

Atelier

UK Housing: The Race to Zero Net Carbon is On

An insider's guide to understanding the issues and opportunities



Foreword

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Co-Managing Director, Atelier**



At Atelier we've spent a lot of time researching climate change and deciding how we as a company should respond to the challenges before us.

The UK has pledged to achieve net zero carbon emissions by 2050, and this fast-approaching goal is helping us focus our energies on areas where we feel we can provoke debate and bring about meaningful change.

Of course, with an issue as complex as climate change, it's never easy finding a place to start, though central to this report is the conclusion that the current EPC standard has become hopelessly outmoded. We feel there is an urgent need for a new system that tracks a wider variety of metrics, helping both the property industry and home-buyers to make more informed choices and understand better how homes impact climate change.

With the UK preparing to host the UN climate summit (COP26) in November, now is the time to begin implementing the radical changes necessary to tackle our emissions and deliver better homes overall. We have every incentive to do so, for in business the view from the front of the pack is always the best. And while some see the estimated £250 billion cost of upgrading our homes as prohibitive, others see a solid business case for galvanising stakeholders within the industry and committing ourselves to the challenge.

I am convinced that if we let science and technology lead the way, then society will be better for it, and by sharing our research we hope we can assist others in starting their carbon reduction journey too.

Moving UK housing to net zero

Executive summary

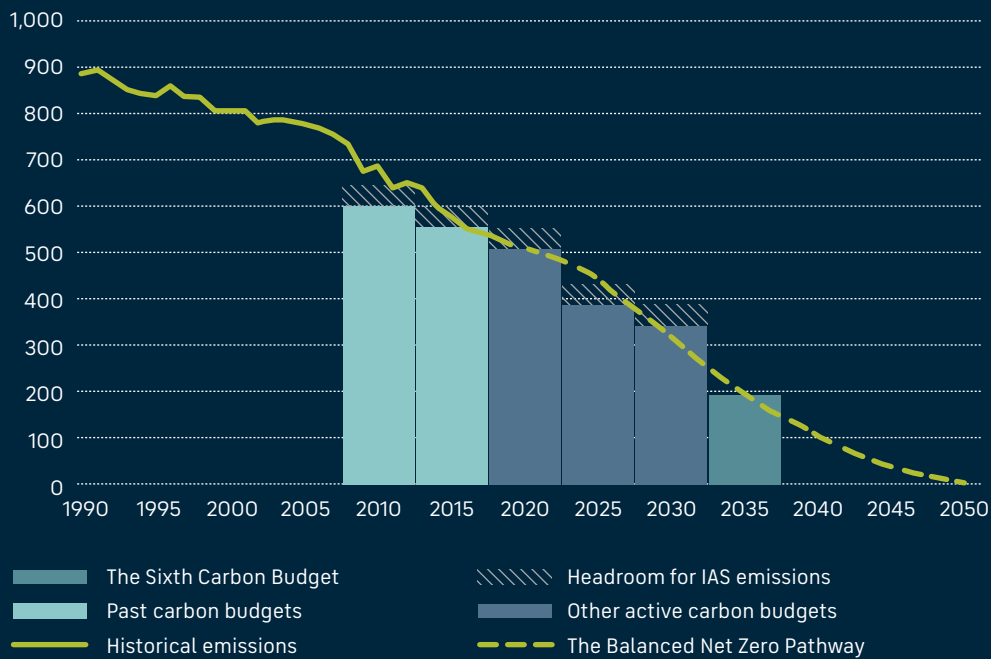
- The UK's hosting of the UN climate summit (COP26) in November throws a spotlight on the Government's commitment to get the country to net zero carbon emissions by 2050. While there are some encouraging signs, it is too soon to gauge the strength of political resolve to act long term.
- About 19 million homes in the UK will have an Energy Performance Certificate (EPC) rating below the minimum target of band C by 2035, if they are not retrofitted with better energy efficiency. As many as 29 million homes will need to replace their heating systems with greener technology. Such a huge programme of improvements to Britain's frequently old and energy-inefficient housing stock will be a colossal undertaking. But it tells only part of the story.
- Progress towards net zero is currently being hampered by the absence of a national standard for the construction industry in calculating and mitigating carbon emissions.
- The UK must either replace or implement far-reaching reforms to the current EPC system, if it is to effectively eliminate carbon emissions from our homes and meet its legal commitment to reach net zero carbon by 2050.
- In the absence of a system that incorporates measures of both embodied and operational carbon, the current system of EPCs amounts to something of a "green herring" with well-meaning buyers of new-build homes being bamboozled by a measure that's of only limited value when it comes to representing a home's green credentials.
- Turning to lending, the Government must introduce or support radical green finance initiatives, if we are to accelerate the transition and motivate households to act on energy measures.
- Older home-owners must be incentivised to either downsize or invest in energy improvements.
- The broad strategy of the UK and devolved nations, is to reduce energy needs by improving the energy efficiency of homes, and to decarbonise domestic energy supply in favour of green electricity and eventually hydrogen.
- A huge step-up in effort is required in this decade, when much of the focus will be on retrofit energy improvement, and developing the decarbonisation technologies and infrastructure around heat pumps and low-carbon hydrogen, with the total upfront cost for upgrading homes by 2050 estimated to be about £250 billion.
- While the challenges around homes going carbon-neutral are immense, so too are the opportunities for businesses that are engaged in or support new-build and retrofit.

