

Section 1 Contemporary issues

Chapter 3

The zero-carbon challenge

John Perry

The urgency of tackling the climate crisis has been underlined by news that 2020 was, along with 2016, the warmest year in the Earth's recent history. New research into ocean temperatures also revealed that the planet is hotter than it has been for at least 12,000 years. Amidst criticism that action is being taken too late and too slowly, governments worldwide have begun to respond to the crisis via programmes to reduce greenhouse gases and, in particular, carbon dioxide (CO₂) emissions. Moreover, with the next UN climate summit (COP26) taking place in November in Glasgow, 2021 has been described by the BBC as a 'crunch year' for tackling the climate crisis, a message repeated by the *Financial Times*, *New York Times*, *The Independent* and other media.¹ Similar messages have been given to the readers of tabloid newspapers, such as *The Sun*.²

There have been widespread calls for a 'green recovery' from the pandemic, with the official Climate Change Committee (CCC) urging the government to 'use climate investments to support economic recovery and jobs'. Housing has been the focus of many of the green initiatives called for or announced in advanced economies, including the UK, for at least three reasons. One is that action can be taken relatively quickly in the domestic sector compared with (say) transport. Another is that insulating homes creates jobs – possibly up to 86,000 annually across the UK.³ And the most important reason is that around 40 per cent of emissions are from households and their activities (including travel), with heating homes and cooking food specifically accounting for 15 per cent. The CCC, which monitors UK progress on climate targets, said that reaching net zero is not possible 'without near complete decarbonisation of the housing stock'.

This chapter looks specifically at what is required to achieve 'zero carbon' in UK homes, concentrating on the fabric of dwellings and domestic energy consumption. It considers:

- the UK's emissions targets
- issues in translating emissions targets into targets for housing
- emissions from energy supply as a key factor in decarbonising homes
- achieving 'net-zero carbon' in new homes and in the existing stock

- whether the targets will be achieved
- the action now required to meet the targets.

Achieving zero carbon does of course have implications for the whole of a landlord's operations, e.g. construction, products, travel, vehicle fleets, offices, water consumption, etc., but this chapter focuses on decarbonising the housing stock itself.

The UK's emissions targets

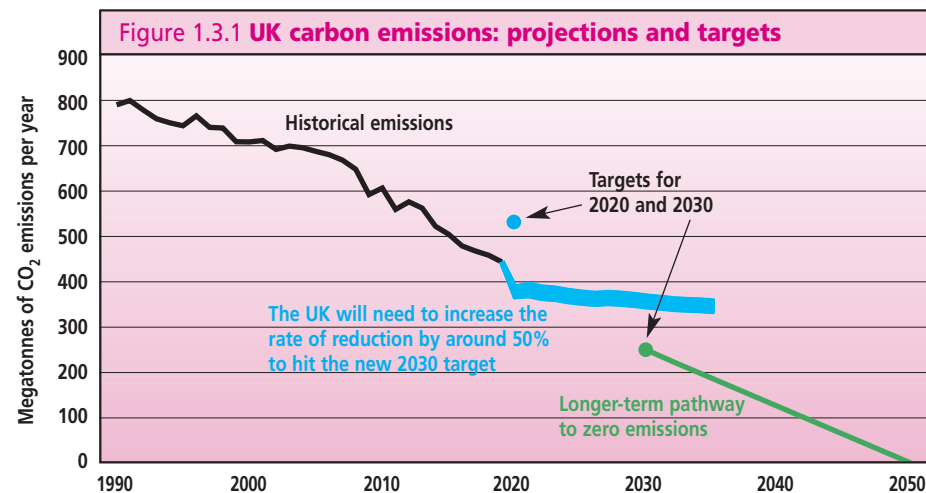
Under the Climate Change Act 2008, the UK was committed to reducing net greenhouse gas emissions by at least 80 per cent below their 1990 levels by 2050. Then in June 2019, the legislation was amended to require a 100 per cent reduction in the UK's net emissions (again relative to 1990 levels) by 2050. If achieved, the UK would become a 'net-zero' emitter. 'Net-zero carbon' (NZC) means that total CO₂ emissions are equal to or less than the emissions the UK removes from the environment. This must be achieved principally by emission reduction but can also rely to some extent on emission offsetting or removal (e.g. measures such as tree planting or carbon capture).

