

# Decarbonising our housing stock

## Context

In the face of the current climate emergency the case for a deeper focus on sustainability across the housing sector has never been stronger. The cost of climate change over the course of the 21<sup>st</sup> century will be substantial. The need for businesses and housing associations to act responsibly will become a key part of strategy and operations.

On top of this, energy costs are expected to grow ahead of wages and inflation. As housing providers for households often on low incomes, housing associations can help prepare for a low carbon future and mitigate fuel poverty. The public is also becoming more conscious about green issues, and this is likely to bring greater scrutiny of large organisations.

## Regulatory compliance

### *Official regulatory targets*

- The UK Government has officially committed to achieving net-zero carbon emissions by 2050.
- The UK Government has recently doubled down on their net-zero target by unveiling plans to cut emissions by 78% by 2035, compared to 1990 levels.
- The Greater London Authority has set a target for London to be zero carbon by 2050, with London's buildings accounting for nearly 80% of its carbon emissions.

### *Compliance with Energy and Social Housing White Papers*

Regarding compliance with regulation, in the recently [published](#) Energy White Paper (December 2020), Government set their vision around transitioning to net-zero by 2050 and what this will mean for us all as consumers of energy in our homes and places of work. Greening our homes will especially require higher degrees of buildings insulation, combined with a shift from gas to electricity as heating energy source.

In relation to the social rented sector, both the Social Housing and Energy White Papers reference the intention to undertake a review of the Decent Homes Standard to ensure it is consistent with updated regulation around energy performance.

### *Legal obligations and mandatory requirements*

With regards to new build homes, legislation is much more accurate in setting out expectations for the housing sector to deliver new sustainable homes, in line with the requirements set out in the Future Homes Standard. The Future Homes Standard is a [set](#) of standards that will complement the [Building Regulations](#) to ensure new homes built from 2025 will produce 75-80% less carbon emissions than homes delivered under current regulations. Once legislation is passed in 2025, all new homes will have to be built according to the standards.

On the other hand, when it comes to existing homes, legislation is much more vague and the sector has not yet been put under specific obligation to retrofit homes to a higher environmental standard in the foreseeable future.

The formal retrofitting targets for residential buildings – which form part of the Clean Growth Strategy (2017) – have been presented as aspirations, rather than regulatory obligations. The Clean Growth Strategy (2017) sets out Government’s ambition for *‘all fuel poor homes to be upgraded to Energy Performance Certificate (EPC) Band C<sup>1</sup> 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.’*

The Clean Growth Strategy [proposed](#) this 2030 aspiration in 2017, and was meant to be followed by consultations with the sector on how to enforce the proposed targets. However, no consultation on this “ambition” has been undertaken thus far, Brexit and Covid19 intervening in terms of government priorities over the following years.

In the Energy White Paper (December 2020), the 2035 commitment was reiterated for all homes, but nothing specific for social housing was proposed, apart from restating the manifesto commitment for the Government to invest in the sector to meet the Band C target and beyond.

In February 2021 the Government published the Fuel Poverty Strategy for England, restating once again the old statutory target – set for Government, not the social housing providers – as set out back in December 2014: *‘The fuel poverty target is to ensure that as many fuel poor homes as is reasonably practicable achieve a minimum energy efficiency rating of Band C, by 2030.’* But there is currently no indication that the Government will pass this obligation timeframe through to the sector.

On a more positive note, the Government has indicated in a recent response to an Environmental Audit Committee report that they are still *“committed to review the Decent Homes Standard for social housing, taking account of energy efficiency and decarbonisation of social homes”*, although they have not mentioned any specific date other than the 2035 Band C date, stated above.

In that regard, the Climate Change Committee (CCC) has recently recommended a new target of EPC Band C by 2028, and further clarification on targets and timelines are expected in the Government’s Heat and Buildings Strategy due in Autumn 2021.

## **Opportunities and challenges for the housing sector**

### **Opportunities**

- A number of economic benefits are associated with energy efficiency. Properties in SAP bands A and B have an improved sales value of 14% on average.<sup>2</sup> Analysis on Orbit’s stock by RE:NEW predicted £4million could be saved over 20 years through retrofit.<sup>3</sup>
- Sustainability investment would increase housing associations (HAs) contribution to net-zero, as well as enhancing external reputation among the general public. 82% of councillors said investment in a community, including green space, would make developments more acceptable.<sup>4</sup>

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<sup>1</sup> SAP ratings show the energy performance of a property on a scale of 1 to 100, with A to G categories within this scale. The rating is a calculated based on energy cost per m2 and is linked to theoretical running costs. Once an SAP calculation has been agreed, it will be used to form the Energy Performance Certificate (EPC).

<sup>2</sup> Energy saving measures boost house prices (2013) – [gov.uk](http://gov.uk)

<sup>3</sup> Positive Energy – The Business Case for Retrofit. RE:NEW (2016)

<sup>4</sup> Profitable Places: Why housebuilders invest in landscape (2014)

- Sustainability can produce significant benefits for residents too, e.g., cheaper energy bills and the health benefits of a warmer home. Fuel bills are paid for from low-income residents' residual incomes, with no variance in benefits for the energy efficiency of a home. As a result, 84% of social landlords state their primary motivation for retrofit is to reduce fuel poverty and improve affordability.<sup>5</sup>
- Technological developments present an opportunity for landlords to have a greater impact on sustainability, e.g., smart-thermostats and the zero-carbon retrofit model Energiesprong.