Background

When the UK hosts November's UN climate (COP26¹) summit in Glasgow, it will be against a challenging backdrop, that scientists believe that the window to tackle global warming and the associated extreme weather systems is closing fast².

The UK Government has sought to be at the forefront of efforts to tackle global warming in recent years. In 2019 the UK became the first major economy to enact legislation that commits to reduce its greenhouse gas emissions to net zero by 2050, and it has matched this with ambitious targets to shrink emissions over the intermediate years. The latest "carbon budget"³, covering the 2033-2037 period, looks to achieve a 78% reduction compared to 1990 levels.

CHART 1: THE SIXTH CARBON BUDGET, MILLION TONNES CO2 EQUIVALENT EMISSIONS A YEAR



Source: *The Sixth Carbon Budget: The UK's path to Net Zero*, Climate Change Committee, December 2020

Note: Emissions shown including those from international aviation and shipping (IAS).

1. Conference of the Parties
2. *Climate Change 2021: The Physical Science Basis*, Intergovernmental Panel on Climate Change, August 2021
3. *Sixth Carbon Budget*, Climate Change Committee, December 2020

The 2020s is a crucial decade in which to get things done, according to the UK's Climate Change Committee⁴. Actions to tackle climate change look set to become one of the enduring and dominant themes of Government policy, as we move into a post-Covid environment.

The UK Government is making all the right noises on tackling climate change, and sees environmental actions as integral to its Build Back Better plan⁵ and a key driver of jobs growth⁶. While there will be key policy announcements – including the Heat and Buildings Strategy, which will set out detailed plans on how to encourage consumers and businesses to make energy savings and switch away from fossil fuels for their heating, and the Treasury's over-arching Net Zero Strategy paper, which will assess the cost of the Government's climate change policies and how to fund these – in the run-up to COP26, critics worry that delays to these signal that policy measures are at risk of being diluted because of the potential cost to home-owners.

4. *The Climate Change Committee is an independent, statutory body established under the Climate Change Act 2008 to advise the UK and devolved governments on emissions targets, and to monitor progress made in reducing greenhouse gas emissions, and preparing for and adapting to the impacts of climate change.*

5. *Build Back Better, March 2021*

6. *The Ten Point Plan for a Green Industrial Revolution, HM Government, November 2020*



Where does housing fit in?

Housing represents a crucial sector within the overall context of climate change.

