Building Back Britain Commission

Building Back Britain: Net zero and the housing challenge

Second report of the Building Back Britain Commission

May 2022

WPI STRATEGY

Contents

About WPI Strategy

WPI Strategy is one of the UK's leading political communications consultancies, with a track record of delivering high impact public affairs campaigns. We offer senior strategic counsel and work extensively with our sister company, WPI Economics, to ensure that campaigns are underpinned by evidence-based content.

Economic analysis for this report was conducted by Chris Walker, an associate at WPI Strategy and a former government economist, who spent over 12 years as a civil servant in the Treasury, Department for Work and Pensions, and the Department for Communities and Local Government where he was a senior economic adviser. He now works as a research and economic consultant on housing, planning and local economic growth.

wpi-strategy.com nick@wpi-strategy.com @wpi_strategy

About the Building Back Britain Commission

The Building Back Britain Commission is focused on providing Government and other political figures with new, constructive policy ideas on the role housing will play in helping to deliver the nation's top priorities as we seek to emerge from Covid-19 and into economic recovery.

The Commissioners are senior leaders drawn from across the housing and construction industry:

Terrie Alafat CBE, Chair, The Riverside Group

Rob Boughton, CEO, Thakeham

Jason Millett, CEO for Consultancy, Mace

David Thomas, CEO, Barratt Developments

Nigel Wilson, CEO, Legal & General

Steve Wood, CEO, NHBC

The Commission is supported by a high-level Advisory Group made up of Create Streets; Federation of Master Builders; Green Finance Institute; Home Builders Federation; National Housing Federation; Royal Institute of British Architects; Housing Partnership Network; Society of Local Authority Chief Executives; Housing Europe and Housing Partnership Network.

For more information about the Building Back Britain Commission, please visit: **www.buildingbackbritain.com**

Foreword

By Terrie Alafat, Chair, Building Back Britain Commission

The global energy crisis has underlined the urgent need to make our homes more energy efficient. More than ever, we must do everything possible to ensure that both new developments and existing homes have the highest possible levels of emissions reductions.

In our second of two reports, the Building Back Britain Commission explores the twin challenges of decarbonising our housing stock and building highly energy efficient new homes. In doing so, we amplify a theme that was present in our first report on housing and the levelling up challenge. Levelling up and the Government's drive to achieve net zero emissions by 2050 are strongly linked.

Our analysis of existing stock reveals significantly higher barriers to retrofitting homes in local authorities designated as levelling up priority areas, largely as a result of lower property values. We can see that for many homes in these areas, retrofit is likely to be financially unviable without some public subsidy. The problem is particularly acute in local authorities such as Blackpool, where 9 in 10 homes fall below a critical price threshold.

We propose that the Government should immediately focus attention on improving very low-value housing in levelling up areas. To start making the necessary progress towards net zero, financial support for retrofit will need to be provided to homeowners in the areas we have identified on a far greater scale than we have yet seen.

At the same time as improving energy efficiency levels in existing homes, further action is needed to support pioneering net zero developers. This will ensure that the homes we build today do not become the retrofit projects of the future. Government should also consider whether existing tax levers could be used to drive demand for more energy efficient properties. Finally, it will need to recognise the challenges posed by older homes beyond realistic repair and build on what has worked in previous regeneration schemes.

Having engaged constructively with the Secretary of State for Levelling Up, Housing and Communities and other Government figures on our first report about housing and levelling up, our Commission now looks forward to working with the ministers as they consider our latest findings and recommendations regarding housing and net zero.

By taking the action that we suggest, Government could have a win-win. In the long-term, taking radical action now to make our homes more energy efficient will enable the UK to make much-needed strides forwards on the path towards net zero. In the short-term, it will also mean lower fuel bills for millions of people who are suffering as a result of the energy crisis and urgently need help with the cost of living.

Executive summary

The energy crisis facing the UK has further underlined the importance of the net zero agenda. The need to meet the twin goals of making the nation's housing stock less energy intensive and reducing fuel poverty has never been more urgent.

No one doubts that we need to see major reductions in carbon emissions from our existing homes. In this report, we have sought to provide clarity around the geography of that task by undertaking a full analysis of the challenge presented by existing homes. This was done by mapping the housing stock in England in need of retrofitting.

In the average English local authority, 58.4% of homes are below an EPC band C and the cost of getting all homes up to this standard is likely to be at least £200 billion. Within this, our analysis identified five key retrofit risk factors: very low EPC rating, old housing stock, conservation requirements, low market value, and EPC band C unattainable within current retrofit technologies. Our key findings showed that:

- Feasibility for low market value homes is the big challenge, with a tipping point of £162,000 for the average sized home. For homes under the tipping point, retrofit is likely to be financially unviable without some public subsidy, due to the cost of work exceeding the potential house price gain.
- More than one third of homes in levelling-up areas are below the critical house price threshold for viability, versus less than one in 10 in non-levelling up areas.
- Across the UK there are 2.8 million homes which are valued under £162,000, have an EPC rating below C and are located in levelling-up areas.
- There are also many homes for which a band C rating is simply unattainable within current retrofit technologies. This is the case for 10% of all homes, rising to 20% in the city of London.
- Looking across all five retrofit risk factors, homes in levelling up local authorities have significantly higher overall retrofit risk (66.5%) than those in non-levelling local authorities (49.7%), with this driven primarily by lower property values and secondarily by a higher incidence of very old homes.

From these findings, we identify a case for prioritising Government attention on very low-value housing in levelling up areas. As well as making progress towards net zero, this would help to tackle rising fuel poverty by giving millions of people energy security in a world of volatile fossil fuel prices and supply.

With around one in five of the homes that will exist in 2050 yet to be built, we must simultaneously do everything possible to ensure that all new developments have the highest possible levels of emissions reductions. New build developers are already leading the way here with significant steps forward in recent years. The average new build home now emits more than 2 tonnes less of carbon each year than the average existing home and consumers are feeling the benefits with significantly lower energy bills.

However more still needs to be done to remove constraints and enable the transition to net zero to happen at the scale and pace required. In the years ahead, partnership with Government on key areas of policy will be critical in advancing net zero ambitions and encouraging more developments designed to include facilities and infrastructure that support communities to adopt more sustainable lifestyles. Crucially, action should be taken to encourage deeper integration of modern methods of construction that will allow the housebuilding industry to be more self-sustaining in net zero efforts.

Alongside Government, the private sector will also have a critical role to play in deploying the additional capital required to help drive up energy efficiency in our homes, through products such as green

mortgages. Given the vast scale of the net zero challenge with housing, we propose Government adopts a 'pathway' approach that focuses first on five achievable 'wins', which can pave the way for tackling bigger challenges later:

1. Over the next decade, householders in low-value homes, where the cost of retrofitting is likely to be financially unviable, should be provided with Government grants funded via public borrowing.
2. Householders in higher-value homes should be able to access low-interest unsecured loans over 10 years at similar rates to the cost of Government borrowing.
3. Funds from the planned expansion in investment should be used to create new incentives via research and development tax credits for the uptake of net zero construction technologies.
4. Government should consult on how to improve take-up of green mortgages and review the way we tax residential property to establish whether changes can be made to drive demand for more energy efficient properties.
5. Government should recognise the challenges posed by older homes beyond realistic repair and build on what has worked in previous regeneration schemes by establishing 'housing decarbonisation zones'. Within these, Government should commission Homes England to work with local authorities to develop a locally-led programme for replacing older homes beyond realistic repair in order to reach net zero while local authorities and their partners could harness a range of tools and investment streams in a single place.

Introduction

The UK has ambitious plans to cut greenhouse gas emissions further and faster than any other major economy in the next decade. In December 2020, the Prime Minister announced that there will be a reduction of 68% in annual carbon emissions by 2030, compared with 1990 levels. This builds on the legislation that Parliament passed to make the UK a 'net zero' emitter by 2050, with the UK's net emissions of greenhouse gases reduced by 100% relative to 1990 levels.

Clearly, we need to see major reductions in carbon emissions from our existing homes. Domestic properties currently account for 30% of energy use, and in 2020 residential buildings accounted for more than 20% of all UK CO2 emissions, with the figure having increased from the previous year, probably due to people spending more time at home due to the Covid-19 pandemic.[1]

Driving these emissions is the fact that we have some of the oldest and leakiest buildings in Europe, with 16% of dwellings in England built before 1930. While homes built in England after 2012 have a median energy efficiency score equivalent to band B, those constructed prior to 1900 carry a median score equivalent to band E.[2]

In the years ahead, millions of homes will require retrofitting to become energy efficient. Acknowledging this in the 2018 Clean Growth Strategy, the Government stated that "we want all fuel poor homes to be upgraded to Energy Performance Certificate (EPC) Band C by 2030 and our aspiration is for as many homes as possible to be EPC Band C by 2035 where practical, cost-effective and affordable". In 2020, the Climate Change Committee recommended that, to achieve net zero, all buildings achieve EPC C "over the next 10 to 15 years".

There is, however, a need to reform the EPC system to help educate consumers and encourage them to move away from traditional gas heating systems. While EPC certification is well-established and easy to understand, its methodology currently prioritises cost over carbon. So heating a home with gas is currently more affordable than using renewable technologies, therefore a home with an electric-powered air source heat pump, for example, will have a lower EPC rating than a home with a higher carbon gas-powered heating system. Government could also help provide independent, online advice to support people to reduce their own energy consumption, raise awareness of the benefits of investing in energy efficiency measures and build confidence in the new low carbon technologies.

Over the past decade, some progress has been made under the EPC system. English Housing Survey data on energy ratings shows that the proportion of dwellings in the highest SAP energy efficiency rating bands A to C has increased considerably between 2010 and 2020. But the same data also make clear that there is still much further to go, with the majority of homes still not in the top three bands and 10% of dwellings in the lowest three bands.[3]

The House of Commons Environmental Audit Committee is therefore not exaggerating when it says the task ahead is "colossal". [4] Around 80% of the buildings that will be with us in 2050 have already been built and many will require retrofitting. In England alone, over ten million owner occupied homes and over three million private rented sector landlords need to upgrade the energy efficiency of their homes to become A, B or C rated by 2035 for the Government's to achieve its climate aspirations.

At the same time, building new homes that are fit for the future will be key to achieving net zero, with the challenge recognised by the Future Homes Hub, which brings together representatives from across all the sectors that shape new homes, including the government, housebuilders, utility providers, material suppliers and environmental groups. As the Future Homes Delivery Plan, published in 2021 by the Future Homes Hub, states: "One of the defining challenges of our time is, simultaneously, to tackle the shortage of high-quality homes; avoid adding to climate change; improve biodiversity and our wider natural environment; create homes that are high quality, comfortable, safe and ready for inevitable changes in our climate; and create beautiful neighbourhoods where people want to live and work."

In its manifesto for the 2019 general election, the Conservative Party pledged that it would commit £9.2bn to energy efficiency measures, including £2.5 billion over five years to 2025 for Home Upgrade Grants to support deep renovation for low income households living in highly inefficient homes.

What Government is doing

The Government took an incremental step forward in the net zero journey in 2020 by setting the Future Homes Standard at a level which means that new homes will move away from fossil fuel heating and be future proofed with high levels of energy efficiency. The Future Homes Standard will come into force in 2025 and should ensure that all new homes will produce 75%-80% less carbon emissions than houses delivered under current regulations. More immediately, new regulations due to come into effect in 2022 are intended to reduce carbon emissions from new-build homes by about 30% compared with current standards.

Further strategic direction on how the UK will decarbonise our existing homes, and other buildings, was provided in the Heat and Buildings Strategy, published in October 2021. This shows a clear recognition by the Government that we must move away from heating our buildings with fossil fuels and towards a future with a mix of low-carbon technologies used for heating.

The strategy outlines the ambition of phasing out the installation of new natural gas boilers from 2035, although the actual wording in the document is weaker than previously reported in the media. It states that the Government is "aiming to phase out the installation of new and replacement natural gas boilers from 2035, once costs of low-carbon alternatives have fallen". In the strategy the Government acknowledges that there is still some uncertainty around what a decarbonised heating system will look like in 2050. However, it emphasises that we must "accelerate no and low-regrets action now" to have any chance of meeting the net zero target.

No matter what happens with other technology, the Heat and Buildings Strategy stresses that heat pumps will play a major role in the country's transition. It reiterates the aim of building the market to install at least 600,000 hydronic heat pumps per year by 2028, as announced by the Prime Minister in his ten-point plan for a green industrial revolution. There is also vital recognition in the Heat and Buildings Strategy that many households may struggle to make the move to clean electric heating, and that in these cases help will be needed to ease the transition.

Alongside the Heat and Buildings Strategy, the Government announced a £3.9bn worth of funding package to help pay for the decarbonisation of heat from buildings up until 2025, including £800m for the Social Housing Decarbonisation Fund. Last year, the Government announced that £562 million funding would enable over 200 local authorities across England and Scotland to fund an upgrade of the UK's least energy efficient and fuel-poor homes. Since 2013, the Energy Company Obligation scheme has also provided low-income households with grants to make their homes more energy efficient, with insulation and boiler replacement and repair among the most common improvements that can be made on the scheme. Over 3.1 million measures have been installed in over 2.3 million homes under the scheme and in its Sustainable Warmth Strategy, Government committed to extending ECO from 2022 to 2026 and expanding its value to £1bn per annum.[4]

To help the switch from gas boilers to low-carbon heat pumps, which can cost between £8,000 and £15,000, the Government has said that households will be offered subsidies of £5,000 from April 2022. However, the grants will fund just 90,000 pumps over three years - some way short of the 25 million UK homes with gas boilers. Most recently, in the 2022 Spring Statement, the Chancellor announced that the Government will abolish VAT on energy-saving household measures such as solar panels, insulation, and heat pumps over the next five years. It means that solar panels will be about £1,000 cheaper for households to install from April 2022, while heat pump installations will be about £500 cheaper, cavity insulation installations costs will fall by about £190, and loft insulation by about £160 for the average household.

The Government's energy strategy, outlined in April 2022, focused on energy supply and outlined a wide-ranging plan to boost domestic energy production through a range of power sources. Yet many in the housing sector and beyond are keen to see more detail on how Government will drive greater energy efficiency in new and existing homes and buildings. In this report we examine the options for progress by focusing on the challenges and opportunities, while also looking at how to incentivise consumers.

What more needs to be done

The industry is clear that decarbonising new homes and retrofitting existing homes both bring a multi-faceted set of challenges. The Future Homes Hub has stated that future-proofing new homes with high levels of energy efficiency is just the beginning of what new developments can unlock. Its Delivery Plan makes the ability of new developments to deliver whole-impact abundantly clear, with zero carbon placemaking principles supporting low carbon healthy lifestyles. "Planning and design are critical to quality of life, sustainability and thriving nature. Location, layout and design of developments, how well integrated they are with nature … how well connected they are to social infrastructure and how well designed they are visually are all critical to support wellbeing, sustainability and the ability to restore wildlife," it states.

In its examination of the retrofit challenge, the Construction Leadership Council states that it "will require an integrated approach to transforming the energy and water needs and technical systems in homes, requiring quality in design, installation and customer care".[5] Rather than just one or two insulation measures, this could mean refurbishing an entire house with several insulation measures to reduce heat loss as well as installing a heat pump or similar low carbon technology to replace a gas boiler.

The CLC's report, Greening Our Existing Homes: National retrofit strategy, sets out the case for the UK Government, working in partnership with industry, finance, and other community-based bodies to introduce a national retrofit strategy to make our existing homes greener and more energy and water efficient. "We hope that 2021, the year when the UK hosts the United Nations Climate Change Conference, will be the ideal moment for all these bodies to unite behind the principle of a national retrofit strategy, and take the bold action needed to reduce carbon emissions before it is too late," states the report, published in June 2021. Of course, no such national retrofit strategy has yet emerged but there remains an appetite across the housing sector and beyond for radical action on retrofit.

However it is approached, the challenge of retrofitting all of the nation's homes to the net zero carbon standard by 2050 while simultaneously driving forward net zero standards in new build and encouraging consumers to take advantage of energy efficiency measures will not be easy. In those areas where the cost of retrofitting exceeds a significant proportion of the value of the home itself the challenge will be immense.

In this report we propose a number of measures, but more widely, the only solution will be a comprehensive regeneration policy framework. In its 2021 No Place Left Behind report, the Commission into Prosperity and Community Placemaking argues that a large-scale programme of locally-managed, area-based retrofit, incentivised through the tax system, will offer multiple benefits compared to a supplier-led, home-by-home approach. It adds that "without this level of area-wide improvement it is impossible to see how the housing stock of left behind places could ever reach net zero – or how values could close the gap with more affluent neighbourhoods."

In line with such thinking, our Commission would highlight the need for neighbourhood-specific strategies to secure area-wide housing improvements across all tenures. This reflects the reality that, for many areas, a combination of retrofit, stock replacement and new build will be required, with planning on a neighbourhood-by-neighbourhood basis.

Chapter 1 – Improving energy efficiency in our existing homes

The vast majority of homes in the UK use natural gas central heating. According to the English Housing Survey the figure stands at around 90% while over a third of our electricity supply is generated from natural gas fired power stations.[6,7] The carbon intensity of our energy supply inevitably means that higher energy use in our homes results in higher carbon emissions.

Improving the energy efficiency of our homes is therefore seen as a vitally important way of reducing our carbon footprint and tackling climate change. It is also clearly necessary for reducing fuel poverty and energy bills in the face of a cost-of-living crisis, in a large part because of the spike in wholesale natural gas prices since last Autumn.

Analysis of the EPC data underlines the vast scale of the challenge. The numbers in each EPC rating reflect the government's Standard Assessment Procedure (SAP) and go from 1 to 100 SAP points. The Government has stated aim of ensuring that all homes meet EPC Band C, which equates to 69-80 SAP points, by 2035.

Our analysis of the data finds that in the average English local authority, 58.4% of homes are below an EPC band C. There is considerable variation from one local authority to the next, with nearly 90% of homes in the Isles of Scilly below EPC band C. Next worst are around half a dozen local authorities such as Hyndburn where around three quarters of the housing stock are below EPC band C, as can be seen amongst red areas of the map.

