achieve this, advice needs to be authoritative, trusted, salient and forward-looking.

Authoritative advice relies on a foundation of thoroughly researched and well-established evidence for the advice provided. It requires a repository of advice and information that is Government-endorsed. This has been recommended by the *Each Home Counts Review* as a central information hub and is at least partially implemented via the Government's *Simple Energy Advice* website[89], which is accompanied by a phone service to talk through web-based information. While welcome, it in fact provides a lower level of service than the previous Energy Saving Advice (telephone) Service, which itself was a significant step down from the advice that was provided by the national network of 52 Energy Efficiency Advice Centres and accompanying hotline before that.

Trusted and salient advice uses authoritative information, delivered by trusted agents in a way that is relevant to local context and individual circumstances. To achieve this, a plurality of agents is needed to accommodate households' varying perspectives on who they feel they can trust. In addition, advice through trusted agents needs to be salient to the locality (e.g. rural or urban energy efficiency considerations, flats/houses, heritage housing, the nature of the local supply chain) and to socio-economic circumstances (e.g. renters, landlords, developers, owner occupiers, high or low levels of fuel poverty).

France has established a network of 450 local renovation information service points under a national one-stop shop umbrella and communications campaign. To achieve this, it leveraged the national energy agency's regional branches and the national housing agency's regional advice outlets, including local authority advice points to which the housing agency delegates, and regional housing information agencies[90]. There are similar networks that could be leveraged for consistent and coherent advice provision in the UK, such as Citizens Advice Bureaus and local charitable energy agencies.

Even more pertinently for the UK Government, *Home Energy Scotland's* advice service is deeply integrated into Scotland's energy efficiency programme. Its website is more comprehensive than Simple Energy Advice, like in France it also comprehensively integrates local knowledge through a network of regional advice centres, and critically, it provides expert in-home visits for vulnerable customers or those seeking to install advanced home energy improvements. Where appropriate, referrals are made to one or more of the Scotland's support schemes.

In achieving EPC Band C for existing homes, multiple home energy improvements will be needed in most cases. It will often not suit customers to undertake them simultaneously as a 'deep renovation'. In addition, EPC Band C will not be the end-point on the path to net zero homes, and measures to prevent overheating, improve resilience to flooding and to save water urgently need to become part of the mix. Therefore, **advice must be forward-looking**: deep renovations that are carried out in stages will become an important part of the renovation landscape, and tools will be needed to support this, as the recommendations currently provided on EPCs are not fit for this purpose. Personalised renovation roadmaps, or 'building renovation passports' to facilitate staged renovation, will therefore be essential.

[89] www.simpleenergyadvice.org.uk

[90] Ministère de l'Environnement, de l'Energie et de la Mer (2017) National Energy Efficiency Action Plan

Figure 10: Summary visualisation of Germany's federal individual building renovation roadmap[91]

Renovation roadmaps are especially important to optimise the schedule for carrying out improvements when homes change ownership – new owners are able to see what renovations were undertaken previously and how they might take forward the home's journey towards EPC Band C – and beyond. Roadmaps are likely to be an essential tool to manage implementation of BEIS' plans for progressively tightening Minimum Energy Efficiency Standards in the private rented sector, and could help ensure that all appropriate, rather than cherry-picked, energy efficiency improvements are delivered to low-income households under the Energy Company Obligation. More broadly, roadmaps help to manage the links between renovation activity and government schemes supporting energy efficiency and heat decarbonisation – in effect mirroring a national programme at the individual building level. In addition, they would be invaluable to the supply chain and for supporting quality assurance and safety, covering advice, finance, installation and aftercare, which is why the Green Finance Taskforce made roadmaps one of their central recommendations to unlock the flow of green investment into buildings[92].

The UK would not be the first country to introduce roadmaps; it could build on a growing evidence base to design and implement its own method. An increasing number of the UK's European neighbours have been introducing roadmaps, which have been authoritatively assessed by the Buildings Performance Institute Europe for the European Commission's Horizon 2020 programme[93].