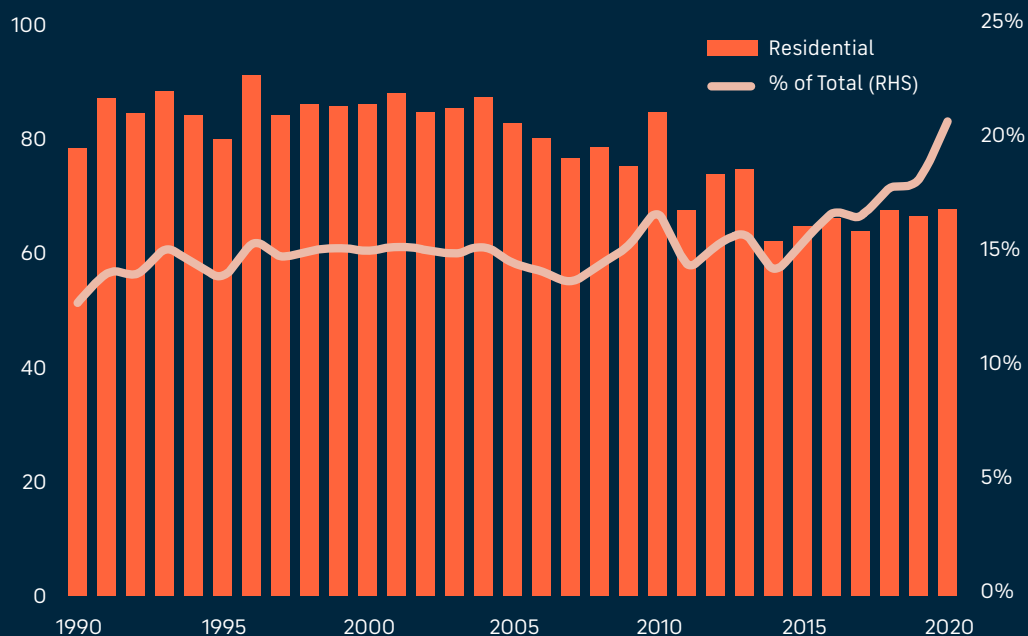
Data from the Department for Business, Energy and Industrial Strategy (BEIS) suggests that residential buildings account for a fifth of our overall CO₂ emissions, the third biggest source after energy supply and transport.

To all intents and purposes, the UK must eliminate domestic carbon emissions if its overall net zero carbon (NZC) targets are to be credible.

While our domestic energy use is close to the EU average, and our track record in energy saving has been somewhat better since 2000, studies⁷ suggest that the UK and other countries have experienced a slowing rate of progress in recent years.

Indeed, absolute emissions from UK housing have not fallen in recent years. As a result, housing's share of overall emissions has actually risen, as energy supplies continue to shift in favour of green alternatives.

CHART 2: HOW MUCH RESIDENTIAL BUILDINGS CONTRIBUTE TO UK'S CARBON EMISSIONS



Source: BEIS, 2020 UK greenhouse gas emissions provisional figures

Notes: Emissions are shown in megatonnes of carbon dioxide equivalent. 2020 figures are provisional.

7. [International comparisons of household energy efficiency](#), BEIS, 2020

What actions are needed?

The Climate Change Committee's June 2021 progress report to Parliament, provides a comprehensive snapshot of where the UK has got to with reducing emissions (the focus of this paper) and adapting to climate change, and what next steps are looked for.

Much of housing's carbon footprint relates to domestic heating, which is predominantly gas-powered.

Broadly speaking, the strategy of the UK Government and its devolved administrations (housing is a devolved activity) is:



- to reduce energy needs by improving the energy efficiency of homes, and



- to decarbonise domestic energy supply by shifting away from fossil fuels to greener electricity, and prospectively hydrogen.

The Climate Change Committee anticipates that household investment will initially focus on energy-efficiency measures, but progressively shift to low-carbon heat sources (which over time are expected to deliver the bulk of carbon savings).





Energy efficiency

The Government's 2017 Clean Growth Strategy calls for all homes to achieve an Energy Performance Certificate (EPC)⁸ rating of C or higher by 2035.