Since 2008, the government has set five-year climate targets, called 'carbon budgets', produced by the Climate Change Committee (CCC). The latest carbon budgets embody the UK target of net-zero carbon by 2050 and they also spell out how it relates to the devolved administrations. The net-zero target for Scotland is earlier, 2045, while the Welsh target is to reduce emissions by 95 per cent (on 1990 levels) by 2050, or to achieve net zero if possible. The CCC recommends an 82 per cent reduction by 2050 for Northern Ireland, with an interim target of 48 per cent by 2030.

Targets set under the first three carbon budgets were achieved: output of greenhouse gases has gone down by around 45 per cent from 1990 levels. However, there is considerable doubt as to whether the fourth and subsequent budgets can be met, and specific warnings have been issued about lack of progress in housing. As the latest carbon budget says, 'we won't reach NetZero simply by wishing it'.⁴

In addition to its domestic commitments, under the 2015 Paris Agreement the UK and other signatory countries are committed to keeping emissions in line with the goal of a 1.5°C limit on global temperature rise. All signatories had to produce policy statements called Nationally Determined Contributions (NDCs) by 2020; the UK's NDC was published in December 2020 and sets out the most ambitious targets yet for reducing emissions (see Figure 1.3.1). It focuses on targets for 2030, which are meant to show the pathway to the government's goal of net-zero emissions by 2050. By 2030, the government's new aim is for emissions to be 68 per cent below 1990 levels, a significantly tougher target than the previous aim of a 57 per cent reduction and one which will put the UK among the first countries to bring domestic emissions into line with the goal of limiting global temperature rise to 1.5°C.

The NDC has mainly won plaudits for its ambition, but critics say there are major hurdles ahead. The UK will need to adopt and implement rigorous policies to achieve the new target and firmly set itself on a faster path to net zero. The next ten years are critical because global CO₂ emissions must be cut by about half their present levels by 2030. For example, around 87 per cent of the UK's electricity will need to come from low-carbon sources by the end of this decade, up from just over half now.



Source: Climate Action Tracker.

Issues in translating emissions targets into targets for housing

Housing is one of the sectors in which firmer targets and a clearer strategy to achieve them still need to be set. However, there are several reasons why this is not straightforward:

- Separate targets are needed for new and existing stock.* The very different nature of new build and retrofit suggest not only that the pace of change in each will be different, but also that there are key differences in the approaches required. For example, in new build it is easier to minimise 'embedded carbon' (energy used in materials and in construction). It is also possible to specify fabric standards in building regulations and to achieve those standards via off-site construction. With new build, even in the private sector, there is a clear 'trigger point' for action, whereas for existing private homes trigger points are less clear (on resale, on reletting?). Furthermore, much retrofit is likely to be phased, with the additional complication that work done at an early stage should not have to be redone to achieve higher standards later.
- Private finance must be mobilised.* Most of the stock is privately owned and needs substantial retrofit work. While pump-priming public money is important, attractive financial packages are required to encourage owners to invest. The government has an innovation fund for green finance,⁵ it is slowly gaining traction but lenders still struggle given that energy costs are low and thus incentives are limited. More progress has been made in the EU where 23 lending institutions have adopted the Energy Efficient Mortgage Label.⁶
- Social housing needs a balance of public funding and self-financing.* With retrofit costs in excess of £20,000 per dwelling, the social sector needs both initial government funding and the ability to develop long-term sustainable finance, whether through so-called 'warm rents' (i.e. rents raised to reflect part of the savings in a tenant's fuel bills) or other mechanisms.
- Compliance and monitoring pose unique problems.* The housing stock is in multiple ownerships but unlike (say) vehicles, homes are rarely replaced. Compliance depends on persuasion; retrofit depends on multiple installers and new materials which present challenges even greater than installing from new (of

which a tragic example was the Grenfell Tower fire). Monitoring of the results is intrinsically difficult (e.g. much insulation work cannot be readily inspected once it is completed). A ‘performance gap’ between predicted and actual results is far too common. Energy Performance Certificates (EPCs) have several weaknesses and government is committed to reviewing how they work.