[91] BAFA (2017) Mein Sanierungsfahrplan [Beispiel]

[92] Green Finance Taskforce (2018) Accelerating Green Finance

[93] BPIE (2018) The Concept of the Individual Building Renovation Roadmap: An in-depth case study of four frontrunner projects

Going hand-in-hand with advice services and customer support, quality and safety of home energy renovation is paramount. The UK has a promising framework in the offing if it fully implements the recommendations made by the Each Home Counts review. The new quality and standards framework including the Quality Mark need to be implemented as swiftly but also as practically and comprehensively as possible to avoid unintended consequences. Regular review of what works and what does not is vital and should be continuous to ensure the framework's effectiveness and good quality outcomes. If the Government makes the Quality Mark a requirement for all Government-supported installations – including in the able to pay market – and in addition demonstrates a clear policy and financial commitment to a step-change in energy efficiency investment, then this would naturally have a positive and uplifting impact on the wider industry. It would support quality outcomes, ensure industry is able to invest confidently in skills needed across the supply chain, and deliver economies of scale for accreditation.

CURRENT GOVERNMENT OPPORTUNITIES TO TAKE THIS FORWARD	
BEIS Energy White Paper / Energy Efficiency Action Plan	• Scale up advice network and provision for all households; introduce Quality Mark requirements for Government-supported installations • Set out plan for introducing Government-backed renovation roadmaps for individual properties
2019 BEIS England Fuel Poverty Strategy Review	• Further ensure that ECO delivers all appropriate energy efficiency measures to fuel poor households

3.7 Summary: The Buildings Energy Infrastructure Programme progress tracker

The table below summarises the assessment of Government progress on all the individual elements of the EEIG's Buildings Energy Infrastructure Programme. It also introduces a summary assessment of progress against the six overarching steps the Government needs to take.

Table 4: Full set of EEIG recommendations and progress made

	EEIG RECOMMENDATION	PROGRESS MADE
1. Clear governance arrangements and national infrastructure priority	Set clear targets	2017 Clean Growth Strategy set out goal to improve all homes to energy rating of C by 2035 where 'practical, cost-effective and affordable', with goals for the rented sectors for 2030, complementing England fuel poverty target.
	Designate energy efficiency a national infrastructure priority	The National Infrastructure Commission, it its first Infrastructure Assessment, identified energy efficiency as an investment priority, but did not recommend enough action or public capital to meet the Band C 2035 target. Government has taken no action so far.
	Establish dedicated delivery agency to manage cross-departmental coordination and effective delivery	No action taken so far.

EEIG RECOMMENDATION		PROGRESS MADE
2. Ring-fenced funding	Ring-fenced additional public capital investment of £1 billion per year to 2035, suitably deployed.	The National Infrastructure Commission recommended £3.8 billion of infrastructure funds be allocated to energy efficiency improvements in social housing over 10 years, which is not sufficient. No action to allocate public capital investment yet taken by Government.
3. Proper incentives for the able to pay market	Introduce a revenue-neutral Stamp Duty-based incentive, linking level of Stamp Duty paid to energy performance of the property.	Whilst a trial was explored in BEIS' call for evidence on building the market for energy efficiency, and recommended by the Green Finance Taskforce, no action to establish a trial has been taken.
	Demonstrate at scale options for low-cost finance, income tax relief and partial grants for energy efficiency and roll out the most effective approaches.	The Green Finance Taskforce recommended such drivers of demand for energy efficiency be introduced to incentivise mortgage lenders and retail banks to introduce financial products to support home energy renovation. The £5 million Green Home Finance Fund to help pilot new financial products, announced in the Green Finance Strategy, is too small in relation to the challenge. Plans to consult on the merits of setting requirements for lenders to improve the energy performance of homes they lend to have potential, but a decision on them would appear to be a long way off.
4. Regulation to help frame individual choices	Signal intention to tighten standards in the private rented sector and review need for standards in social rented sector. Introduce incentives for landlords who go further.	Intention signalled in Clean Growth Strategy for strengthened rented housing standard of a C rating from 2030, but this has not yet been confirmed. No action taken on landlord incentives, but private landlord investment requirement per property for meeting current MEES raised from £1,500 to £3,500 – should have been raised to £5,000.
	Signal intention introduce a minimum standard from 2025 in owner occupied homes at point of sale or major renovation.	No action taken.
	Require that all new dwellings built from 2020 meet at the very least the 'Zero Carbon Homes' standard previously proposed by the Zero Carbon Hub; from 2025 no longer connected to the gas grid, climate resilient and highly energy efficient, covering cooling, lighting and hot water in addition to heating; from 2030 net zero carbon in operation, covering all energy uses.	Spring Statement 2019 announced the introduction of a Future Homes Standard for ensuring low carbon heat supply by 2025. Consultation launched on interim standard for 2020. Previous Prime Ministerial announcement of Buildings Mission with aim of at least halving all energy consumption in new buildings compared to homes built today by 2030.