This would cut domestic energy usage by 25%, with considerable benefits in terms of lower emissions, smaller upgrades to the electricity grid and new power supply, and lower household bills.

Better energy efficiency can be delivered by higher standards and, in the case of existing homes, also through retrofit.

Scotland has moved more comprehensively in this area, with a long-term programme⁹ aimed at making Scotland's buildings warmer, greener and more energy-efficient. The UK Government plans for a Future Homes Standard to take effect in England from 2025. New homes will be expected to produce 75-80% lower carbon emissions compared to current levels, and (as an interim measure) 31% lower emissions from this year.

The House of Commons Environmental Audit Committee (EAC) has recently launched an inquiry into the sustainability of the built environment, amid concern that current policy may not give sufficient attention to the embodied carbon cost of new-build. Embodied carbon is the footprint that comes from harvesting, transporting and manufacturing of building materials. This has been estimated at 11% of all human-caused emissions on the planet.

8. Energy Performance Certificates (EPCs) were first introduced by the UK Government in 2007, and their use subsequently extended to newly-built properties and those being sold or rented. An EPC gives information about energy bills, the energy efficiency of a property, with a rating from A to G, as well as its heating source, and potential costs and savings from investing in measures such as insulation or double glazing.

9. See [Energy Efficient Scotland Route Map](#), Scottish Government, May 2018





The building industry is responsible for much of the human-caused emissions we wish to eradicate, and the carbon impact of building new residential dwellings cannot be overstated.

When viewed holistically, the carbon impacts from both embodied carbon (the carbon discharged from materials and the construction process) and operational carbon (the carbon impact of operating a residential property) are considerable.

Yet in the UK there exists no single recognised standard or methodology to measure the full carbon impact of residential real estate.

This creates a significant barrier for home-owners, developers, financiers and others in the construction value chain wishing to measure and improve their carbon impacts.

When viewed in this way, the Government's EPC targets seem too narrow, as they fail to take into account the full carbon impact of designing, building and operating a property. In some instances, they may amount to so-called "greenwashing" with consumers effectively being deluded in their thinking that their "energy-efficient" home represents a better outcome for the environment.

Developing robust data on each material's carbon emissions and lifespan, is key to understanding the footprint of each building, and ensuring we put in place material substitutions that will cut carbon emissions.

The development of a new, improved, national standard may indeed make the current system of EPCs redundant.



Retrofit

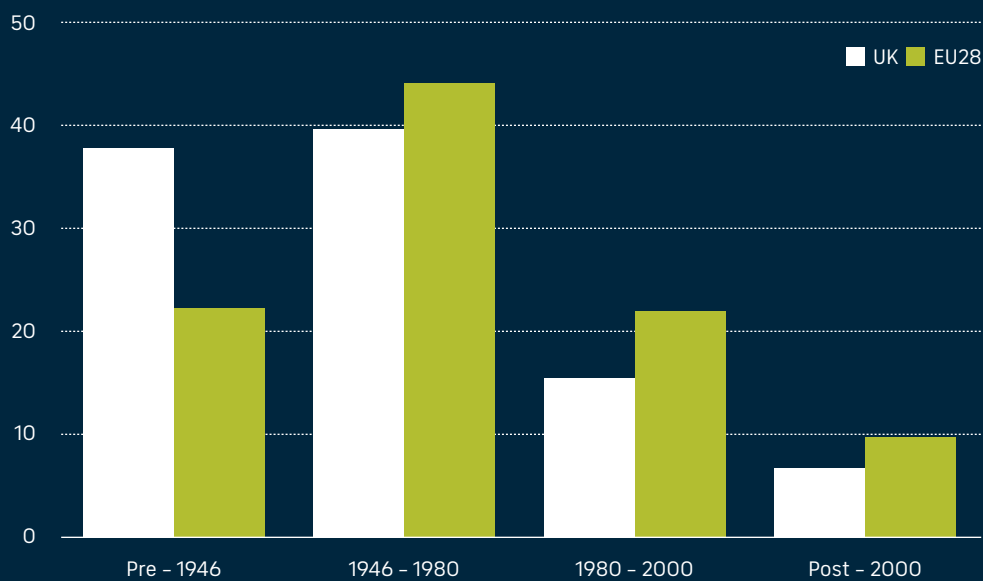
Retrofit is a major challenge for the UK.