At the other end of the scale, only around a quarter of homes in Tower Hamlets are below an EPC band C, with a cluster of half a dozen local authorities, mainly inner London, with around only 40% below an EPC band C, as well as new town Milton Keynes.

There is a cluster of worst areas for homes below EPC band C – around the North West and the South West, and along much of the coast of Essex. London and the home counties generally have fewer homes below an EPC band C.

The nature of many homes in the UK means there are several challenges to retrofitting them to improve their EPC rating, with some coming at a significant cost. The cost of getting all homes to an EPC band C has been estimated as high as £330 billion by estate agent Savills, though the EHS estimates imply a cost closer to £200 billion.[8] This means a realistic, cost-effective - and probably targeted - retrofit policy must be found.

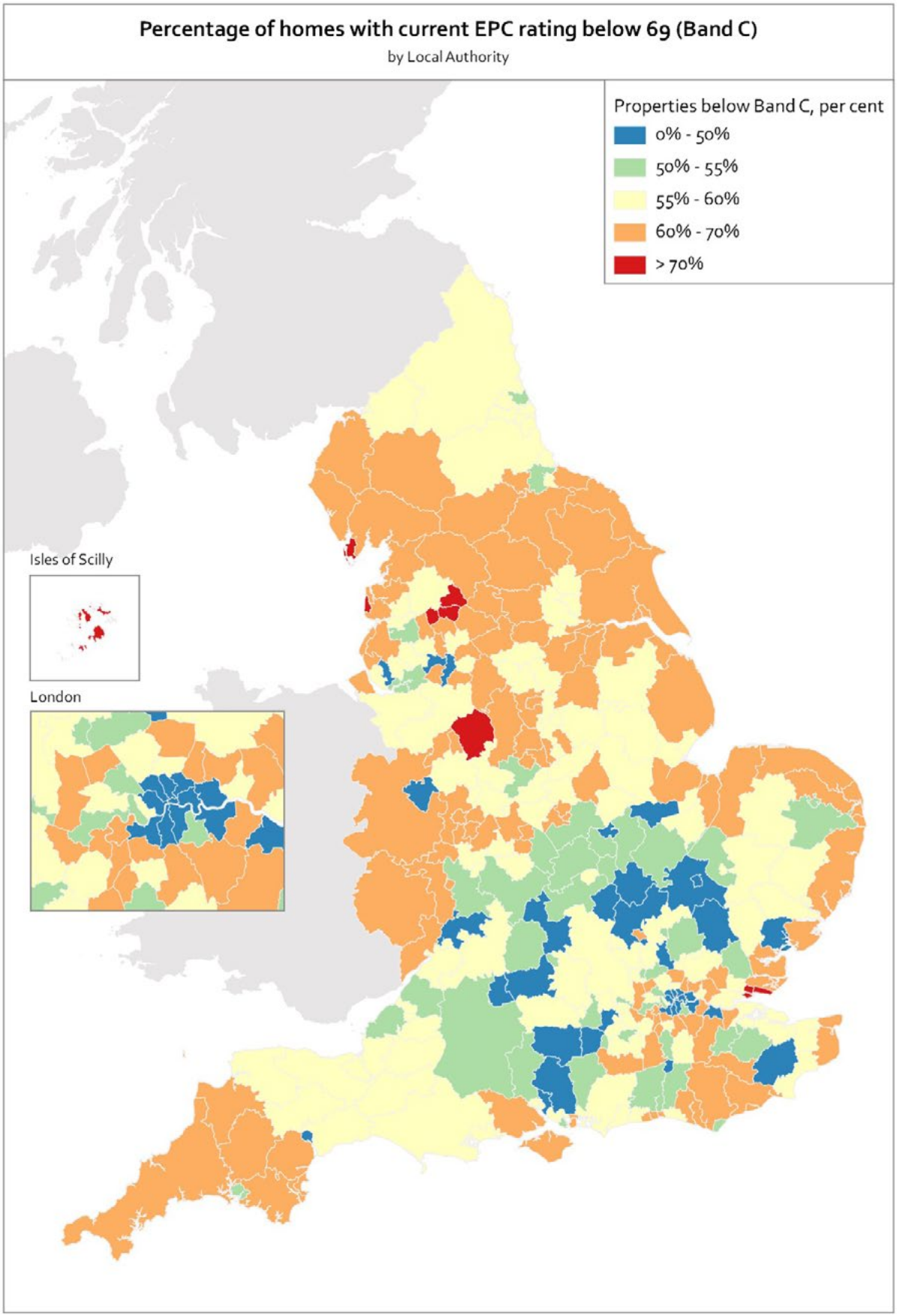
In order to pinpoint the problems we are dealing with, our analysis mapped the current housing stock at local authority level in terms of homes that are difficult to retrofit due to cost or practical reasons. Using EPC and other data to explore the retrofit feasibility risks around bringing homes below a band C to that level, we identified five key retrofit risk factors:

1. Very low EPC rating: namely homes in bands E, F, or G, which significantly increases the cost of getting to a C rating compared to being in band D
2. Very old housing stock: amongst other things this means the homes are less likely to be airtight - or simply not designed to be - precluding deployment of certain technologies such as heat pumps

3. Likely conservation requirements: where a sympathetic retrofit of homes is not feasible, often due to the regulations

4. Low market value: this makes it difficult for home owners to recoup the cost of a retrofit from the resulting increase in their property value, which as well as acting as a disincentive can render retrofit financially unviable

5. EPC band C unattainable: or a potential EPC band which is only up to a D, which probably means these homes cannot be brought to band C with current retrofit technologies


Percentage of homes with current EPC rating below 69 (Band C)
by Local Authority
Properties below Band C, per cent
0% - 50%
50% - 55%
55% - 60%
60% - 70%
> 70%
Isles of Scilly
London

Retrofit Risk factor 1: homes with very low current EPC rating

According to the English Housing Survey (EHS) Energy Report, 2019/20, the average cost to raise the average home in bands D to G to a band C is £8,110, with some variation by tenure. In particular, the social rented sector costs markedly less. But, as the EHS alludes, the average masks the fact that, for two thirds of these properties, the cost would be under £10,000, whilst for 11% the cost would be £15,000 or more.

The EHS has also produced estimates of the cost of retrofit by current EPC rating band and finds that whilst the average D rated property would cost only £6,472 to get to a C, the average E rated property would cost more than double (£13,285) and the average F & G rated home would cost treble (£18,858). Homes with a very low EPC rating – defined here as EFG – are therefore more likely to be prohibitively expensive to retrofit.

The EPC data shows that for the average English local authority, 18.7% of homes are EPC bands EFG. But for Cornwall and Isles of Scilly, 31.3% and 61.9% homes are EPC bands EFG. The London boroughs feature as having fewest very low EPC rated homes.

Across England there appears to be concentrations of very low EPC rated homes in the South West more broadly than any other region, with significant pockets in three other regions. There is little difference between levelling up areas and non-levelling up areas.

Five LAs with most homes with 'very low' current EPC ratings

	% All homes whose current EPC rating is EFG	% PRS homes whose current EPC rating is below EFG
Isles of Scilly	61.9	66.9
Eden	38.2	51.3
West Devon	32.5	35.7
Pendle	31.4	31.9
Cornwall	31.3	37.8

Five LAs with least homes with 'very low' current EPC ratings

	% all homes whose current EPC rating is EFG	% PRS homes whose current EPC rating is EFG
Tower Hamlets	5.3	6.4
Crawley	7.8	9.1
Milton Keynes	8.3	9.7
Hackney	9.3	10.8
Islington	9.3	9.5

Homes with very low EPC ratings: levelling up areas versus non levelling up LAs

	% all homes whose current EPC rating is EFG	% PRS homes whose current EPC rating is EFG
Levelling up LAs (priority need)	19.8	23.5
Non-levelling up LAs	18.3	21.6

Homes with very low EPC ratings: tenure split, LA average

% Owner occupier rating EFG	% Private renter rating EFG	% Social renter rating EFG
24.0	22.2	7.9%

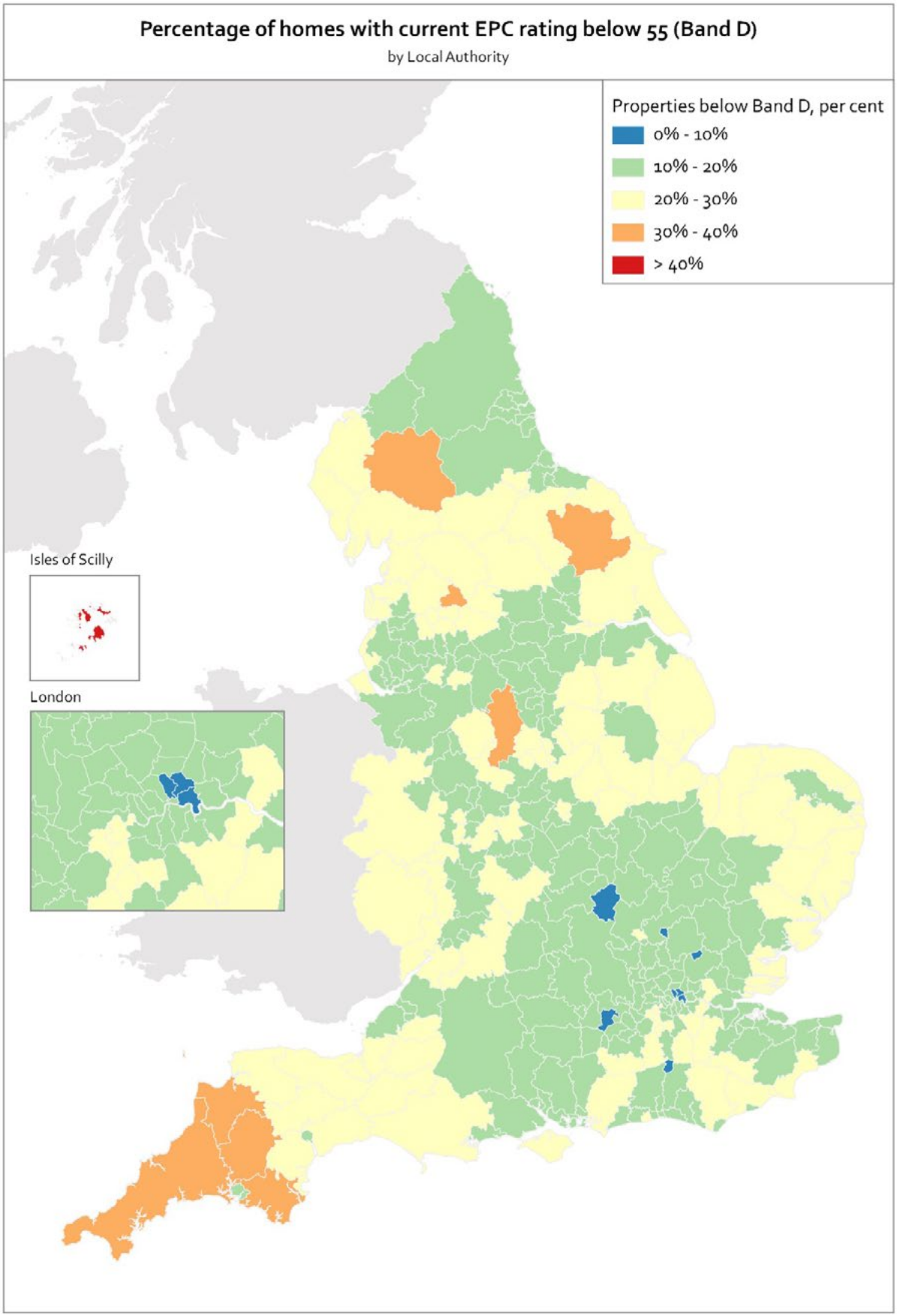
Retrofit Risk factor 2: very old homes

There is a strong correlation between the age of homes and their EPC rating (and EPC rating potential). The EPC data shows a big jump in EPC ratings for homes built from 1950. Aspects that make older homes less energy-efficient include a lack of cavities in walls - with or without insulation – and air tightness, and older homes were often designed to be 'breathable' and have natural air ventilation as opposed to being airtight.

Five LAs with least homes with 'very low' current EPC ratings

Construction age band	EPC rating (a)	EPC rating potential (b)	Gap (b-a)
Before 1900	52.6	75	22.4
1900-29	57	77.3	20.3
1930-49	59.3	78.3	19
1950-66	62.6	78.8	16.3
1967-75	63.4	79	15.6
1976-82	66.4	80.6	14.1
1983-90	66.8	79.7	12.9
1991-95	66.6	80	13.4
1996-02	69.6	80.3	10.7
2003-06	75.1	82	6.9
2007-11	77.5	83.1	5.7
2012+	81.8	88.7	6.9

Unsurprisingly, the EPC data show older homes are based around older settlements including Greater London and Greater Manchester and the metropolitan areas of the North West (see red areas of map).


Percentage of homes with current EPC rating below 55 (Band D)
by Local Authority
Properties below Band D, per cent
0% - 10%
10% - 20%
20% - 30%
30% - 40%
> 40%
Isles of Scilly
London

In Kensington and Chelsea and Hammersmith and Fulham 70% of all homes were built before 1950, the highest proportions of any English local authority. In these areas, the percentage of homes in the private renter sector (PRS) that were built before 1950 is even higher. New towns Harlow and Stevenage are opposite.

Two LAs with most very old homes

	% all homes that were built before 1950	% PRS homes that were built before 1950
Hammersmith and Fulham	69.7	73.2
Kensington and Chelsea	69.7	73.9

Two LAs with least very old homes

	% all homes that were built before 1950	% PRS homes that were built before 1950
Harlow	3.7	2.7
Stevenage	4.2	3.9

Very old homes: levelling up areas versus non levelling up LAs

	% all homes that were built before 1950	% PRS homes that were built before 1950
Levelling up LAs (priority need)	40.2	51.7
Non-levelling up LAs	33.3	39.3

Very old homes: tenure split, all LAs

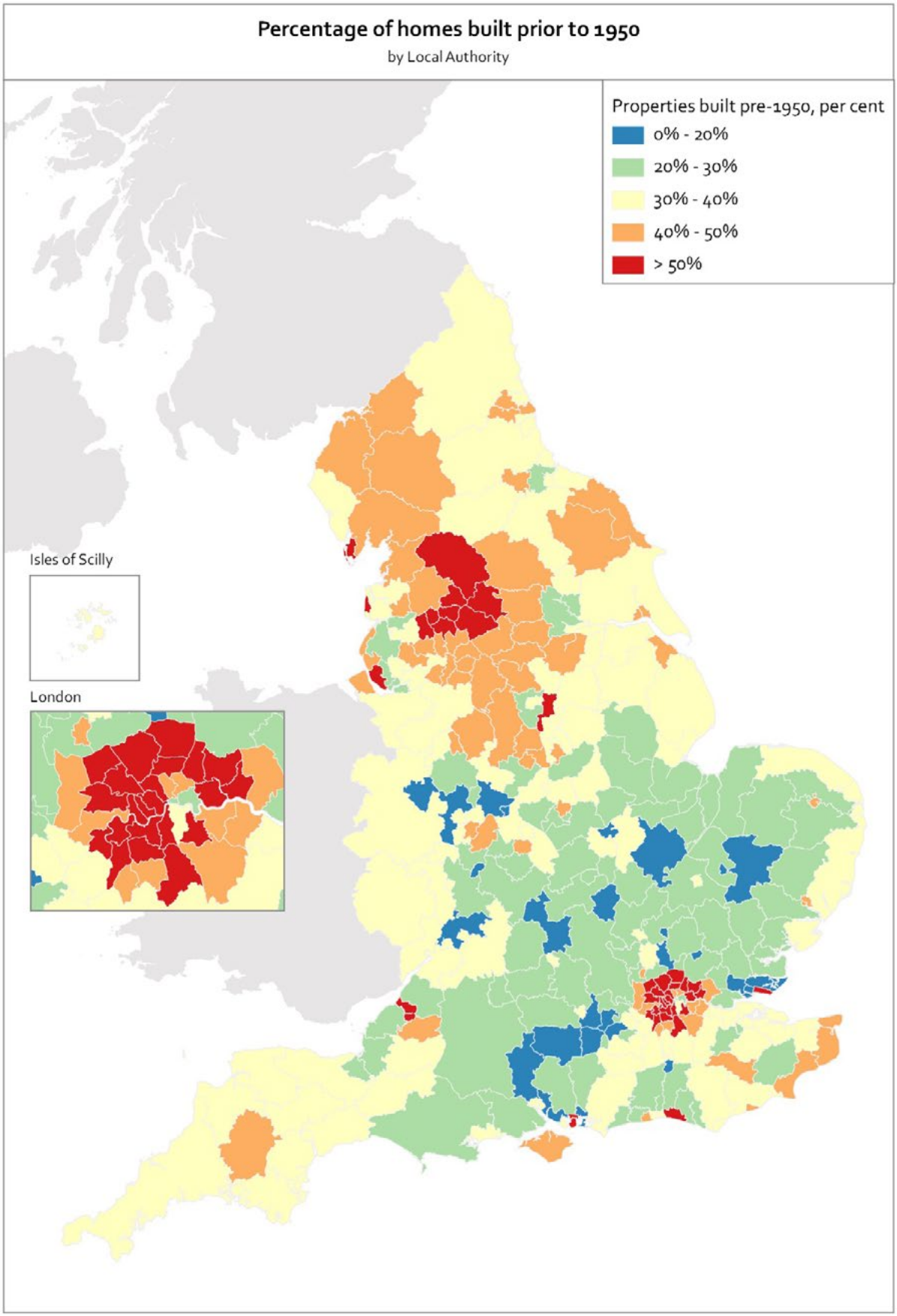
% of Owner occupier	% of Private renter	% of Social renter
38.2	43.0	18.3

Retrofit Risk factor 3: homes with likely conservation requirements

Many homes, including listed or historic ones, may present a particular challenge for retrofit because the works can conflict with the need to protect their special architectural and historical merit.[9] In their standard form, many common EPC-enhancing measures such as installing insulation or double glazing can harm the authenticity of a listed or historic building. They may also simply be too expensive.