EEIG RECOMMENDATION		PROGRESS MADE
5. Long-term, fair and local delivery	Require England's local authorities to publish local energy efficiency and fuel poverty plans and allocate capital funding to them based on need so that local schemes can be delivered.	No action taken.
	Establish a national grant scheme for low-income households in England to complement local schemes and ECO delivery, as well as to ensure households unable to access the latter two routes can get help.	No action taken.
	Provide long-term non-capital support to local authorities for drawing up local plans and helping them to raise additional capital.	The Local Energy Programme is supporting Local Enterprise Partnerships with £10 million to develop local energy strategies, and for five regional energy hubs to produce a pipeline of clean energy projects. Unlike the support available from BEIS' Heat Networks Delivery Unit for local authorities pursuing heat networks projects, there is no public capital to pump-prime investment.
6. Quality advice, installation and aftercare	Establishment of a national network of locally tailored advice centres	No action taken. A new website with phone-assisted support has been launched, but the Energy Saving Advice Service has been ended.
	Introduction of a renovation roadmap methodology to replace recommendations made on Energy Performance Certificates	Recommended by Green Finance Taskforce. No action taken.
	Full and swift implementation of the Each Home Counts review's recommendations	BEIS policy intent is for the Each Home Counts Quality Mark to become part of the Energy Company Obligation 3 (2018-2022) installations 'at a later date'. Safety standards are under rigorous review.

4 Taking energy efficiency forward

4.1 Next steps

This report has considered concrete, near-term opportunities for the Government to take all recommendations forward, going with the grain of policy development processes already underway. A possible Energy White Paper (absorbing the originally planned Energy Efficiency Action Plan), the England Fuel Poverty Strategy Review, the Review of Parts L and F of the Building Regulations for 2020 and the National Infrastructure Strategy are key, but other developments in the Housing, Health, Environment and Work & Pensions Departments will also be important. Given the clearest gap is investment, forthcoming fiscal events, including Budget 2019 and the Spending Review 2020 are particularly important.

It is therefore critical that BEIS – the lead department for home energy efficiency – puts forward a coherent and ambitious case for greater public investment in the Budgetary and Spending Review processes. This case will be strengthened if it is supported by the other Departments – Environment, Work & Pensions, Housing, Health and Treasury – whose policy objectives are served by an energy efficiency infrastructure programme, as shown earlier in this report. At the same time, in light of the 2050 net zero target, serious consideration needs to be given to going faster on home energy efficiency. The Box to the right shows that aiming for 2030 for all homes to achieve EPC Band C, while more ambitious, could deliver a higher net financial benefit.

EPC Band C by 2030?

At this juncture – given the Government's adoption of a binding net zero greenhouse gas emissions target – it will be important to consider whether the UK could go faster on making our homes more energy efficient.