For one thing, most homes that will exist in 2050 (three quarters or more) already do so, even if high rates of new-build are achieved over the coming decades.

For another, the UK has some of the oldest housing stock across Europe, with nearly 38% of its homes dating from before 1946 and much of that predating 1919.

Average CO2 emissions and energy bills for existing houses are more than twice as high as those for new houses, according to ONS analysis¹⁰. Meanwhile, an English Housing Survey report¹¹ confirms that older dwellings are less energy-efficient.

CHART 3: AGE OF UK AND EU HOUSING, % OF STOCK

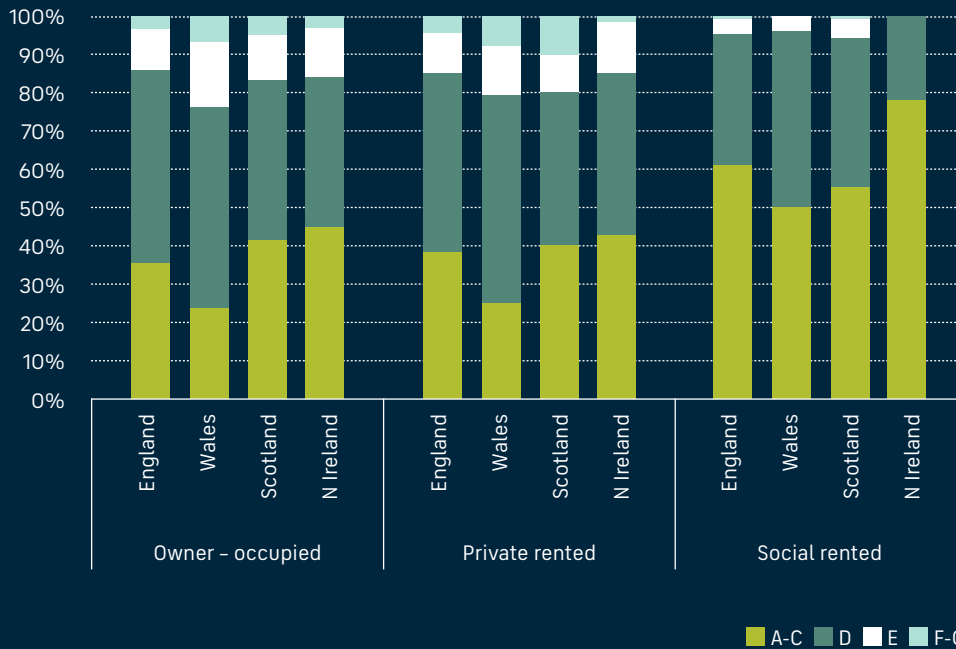


Source: Eurostat, EU-SILC, 2015

10 . *Energy efficiency of housing in England and Wales*, ONS, September 2020

11 . *English Housing Survey Energy report 2019-20*, MHCLG July 2021

CHART 4: ENERGY PERFORMANCE BANDS IN THE UK BY TENURE



Source: UK Housing Review 2021, Chartered Institute of Housing
 Note: Figures derived from English Housing Survey and national house condition surveys.

We get a sense of the enormity of the challenge for housing, if we contrast the current energy performance ratings of existing properties with where we need them to be.

About 19 million homes are rated EPC D or worse, according to a 2019 report¹², and this implies that 1.2 million homes would need to be renovated each year to achieve the 2035 target.

Such a transformation would require a comprehensive and long-term investment programme. This does not come cheap, although estimates of the likely cost vary greatly.