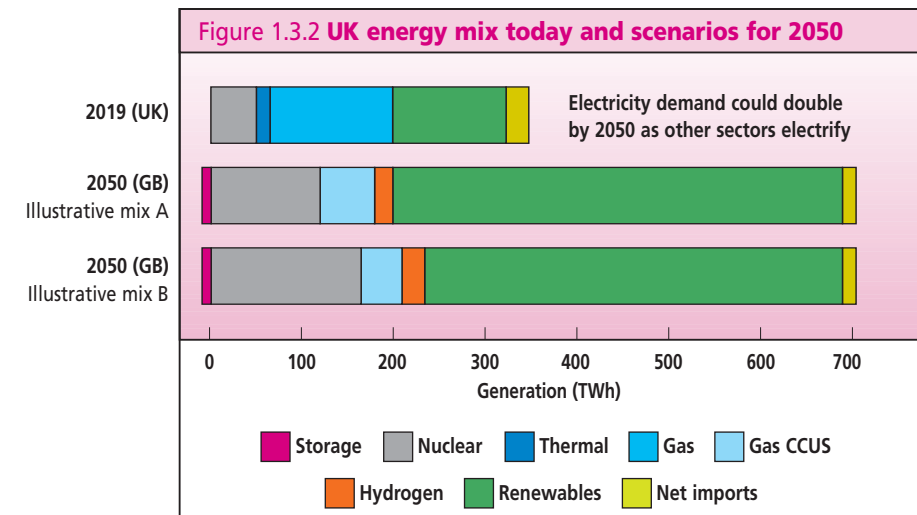
- *A complex division of responsibilities has to be overcome.* Whereas the overall targets are set at UK level and administered by the Department for Business, Energy & Industrial Strategy (BEIS), housing policy is administered by MHCLG and, as a devolved function, by the respective departments in the other UK administrations. This means that the UK housing targets are, in practice, subject to reinterpretation in Scotland, Wales and Northern Ireland, as explained below and that monitoring arrangements, to determine whether UK targets are being met, are shared between a range of Whitehall and devolved departments and agencies. In addition, of course, targets are likely to have to be set in different ways and with different monitoring arrangements in the different housing tenures.
- *Expectations about decarbonising the electricity grid underly housing targets.* In theory, the more the stock relies on electricity as its energy source for heating, cooking and appliances, and the more the grid decarbonises, the less work is needed to improve the stock’s fabric standards. However, to meet higher domestic requirements and provide for vastly more electricity use in vehicles, the grid’s capacity will have to grow. The issue has clear implications for setting standards and is discussed in more detail below.
- *Fabric first or heating first?* A related issue is about priorities. A ‘fabric first’ approach – prioritising energy efficiency in the fabric of the dwelling via improved insulation and other measures – is logical, because the more efficient the fabric the lower the heating requirement. However, both the Whitehall and Scottish governments have set targets to promote low-carbon heating and phase out gas boilers, a priority supported by CCC-commissioned research which shows that rapid CO₂ savings should result.⁷

Because the last two issues are both crucial and raise more general issues, they are now considered in more detail.

Emissions from energy supply as a key factor in decarbonising homes

A vital factor in decarbonising dwellings is their energy supply, especially for heating. Currently, home heating is largely powered from non-renewable sources such as gas or oil while the alternative, electricity, is still roughly 40 per cent dependent on high-carbon power sources. Broadly speaking, there are two routes to decarbonising home-energy supply: switching to electricity and drastically reducing fuel bills through ‘fabric first’ investment or waiting for the gas supply to be decarbonised.

The first scenario depends on a huge shift in the capacity of power generation and distribution, as well as in how the power is generated. This is because electricity demand is forecast to double by 2050 as it becomes the main power source for the whole economy, including vehicles as well as homes. Figure 1.3.2, from the Energy White Paper, shows the current mix of power sources (for 2019) and two alternative scenarios for a doubled supply of electricity in 2050. Scenario A puts major reliance on renewables while Scenario B relies more on nuclear power. Either results in near-decarbonisation of the grid but both are very challenging to achieve.



Source: Energy White Paper, 2020.

Note: Gas CCUS is gas using carbon capture, utilisation and storage technologies.

Under a scenario where the only home-energy supply is electricity, space heating would require either air- or ground-source heat pumps or – if the building fabric is highly energy-efficient – smaller electric heating systems managed by smart controls; cooking would use electricity rather than gas. The government has set a target to achieve 600,000 heat pump installations per year by 2028 and is likely to prohibit the installation of conventional gas boilers in new homes from 2025. It promises a new Heat and Buildings Strategy ‘early in 2021’. The Scottish Government is already consulting on a target of one million homes being converted to low-carbon heating by 2030, with at least 64,000 households installing renewable heating systems per year by 2025.⁸

The government’s plans for the Future Homes Standard (FHS) explicitly rely on decarbonised electricity:⁹

As we move towards a decarbonised electricity grid, homes built to the Future Homes Standard will become net zero carbon over time with no need for further adaptations or changes, as they will not be reliant on fossil fuels for their heating.