Unfortunately, reliable listed buildings data are not available to the local authority level, and so an alternative way of capturing homes with likely conservation requirements is to look at whether homes are located in one of the following:[10] (i) heritage-at-risk areas ; (ii) national parks and gardens ; (iii) scheduled monuments or ; or (iv) world heritage sites.

There is no significant disparity of homes with likely conservation requirements between levelling up areas and non-levelling up areas.


Percentage of homes built prior to 1950
by Local Authority
Properties built pre-1950, per cent
0% - 20%
20% - 30%
30% - 40%
40% - 50%
> 50%
Isles of Scilly
London

There were a few areas with high risk scores due to world heritage status. These areas are picked up by the data - see red areas of map. The City of Bath is a world heritage site, South Lakeland and Eden encompass a large part of the Lake District (also world heritage site). Royal Tunbridge Wells, like a modest number of other local authorities, have large areas of 'heritage at risk' (a type of conservation area).

Three LAs with most homes with likely conservation requirements

	% all homes with likely conservation requirements	% PRS homes with likely conservation requirements
Bath and North East Somerset	52.5	71.6
City of London	29.8	27.9
South Lakeland	25.4	38.4

Three LAs with least homes with likely conservation requirements

	% all homes with likely conservation requirements	% PRS homes with likely conservation requirements
Blackpool	0.0	0.0
Swindon	0.0	0.0
Slough	0.0	0.0

Likely conservation requirements with levelling up areas versus non levelling up LAs

	% all homes with likely conservation requirements	% PRS homes with likely conservation requirements
Levelling up LAs (priority need)	1.3	2.6
Non-levelling up LAs	1.6	2.8

Likely conservation requirements: tenure split, all LAs

% of Owner occupier	% of Private renter	% of Social renter
1.5	2.8	1.3

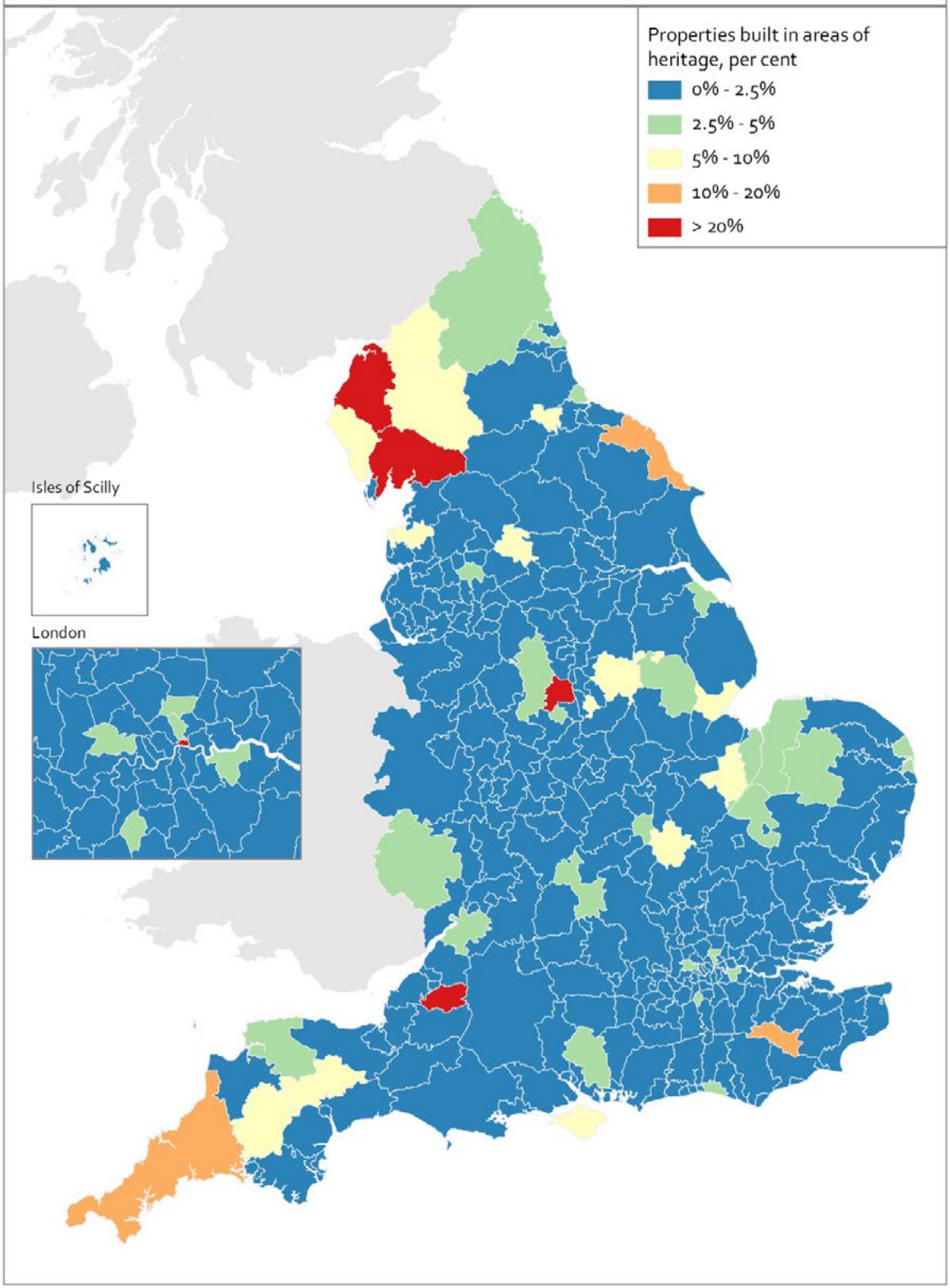
Retrofit Risk factor 4: homes of low market value

Owners of low-value homes, whether occupiers or landlords, are less likely to be able to recoup the cost of a retrofit in resale value (asset appreciation) of their property. This may pose problems of financial viability, including when borrowing to carry out the retrofit, and may also act as a financial disincentive. This is distinct from the idea of payback periods – the time taken for energy savings to pay back the upfront cost of the retrofit. It is much more likely to be an issue where you have homes that are in very low value areas conjunct with their being in a very low EPC band (i.e. E, F, or G).

Nationwide has estimated that properties in EPC band A or B have a 1.7% house price premium, and those EPC band F or G a 3.5% house price discount, compared to properties in EPC band D.[11] That suggests a

Percentage of homes built in Heritage-at-risk, national parks and gardens, scheduled monuments or World Heritage sites

by Local Authority



house price gain of around 5%, at most, of getting the average property up to an EPC band C. Using the EHS estimates for the average cost of retrofit to achieve this (£8,110 for all properties, discussed earlier) implies a critical house price threshold of £162,000 for an average-sized home. Below the threshold, which varies by home size, retrofit is likely to be financially unviable without some form of support.

Here the ONS house price data[12] convey a stark north-south divide, contrasting the blue area of map to the clear ribbon of orange and red running from the Wirral through to the Humber Estuary, and arc's of orange and red from the Cumbrian coast up through the borderlands and around to Tyneside and down to the Tees Valley.

This retrofit feasibility risk factor also, unsurprisingly, gives the starkest difference between levelling up areas and non-levelling up areas with 37.9% of homes in the former below the critical house price threshold for retrofit viability versus 9.3% in the latter.

Across the UK, there are 2.8 million homes valued under the critical house price threshold which have an EPC rating below C and are located in levelling-up areas.

The homes that meet all three criteria are financially unviable to retrofit because the cost of retrofit is too high in relation to the value of the home. The exact viability threshold in each home will vary depending on the type of home and the retrofit needed, but the typical home value where retrofit is unviable is around £162,000.

Homes that are financially unviable to retrofit, by LA

	% of homes in need of retrofit but unviable	No. of homes in need of retrofit but unviable
Blackpool	70%	49235
Burnley	69%	28359
Hyndburn	67%	24949
Pendle	64%	25938
Kingston upon Hull, City of	61%	74434
Blackburn with Darwen	58%	35752
Stoke-on-Trent	58%	68037
Middlesbrough	55%	35215
North East Lincolnshire	55%	41303
Barrow-in-Furness	54%	18062
Hartlepool	54%	23871
Bradford	53%	116172
Redcar and Cleveland	53%	34446
Doncaster	52%	71621
County Durham	50%	123059
Mansfield	47%	23223
Sunderland	46%	59175
Rossendale	44%	14221
Preston	44%	28524
St. Helens	44%	36785
Stockton-on-Tees	44%	38290
Oldham	44%	41859
Wigan	44%	64492
Rotherham	43%	49845
North Lincolnshire	43%	32661
Gateshead	42%	39609
Bolton	41%	50716

	% of homes in need of retrofit but unviable	No. of homes in need of retrofit but unviable
Rochdale	40%	37702
South Tyneside	39%	27967
Liverpool	38%	88179
Wakefield	37%	58156
Bassetlaw	36%	18908
Tameside	36%	36799
Lincoln	35%	15784
Derby	35%	39219
Boston	33%	10133
Knowsley	33%	22469
Northumberland	33%	51693
Wolverhampton	32%	35752
Walsall	31%	36676
Scarborough	31%	18555
Sandwell	30%	40276
Nottingham	30%	42032
Erewash	30%	15575
Newcastle upon Tyne	28%	37630
East Staffordshire	28%	14883
Chesterfield	28%	13855
East Lindsey	25%	16831
Great Yarmouth	24%	11041
Dudley	24%	33126
Newark and Sherwood	24%	12923
Bury	23%	19343
Birmingham	20%	86945
Leeds	19%	67939
Staffordshire Moorlands	19%	8542
Wyre Forest	17%	8088
Kettering	17%	7704
Manchester	16%	36969
Peterborough	15%	12797
Gloucester	13%	7471
High Peak	13%	5574
Torbay	13%	8362
Leicester	12%	16828
Sedgemoor	11%	5887
Worcester	10%	4704
Tendring	10%	7137
Richmondshire	9%	2258
Wellingborough	8%	2864
Stockport	8%	10015
King's Lynn and West Norfolk	7%	5501
Dover	6%	3356
Torridge	5%	1748
Forest of Dean	5%	2018
East Northamptonshire	5%	2115
Gosport	5%	1951
Hastings	5%	2006
Luton	4%	2807
Eastbourne	3%	1355

	% of homes in need of retrofit but unviable	No. of homes in need of retrofit but unviable
Rother	2%	958
Thanet	2%	1394
Swale	2%	1270
Folkestone and Hythe	2%	944
Southend-on-Sea	1%	902
Mendip	1%	507
Derbyshire Dales	1%	236
Trafford	1%	628
Gravesham	0%	142
Newham	0%	0
Barking and Dagenham	0%	0
Canterbury	0%	0
Lewes	0%	0
Harlow	0%	0
Isles of Scilly	0%	0

Five LAs with most homes with low property value

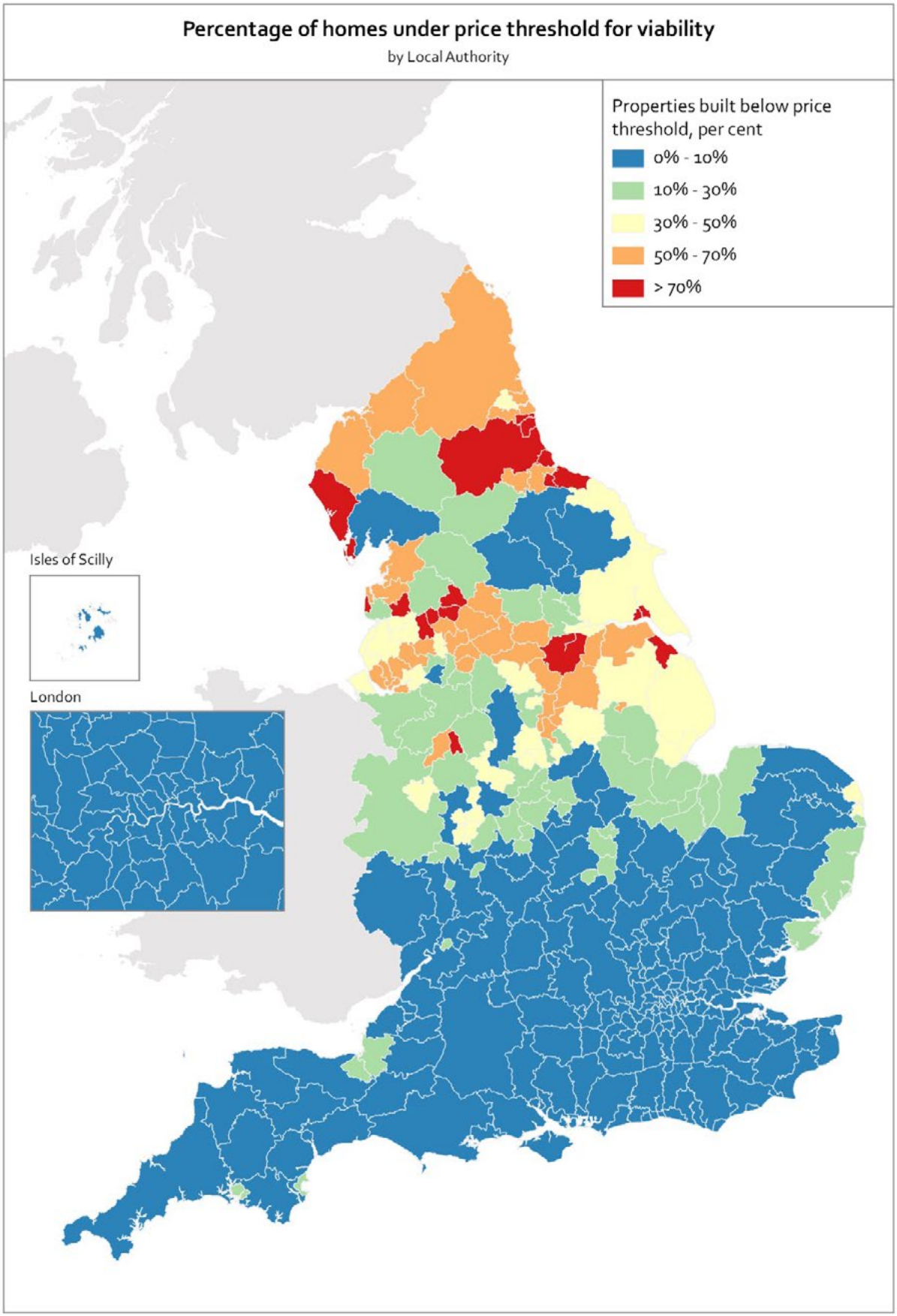
	% all homes below critical house price	% PRS below critical house price
Blackpool	92.3	94.5
Kingston upon Hull, City of	89.2	91.9
Burnley	87.6	92.3
Hyndburn	85.1	89.6
Middlesbrough	83.2	88.1

Homes with low property value: levelling up LAs versus non levelling up LAs

	% all homes below critical house price	% PRS below critical house price
Levelling up LAs (priority need)	37.9	42.4
Non-levelling up LAs	9.3	9.8

Homes with low property values: tenure split, all LAs

Owner occupier	Private renter	Social renter
19.6	19.4	10.9


Percentage of homes under price threshold for viability
by Local Authority
Properties built below price threshold, per cent
0% - 10%
10% - 30%
30% - 50%
50% - 70%
> 70%
Isles of Scilly
London

Retrofit Risk factor 5: homes where an EPC band 'C' is unattainable

Some homes may be unable to attain an EPC band C, perhaps because they are listed or very old (see next section on this) or they are in a rural setting with no connectivity to the gas grid thus depending on oil to heat their homes (oil being even worse the gas for carbon emissions). More than one million homes in the UK currently use oil for heating, according to Ofgem.

The EPC data shows that, for the average English local authority, nearly 10% have a potential EPC which is below a band C. But for Isles of Scilly and City of London 20% of homes are unable to attain an EPC band C. Around 5% of homes are unable to attain an EPC band C in local authorities with the fewest such homes.

Across England there appear to be concentrations of homes unable to attain an EPC band C in the South West, the west end of London, and Cumbria – see red areas of the map. There is little difference between levelling up areas and non-levelling up areas (9.2%% vs 10.2%).