A recent ONS study¹³ looks at a range of energy improvement measures that could be made, and specifically those that would be needed to bring homes in England up to a minimum C rating. It reckons that the average cost would be more than £8,000, although this varies according to the current energy rating of the property, as shown in Table 1.

12. *Making energy efficiency a public and private infrastructure investment priority*, Energy Efficiency Infrastructure Group, October, 2019

13. *English Housing Survey Energy report 2019-20*, MHCLG, July 2021



TABLE 1: COSTS AND SAVINGS ASSOCIATED WITH UPGRADING HOMES TO EPC BAND C

Existing EPC Band	Installation cost £	Energy cost saving £pa	Simple payback Years
D	£6,472	£179	36
E	£13,285	£594	22
F or G	£18,858	£1,339	14

Source: English Housing Survey Energy report, 2019-20

These figures suggest that the aggregate cost of upgrading to a C rating could be more than £100 billion.

BEIS estimates that it will cost between £35 billion and £65 billion to bring all homes up to an EPC rating of C by 2035.

While the Climate Change Committee comes in towards the lower end of this range, it envisages that the investment in improving energy efficiency in existing homes will be about £45 billion to 2035, with a total spend of £55 billion by 2050.

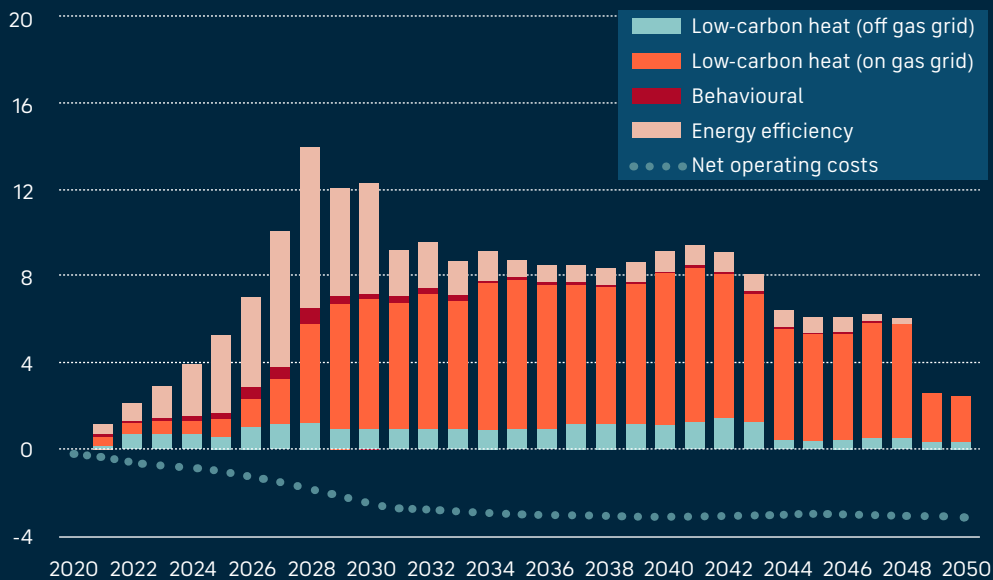


Decarbonising

Whatever the costs of improving energy efficiency, they are likely to be dwarfed by the cost of switching to low-carbon fuels. The Climate Change Committee's baseline projection¹⁴ is that decarbonising measures through to 2050 will represent about 80% of the estimated total £250 billion bill for upgrading homes.

As Chart 5 shows, decarbonising costs will account for the bulk of investment costs from the end of this decade onwards.

CHART 5: HOUSEHOLD INVESTMENT AND ASSOCIATED SAVINGS, £ BILLION



Source: Sixth Carbon Budget, Climate Change Committee, December 2020

While a switch away from fossil fuels is seen as providing a significant win in environmental terms, it comes with huge challenges. New equipment will be needed in most existing homes – 28-29 million in total – with high upfront costs and much uncertainty as to which technologies will prove to be most suitable for which homes.