In other words, homes will be ‘zero-carbon ready’, becoming truly zero carbon only when the grid is decarbonised. Many respondents to the FHS consultation called for even tougher fabric standards, arguing that the FHS should be designed to reduce the burden on the grid because doing so would help decarbonise it more swiftly.

The second scenario, decarbonising the gas supply, would rely on the mass production of ‘green hydrogen’. This is envisaged in both the Energy White Paper and the prime minister’s *Ten Point Plan for a Green Industrial Revolution*. Gas is a cheap fuel source and replacing it with an alternative that uses much of the same infrastructure appears an attractive option. However, green hydrogen requires technology that is only in the early stages of development and is produced by electrolysis of water, which is a low-carbon process only if the electricity comes from renewable sources.

Faced with a choice between reliance on electricity or waiting for low-carbon gas, with uncertainties around both energy sources still to be resolved, a ‘fabric first’ approach looks the safest choice, as it would reduce home energy costs to a minimum while keeping open future options as to how they are supplied.

There are other strategic issues about energy in the home, such as the potential of low-carbon heat networks and of domestic power generation through solar panels, and whether homes should have the capacity to store energy (e.g. in battery systems). Landlords and homeowners face complex choices and decisions with unclear and often confusing advice from government.

Achieving ‘net-zero carbon’ in new homes

A ‘net-zero home’ is one which is highly energy-efficient and fully powered from renewable energy sources, with any remaining emissions offset via recognised methods. The implications for new build are clearly very different from those for existing dwellings. Achieving net zero in new build aims to cut emissions not only from the building’s use but also from its construction (‘embedded carbon’). This is included in the UK Green Building Council’s ‘Framework definition’ whose main steps have been summarised by CIH (see box).

Net-zero carbon homes – the Framework definition

The Framework definition set by the UK Green Building Council has two components:

Constructing the dwelling: ‘When the amount of carbon emissions associated with a building’s product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of onsite renewable energy.’

The dwelling’s energy in use: ‘When the amount of carbon emissions associated with the building’s operational energy on an annual basis is zero or negative. A net-zero carbon building is highly energy efficient and powered from onsite and/or offsite renewable energy sources, with any remaining carbon balance offset.’

CIH has summarised the main steps to achieve net-zero carbon using the Framework definition as:

1. Look at both energy use in construction and use of energy in the completed home.
2. Cut the carbon costs of construction – assess them and offset them.
3. Cut operational energy use – give this priority and monitor the results ‘in use’. This is likely to require a ‘fabric first’ approach:
 - very high levels of insulation
 - high performance windows with insulated frames
 - airtight building fabric
 - no ‘thermal bridges’ in the building’s construction
 - possible use of mechanical ventilation with highly efficient heat recovery
4. Increase renewal energy use – whether on-site or from off-site sources.
5. Offset any remaining carbon via a recognised framework.

Sources: UKGBC (2019) *Net Zero Carbon Buildings: A Framework Definition*. London: UKGBC; CIH (2020) *Warm Homes and a Safe Environment*. Coventry: CIH and Orbit.

In October 2019, the government announced its Future Homes Standard and consulted on interim steps towards its introduction in England in 2025. These include toughening the fabric standards set by the building regulations to produce a 31 per cent cut in CO₂ emissions when they take effect in 2022. Then from 2025, the full FHS will apply, bringing fabric standards equivalent to or in some cases more stringent than those set out in the very exacting Passivhaus standard, the exception being air tightness. A new home built to the FHS will emit 75-80 per cent less CO₂ than one built to 2019 standards. The detailed FHS will be set in performance terms, such as minimum levels of primary energy and CO₂ emissions, and exacting standards for the fabric and for building services standards, but without prescribing the technologies to be used.¹⁰