Five LAs with most homes where an EPC rating of C is unattainable

	% all homes with potential EPC rating below 'C'	% PRS homes with potential EPC rating below 'C'
Isles of Scilly	20.0	13.8
City of London	19.8	21.6
Southend-on-Sea	17.0	17.9
Richmond upon Thames	16.7	17.3
Kensington and Chelsea	15.9	16.4

Five LAs with least homes where an EPC rating of C is unattainable

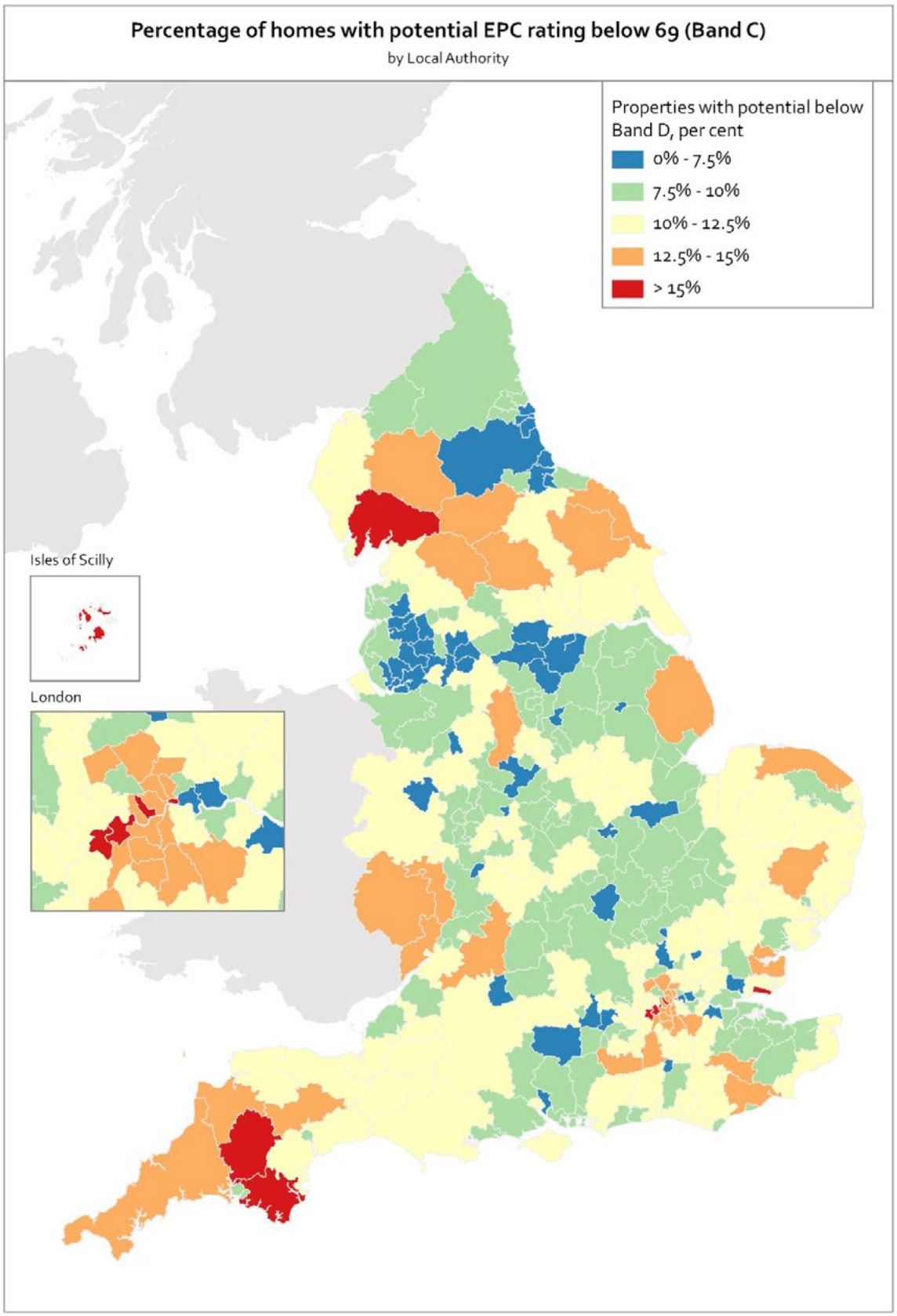
	% all homes with potential EPC rating below 'C'	% PRS homes with potential EPC rating below 'C'
Crawley	4.2	5.5
Milton Keynes	5.0	5.8
Knowsley	5.0	5.8
Telford and Wrekin	5.0	5.9
Sunderland	5.2	9.0

Homes where an EPC rating is unattainable: levelling up areas versus non levelling up LAs

	% all homes with potential EPC rating below 'C'	% PRS homes with potential EPC rating below 'C'
Levelling up LAs (priority need)	9.2	10.5
Non-levelling up LAs	10.2	12.3

Homes where an EPC rating is unattainable: tenure split, all LAs

% of Owner occupier	% of Private renter	% of Social renter
11.5	11.8	6.8



Overall Retrofit Risk

The Retrofit Risk factors outlined can be combined into a single, overall, Retrofit Risk indicator. In essence, this indicator flags where housing retrofit might be most challenging without support across the broad range of measures.

It also potentially allows us to identify where retrofit – or bringing homes currently below an EPC band C up to this band – would potentially be the most cost-effective and deliver the best value for the money per tonne of carbon emission saving.

To reprise, the retrofit feasibility indicator incorporates the following risk factors to flag the LAs with highest overall 'retrofit risk', namely the percentage of homes in a given LA which:

- are in very low EPC band (bands E, F and G) currently
- are unable to attain an EPC band C
- are very old (built before 1950)
- have likely conservation requirements
- have a property value below which retrofit is likely to be financially viable

These are combined on an equal-weighting basis to create the single measure. Two versions of the measure are presented:

Simple measure: takes the % of properties with at least one risk factor present

Score measure: allocates a score according to the number of risk indicators picked up, such that a home with no risk factor scores a 0 and one with all five risk factors scores a 5, with the scores for all homes added up.

We find that these give very similar geographical retrofit feasibility risk profiles to one another (see maps).

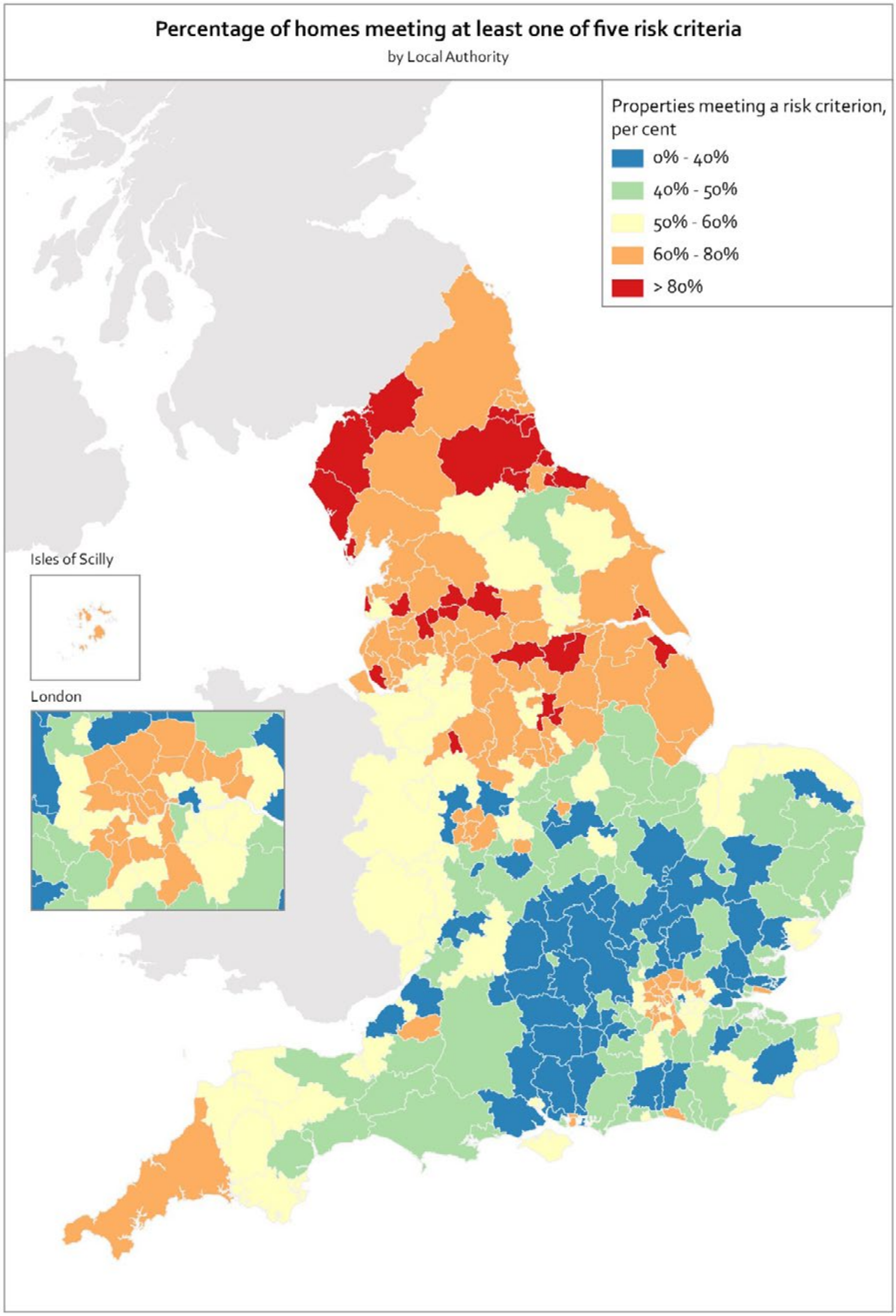
The analysis finds that for the average English local authority, 54.6% of homes have at least one refrofit feasibility risk factor present. This ranges from 96.5% of homes in Blackpool – afflicted mainly by low property values and old housing stock – to just 13.6% of homes in Crawley, mainly due to very low current EPC ratings.

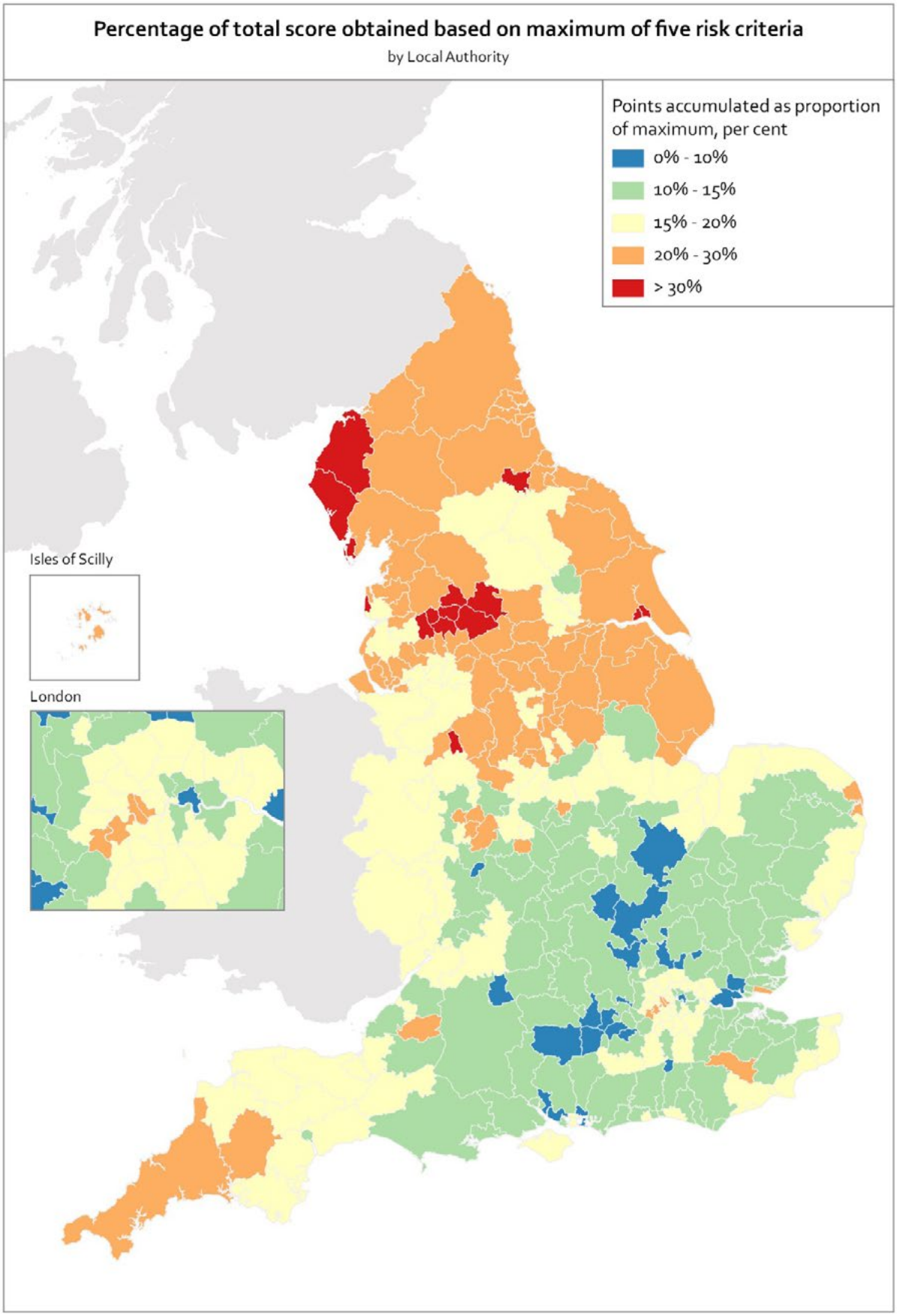
Homes in levelling up local authorities have significantly higher retrofit feasibility risk (66.5%) than those in non-levelling local authorities (49.7%), again driven primarily by lower property values and secondarily by a higher incidence of very old homes.

Both indicators flag large concentrations of the most acute retrofit risks in western parts of Cumbria, parts of Lancashire, and a small concentration on the Humber Estuary around the city of Kingston upon Hull.

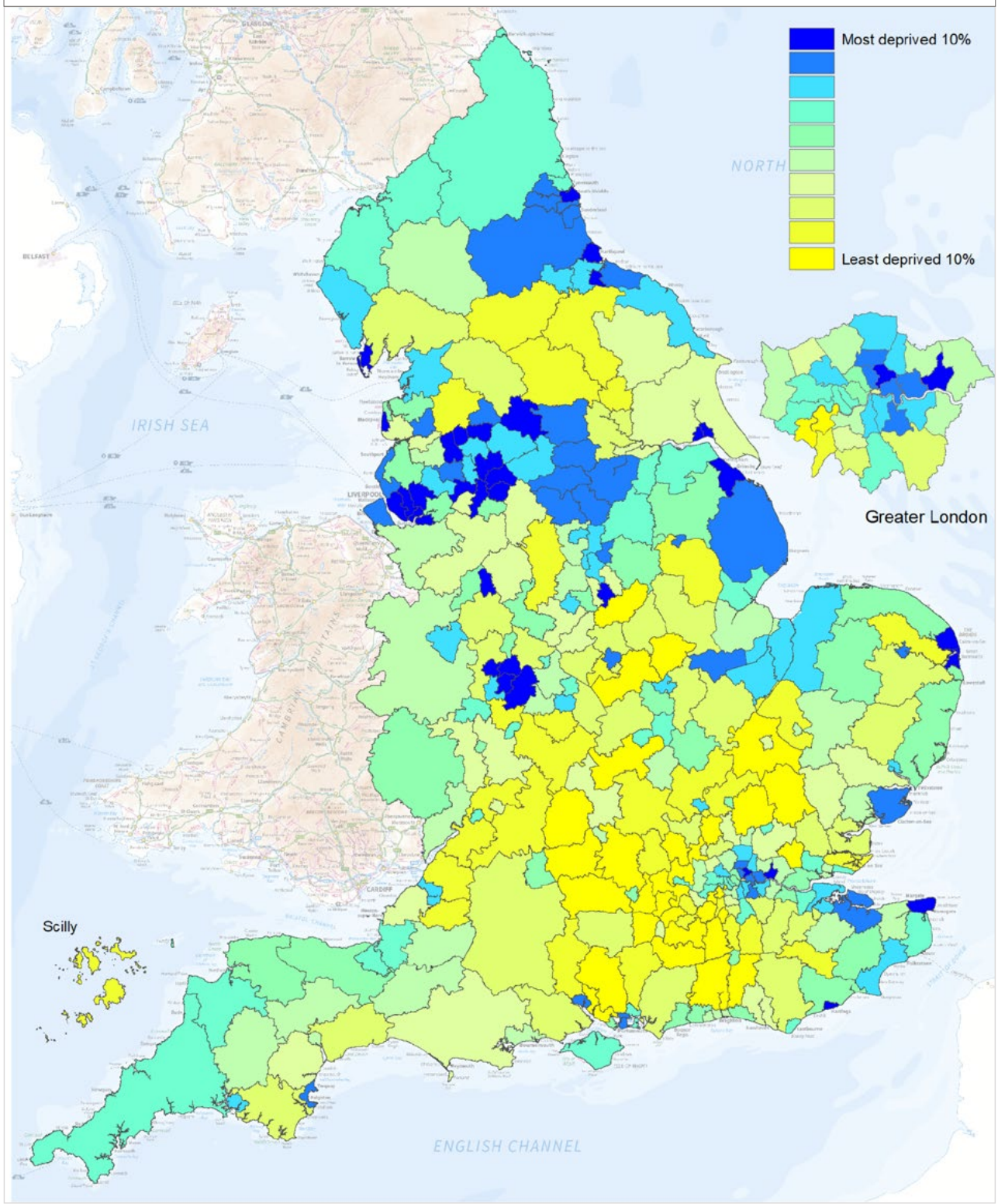
The simple measure flags another large concentration of most acute refrofit risks in the North East centred around County Durham and Middlesbrough.

Potentially acute concentrations in the South West centred around Cornwall are mitigated to some degree by the high property prices there.


Percentage of homes meeting at least one of five risk criteria
by Local Authority
Properties meeting a risk criterion, per cent
0% - 40%
40% - 50%
50% - 60%
60% - 80%
> 80%
Isles of Scilly
London


Percentage of total score obtained based on maximum of five risk criteria
by Local Authority
Points accumulated as proportion of maximum, per cent
0% - 10%
10% - 15%
15% - 20%
20% - 30%
> 30%
Isles of Scilly
London

Average score summary measure of the Index of Multiple Deprivation 2019,
for Local Authority Districts



Source: Ministry of Housing, Communities & Local Government, The English Indices of Deprivation 2019

Ten LAs with highest retrofit feasibility risk

	% all homes where retrofit risky, simple measure (ranked)	homes where retrofit risky, score measure
Blackpool	96.5	37.8
Kingston upon Hull, City of	93.1	31.5
Burnley	92.4	36.6
Hyndburn	91.9	36.9
Pendle	91.7	38.4
Copeland	90.4	32.2
Blackburn with Darwen	88.1	32.6
Middlesbrough	88.0	29.3
Stoke-on-Trent	87.9	30.4
County Durham	86.5	28.2

Ten LAs with lowest retrofit feasibility risk

	% all homes where retrofit risky, simple measure (ranked)	homes where retrofit risky, score measure
Crawley	13.6	3.5
Harlow	16.0	4.1
Stevenage	17.4	4.3
Bracknell Forest	19.2	5.2
Basildon	21.0	5.5
Milton Keynes	21.2	6.0
Basingstoke and Deane	23.4	6.9
Welwyn Hatfield	25.3	7.0
Hart	26.8	7.8
Wokingham	27.5	7.8

Refrofit feasibility risk : levelling up LAs versus non levelling up LAs

	% all homes where retrofit risky, simple measure	homes where retrofit risky, score measure
Levelling up LAs (priority need)	66.5	22.2
Non-levelling up LAs	49.7	15.4

Retrofit feasibility risk (simple measure): tenure split, all LAs

% of Owner occupier	Private renter	Social renter
58.8	59.2	35.2

Case studies – Hammersmith and Fulham and Wirral

Not only are particular local authorities facing very significant retrofit challenges, but problems are also concentrated in particular neighbourhoods within them. To further examine this, we delved down to the sub-local authority level using the EPC data to look at localised spatial concentrations of older homes in two areas.