14. Sixth Carbon Budget, Climate Change Committee, December 2020

Hydrogen is expected to play a key role in the world's low-carbon future, and the UK has recently joined a growing list of countries, including several G7 economies, in setting out an ambitious hydrogen strategy¹⁵. Decarbonising the gas supply in favour of hydrogen appears attractive, as it would use much the same existing infrastructure as gas, but the technology for doing so is currently in its infancy. The UK Government aims to support a significant and rapid scaling-up in hydrogen production by 2030 and beyond. As well as backing innovation across alternative technologies¹⁶, it is consulting on how best to structure price support mechanisms, to ensure that producers can recover their investment costs. By 2050, hydrogen could meet 20-35% of the UK's final energy consumption.

Although low-level trials blending hydrogen into the existing gas network have started, and hydrogen-ready boilers and cookers may appear over the next few years, low-carbon hydrogen for domestic use is very much a longer-term development. For now, decarbonisation is likely to emphasise a continued switch to renewable sources of electricity and the installation of heat pumps¹⁷.

Heat pumps are expensive – roughly £10,000 to retrofit a modest family home with a heat pump system – take up more physical space than a conventional boiler, and work best where there are high levels of insulation. There is also the question of how to expand heat pumps from a fledgling industry that supplies and fits 40,000 systems a year, to one that can deliver the Government's target of 600,000 a year by 2028.

15. *UK Hydrogen Strategy*, BEIS, August 2021

16. *Pure hydrogen does not occur in large quantities naturally, which means that it must be manufactured. The most common production route is steam methane reformation, where natural gas is reacted with steam to form hydrogen. This is a carbon-intensive process, but one that can be made low-carbon through the addition of carbon capture, usage and storage (CCUS), to produce a gas often called "blue hydrogen". Hydrogen can also be produced through electrolysis, where relatively large amounts of electricity are used to split water into hydrogen and oxygen – gas from this process is often referred to as "green hydrogen" when the electricity comes from renewable sources.*

17. *A heat pump is a device that acts as a refrigerator in reverse, extracting heat from the outside air or ground. They are currently used in less than 1% of homes.*





Footling the bill

This brings us to a critical issue – how to encourage households to make a switch, and how to do so without penalising those with limited means. Political disagreement on the best mechanisms is thought to lie behind the delays in key Government policy announcements.

Some Government funding will be targeted at those in fuel poverty or on lower incomes. Despite the shambolic nature of the Government's £1.5 billion Green Homes voucher scheme in England (now shelved), there is clearly a need to help home-owners and landlords meet the cost of major energy-efficient improvements, and there are strong calls for a successor scheme with longer-term funding commitments.

A recent report from the Office for Budget Responsibility¹⁸ assumes that the state covers about half the £250 billion investment costs needed in the residential sector, and while there is considerable uncertainty about this, there will be an obvious need to leverage in significant amounts of private finance. This should be attractive in principle, given that many home improvements are likely to be self-financing over the long term.

Importantly, the Chancellor Rishi Sunak announced in his March 2021 Budget, that the Bank of England's policy remit is being extended, to include supporting the Government's efforts to transition to a net zero economy.

This should be seen as part of a global recognition that financial firms should report on how they are dealing with climate change. Here in the UK, the Prudential Regulation Authority (PRA) has asked¹⁹ the largest banks and building societies to report on the physical and transitional impacts of climate risk, and expects all firms to have embedded their approach to climate risk by the end of this year.

The idea of green finance is developing rapidly, as illustrated by a recent BEIS consultation,²⁰ which gave centre stage to the role that lenders could play in improving the energy performance of mortgaged properties.

18. Fiscal risks report – July 2021, Office for Budget Responsibility, July 2021

19. See [Climate Biennial Exploratory Scenario](#), Bank of England, June 2021

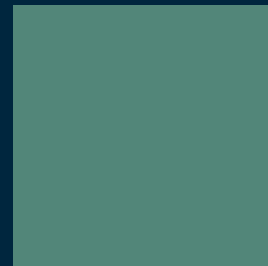
20. [Improving home energy performance through lenders](#), BEIS, November 2020

While lenders question some of the proposed mandatory disclosure requirements for the energy performance of their loan books, there is a strong recognition that they have a key role to play in helping customers understand the benefits of energy improvements, developing financial solutions to achieve this, and stewarding businesses and individuals through the transition.