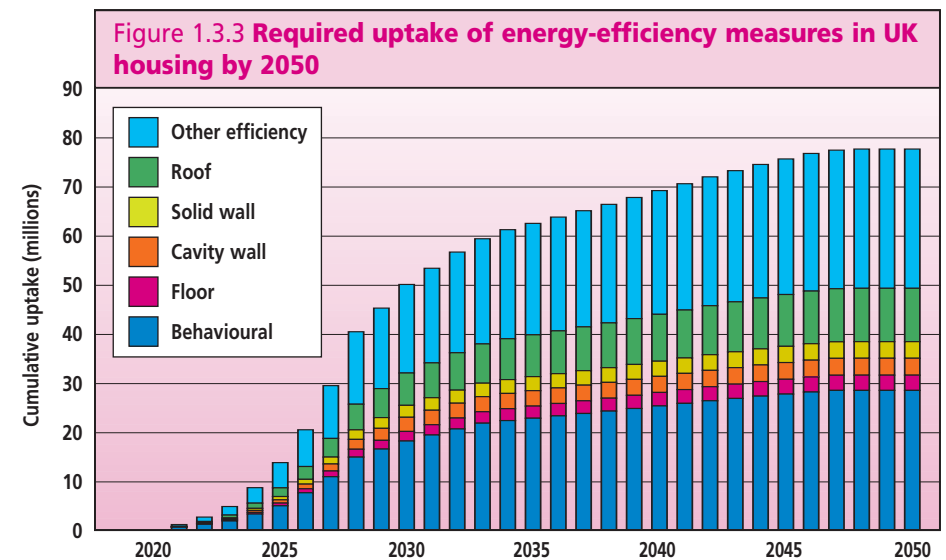
In Wales, a parallel process is taking place to ensure new build homes are NZC by 2025, but affordable housing will have to achieve this standard no later than 2021.¹¹ In Scotland, the government has so far focussed on heating, rather than taking a 'fabric first' approach. It is committed to ensuring that, from 2024, new buildings (including homes) must have heating systems which produce zero direct emissions at the point of use and is planning to issue standards for fabric efficiency in new homes in 2021. Northern Ireland is consulting on an energy strategy which will decide its approach to NZC in new build.

The government has been criticised for delays in introducing a proper standard for new build to reflect the 2020 target, amidst arguments that it is too susceptible to industry pressure to water down the requirements. The prime example was the 2015 decision to drop the 'zero-carbon homes' standard, originally announced in 2006 and due to begin in 2016. As a result, by 2025 some 2.5 million homes will have been built to inadequate standards. These new homes typically fall in EPC band B but will need to be raised to band A by 2050 (an average new home built now emits about 1.5 tonnes of CO₂ per year; this needs to be reduced to 0.3-0.4 tonnes).¹² Using CCC data, the Labour Party estimated that instead of upfront additional costs of £4,800 to achieve NZC in a new home, householders who have bought a recent new build property will face a retrofit cost of £26,300 to bring it up to NZC standards.¹³

Achieving 'net-zero carbon' in the existing stock

Clearly, even more is at stake in upgrading the existing stock than is the case with new build. Inherent constraints in each dwelling's construction have to be overcome and may require phased programmes of work, in which an important objective is ensuring that interim improvements are compatible with the final objective of reaching net zero. In addition, a proportion of stock may not be economically capable of retrofitting to NZC standards, raising questions about its future that must be faced by owners and ultimately may require government intervention in some form.

The Sixth Carbon Budget has an illustrative scenario for the uptake of energy-efficiency measures needed across the UK to achieve the 2030 and 2050 targets (Figure 1.3.3). It shows the enormous scale of the task. For example, loft insulation will have to increase from 27,000 to 700,000 installations per year by 2025, with a five-fold increase in cavity wall insulation; in total by 2050, 3.4 million homes will require solid wall insulation. More than 85 per cent of the UK's 29 million homes have gas boilers that need to be replaced: Northern



Source: Climate Change Committee.

Ireland has a particular problem that 68 per cent of its domestic heating is via oil-fired boilers. Conversion of heating systems will have to occur at pace: by 2030, a total of 5.5 million heat pumps should be installed, of which 2.2 million are in new homes.

Much also depends on behavioural change: people will be expected to operate their heating in completely different ways and they cannot be expected to 'just adapt' without any form of education/training. This is crucial to the success of new technologies but currently is severely lacking.