In our case studies of the London Borough of Hammersmith and Fulham and Wirral Metropolitan Borough Council we also consider the degree to which the housing stock is repetitive, with many homes in a neighbourhood built to the same standardised design template. Where this is the case, harnessing economies of scale could bolster the value for money of retrofit through coordinated 'area-based' retrofit policies.

In this way, while very old homes are a risk indicator in our retrofit risk index, concentrations of homes like these can present an opportunity for cost-effective policy interventions. The Royal Institute of British Architects is calling for a national retrofit programme focussing on interwar homes where it believes the works could prove cheaper[13], because the repetitive designs of the typically terraced and semi-detached homes should allow for economies of scale in a mass rollout.

CASE STUDY 1: Hammersmith & Fulham

The London borough of Hammersmith & Fulham contains some of the oldest housing stock in England. Nearly 70% of homes there are estimated to have been built before 1950, the joint-highest proportion of any local authority in England.[14] The borough has the following breakdown of homes by age, according to estimates using the EPC data:[15]

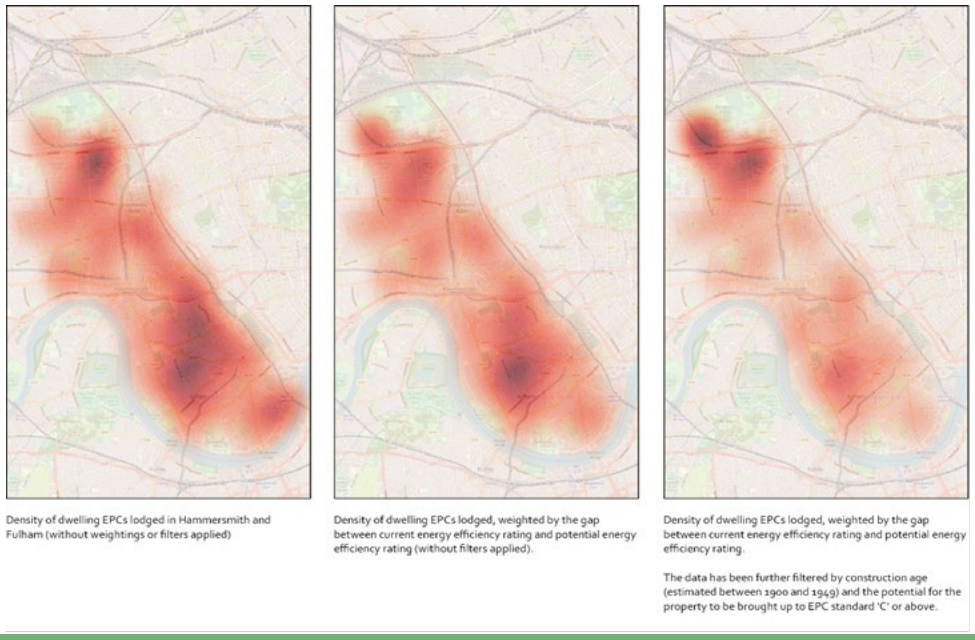
Table 1: estimated construction date of homes in LB of Hammersmith & Fulham

Estimated construction age band	Proportion of lodgements
Before 1900	26.0%
1900 – 1929	29.4%
1930 – 1949	14.3%
After 1950	30.3%
Total	**100.0%**

Around 44% of homes are estimated to have been built between 1900 and 1949 - most of these are likely to be 'interwar' (1919 to 1939). Filtering the data to exclude homes which are judged to not have the potential to reach EPC band C or above reduces this number to around 36 % of homes, indicating that about a third of the housing stock in H&F therefore has 'high' potential for energy efficiency improvements. The tenure split across these is relatively even: 40% owner-occupied and around 30% apeice private rented and social rented.

The leftmost heatmap below simply depicts concentrations of housing in the borough, with darker shades indicating a higher density of housing. It shows three main concentrations of housing (circled): in the northernmost areas of the borough by Wormwood Scrubs and around the White City Estate; a band spanning across central Fulham, including Kingwood Road and Wyfold Road; and in the south-eastern part of the borough next to the river around Imperial Wharf.

Figure 1: housing densities and housing with high potential for improvement, LB of Hammersmith & Fulham



The central heatmap is also a housing density map but weighted according to the gap between current and potential energy efficiecy ratings. The effect is to 'screen out' the Imperial Wharf concentration in the south east, likely reflective of the newly built developments there with higher current energy efficiency ratings and hence lower potential for improvement.

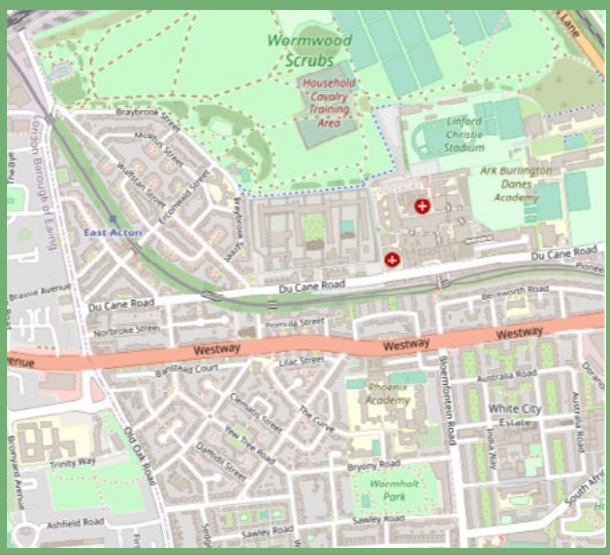
The rightmost heatmap filters the central map to include only housing built between 1900 and 1949 – the 'interwar proxy' [16] - as well as the potential to reach an EPC band C. An obvious pattern emerges: concentrations appear again at the northern part of the authority around the White City Estate, with a relatively lighter hot spot around central Fulham - albeit still pronounced. These two areas could therefore be candidates for 'area based' retrofit interventions. The following heatmaps also split out the housing with high potential for improvement by tenure.

Figure 2: housing with high potential for improvement, by tenure, LB of Hammersmith & Fulham

White City Estate area

The White City Estate area has two main features: the White City Estate itself to the East and South of Westway; and the Old Oak and Wormholt conservation area to the West:

Figure 3: Map of the White City Estate area

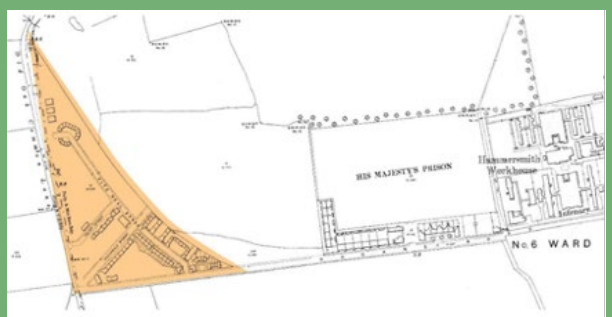


Looking at the social rented housing on the White City Estate, it is noteworthy that the five-storey tenements contained within the White City West is part of the White City Regeneration Area (WCRA). As such, it is subject to a specific plan policy WCRA2, where the council plans to renew the estates and replace existing buildings over time.[17] So whilst this housing has strong potential for energy improvements and is of a standardised design, the concentration indicated on the heatmap is found where the council already has a regeneration policy in place.

The Old Oak and Wormholt conservation area is predominantly two-storey interwar housing. The London Borough of H&F has published a character profile of the conservation area[18] confirming that the northernmost area (Old Oak Estate), situated around East Acton station, was built in two phases between 1912 and 1923, whilst the southern area (Wormholt Estate) was built c.1920 – 1930. The main developers at the time were London City Council (LCC) and Hammersmith Borough Council, explaining the existing concentration of social stock in the Old Oak area, and greater levels of owner-occupation / private-rented housing stock in the Wormholt area.

Both areas collectively were inspired by Ebenezer Howard's vision of Garden Cities and the architecture is reflective of this, with a largely consistent aesthetic. The standardised design if this housing is further suggestive of the potential for 'area based' retrofit as a cost-effective means of improving its energy efficiency.

Figure 4: Map of the Old Oak Estate pre-devlopment, 1910 and 1935



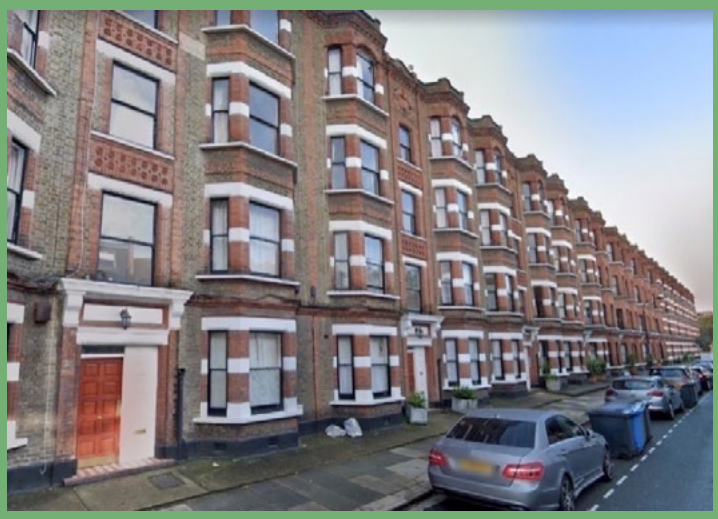
Extract from OS 1910 Historic Map showing the first phase of the Old Oak estate.

Extract from OS 1935 Historic Map showing completed Old Oak Estate.

Central Fulham area

The central Fulham area contains a notable concentration of four-storey Edwardian mansion blocks found on Kingwood Road & Wyfold Road. The properties are predominantly owner-occupied / private-rented and, whilst not strictly interwar, could provide similar potential for area-based retrofit given their repetitive nature. They are probably not suitable for regeneration given their architectural and historical merit.

Figure 5 – Edwardian Mansion blocks of Kingwood Road



Google Streetview

There also appears to be a significant number of homes in the central Fulham area estimated to have been built before 1900, not picked up by the heatmaps. Again, many of these older properties follow a repetitive design pattern and could be part of an area based retrofit approach.

CASE STUDY 2: Wirral

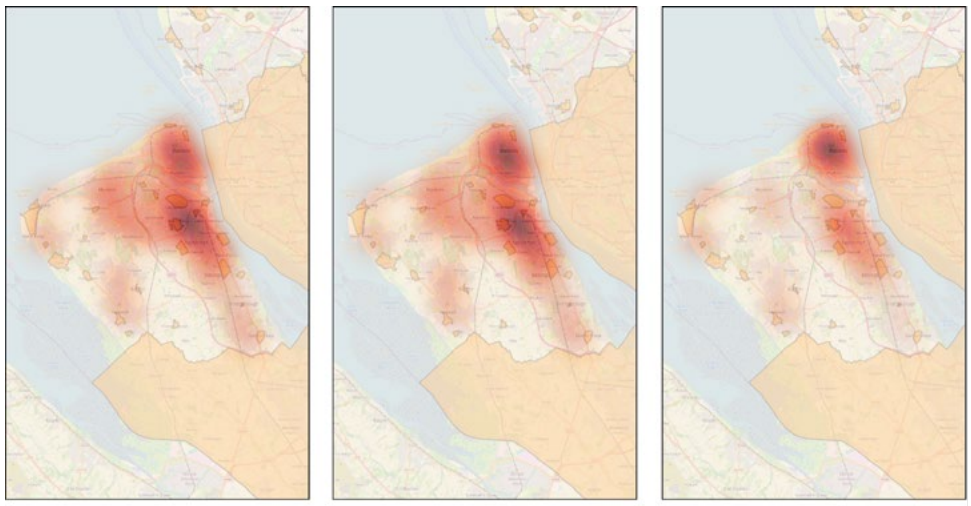
The Metropolitan Borough of Wirral is middling in terms of the age of its housing stock. Around 49% of homes there are estimated to have been built before 1950 and it has the following breakdown of homes by age, according to the EPC data:[19]

Table 2 - Estimated age bands from EPCs

Estimated construction age band	Proportion of lodgements
Before 1900	8.3%
1900 – 1929	22.3%
1930 – 1949	18.2%
After 1950	51.3%
Total	**100.0%**

Following the same process as the previous case study, the greatest housing densities in Wirral are found around Birkenhead facing onto the Mersey, as well as across Wallasey – see leftmost heatmap, below. When the heatmap is then weighted according to the gap between current and potential energy efficiency ratings (central heatmap), it is largely unchanged. Only upon further filtering for properties built between 1900 and 1949, as well as those having the potential to reach an EPC band C, does the picture change, with the greatest relative concentrations remaining around Birkenhead and Wallesey.

Figure 6: housing densities and housing with high potential for improvement, MB of Wirral



Density of dwelling EPCs lodged in the Wirral (without weightings or filters applied)

Density of dwelling EPCs lodged, weighted by the gap between current energy efficiency rating and potential energy efficiency rating (without filters applied)

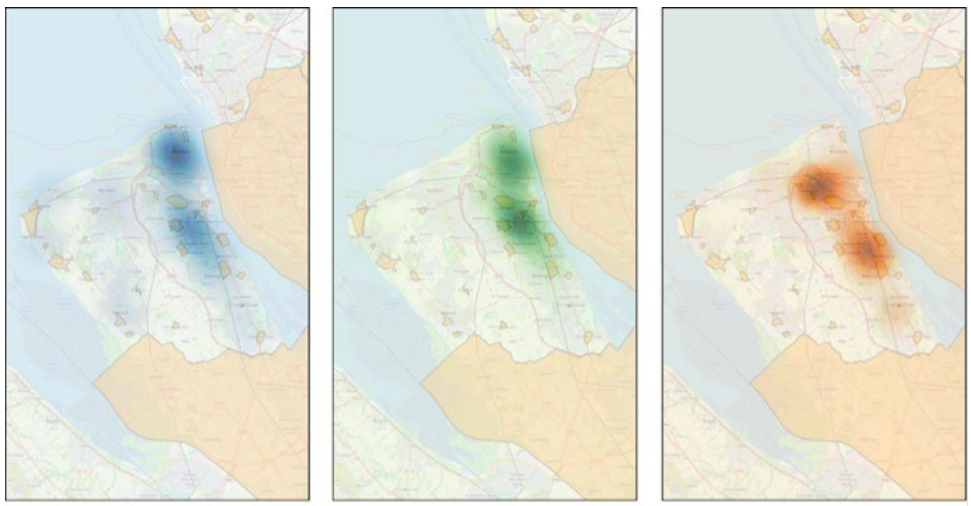
Density of dwelling EPCs lodged, weighted by the gap between current energy efficiency rating and potential energy efficiency rating.

The data has been further filtered by construction age (estimated between 1900 and 1949) and the potential for the property to be brought up to EPC standard 'C' or above.

This is **not** suggestive of obvious spatial concentrations of housing where energy efficiency improvements can be made, beyond just looking at the dwelling density of existing stock. This is in contrast to the previous analysis for Hammersmith and Fulham, which suggested an 'area based retrofit' approach in limited geographies might be appropriate. This is not to say that local concentrations of potential stock that could be improved do not exist in Wirral, just that they are not as easily identifiable.

Further, the clusters consist of varying property types from one area to the next, and in some cases street to street, reflecting the heterogeneity (lack of standardised design) of housing stock in the Wirral overall. When examining by tenure (and estimated build date pre-1950), the situation becomes clearer. Clusters of social housing stock, particularly around Birkenhead North, New Ferry / Woodhey & Edgerton Park areas, and to a lesser extent in Bromborough, have high potential for energy efficiency improvements.

Figure 7: housing with high potential for improvement, by tenure, MB of Wirral



Some of the social stock identified is adjacent to areas which have been already subject to regeneration policies – such as Ilchester Road around Birkenhead North, with significant new build activity having taken place there after existing homes were demolished. Many existing social properties alongside the new properties have refurbished exteriors, although it is not clear to what degree many of these homes have had additional energy efficiency measures put into place. Other nearby properties a few streets away from this new build / refurbishment activity are of differing housing types.

The nature of development and properties across space is therefore very diverse. Streets with high potential properties neighbour those with low potential ones. Recent redevelopment efforts have focussed on re-purposing former industrial land, rather than existing residential areas. This makes for a difficult policy environment when looking for broad-area-based solutions to improving energy efficiency of the housing stock. Gone are the low hanging fruit, such as the 'River streets', with demolition activity waning over recent years.

The above analysis suggests that while there is some scope for improvement in energy efficiency of the social stock in the Wirral – and this aligns with findings in other reports, including by Homes for the North – it would be very difficult to execute as part of a broad area-based approach.

However, there are concentrations of high potential owner occupied housing and private rented housing in south Wallasey, particularly the Poulton, Egremont and Seacombe areas, and in a broad band stretching across Birkenhead North, past Birkenhead central and down towards Rock Ferry / New Ferry areas. In terms of characteristics, the housing is more homogenous compared to the high potential social stock, and is typically high density terraced housing within distinct estates. These, in contrast with the social stock identified above, could present area-based retrofit opportunities for cost-effective gains in energy efficiency, with parallel streets of high-density terraced housing with near-identical layouts.

Benefits of retrofit

As well as measuring a home's energy efficiency, EPCs also record a dwelling's estimated annual CO2 emissions. According to the data for England, the average band A home emits only 0.4 tonnes of CO2 a year whereas a band G home emits 12.9 tonnes. Most existing homes are in EPC band D which emit 4.2 tonnes on average.

Across England, it is estimated from the EPC data that homes emit 96 million tonnes of CO2 a year. Bringing all homes below an EPC band C to an EPC band C would therefore save 37 million tonnes of CO2 a year, equivalent to flying from London to Cape Town and back 14 million times every year. [20] However, our feasibility analysis shows that at least 10% of homes cannot feasibly be brought to a band C rating. Taking this into account, it is found that bringing only those homes with the potential to be brought to an EPC band C to that level would save 28 million tonnes of CO2 a year.