In 2017, the Centre on Innovation and Energy Demand, the Environmental Change Institute, the Regulatory Assistance Project and E3G assessed the remaining potential for energy savings in the UK housing stock and what would be cost-effective to pursue to 2035 based on the CCC's least cost pathway to meeting the fifth carbon budget. Its assessment is therefore broadly consistent with meeting the Clean Growth Strategy's target for all homes to reach EPC Band C by 2035. Using HM Treasury's energy and climate policy appraisal methodology, it found that a quarter of today's residential energy demand could be saved by 2035, and the residential sector's emissions reduction gap for the fifth carbon budget closed, at a net present value to the UK of £7.5 billion. Appraised as an infrastructure investment, the financial benefits – to the economy, reduced power system investment needs and from improved health – amount to an estimated £47 billion more.

In light of the net zero target, high public support for urgent action, and the scientific need to reduce greenhouse gas emissions faster than previously thought, E3G has re-run the same energy and climate policy appraisal above to achieve the same energy and carbon savings, but by the end of 2030.

While it would be more challenging for the supply chain and require more investment per year, it represents a higher net present value of £10.4 billion. The wider infrastructure benefits to 2030 have not been estimated for this report, but are likely to exceed the additional £47 billion associated with the 2035 goal. Alongside this, it would create more breathing room for harder to decarbonise sectors, most immediately the decarbonisation of heat supply, by creating favourable conditions that reduce the challenge of heat supply decarbonisation, as laid out in section 2.2, sooner.

In addition, it would bring the less practical but no less important benefit of bringing the medium-term goal for all homes' energy efficiency improvement into line with England's fuel poverty target deadline of 2030. This could foster a greater sense of inclusivity as the UK's housing stock is transformed, firmly deal with issues of low income households moving into less efficient homes after 2030, and foment a greater sense of collective urgency.

The table on the next page sets out what the opportunities for near-term Government action are – relevant both to the current 2035 target and to a potential 2030 goal – and how these opportunities can be used to drive the EEIG's recommendations for an energy efficient housing stock forward.

	Clear governance arrangements and national infrastructure priority	**Ring-fenced additional public capital investment of £1 billion per year to 2035**	**Proper incentives for the 'able to pay' market**	**Using regulation to help frame individual choices**	**A long-term delivery programme with local authorities funded to take the lead**	**Quality advice, installation and aftercare**
BEIS Energy White Paper / Energy Efficiency Action Plan	Establish clear framework for governing able-to-pay sector progress towards Clean Growth Strategy 2035 target Set out consultative process and timetable for developing and publishing a National Capital Raising Plan for climate compatible infrastructure. Initiate process for establishing a covenant between government and finance providers for driving energy efficiency investment Ensure that the 'energy efficiency first' principle is operationalised by instituting energy planning requirements that prioritise energy efficiency investment where more economical	Set out national energy efficiency investment requirement in able-to-pay households to 2035 and beyond	Build on actions planned in Green Finance Strategy to design and launch programme of demonstrations of incentives that leverage investment from able-to-pay households and incentivise mortgage lenders and retail finance providers to provide financial products	Establish clear timetable for rented sector regulation. Set out intention to regulate for minimum energy efficiency standard of E from 2025 at point of sale or major renovation of property Set out timetable for replacing Energy Performance Certificates with renovation roadmaps	Require local authorities to develop and publish local energy efficiency investment plans. Provide support for plan development and raising capital, analogous to Heat Networks Delivery Unit	Scale up advice network and provision for all households; introduce Quality Mark requirements for Government-supported installations Set out plan for introducing Government-backed renovation roadmaps for individual properties

	Clear governance arrangements and national infrastructure priority	**Ring-fenced additional public capital investment of £1 billion per year to 2035**	**Proper incentives for the 'able to pay' market**	**Using regulation to help frame individual choices**	**A long-term delivery programme with local authorities funded to take the lead**	**Quality advice, installation and aftercare**
2019 BEIS England Fuel Poverty Strategy Review	Include all low-income households living in homes below EPC C in the measurement of fuel poverty. Issue new fuel poverty action plan with clear roles and responsibilities for actors under reviewed strategic framework	Set out how investment gap of at least £8.9 billion to 2030 identified by Committee on Fuel Poverty will be closed		Set out proposals for assisting low-income owner occupiers who may be affected by regulation in future	Establish role for local authorities in deploying missing capital investment	Further ensure that ECO delivers all appropriate energy efficiency measures to fuel poor households
2019 MHCLG Consultation on Parts L and F of the Building Regulations for 2020				Adopt from 2020 a standard that is at least as good as the 'zero carbon homes' standard previously proposed by the Zero Carbon Hub Ensure this is compatible with, and set out, a clear trajectory for strengthening Parts L and F for 2025 and 2030 to broaden regulated energy uses, address climate resilience and move towards operational net zero carbon for all energy use in 2030 Establish clear mechanism for governing links between Transforming Construction Challenge, industry leadership in developing new standards and future reviews of Parts L and F		