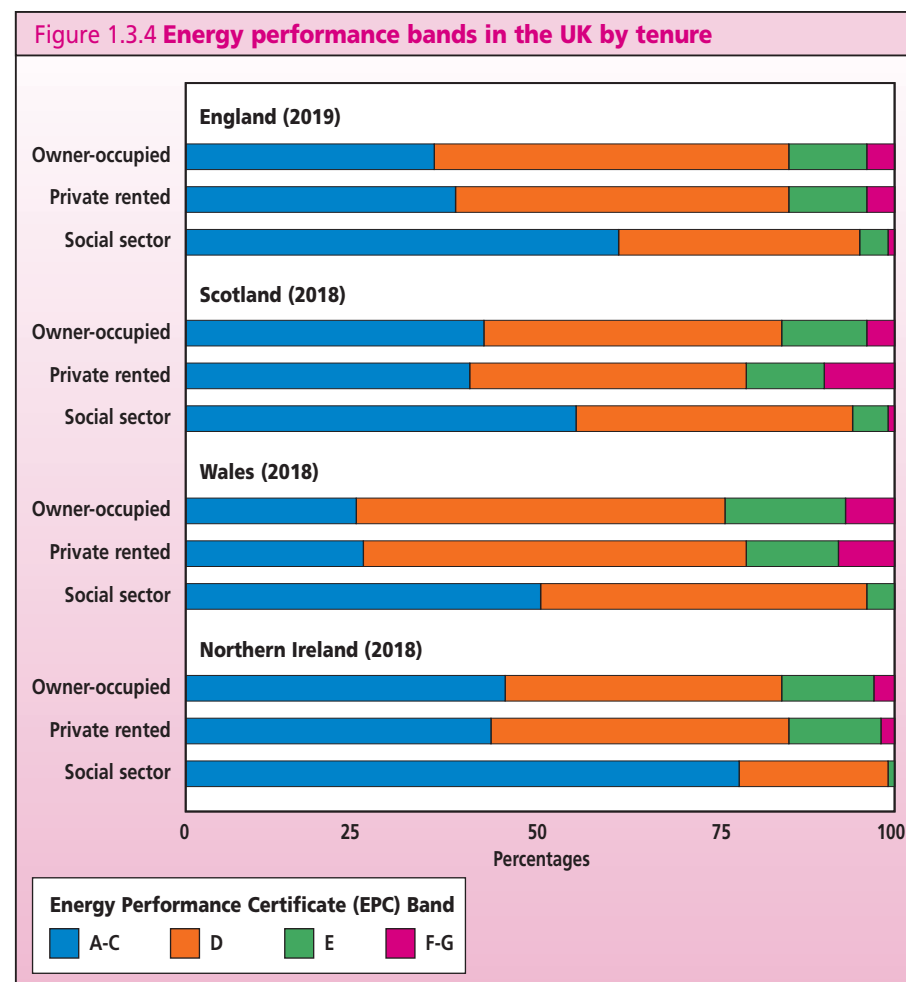
The CCC sets out a massive programme of change to be achieved in a very short time.

What targets has the government set? So far, as a steppingstone to NZC in 2050, there is an initial target for the fabric performance of the UK's existing stock, which calls for:¹⁴

- all fuel-poor homes to be upgraded to Energy Performance Certificate (EPC) band C by 2030
- as many homes as possible to be EPC band C by 2035 where practical, cost-effective and affordable.

Currently 19 million UK homes fall below band C, so at least 1.2 million must be retrofitted each year to achieve a 2035 target. The Energy Efficiency Infrastructure Group (EEIG) says this requires annual investment of £5.2 billion, with government funding of £1.7 billion leveraging £3.5 billion from owner-occupiers and landlords.¹⁵

Figure 1.3.4 shows how the retrofit task varies considerably according to tenure. Social housing is more energy-efficient than the other tenures: across the UK at least 50 per cent of social homes have EPC ratings of band C or above, and in Northern Ireland the proportion reaches 78 per cent. This is likely to be partly a result of retrofit work and partly because the social stock tends to be newer. In no part of the owner-occupied or private rented sectors does the proportion of



Sources: English Housing Survey, dwelling sample; Scottish House Condition Survey; Welsh House Condition Survey 2017-18; NI House Condition Survey 2016.

dwellings reaching band C exceed 50 per cent. In England, 35 and 38 per cent respectively of dwellings in the two sectors reach at least this level, but in Wales this falls to about a quarter in both sectors. Performance is rather better in Scotland (42 and 40 per cent respectively for the two tenures) and in Northern Ireland (45 and 43 per cent).

Will the targets be achieved?

The government has promised to 'implement the Future Home Standard in the shortest possible timeline' but the key test of its ability to meet the CCC's carbon budgets and hence its targets for 2030 and 2050 is whether its measures will tackle emissions from the existing stock.

The government pledged £9.2 billion in its manifesto to improve energy efficiency, beginning in 2020/21, but announced plans only for part of this. In November the prime minister's *Ten Point Plan for a Green Industrial Revolution* said the initiatives could 'help to improve the energy efficiency of around 2.8 million homes, improving around 1.5 million to EPC C standard by 2030'. A £2 billion Green Homes Grant in England offers up to £5,000 per house, rising to £10,000 for low-income households. The chancellor forecast that it would upgrade 650,000 homes, implying an average spend of about £3,000 per house. This fell short of the rate of installation needed to meet the target, but actual progress has been far worse. By February, although there had been 103,000 applications under the scheme in four months, just one-in-five had been approved and work completed in only 2,777.¹⁶ Amidst criticisms that the scheme is a 'shambles', countered by government claims of 'lack of interest from consumers', funding was cut: next year only £320 million will be available, although the £500 million of the original fund directed through local authorities to assist low-income households is still going ahead.