It is encouraging to see that mortgage lenders and other financial firms have started to embrace green finance ideas, by offering better product terms for customers who plan to purchase energy-efficient homes or to make green improvements.

At this stage, lenders bear the financial impact of such funding themselves, with the result that households see only modest immediate benefits in terms of lower mortgage rates or extra borrowing capacity. Longer term, it is hoped that such benefits will grow, as green issues work through the financing and regulatory landscapes, and firms themselves enjoy lower funding costs and/or capital relief from funding energy-efficient or carbon-reducing activities.

To accelerate the growth of green finance, the Government might look at introducing schemes that make it easier for both home-buyers and lenders to “go green”. The Government, in conjunction with a number of leading high street lenders, has recently introduced a much publicised 95% loan scheme for first-time buyers. Going forward, similar schemes could be introduced to support “green buyers”, whether they are first-time buyers or not.



Challenge and opportunities

There is a growing consensus regarding the need to tackle climate change, and this paper underlines that housing is a key piece of the jigsaw here in the UK.

There is an urgent need to reform Energy Performance Certificates (EPCs), given that they have a pivotal role to play in improving energy efficiency and moving towards net zero in homes. The Government has an action plan²¹ that addresses some of the current shortcomings. But there are many strands to this, from improving the basic accuracy and quality of reports, to technical changes that mean they reflect real-world rather than modelled performance.

Longer term, the Climate Change Committee and other stakeholders see opportunities for incorporating smart meter data in digital Green Building Passports, which could guide householders on actions to take, and unlock large sums of green finance by providing a robust source of information to raise finance against.

As well as reforming EPCs, the Government may also need to look at housing market and wider economic reforms.

Making our homes greener is hugely challenging, with many of the investments needed to deliver better energy efficiency, or to decarbonise the housing stock, facing heavy upfront costs and slow payback periods, and choice of decarbonising technologies unlikely to be settled over the near term.

21. *Energy Performance Certificates for Buildings: Action Plan*, BEIS, September 2020

While the UK and devolved governments are rightly taking a lead on these issues, the state cannot fix things on its own. In order to shift behaviour, the public and private sectors must combine to educate households to use less and greener energy in their homes, and to shape the incentives to adapt their homes.

A key task is to promote a housing market that better reflects the energy efficiency and carbon emissions of homes, and for these features to take centre stage when households are thinking about moving home or improving their existing properties. This is not the case currently, with the latest BEIS research²² showing that only 6% of households know the EPC of their home, and that just 3% of households make changes on the back of EPC guidance. This matters hugely when the Government hopes to encourage home-owners and financial firms to invest tens of billions of pounds in upgrades.

Achieving net zero for housing at pace, implies making better use of our existing housing stock. Yet much of the stock of larger, older and less energy-efficient homes is owned – and under-occupied – by older home-owners, and the tax system currently favours ownership of large homes and discourages downsizing by older households.

Although this is a marathon not a sprint, with significant lead times in such areas as developing new technologies, building new supply chains and reskilling workers, a significant momentum for change is building.

While the jury will be out for many years as to whether the UK is doing enough, there are undoubtedly huge opportunities for businesses that are directly involved in new-build or retrofit, and the finance, advice and other services that indirectly support such activities.

22. *Public Attitudes Tracker Wave 35*, BEIS, September 2020



About the author

Bob Pannell is a leading housing and mortgage economist and the former Chief Economist of the Council of Mortgage Lenders. Bob has been at the forefront in analysing and forecasting the UK housing and mortgage markets for over 30 years and is a trusted advisor and contributor to the property and mortgage markets, regulatory bodies, and Government.

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