	Clear governance arrangements and national infrastructure priority	**Ring-fenced additional public capital investment of £1 billion per year to 2035**	**Proper incentives for the 'able to pay' market**	**Using regulation to help frame individual choices**	**A long-term delivery programme with local authorities funded to take the lead**	**Quality advice, installation and aftercare**
2019 HMT National Infrastructure Plan	Establish energy efficiency as a national infrastructure investment priority with a capital-raising plan, consistent with a National Capital Raising Plan for climate compatible infrastructure, with progress tracked by HMT	Set out how overall energy efficiency investment gap of £5.2 billion per year to 2035 will be closed			Establish role for local authorities in deploying missing capital investment. Implement National Infrastructure Commission's social housing recommenda-tions	
2019 Budget and 2020 Government Spending Review	Align departmental spending with climate targets, and therefore allocate public infrastructure capital to energy efficiency investment over the Spending Review period as the foundation for longer term investment	Ring-fence additional public capital investment of £1 billion per year for residential energy efficiency, bringing UK total to £1.7 billion	Tweak Stamp Duty to reflect energy performance of properties. Allocate £0.6 billion for rollout of incentives and low-cost finance, preceded and informed by demonstrations of able-to-pay incentive schemes	Launch fiscal incentives for private and social landlords who renovate to higher standards than minimum requirements Commit to timetable for faster adoption and implementation of Future Homes Standard		

4.2 Conclusion

This report shows the stark reality of where UK energy efficiency policy stands but also demonstrates the huge opportunities that will come from meaningful action now.

Overwhelming expert and political consensus exists on the need for a large-scale energy efficiency infrastructure programme for UK homes and buildings and the significant, wide-ranging benefits are clear and backed by a wealth of evidence.

Making our buildings efficient is also the first, basic step to meeting the net zero target, is written in to all the expert scenarios on how to lower emissions and is crucial for success in decarbonising heat affordably. Too often the costs of not acting decisively have been ignored; if we do not act now, costs to tackle buildings will rise and the task will be more difficult. As the Committee on Climate Change has repeatedly stated, there are no genuine, cost-effective alternatives to tackling heat in buildings: energy efficiency is the best and least-cost part of any solution to decarbonising heat and an immediate priority.

The technology and the solutions on how to 'do' energy efficiency already exist - compared to many sectors where decarbonisation solutions are either complex or yet to be discovered. We have proposed a practical and cost-effective programme, and now the investment must be injected by Government to do it.

Action will require far closer coordination and working between government departments, alongside a minimum level of upfront investment to create the boost needed for the private sector and the supply chain to make efficient buildings a reality. The minimum additional investment required of £1 billion a year – compared to other infrastructure spending such as on roads, or rail – is modest. No other country has succeeded in driving forward significant private investment in energy efficiency without initial public capital outlay. Without this, policy will fail and the UK's overarching tasks on climate and homes will become that much harder.

There are huge co-benefits to making this investment: to health, to reducing bills, to jobs and to the wider economy. They have been consistently under-valued by Government. Narrow cost-benefit analysis rather than appraising energy efficiency as an infrastructure investment results in 'knowing the price of everything and the value of nothing'. The net zero target presents a clear imperative to change the way policy is framed, assessed and its results evaluated.

A successful energy efficiency infrastructure programme can leave an enduring legacy for the UK, helping people to live and work in affordable and healthy homes and buildings, long into the 21st century, while at the same time contributing to our wealth and our goals for a safer climate. It is time for action.

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