Further account must be taken of the possible behavioural response to improvements in energy efficiency and resultant lower energy bills, namely that people will increase their consumption of energy in response. In appraisal analysis this is called the 'rebound effect'. Taking a modest 20% rebound effect into account suggests a 22 MtCO2 a year saving from a ubiquitous retrofit policy applied to all homes below an EPC band C and with the potential to be brought to that level. This is just under a quarter of all current estimated emissions from homes in England.

BEIS also publishes carbon prices enabling appraisers to value, or 'monetise', the value of CO2 savings. Applying these values to the carbon savings set out shows an economic benefit or 'social value' of GHG reduction of £9 billion a year if all properties in England below an EPC band C are brought to that level and £6.7 billion a year for only properties with the potential to be brought to this level, excluding rebound effect.

These figures should be treated with caution being as they are based on SAP 2012 assessments which reflect an out-of-date estimate of carbon emissions from electricity consumption from the national grid. Because more renewables have since come on stream, particular off-shore wind in place of coal and natural gas generation, the social benefit of averted climate change is likely to be somewhat lower.

Furthermore, this is the social benefit of GHG reduction only. It does not include the highly significant private benefit to individuals of reduced energy bills nor the social benefit such as potentially improved health outcomes from fewer colder homes.

Next steps

Our analysis makes clear that public policy may need to consider better alternatives than are currently available to retrofit some of our housing stock. The way forward is likely to differ dependent on home and location. What is clear, it transpires, is that a one size fits all retrofit policy is unlikely to be cost-effective and the risks must be carefully navigated.

We can see that homes in levelling up local authorities are a significantly higher retrofit risk proposition than those in non-levelling up authorities across two of the five retrofit feasibility risk factors, namely having low market values and being very old (built pre-1950). Broadly there is little to distinguish the retrofit feasibility risk between owner-occupier sectors and private rented sectors, either overall or on any of the constituent feasibility risk factors. The social rented sector is a much lower risk proposition for retrofit across all feasibility risk factors. However it is also the sector where retrofit is most easily achieved given existing Government levers such regulation, standards and the Social Housing Decarbonisation Fund (SHDF). As such, there is an argument for prioritising SHDF on levelling up areas, in accordance with need.

Given the huge sums involved, universal retrofit is unlikely to be a realistic and cost-effective policy. Instead, there is a case for prioritising Government attention on very low-value housing in levelling up areas, as these homes are highly unlikely to be retrofitted by homeowners or landlords due to being unviable on cost grounds. While the Energy Company Obligation scheme currently provides low-income households with grants to make their homes more energy efficient, if we are to make real progress towards net zero then a more radical and wide-ranging scheme is needed to decarbonise heat from our existing homes. Going further, all householders in very low value homes should be provided with Government grants. While some landlords in the private rented sector may still require further incentives, this action would significantly accelerate progress towards net zero while also helping to tackle rising fuel poverty by giving millions of people energy security in a world of volatile fossil fuel prices and supply.

We estimate that retrofitting homes in levelling up areas that are below an EPC band C and that are below the critical price threshold of £162,000 would cost around £28bn. However, this figure could be reduced very substantially by further targeting. For example, focusing on the private rented sector, which is the biggest challenge, would bring the figure down to around £1bn. A more effective strategy might be to develop a metric for levelling up areas which targets low-value housing for grants to bring them to EPC band C rating, or to regenerate clusters of low-value housing if retrofit is practically unviable.

Going further, the Government could consider establishing 'housing decarbonisation zones', focused on target areas identified using the type of evidence our work has considered. Within housing decarbonisation zones, these local authorities and its partners would harness a range of tools and investment streams in a single place. This could include Homes England-funded stock replacement using MMC, retrofit grants to householders in low value homes, the Social Housing Decarbonisation Fund for social stock, and possible fiscal incentives such as differential council tax rates. This could be complemented by enhanced household advisory and support services, as well as skills and training initiatives funded through the UK Shared Prosperity Fund.

Chapter 2: A greener approach to new build

While efforts to reduce emissions from the UK's housing stock will primarily focus on existing stock, they must also take account of the fact that around 20% of homes that will exist in 2050 but are not yet built. Put simply, everything possible should be done to ensure that new developments have the highest possible levels of emissions reductions. Crucially, the homes we build today must not become the retrofit projects of the future.

Much progress has already been made here. In the UK, a home's energy efficiency is measured by an Energy Performance Certificate (EPC), in much a similar way our electrical appliances are. The rating depends on the amount of energy used per M2 and the level of carbon dioxide emissions. Homes are rated on a scale of A to G – with A the most efficient and G the least. Our analysis of EPC data in England shows that the average existing dwelling is in EPC band D and emits around 4 tonnes of carbon a year, whereas the average new build dwelling is in EPC band B and emits around 1.4 tonnes of carbon a year.[21]

In line with this, the Home Builders Federation has stated that the average new build home emits 2.38 tonnes less of carbon each year than the average existing home and that new home occupiers are reducing carbon emissions by 576,000 tonnes each year, compared to if they had bought an equivalent older property.[22] Much of this difference is likely down to energy efficiency, given new build homes are of a similar size, have continued to employ predominantly natural gas central heating systems and use the same electricity supply as existing homes.

With new build homes being considerably more energy efficient than older properties, many consumers are already feeling the benefits. Research in late 2021 suggested that new-build homes can see homebuyers cut their energy bills by as much as 60%. Warwick Estates looked at the energy costs associated with running both new-build and existing homes on an annual basis. They found that energy bills from existing properties in England cost an estimated £797 per year, whereas for new-builds annual energy bills cost only £390.[23] Similarly, research published in early 2022 showed that across England and Wales the average energy bills for a new-build home was £401, compared to £825 per year for all homes.[24]

The Home Builders Federation found that running costs for all new build homes issued with an EPC in the 12 months to September 2021 came to approximately £116 million.[25] If these homes had been built to the same standards as the existing properties in the sample, running costs would have been around £228 million. Therefore, the HBF found that owners of new build homes were collectively able to save an estimated £112 million over the course of the year, approximately £435 per dwelling. For owners of houses, rather than flats or bungalows, the savings were even more substantial. The combined bills for older houses cost an average of £1,029 per year, compared with £474 for the average new house, a saving of £555 per year.

Further progress

Partnership with the Government on key areas of policy will now be critical to driving the further progress on net zero that housebuilders and others want to see. Ambitious objectives have been laid out by the Future Homes Hub whose Future Homes Delivery Plan sets the goal of high-quality homes that are zero carbon ready and sustainable with target levels to be set for 2025. This commitment is in line with the Government's Future Homes Standard and the Climate Change Committee's advice on the contribution required for new homes, which states that new homes should also deliver ultra-high levels of energy efficiency as soon as possible and by 2025 at the latest, and that designing in these features from the start is around one-fifth of the cost of retrofitting to the same quality and standard.[26]

CASE STUDY: The Z House

After announcing its commitment to building zero carbon homes from 2030, Barratt's first step in achieving this ambitious target was to build a concept home of the future – the Z House. Built on University of Salford's main campus, this is the first home in the country to be built by a major housebuilder that goes substantially beyond the Future Homes Standard.

The home will test and monitor the most modern sustainable housing technology such as an air source heat pump, infrared panels, plaster that eliminates pollutants, a fridge that keeps food fresh for longer, heated skirting boards, air-powered showers, electric vehicle charging points, PV solar panels and battery storage. Importantly, the home will also be lived in by a University academic in order to better understand the customer's experience of zero carbon living.

The Z House, built using modern methods of construction, is part-funded by the Government and has been developed in partnership with over 40 leading organisations from across the housebuilding, sustainability and technology sectors.

It features cutting edge technology such as overhead infrared panels that can provide instant zero carbon heat, air-powered and smart showers will save families hundreds of pounds per year in water and heating bills, plaster which eliminates pollutants giving cleaner, healthier air and appliances which reduce food wastage and water consumption.

It also boasts heated skirting boards that the manufacturers say deliver 10% more heat than traditional radiators while also saving space and artificial intelligence which optimise when devices consume electricity, ensuring customers maximise use of either free solar energy or low-cost electricity from the grid.

The Z House will measure how people use the house in the real-world, helping make sure that all new zero carbon homes in the future are easy to use for customers. The lessons learnt will be shared across the industry, benefitting everyone – from customers to other housebuilders.

A small group of pioneering developers are already taking action to reduce operational emissions more rapidly than the Future Homes Standard and to get to zero carbon in advance of decarbonisation of the grid, alongside placemaking efforts that aim to reduce transport emissions, increase biodiversity, and reduce health and social inequality. Furthermore, the Future Homes Hub is committed to investigating the scope to further reduce energy demand and emissions across the sector, as part of a system-wide approach to reducing emissions, including the role of new homes in reducing unregulated emissions and the contribution that might be made to reducing energy use through modern demand management systems and technologies.

CASE STUDY: Dundonald

Dundonald is a Riverside Group development of 63 new homes for rent in South Ayrshire, which is due to be completed in late 2022. It is the first modular project within the group, with the homes built in Connect Modular's nearby manufacturing facility.

Modular homes were chosen by Riverside as modular living has the potential to accelerate build times, improve quality control and deliver enhanced sustainability by reducing waste and increasing energy efficiency. "Developments like Dundonald allow us to tackle the housing crisis at speed and scale as well as helping housing providers like ourselves and local authorities to achieve government targets, not only around housing but around climate change too" says Riverside Scotland managing director Diana MacLean.

In comparison to a traditional build project, fabrication under factory conditions diminishes waste, improves quality, negates the impacts of adverse weather and allows for overlap of site preparation and build phases. For example, construction waste is up to 85% less that on traditional sites.

In opting for modular living at Dundonald, Riverside were clear that the use of offsite technology makes a real difference in lowering the environmental impact of modular developments. Energy consumption, building running costs and overall energy efficiency levels have been substantially improved by specifying offsite technology. Compared to an equivalent, traditionally built project, up to 67% less energy is required to produce a modular building.

Controlled factory conditions also make it easier to improve the future sustainability of homes. For example, better air tightness is achieved as standard while the combination of a highly insulated building envelope and solar PV panels also means significant savings on energy consumption and bills for tenants.

As well as improving the lifetime carbon emissions of new homes, and lowering consumer bills, there is also a need to focus on embodied emissions which are caused by the extraction, manufacture and assembly of materials plus maintenance and end-of-life disposal. Buildings are currently responsible for 39% of global energy related carbon emissions, of which 28% comes from operational emissions and a further 11% comes from materials and construction.[27] Embodied carbon therefore poses a significant challenge, and one that the housing sector is under no illusions about.

The Future Homes Delivery Plan states that "as legally backed national targets are translated into specific policies affecting home building, we will need to reach net zero emissions for the whole lifecycle of the building, including the embodied carbon in the products and processes for construction of homes; and net zero for how business operations are managed more widely". In line with this, the plan sets out the objectives of achieving production and construction methods that are net zero and sustainable by 2050 with substantial progress by 2025 and 2030, and businesses operations in line with the Race to Zero: net zero by 2050 with a 50% reduction by 2030. Similarly, the CCC makes clear that "addressing the embodied

carbon associated with homes will be a necessary part of any ambition to drive towards future 'net zero' greenhouse gas or carbon targets".

Housebuilders on the Building Back Britain Commission are committed to moving forward on all of these fronts and delivering low carbon homes for their customers. Legal & General has committed to making all of its new housing stock operational net zero carbon enabled by 2030. Barratt Developments has set targets to ensure its new standard house types will be net zero carbon by 2030 and that by 2040 it will become a net zero emissions business covering all of its direct operations. Going even further, Thakeham has set especially challenging targets. From 2025, every Thakeham home will be zero carbon in lifetime operation and the firm is also pioneering in its commitment that all new homes will be carbon neutral in production from 2025.

However, for those developers committed to net zero targets, there needs to be a level playing field and greater clarity on the Government's roadmap. For example, while many developers are moving ahead with heat pumps, question marks remain over the long-term plan for hydrogen in our homes. More widely, our Commission has already said that all new-built homes must be operational net zero from 2030 while housebuilders and the wider industry accelerate plans to be carbon neutral in construction. The danger is one of a terrain in which firms who have not set such ambitious targets are able to feed less cost into their models, enabling them to buy more land. By sending out a clear and direct message - such as already exists in the automotive sector where the UK plans to ban the sale of new petrol and diesel cars by 2030, and hybrids by 2035 - the Government could level the playing field and help to ensure that there are no adverse commercial consequences for those developers who commit to ambitious net zero targets.

As more developers do commit to creating more sustainable developments, we must also be mindful of how these are measured and communicated. Key to this is consistent methodology on measuring carbon and embodied carbon right through the value chain. Accurate comparisons are also essential for home buyers to be able to compare developments in their search for a home that will help them reduce their impact. This comparison becomes challenging when there are a range of topics and differing terminology, as is presently the case. We therefore need to see further progress on frameworks and certifications for new build housing that makes the sustainable choice clearer.

Modern methods of construction

Deeper integration of modern methods of construction (MMC) will play a key role in helping developers to meet the net zero challenge. While clearly not a silver bullet for everything, MMC can help with reducing embodied and operational carbon emissions, as well as speeding up delivery and addressing traditional construction skills shortages.

In our first report, we considered what MMC actually means and set out many of the potential environmental benefits of modern methods of construction. Those points are worth restating here While there is not a precise definition of MMC, the term is often used collectively for a wide range of non-traditional building systems. These are categorised in the report, Modern Methods of Construction working group: 'developing a definition framework' (2019) from the MHCLG which identifies seven different MMC categories within its MMC framework. These range from pre-manufacturing 3D primary structural systems and pre-manufacturing 2D primary structural systems to traditional building product led site labour reduction/productivity improvements and site process led labour reduction/productivity improvements.

Advocates of using MMC cite several benefits to using these methods in comparison with traditional construction techniques. The Housing, Communities and Local Government Committee's July 2019 report on Modern Methods of Construction lists 13 such benefits with quicker and more predictable delivery at the top of the list, reflecting the fact that MMC moves housebuilding construction activity away from the construction site and concentrates it.

Higher productivity and efficiency means significantly less waste than with traditional construction and less disruption to surrounding residents with less materials and construction traffic. A note supplied to the Housing, Communities and Local Government Committee by Buildoffsite states that factories can be optimised to minimise material waste below 1% of the total, whereas traditional construction has been shown to vary typically between 18% and 22%. Meanwhile evidence from the London Planning Committee states that with offsite technology buildings can be built and occupied in half the time of conventional buildings, requiring fewer vehicles to transport materials to site, which massively reduces traffic, pollution, noise and disruption, in turn improving local air quality.[28]

As a result, modular-delivered homes also offer a dramatic improvement in embodied CO2 compared with traditional construction. Heriot Watt University research found that just one building saved the equivalent CO2 to planting 160,000 trees. [6]. Build Homes, Build Jobs, Build Innovation also point to research demonstrating that offsite technology can cause nearly 40% fewer emissions than traditional construction. This equates to saving 26,000 tons of CO2 - or 7,000 vehicles being taken off the road for a while year, states that report. Furthermore, WRAP estimate that modular construction can reduce energy used in the construction process by 67% and waste produced onsite, by 70–90% in comparison with traditional construction methods.[29]

Government has made some encouraging noises on MMC. In the 2021 Budget, the Chancellor unveiled plans to establish a Modern Methods of Construction Taskforce to accelerate the delivery of MMC homes in the UK, backed by £10m of seed funding. The strategic importance of MMC can also be seen in Government housing programmes, such as the Affordable Homes Programme 2021-26, which plans to deliver up to 180,000 new homes with 25% delivered through Strategic Partnerships using MMC.

Our first report set out further steps that the Government could take to bring about the further innovations in MMC that would pave the way for more highly energy-efficient developments. We backed the creation of explicit new targets for the increase of MMC in housing delivery, including a commitment to build 75,000, high-quality, MMC homes a year by 2030. To tackle skills shortages, we advised that the Government should commit to creating at least one 'construction cluster' in every part of Great Britain by 2030. These clusters would be major regional training hubs where new skills, including for MMC delivery, would be promoted. In this way, construction clusters could help to ensure that the skills required by the transition to net zero are present in different sectors and regions across the country. The critical need for policies such as these to be part of the net zero agenda has been underlined by modelling by the CITB, using data from the Climate Change Committee's balanced scenario. This suggests that an additional 350,000 FTE workers will be needed by 2028, to be mainly involved in delivering improvements to existing buildings that will reduce energy demand.[30]

In addition, the tax system could be used to encourage investment in carbon zero MMC factories. Our first report suggested that companies should be allowed greater incentives to offset tax costs to encourage investment in zero carbon MMC factories. It is also the case that investment in research and development could increase uptake of net zero construction technologies, while also helping to mature and expand these markets and supply chains and skills. The Government's plan currently is to increase public R&D investment to £20bn by 2024-25, with a target for total UK R&D investment to reach 2.4% of GDP by 2027. Moving the construction sector towards net zero would be a perfect target for this.

While there is some excellent innovation going on in house building, the construction sector generally has been slower to innovate and adopt new technology than other major industries, due typically to ever-squeezed margins. To address this, Government should use funds from the planned expansion in investment in R&D to create new incentives via R&D tax credits for the uptake of net zero construction technologies. Accelerating innovation through new incentives such as this would make the change to net zero much more achievable.

CASE STUDY: Ockford Ridge

Ockford Ridge is a regeneration of a council estate in Godalming owned by Waverley Borough Council. Comprising houses that were no longer deemed fit for purpose, the regeneration by Thakeham has delivered 37 new homes that will help the council to meet its housing needs as well as demonstrating its carbon neutral commitment.