In its 2019 manifesto, the government also promised a ten-year Social Housing Decarbonisation Fund worth £3.6 billion. So far £110 million has been announced as a firm programme in England, with the remainder promised on a phased basis. This would join other, earlier schemes which now have much-reduced impact. ECO (the Energy Company Obligation) is investing about £500 million annually in home-insulation measures and 2.1 million have been completed since it began (across Great Britain) in 2013, but with varying impact in achieving required EPC levels. Northern Ireland's equivalent to ECO is the Sustainable Energy Programme which will spend about £8 million in 2020/21. The Renewable Heat Incentive is spending £147 million across Great Britain in 2020/21 but will end in March 2022; a replacement scheme, the Clean Heat Grant, will offer up to £4,000 for each new installation from April 2022 but the budget for it has not yet been set.

The government is also consulting on stronger regulatory measures. These would require homes in the private rented sector to reach EPC Band C by 2028, 'where practical, cost-effective'; it will also consult on a mandatory requirement on lenders to declare the energy efficiency of homes when they are sold. In the social sector, however, although a number of landlords have committed to the targets to achieve EPC band C, so far there is no regulatory requirement to do so. The Energy White Paper now promises a 'long-term regulatory framework' across the residential sector, with proposals to be issued in 2021.

In 2018, Scotland published a 'route map' to meeting the EPC band C target by 2040, now to be upgraded to a 2030 target. It has various funding programmes of its own, such as Warmer Homes Scotland and area-based schemes run by councils which together have made about 120,000 installations since 2013. It has also pioneered the setting of energy-efficiency standards, not just in the social and private rented sectors but – under consultation – a possible standard for owner-occupied stock from 2024. If this goes ahead, it will require houses to be certified as EPC band C where feasible, when sold or under major renovation. Unlike England, Scotland has a strategy which shows whether the combination of carrots (funding) and sticks (required standards) is delivering the required pace of change. Nevertheless, it is being urged to double public investment in retrofit.¹⁷

Wales has two small programmes ('Nest' and 'Arbed') but not yet a full delivery programme, although pilot schemes are in hand. Progress in Northern Ireland was inevitably delayed by the suspension of devolved government and it now faces a major catch-up task, especially given its dependence on oil-fired home heating and the aftermath of the scandal surrounding the earlier (non-domestic) Renewable Heat Incentive scheme. The agreement to restore the Northern Ireland Assembly promised targets for reducing carbon emissions but these are not expected until 2021, making the targets harder to meet.

The inevitable conclusion is that neither current programmes, nor those in the pipeline, are sufficient to meet the interim energy performance targets, let alone that of achieving net-zero carbon by 2050. This is not just an issue about the

scale of the programmes, but also the approach to running them and their on-off nature (most recently exemplified by the handling of the Green Homes Grant). In conclusion we look at the action needed if the targets are to be met.

The action now required to meet the targets

The government has not been short of advice on how to meet its targets, whether officially from the CCC or from trade bodies and other interested groups. It is fair to say that there is consensus on four key issues.

First, policy certainty is required. In its recent Net Zero Review, the Treasury explicitly recognises the importance of policy certainty and a stable environment to encourage private investment and reduce the costs of achieving NZC.¹⁸ It points to the consistent policy environment for offshore wind as successfully driving investment in that sector. Demands for policy certainty have been echoed in Scotland, Wales and Northern Ireland. For example, the Welsh Government's advisors call on it to 'make a strategic commitment to national residential decarbonisation and stick to it'.¹⁹

Second, decarbonising the housing sector demands a clear strategy, operating over a long timeframe. Now that the government has set clear and demanding objectives it is vital that it acknowledges that a robust strategy is essential if they are to be delivered. There is plentiful guidance on the form it might take. For example, the Construction Leadership Council (CLC) is consulting on a National Retrofit Strategy, which would focus initially on behavioural change, pilot schemes and training programmes in the building industry, gearing-up to rapid implementation over the period to 2022-30.²⁰ As well as addressing the questions posed earlier in this chapter, any strategy will need to focus strongly on delivery mechanisms – reskilling the workforce, promoting a supply chain, providing the incentives for the social sector to take the lead.