The homes feature solar panels to generate electricity and reduce heating and lighting bills; waste heat recovery from the boiler flues and high specification glazing to reduce heat losses through the glass. Thicker ground slab insulation and wall insulation has also been added along with modern methods of timber-framed construction with lower embodied carbon. Across the site, gardens include pollinator fruit trees and sensitive carbon-absorbing soft landscaping, making maximum use of low-carbon hard landscaping materials. Electrical vehicle charging points have been provided in many of the new homes, as have built-in swift bricks, bat boxes and hedgehog holes in fencing to allow their free movement to support wildlife on Ockford Ridge.

The energy efficiency measures and renewable technology enables each house on the site to achieve net zero carbon emissions. The homes achieve an Environmental Rating of 99 out of 100, the thermal efficiency of the walls is 0.15 W/m2K and the windows are triple glazed with a low-emissivity coating that makes them nearly three times more insulated than older double glazed windows. The quality of the design and the construction means every house exceeds air tightness levels that are more than twice that of building regulations, saving heated air from escaping.

Technology in the home reduces the need for energy even further. The LED lighting, heating controls, and heat recovery systems for the air and the hot water help save energy and money. Renewable technology like the solar photovoltaics on every roof mean that the homes generate enough electricity to compensate for the emissions used by the heating system. Across the site, solar panels produce over 38,000kWh of energy, saving nearly 20,000kg of carbon emissions from being produced.

Waverley's new Mayor, Councillor John Robini, said: "I'm looking forward to seeing these new homes literally rise from the ground. There will be 17 spacious, attractive and affordable homes, built to the highest current standards. I am also excited because this scheme starts to translate our Carbon Neutrality Action Plan into actual houses, by creating energy efficient, low carbon homes for the future."

Crucially, actions such as this to encourage greater take up of highly energy efficient modular homes will enable the housebuilding industry to be more self-sustaining when it comes to further reducing both operational and embodied carbon. More should also be done to give regulators and insurers the confidence to back new ways of building that will enable the industry to dramatically reduce levels of embodied carbon. These include cross-laminated timber – multiple layers of wood engineered into a sturdy single block – which can be manufactured offsite, so construction is quick and precise.

Compared to traditional materials as such as concrete and steel, timber boasts a host of environmental benefits including carbon sequestration, significantly faster build times with minimal waste and powerful heat insulation properties. The CCC has highlighted how increased levels of timber construction in the UK would result in significant additional amounts of carbon stored in the built environment. The committee's report, 'Biomass in a low-carbon economy', also notes that timber frame and engineered wood construction systems result in the displacement of high-embodied carbon materials such as cement and brick. The total amount displacement over the full lifecycle of a building will vary depending on a wide-range of factors, however the balance of evidence suggests timber construction can reduce fossil fuel emissions to the atmosphere overall, it states. Elsewhere, cross-laminated timber has been shown to be extremely positive for the environment, with embodied carbon estimated at around 60% lower than traditional construction.[31]

Timber also consistently performs well against fire safety tests, with cross laminated timber's fire resistance provided by it charring rather than fully igniting in a fire. Nevertheless there is a historical reluctance to adopt timber due to misconceptions over its safety credentials. In recent years, this has existed in the housebuilding and construction industry but also among insurers[32] - something that is thought to have been exacerbated by renewed scrutiny of fire and building safety regulation, at the heart of which lies the Building Safety Bill.

The danger of not taking action to overturn this reluctance and remove insurance barriers blocking timber construction has been highlighted by Paul Lowe, a partner at the law firm Weightmans. "Ultimately, if these restrictions end up blocking the progress of housing and construction projects involving timber, the country's journey to net zero could be significantly hampered," he warned.[33] To ensure that this does not happen, the Government should look at investing in research and development to test and prove the safety of low carbon materials and working with supply chains to accelerate innovation. There is also a case for Government action to enable insurance underwriting for new materials like cross-laminated timber.

Housing and transport

New housing developments also have a role to play in reducing emissions from other sectors of this economy. Chief among those other sectors is transport which produced 27% of the UK's total emissions in 2019. Of this, the majority (91%) came from road transport vehicles.[34] Overall transport emissions increased until a peak in 2007, before decreasing year-on-year until 2013, when emissions started increasing again. Emissions only started declining again in 2018. It is vital therefore that new developments enable sustainable travel and this should be a primary consideration at the beginning of the planning process.

In the recent past, it is not clear that this has been happening. A report in 2020 by Transport for New homes examined 20 garden communities that received a share of £3.7 million Ministry of Housing, Communities and Local Government funding from 2017-2019. While garden communities were envisaged as sociable, green communities, the report found that the reality threatened to be very different as the 20 communities created were creating up to 200,000 car-dependent households and non-driving residents would have to walk up to seven miles to access the nearest town centre or railway station. "Rather than being centred on sustainable transport, it looks like garden communities are to become car-based commuter estates just like any other - exactly what the Government wanted to avoid," the report concluded.[35]

In order to reduce transport emissions, a number of actions are needed. One aspect is electric charging points, which must be installed at new homes with off street parking, or nearby for those without off street parking to enable overnight vehicle charging. In keeping with this, new homes and buildings in England will be required by law to install electric vehicle charging points from next year. The move was announced in November 2021 with the Government saying we will see up to 145,000 charging points installed across the country each year. However, concerns have been raised about the lack of charging infrastructure. The

CASE STUDY: Devon County Council

In February 2019 Devon County Council (DCC) declared a climate emergency. As part of this DCC embarked on an ambitious journey to reduce carbon emissions across its estate and become a net zero organisation by 2050 at the latest. It established The Devon Climate Emergency Response Group in May 2019 to identify and recommend pathways to net zero.

Working with council partners, DCC secured funding from the Government's Sustainable Warmth initiative to improve the energy performance of some the least efficient properties in Devon.

Mace is therefore providing retrofit design services across 572 homes across Devon, working closely with the council, the Devon Climate Emergency Response Group and the local community to design high quality, effective upgrades to reduce carbon emissions as well as deliver energy savings for residents of low income households. All measures are being designed in line with PAS 2035 domestic retrofit standards.

Mace began working with DCC in 2022 following appointment under the SCF Consult framework, with the project continuing until the end of March 2023.

Policy Exchange think tank has warned the rollout of charging points has fallen behind and said there is a risk of "charging blackspots" in small towns and rural areas unless it speeds up.[36]

Research by the Homes Builders Federation indicates that house builders hold the key to unlocking the UK electric car industry, as over 70% of Brits have stated that they would be persuaded to buy an electric vehicle if their home had a charging point.[37] But crucially, new homes should be designed to facilitate sustainable travel by other means than cars. As the CCC has stated, this includes planning neighbourhoods around infrastructure to encourage walking, cycling, the use of public transport and electric vehicles. "Walking and cycling routes should be well lit, feel safe and be segregated from busy traffic. Integrating consideration of sustainable transport into plans for new houses should ensure developments are easy to serve by public transport. Local authorities must consider where best to locate new homes to minimise the need to travel to work and amenities such as shops and schools."

To ensure that this is the case, the CCC has stated that transport planning must be integrated with local housing plans and be accompanied by clear coordination at a regional level. Local authorities must consult the bus industry at the Local Plan stage to ensure new housing areas can be serviced by commercially viable routes, says the CCC. This would help to ensure that new housing is linked to bus and other public transport routes, with integrated timetabling, information provision and smart ticketing. "Local plans must incorporate funded public transport networks and cycle networks to link new homes to sustainable transport possibilities. If new roads are built, the inclusion of bus priority lanes should be considered, as well as provision for cyclists and pedestrians."

Where this does not happen or it proves not possible to ensure new housing areas can be serviced by commercially viable routes, then there may be a need for Government to take more radical action to ensure that new homes can promote sustainable travel. In particular, the CCC has proposed that the Department for Levelling Up, Housing and Communities and the Department for Transport should explore the potential for new rail stations, and light rail, tram and bus (including bus rapid transit) routes to unlock areas for housing development whilst offering solutions that also benefit the existing communities.

More widely, if net zero ambitions are to become reality, ambitious policy solutions will be needed to help ensure that future developments are designed to include facilities and infrastructure that support the surrounding existing communities to adopt more sustainable lifestyles, in which people are more connected to nature.

Chapter 3: The role of consumer incentives and green finance

Global consciousness of the climate crisis has never been more pronounced. The biggest ever opinion poll on climate change, in 2021, found that two-thirds of people think it is a "global emergency". The UN Development Programme questioned 1.2 million people in 50 countries for the poll and found the highest proportion of people saying there is a climate emergency was in the UK and Italy, both at 81%.

It follows that what were once 'nice to have concepts', such as energy efficiency and green heating, are now high on the agenda of consumers as they consider the type of housing that they would like to live in. When Nesta examined attitudes in this area a clear majority of people (84%) agreed that everyone will have to adopt energy efficiency and green heating measures in their homes sooner or later. A similar proportion (83%) were open to adopting energy efficiency measures with a total 15 per cent saying they had recently done so.[38]

Research by the Home Builders Federation has also indicated that concerns around the energy crisis and a desire for more sustainable living play a major role in home-moving decisions in the UK. The research found that 3 in 4 people are worried about the energy performance of their current home, with 1 in 4 saying energy efficiency will be 'crucial' to their next home move. Being 'eco-friendly' and 'having a good EPC rating' are now the second and third most desirable features in a new home, behind outdoor space, according to the research.[39]

The main barrier to adopting energy efficiency measures is cost, with financial considerations potentially putting off both low and middle earners, as well as asset-rich, cash-poor pensioners. Nesta found that 52 per cent of people agreed that the upfront cost of a new energy efficiency measure and installation would be too expensive, with 45% of people saying that the upfront cost is more important than the ongoing cost. Subsequent expenses were slightly less of a concern but a substantial minority of people (41%) said that the running costs of an electric heating system would be too expensive. Yet while cost is consumers' biggest concern, it is not the only barrier. For example, 32% strongly agree that there is not enough clear evidence about which energy efficiency measures are right for them and the same proportion strongly agree that it's difficult to find the right tradespeople to complete the installation.

Green Deal and Green Homes Grant

Subsidies for heat pumps and moves to abolish VAT on heat pumps and solar panels are the latest attempts by Government to incentivise households to make energy-efficient home improvements. In 2013, the now-defunct Department of Energy and Climate Change implemented the Green Deal which provided loans to households to finance energy-efficient home improvements, with the loan designed to be paid back through the savings made on energy bills. However, this scheme suffered from extremely low demand as only 14,000 households took out a loan, leading to a cost to taxpayers of £17,000 for every loan arranged.

The original scheme ran from 2013 to July 2015, when the Government stopped supporting the Green Deal Finance Company. In 2016, the Commons Public Accounts Committee judged the Green Deal to have been an overly complex scheme with many process steps and excessive paperwork. The committee found that this was a result of the department not undertaking enough work to understand consumer needs, and how to make it easier for them to apply. "In practice, householders were not persuaded that energy efficiency measures were worth paying for through the Green Deal and take-up of loans was abysmal," they stated.

"The Department's forecast that the Green Deal Finance Company would provide loans worth more than £1.1 billion by the end of 2015 was wildly optimistic—the actual figure was £50 million."[40]

The main green stimulus policy announced by Government since the Green Deal has been the Green Homes Grant. This was unveiled in July 2020 by the Chancellor as an urgent response to the Covid-19 crisis, aiming to support jobs at a time of significant risk for the economy while also reducing carbon emissions from homes. With £2 billion of funding allocated to it, the scheme provided vouchers worth up to £5,000 for energy-saving improvements and was intended to mobilise the energy efficiency supply chain. Homeowners were expected to identify a certified installer and apply for vouchers with the installer receiving the grant funding once they had fitted the measure.

The Green Homes Grant was abruptly scrapped in March 2021, just over six months after its launch. The Commons Public Accounts Committee subsequently found that around 47,500 homes upgraded compared to the 600,000 originally envisaged, delivering a small fraction of the expected jobs and accounting for just £314 million out of the original £1.5 billion budget.[41]

This outcome should not be seen as evidence of a lack of interest from consumers. According to polling by YouGov commissioned by the Energy and Climate Intelligence Unit, 22 times more households were interested in taking part in the scheme than it had capacity for.[3] Rather than the problem being a lack of applications to start with, the Public Accounts Committee found that there were significant delays to applications being processed. By August 2021, 52% of voucher applications were eventually rejected or withdrawn, while 46% of installer applications failed, the committee found. Explaining this, the committee pointed to the complexity of the scheme which meant it was difficult for homeowners to ensure they met all of the various criteria fully, resulting in the high percentages of failed applications.

More recently, it was announced that households would be offered subsidies of £5,000 from April 2022 to help them make the switch from gas boilers to low-carbon heat pumps, which can cost between £8,000 and £15,000. However the grants will fund just 90,000 pumps over three years - some way short of the 25 million UK homes with gas boilers. Against this backdrop the National Infrastructure Commission was tasked with finding a viable way to further roll out heat pumps and practical solutions to pay for them. In 2021, Sir John Armitt, chairman of the Commission, said that one option was adding the cost of the heat pump to a mortgage with other options including commercial bank loans and government loan schemes that would have to be paid for through energy bills or general taxation.

Schemes in Europe

Schemes elsewhere in Europe suggest that progress can be made on attempts to decarbonise domestic properties. In France, the government launched a similar scheme to the Green Homes Grant, also as part of a post-Covid green recovery. Ma Prime Rénov (My Renovation Bonus) provided €75 per sq metre for insulation and €4,000 for a heat pump. In July 2021 France's ecological transition ministry declared the scheme a "resounding success" and others have agreed. Jess Ralston, of the Energy and Climate Intelligence Unit, an independent non-profit, said that France's figures back up this claim of success: in the whole of last year 190,000 applications were submitted to the scheme and halfway through 2021 this had already doubled to 380,000. Continuing at that pace a full year may yield over three-quarters of a million applications – which is rather different to the 700,000 applications expected by ministers in charge of the scheme, she noted.[42]

Ralston says that examining the reasons why Ma Prime Rénov was far more successful than the UK reveals "a not-so-shocking fact: making it quick and easy to access the scheme meant much more uptake". This appears to be borne out by average response times to an application. This was just 11.5 days in France, whereas delays in issuing vouchers and payment when the work was completed were a major issue in the UK. However there is one important difference to bear in mind when comparing the two schemes. It is that of the heating systems applied for in France, 8% were gas boilers - something that the Green Homes Grant did not support and was widely hailed as a positive step towards the path to net zero.

Meanwhile in Germany, the Kreditanstalt für Wiederaufbau (KfW or Reconstruction Credit Institute) scheme has been up and running for the last ten years covering many different aspects of retrofit including energy efficiency and heating. In 2019, the KfW had 326,000 applications, up to 600,000 by September 2020, driven by increased uptake in renewable heat and energy efficiency in new and existing buildings. This means it is less comparable to the Green Homes Grant but Ralston notes that it still teaches vital lessons on the importance of longevity of funding.

"Clearly, there are lessons that can be learned from looking at the UK's experience with the Green Homes Grant compared to Germany and in particular, France, which had similar timescales and funding to the UK but delivered the target improvements due to successful administration of the scheme," Ralston concludes.

Those MPs who scrutinised the Green Homes Grant have also said that the Government now needs to consider carefully how to approach such schemes in future. The Commons Public Accounts Committee stated that "Government needs to stick to a stable, long-term plan, to renew the confidence of industry and consumers in taking the actions needed to realise Government's net zero ambitions." Elsewhere, the Environmental Audit Committee recommended that a multi-annual scheme must be delivered to provide the financial support to owner occupiers and build trust within the industry to encourage installers to get accredited and enable companies to hire staff.[43]

Green mortgages

Alongside the Government, the private sector will have a critical role to play in deploying the additional capital required to help drive up energy efficiency in our homes. Products such as green mortgages could provide access to better mortgage terms - lower interest rates or extra borrowing capacity - to those who purchase energy efficient homes or who commit to upgrading the properties' energy performance.

Recently there have been signs that consumers have an appetite for such products. Research in 2020 found that one in five homeowners would be willing to pay an extra £100 a month for a mortgage if it helped to lower their carbon footprint. This interest from customers was largely driven by the opportunity to save money on energy bills (53%), but 43% also wanted to take out these products in a bid to feel that they are doing their part to save the environment.[44]

In the Net Zero Strategy, published in 2021, the Government acknowledges the importance of making progress in this area. That document states that "catalysing the market for Green Finance is a priority", adding that Government is working with mortgage lenders to support homeowners to improve the energy performance of their properties. Government is also exploring the case for a further green home finance innovation programme, focussed on supporting lenders to develop green finance products targeted at consumer types who will be impacted by future regulation, and which the market is unlikely to develop on its own in the short term.

Currently, some 11 banks and building societies in the UK offer green mortgages. However, most of these only apply to buyers purchasing homes with EPC ratings A and B, which only make up 3% of all homes in the UK. For example, NatWest offers a reduced rate on a two year or five year fixed rate mortgage for homes with an energy efficiency rating of A or B; Halifax offers £250 cashback to those buying a property which has an EPC rating of A or B; and Ecology Building Society offers discounted mortgage rates to homeowners building or converting sustainable homes, or undertaking retrofits and energy improvements. For sustainable homes and retrofits, the size of the discount that homeowners receive depends on the outcome once the project is completed. For retrofit discount mortgages, a 0.25% discount is applied to Ecology's standard variable rate for each Energy Performance Certificate (EPC) grade that the property improves. Other lenders are still considering whether to dip their toes in the water. Although Santander does not currently offer a green mortgage, it would "eventually like to use its scale to negotiate better energy deals or retrofit prices for its customers".

The Government should consult on how to work with banks and building societies to improve take-up of green mortgages. Alongside this, there could be a specific focus on products for pensioner owner occupiers who may be living in fuel poverty due to inefficient homes, but without access to mortgage. For asset-rich cash-poor pensioners especially, one option could be a form of equity release, where loans are paid from the eventual sale of the property. There are twice as many products on the market as two years ago, and competition has pushed interest rates down. However, while equity release has become more mainstream, the costs can add up and it is still often seen a high-risk move. The Government could look at how to minimise any such risks and provide more attractive options to pensioner owner occupiers who would benefit from more energy efficient homes.

Low interest loans

Low interest loans are another product that could make driving up energy efficiency levels a more financially attractive prospect for consumers. In the UK, Nationwide's 'Green Additional Borrowing' product allows homeowners to apply for an additional £5,000 to £25,000 to make green home improvements at a reduced rate of 0.75%. Meanwhile in the United States, PACE financing (property assessed clean energy financing) can be used to cover energy-efficient upgrades or the installation of renewable energy sources for commercial, industrial, and private residential properties.

With a PACE loan, the property serves as collateral and the debt is tied directly to the property, rather than its owner. Any remaining balance on a PACE loan remains intact when ownership of the property changes hands. Unlike a traditional mortgage loan, PACE financing doesn't require an upfront down payment. PACE loans are repaid through property assessments, as an addition to the owner's regular property taxes. These assessments are typically spread out over a specific time frame, which may range from five to 25 years, based on the amount of financing involved.

PACE is not without its critics. In 2021, the US comedian and Last Week Tonight host John Oliver claimed the scheme was "putting vulnerable people in a position where they're risking their homes" and called it "yet another example where a well-meaning public program has been corrupted by the presence of private companies".[45] But supporters of the PACE see it differently. They claim: "Property owners love PACE because they can fund projects with no out-of-pocket costs. Since PACE financing terms extend to 20 years, it's possible to undertake deep, comprehensive retrofits that have meaningful energy savings and a significant impact on the bottom line…. Local governments love PACE because it's an Economic Development initiative that lowers the cost of doing business in their community. It encourages new business owners to invest in the area, and creates jobs using the local workforce. PACE projects also have a positive impact of air quality, creating healthier, more livable neighborhoods." [46]

Here in the UK, Jenny Holland, from the UK Green Building Council, told MPs that "the US has got it right with PACE programme loan books able to be aggregated and securitised in order to access wholesale, lower cost capital," she told MPs. In line with this, we believe that there could be merit in Government looking closely at the PACE scheme and considering the feasibility of establishing a similar scheme in the UK, with a focus whether this could be part of a suite of solutions to the financial barriers faced by householders wishing to improve the energy efficiency of their homes.

Other tax levers

Council Tax has previously been floated as a possible tool that could be used to encourage green home improvements. In Scotland there is already legislative provision for Council Tax reductions via local 'energy efficiency discount schemes' under the Climate Change (Scotland) Act 2009. These schemes have had negligible take-up, but Citizens Advice Scotland has stated that this could be for a variety of possible reasons "including the relatively low level of discount available (typically £50), but also lack of promotion/awareness of the schemes, and perhaps administrative complexity". In place of the current regime they

suggest that a new incentive system based upon a level of prompt Council Tax rebate for those who install energy efficiency upgrades should be freshly explored.[47]

Alternatively, ministers could look at linking Council Tax rates to the energy efficiency of a property. This approach would place an extra administrative burden on councils but it is also likely to have a greater impact than offering a one-off rebate after measures are installed. As the UK Green Building Council stated when examining the idea in 2013: "The major advantage of variable Council Tax rates over rebates is that the former offers an on- going advantage benefit to living in an energy efficient home. It is reasonable to assume that, over time, this would feed through to property prices."[48]

The other major advantage that variable council tax rates have over rebates is that such a system could be made to be revenue neutral, while a rebate system would place an ongoing financial burden on councils. Linked to this, the main downside of variable Council Tax is the potential negative consequences for poorer households already paying high amounts of Council Tax.

Reducing Stamp Duty is another way to potentially encourage more energy efficiency improvements by homeowners. Such an incentive would have the key advantage of impacting at the point of sale and could quite conceivably feed through into property value if implemented successfully. In this way, buyers would be incentivised to buy more energy efficient homes and many homeowners might be persuaded to improve the energy efficiency of their houses to avoid seeing the value of their property fall when they come to sell.

Proposing the measure back in 2013, the Green Finance Institute noted that the system could be designed to allow buyers to claim a rebate on Stamp Duty if they undertook energy efficiency work within a given period of purchasing. The body suggested a system of variable Stamp Duty rates that would see house buyers receive a discount if a property is above a given energy efficiency standard, or pay a higher rate if its performance is poor.

A more detailed plan for the same policy was drawn up by UKGBC in 2021.[49] Their "Stamp Duty Land Tax" would be based around HMRC announcing a "SDLT rating neutral point" each year. At point of sale, the basic SDLT value is then adjusted up or down based on the energy demand and carbon performance of the home relative to the Treasury-set 'neutral' level.

Under the proposals, someone purchasing a "future homes standard" end-of-terrace new build with an EPC band A for £250,000 would save £1,653 in Stamp Duty. However, a £250,000 end-of-terrace house from the 1900s with an EPC rating of E would cost its buyer an extra £2,296 in taxes, more than doubling their total Stamp Duty to £4,796. This buyer would be eligible for a tax rebate after retrofitting the property up to standard within two years of moving in.

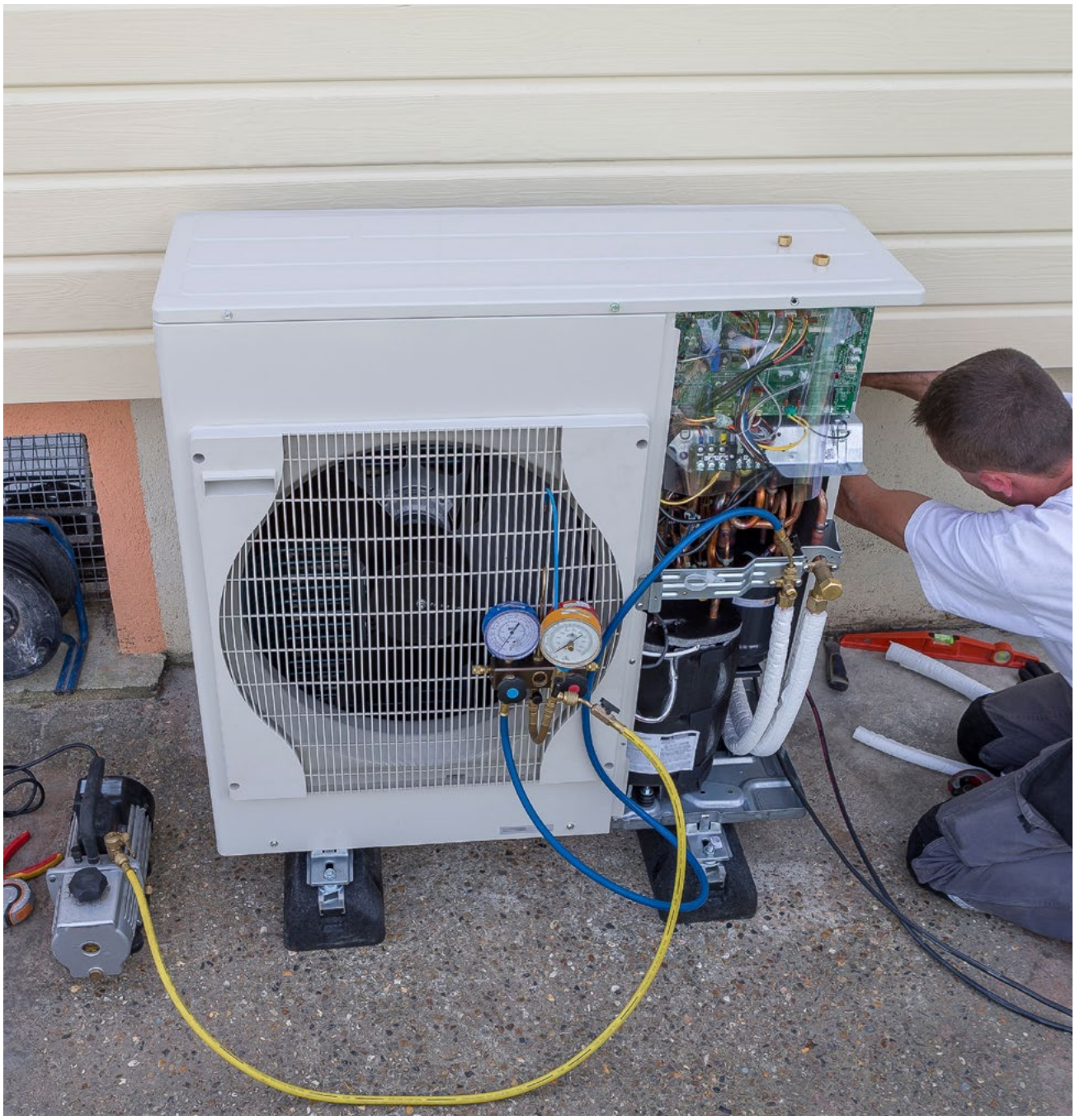
Dr Rhian Mari-Thomas, of the Green Finance Institute, has expressed support for a Stamp Duty rebate as an action to stimulate more private capital, telling MPs that we need to "normalise the concept of energy efficiency improvements as part of the property sale and purchase process".[50] In line with this, our Commission would urge the Government to explore a sliding scale of Stamp Duty linked to energy performance which could drive demand for more energy efficient properties.

One unanswered question around such a Stamp Duty reform concerns the extent to which it would reach some of the older and more affluent people in bigger houses who may be among the biggest carbon emitters. While this deserves further examination, another possible mechanism for encouraging this demographic to undertake energy efficiency work is the inheritance tax system.

Currently in the UK, the first £325,000 of a person's estate is tax-free while a 40% tax applies to anything that goes over this value. If a person leaves their main residence to their children or grandchildren, they may gain an additional tax-free allowance of £175,000, increasing the overall tax-free threshold to £500,000. In order to encourage energy efficiency improvements by older and wealthier homeowners, at a

cost to the Exchequer, there could be a second additional tax-free allowance. Alternatively, at no additional cost to the public purse, Government could state that the £175,000 additional tax-free allowance is dependent on the property meeting a recognised energy efficiency benchmark.

In this report, our Commission is not providing a verdict on which tax levers should be revisited and how. Rather we would like to see various options subjected to scrutiny as part of a wider review of the way we tax residential property. In doing so, Government should aim to establish whether changes can be made that would drive much-needed demand for more energy efficient properties.



Conclusion:
a five step path to net zero

Key to meeting the challenges of retrofitting the nation's existing homes and building highly energy efficient new homes will be ensuring that we have the skilled technicians we need in the construction workforce. In our first report we considered the growing skills shortages in the industry and proposed measures to foster innovation, new methods of construction and improve the level of training available to workers. We proposed that the Government should commit to creating at least one 'construction cluster' in every part of Great Britain by 2030. That recommendation is worth highlighting here as it is a prerequisite to further action.

Beyond this, given the sheer scale of the net zero challenge with housing, we propose the Government adopts a 'pathway' approach that focuses first on very achievable 'wins' which can pave the way for tackling bigger challenges later.

1. **Energising new build**

   Investment in research and development should be refocused to increase uptake of net zero construction technologies, and help mature and expand these markets and supply chains and skills. In particular, with the Government planning to increase public R&D investment to £20bn by 2024-25, funds from the planned expansion in investment should be used to create new incentives via R&D tax credits for the uptake of net zero MMC technologies.

   The Government should also look at investing in research and development to test and prove the safety of low carbon materials and working with supply chains to accelerate innovation. There is also a case for Government action to enable insurance underwriting for new materials like cross-laminated timber.

2. **Enhancing low value homes**

   Householders in low value homes where the cost of retrofitting is likely to be financially unviable should be provided with government grants funded via public borrowing. Over the next decade, all owners would be offered a grant to cover the full cost of the retrofit within a ten year eligibility window. Going much further than the current the Energy Company Obligation scheme, grants should be provided to as many homes as feasible below the critical average house price threshold of £162,000, under which the cost of work would exceed the potential house price gain. Many of the homes falling below this threshold are in areas prioritised for action as part of the levelling up agenda.

   We estimate that a programme of retrofitting homes in levelling up areas that are below an EPC band C and that are below the critical price threshold of £162,000 over the next ten years would cost around £2bn each year. However this figure could be reduced very substantially by further targeting.

3. **Options for other homeowners**

   Householders in higher-value homes should be able to access low interest unsecured loans over 10 years at similar rates to the cost of Government borrowing. To ensure higher take up than was the case with the Green Deal scheme, the new scheme will need to have both significantly lower interest rates and fewer process steps to make it easier for householders to apply.

4. **Considering consumer incentives**

The Government should consult on how to work with banks and building societies to improve take-up of green mortgages. To further normalise the concept of energy efficiency improvements as part of the property sale and purchase process, Government could also explore a sliding scale of stamp duty linked to energy performance which could drive demand for more energy efficient properties. This should be done as part of a wider review of the way we tax residential property to establish whether changes can be made that would drive demand for more energy efficient properties.

5. **Sensitive stock replacement**

The Government should recognise the challenges posed by older homes beyond realistic repair and build on what has worked in previous regeneration schemes in new 'housing decarbonisation zones', focused on target areas identified using the type of evidence our work has considered. Within housing decarbonisation zones, Government should commission Homes England to work with local authorities to develop a locally-led programme for replacing older homes beyond realistic repair in order to reach net zero.

Local authorities and their partners in housing decarbonisation zones could also harness a range of tools and investment streams in a single place. As well as Homes England-funded stock replacement using MMC, this could include retrofit grants to householders in low value homes, the Social Housing Decarbonisation Fund for social stock, and possible fiscal incentives such as differential council tax rates. This could be complemented by enhanced household advisory and support services, as well as skills and training initiatives funded through the UK Shared Prosperity Fund.

Endnotes

1 BEIS, 2020 UK greenhouse gas emissions, provisional figures

2 ONS, Energy efficiency of housing in England and Wales: 2021

3 DLUHC, English Housing Survey, Headline Report, 2020-21

4 BEIS, Energy Company Obligation ECO4: 2022 - 2026

5 Construction Leadership Council, Greening Our Existing Homes: National retrofit strategy

6 DLUHC, English Housing Survey Energy Report, 2019 to 2020 English Housing Survey, 2019 to 2020: energy - GOV.UK (www.gov.uk)

7 BEIS, Energy Trends Fuel Used in Electricity Generation and Electricity Supplied, 2021 Energy Trends: UK electricity - GOV.UK (www.gov.uk)

8 Savills UK | Residential journey to net zero

9 Since 2013, listed buildings have been exempt from EPCs (in the buying and selling process), so long as they meet certain minimum standards for energy efficiency

10 Looking at homes in 'conservation areas' was also considered, but analysis suggested this would be too broad for some local authorities

11 Energy efficiency ratings currently having limited impact on house prices despite push to go green (nationwide-housepriceindex.co.uk)

12 House price analysis conducted at Lower Super Output Area level

13 Architects call for mass insulation of England's interwar suburbs | Housing | The Guardian

14 The other local authority being neighbouring London Borough of Kensington & Chelsea

15 The EPC data have been 'cleaned' by excluding repeat lodgements & missing data (a 'complete case' analysis)

16 The EPC data only contain bands for the estimated year of construction, so filtering on homes built between 1919 and 1939 is not possible

17 White City Regeneration Area (WCRA) outline - https://www.lbhf.gov.uk/planning/regeneration-transforming-our-borough/white-city-regeneration-area

18 Old Oak & Wormholt character profiles - https://www.lbhf.gov.uk/sites/default/files/section_attachments/old_oak_wormholt_conservation_area_character_profile.pdf

19 The EPC data have been 'cleaned' by excluding repeat lodgements & missing data (a 'complete case' analysis)

20 Bulb, We've offset 1 million tonnes of carbon

21 Data for new dwellings are those built in 2021 to Q3

22 Home Builders Federation, Greener, cleaner, cheaper

23 New Start, Research shows new-build homes can reduce energy bills by 60%

24 Estate Agent Today, New homes boast of energy efficiency as price hike looms

25 Home Builders Federation, Greener, cleaner, cheaper

26 CCC, UK housing: Fit for the future?

27 World Green Building Council, Bringing Embodied Carbon Upfront

28 Building Back Britain Commission, Levelling up and the housing challenge

29 ibid

30 CITB, Building Skills for Net Zero

31 Inside Housing, Hanging in the balance: what is the future for cross-laminated timber?

32 In this report 'insurers' refers to buildings insurance providers, as opposed to new home warranty providers who address different risks and have long accepted different types of MMC systems.

33 Building, Our journey to net zero could be thwarted by insurance barriers

34 DfT, Transport and environment statistics: Autumn 2021

35 Transport for New Homes, Garden Villages and Garden Towns: Visions and Reality

36 Policy Exchange, Charging Up

37 Environment journal, 3 in 4 people worried about energy performance of their home

38 Nesta, Decarbonising homes: Consumer attitudes towards energy efficiency and green heating in the UK

39 Environment journal, 3 in 4 people worried about energy performance of their home

40 House of Commons Committee of Public Accounts, Household energy, efficiency measures, Eleventh Report of Session 2016–17

41 House of Commons Committee of Public Accounts, Green Homes Grant Voucher Scheme, Twenty-Seventh Report of Session 2021–22

42 Energy & Climate Intelligence Unit, UK left out in the cold as Europe storms ahead on efficient homes

43 House of Commons Environmental Audit Committee, Energy Efficiency of Existing Homes, Fourth Report of Session 2019–21

44 Financial Reporter, Industry calls for government intervention to stimulate green mortgage market

45 The Guardian, John Oliver rips into US clean-energy loans: 'This business model is fundamentally flawed'

46 PACENation, PACE Basics one-pager

47 Citizens Advice Scotland, Warming Scotland up to Energy Efficiency: Putting Consumers First

48 UK Green Building Council, Retrofit Incentives

49 UKGBC, A housing market catalyst to drive carbon emission reductions

50 House of Commons Environmental Audit Committee, Energy Efficiency of Existing Homes, Fourth Report of Session 2019–21

Our Commissioners

Terrie Alafat CBE

Chair of The Riverside Group

David Thomas

Group Chief Executive at Barratt Developments

Steve Wood

CEO of NHBC

Rob Boughton

CEO of Thakeham

Nigel Wilson

CEO of Legal and General

Jason Millett

CEO for Consultancy at Mace

WPI | STRATEGY

WPI Strategy Limited

11 Tufton Street,
London,
SW1P 3QB

@WPI_Strategy

wpi-strategy.com

April 2022