Third, given the clear necessity for behavioural change, government has a dual task of educating the public to use less energy in their homes, and providing sufficient incentives to lever-in householder investment, both via grant aid and by encouraging banks to create attractive financial packages. Just as massive behavioural change was achieved during the pandemic, a similar shift in attitudes

will be required to achieve zero carbon, and it will have to be sustained over the long term. A lesson from experience with the Green Homes Grant is that the public appetite for change exists, but it could quickly disappear if delivery mechanisms fail or if consumer interests are insufficiently protected.

Fourth, current arrangements for delivery and monitoring of programmes, which are diffuse and confusing, must be reviewed. Cross-sector regulatory requirements will need to become more stringent over time (Scotland is pioneering such an approach). There is a strong case for a national delivery agency with clear responsibility for reviewing standards, achieving the targets and monitoring progress, as the CLC's report recommends.

What are the chances of these issues being properly addressed? There are some grounds for optimism. First, there has been a widening of the so-called 'Overton window', the range of generally accepted policy objectives. One indication is the much wider media acceptance of the urgency of the climate change problem, noted earlier. Another is the shift in public opinion: a YouGov poll showed two-thirds of Britons want the country to be a world-leader in tackling climate change.²¹ The Treasury's Net Zero Review says that 'reaching net zero is essential for long-term prosperity'. Acceptance of the issue's importance crosses virtually the whole political spectrum (although this does not necessarily translate into acceptance of the measures needed).

Second, the pandemic has not only led to widespread calls for a 'green' recovery but has led many people to question the sustainability of current lifestyles. Successful responses to the pandemic, such as the furlough scheme, getting 'Everyone In' off the streets to tackle rough sleeping and the recent roll-out of the vaccine programme, have shown that governments have capacity to achieve rapid change when it is required.

Finally, the climate itself provides regular reminders of the urgency and severity of the problem, and early indications of how problematic life will become unless we act quickly and effectively. As the Treasury itself acknowledges in its Net Zero Review: 'climate change is an existential threat to humanity'. Housing is a huge part of the problem, and needs to become part of the solution.

Notes and references

- 1 Rowlatt, J. (2021) *Why 2021 could be turning point for tackling climate change*, BBC News, 1st January (www.bbc.com/news/science-environment-55498657).
- 2 See www.thesun.co.uk/topic/climate-change-environment/
- 3 Guertler, P. & Rosenow, J. (2016) *Buildings and the 5th Carbon Budget*. London: Association for the Conservation of Energy.
- 4 Climate Change Committee (2020) *The Sixth Carbon Budget*. London: CCC, p.5.
- 5 See <https://www.gov.uk/government/publications/green-home-finance-innovation-fund-competition-successful-bids>
- 6 See www.energy-efficient-mortgage-label.org/
- 7 Currie & Brown (2019) *The costs and benefits of tighter standards for new buildings*. London: Currie & Brown.
- 8 See www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings-consultation/
- 9 MHCLG (2019) *The Future Homes Standard: Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings*. London: MHCLG.
- 10 There is a detailed and accessible explanation of government plans for the FHS by Green Square (see www.greensquare.co.uk/blog/2021/2/1/why-the-future-homes-standard-announcement-is-a-game-changer-for-uk-renewables).
- 11 Decarbonisation of Homes in Wales Advisory Group (2019) *Better Homes, Better Wales, Better World: Decarbonising existing homes in Wales*. Cardiff: Welsh Government.
- 12 See <https://eciu.net/blog/2020/future-homes-standard-no-time-like-2023>
- 13 As reported in *The Guardian*, 23 January 2021 (see <https://www.theguardian.com/environment/2021/jan/23/buyers-of-brand-new-homes-face-20000-bill-to-make-them-greener>).
- 14 See House of Commons Business, Energy and Industrial Strategy Committee (2019) *Energy efficiency: building towards net zero*. London: HoC, paragraph 13.
- 15 EEIG (2019) *Making energy efficiency a public and private infrastructure investment priority* (see www.theeeig.co.uk).
- 16 See www.gov.uk/government/statistics/green-home-grant-vouchers-release-february-2021
- 17 For example, by the Just Transition Commission (www.gov.scot/groups/just-transition-commission/).
- 18 HM Treasury (2020) *Net Zero Review: Interim report*. London: HMT.
- 19 Decarbonisation of Homes in Wales Advisory Group (2019) *op.cit.*
- 20 See www.constructionleadershipcouncil.co.uk/news/national-retrofit-strategy-consultative-document/
- 21 See www.globalwitness.org/en/press-releases/yougov-poll-finds-majority-british-public-want-uk-lead-world-tackling-climate-change/