### Threats

- Producing a business case for a retrofit programme is challenging. Recent work by RE:NEW suggests that while there is a link between energy efficiency and reduced cost, the following threats mean the cost savings are not guaranteed.
- Upfront costs of retrofit remain high and can be prohibitive given the falls in Government subsidy. A lack of funding is cited by 79% of social landlords as the main barrier to retrofit.<sup>6</sup> In fact, although it does exist a relationship between energy efficiency and a reduction in repairs and days void, this relationship is weak and does not guarantee retrofit would pay for itself in the long-term, with fuel cost reduction benefits accruing to residents, not the landlord.
- A significant proportion of the savings assumed by RE:NEW are management savings, e.g., less time spent on mould and condensation queries. However, management costs may not decrease if retrofit results in unanticipated defects.
- Tackling fuel poverty is likely to involve retrofit measures to increase energy efficiency, as measured by SAP scores. The values in the HACT social impact calculator for social value generated by improving energy efficiency by a certain number of EPC bands are quite low, and although rectification of condensation and mould is also likely to deliver social value, it will be challenging to make business cases stack up if relying on social value as a return on investment.

### Developing sustainable new homes

The built environment currently accounts for 42% of the UK's total carbon emissions, making it one of the most polluting industries.<sup>7</sup> According to the Technology Strategy Board, 27% of total carbon emissions in the UK are from domestic buildings alone.<sup>8</sup> Sustainable changes in this sector could lead to a significant decrease in carbon emissions.

In 2019, the UK Government committed to achieving net-zero carbon emissions by 2050. The Government has recently doubled down on this ambitious target by unveiling plans to cut emissions

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<sup>5</sup> State of the Nation Survey: Low Energy Retrofit in Social Housing (2017), p.4

<sup>6</sup> Ibid.

<sup>7</sup> UKGBC, "Climate Change" - [Climate change - UKGBC - UK Green Building Council](#)

<sup>8</sup> Designing Buildings Wiki, "Carbon dioxide in construction", last edited 11 March 2021. [Carbon dioxide in construction - Designing Buildings Wiki](#)

by 78% by 2035 compared to 1990 levels, which would bring the UK more than three-quarters of the way to net zero by 2050.

At the same time, the Government is determined to honour its commitment to bringing the number of new homes delivered up to an average of 300,000 per year by mid-2020s. Clearly, delivering energy-efficient new homes is the only way to ensure we tackle the housing crisis whilst preventing a surge in carbon emissions. And the sector is well aware that building the much-needed new homes should not jeopardise our efforts to halt disastrous levels of climate change; they should be seen as interdependent objectives.

In this regard, the International Energy Agency (IEA) estimated that building carbon emissions need to fall by 50% by 2030, which is 6% per year, to achieve 80% reduction by 2050.<sup>9</sup> New buildings and new homes being built in the next 30 years must therefore be built at a low or net-zero carbon level.

In response to the consultation on Future Homes Standard, the G15 argued that the Government should aim for a national target of 100% reduction in carbon emissions from new build homes in order to meet net zero by 2050. The G15 recommended adopting a fabric first approach with regards to new build homes and increasing the energy efficiency target within Building Regulations to 35% of CO2 reduction, as already required by G15 members.

### **The environmental impact of housing construction**

Despite the current emphasis on building energy-efficient homes, construction of new homes is in itself a major source of carbon emissions. To decarbonise the sector, the Climate Change Committee have suggested various options to reduce emissions from the manufacturing and construction industry, such as resource efficiency, material substitution, energy efficiency, fuel-switching, and carbon capture and storage.<sup>10</sup>

There are several layers of sustainability to consider in construction; the provision of new homes should be laid out so that it does not have adverse effect on the environment in the construction phase, and should be aimed at delivering building products which have a neutral or positive effect on the environment over time. This means designing homes which are durable, using carbon neutral materials, and prepared for the adverse effects of climate change. This will protect the environment, but it will also have a positive impact on providers' resources in terms of reduced costs of maintaining and/or refurbishing/redeveloping buildings in future.

Implementing the use of sustainable materials in construction can play a significant role in delivering environmentally sustainable new homes. Concrete is responsible for 4-8% of the world's carbon emissions, with 10 billion tons produced every year. At the moment, one of the largely explored alternatives to the use of cement – as well as mortar and brick production – is a greater reliance on modern methods of construction (MMC). Among the MMCs that are building momentum in the

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<sup>9</sup> Pippa Neill, "Construction industry accounts for 38% of CO2 emissions", Environmental Journal, 16<sup>th</sup> December 2020. [Construction industry accounts for 38% of CO2 emissions - Environment Journal](#)

<sup>10</sup> The Climate Change Committee, "The Sixth Carbon Budget: Manufacturing and construction", pp.9-11. [Sector-summary-Manufacturing-and-construction.pdf \(theccc.org.uk\)](#)

industry are modular construction, timber framing, hempcrete, and potentially the adoption of cross-laminated timber (CLT).<sup>11</sup>

However, as [reported](#) in the Parliamentary Consultation on MMC (June 2019), the lack of confidence in the durability of MMC buildings has so far been a major barrier to significant uptake in the UK. High profile issues with modular homes developed between 1980s and early 2000s have caused widespread reputational damage, and discouraged financial service providers – including valuers, insurers and mortgage lenders – from entering the sector.

In this sense, it is particularly necessary that the Government provides guidance on how MMC homebuilders might reach the required standards in relation to Safety and Quality. Collecting aggregate data and technical information on construction, materials and maintenance of different types of MMC would inform stakeholders and financial service providers of the likely performance of homes built using the same method in future.

Homes England have recently committed to increasing the use of MMC and are conducting a research pilot over 1,800 homes.<sup>12</sup> This programme will hopefully give the sector the confidence to fully invest in MMC in the future. Furthermore, the Heat and Building Strategy, due to be released later this year, is set out to include actions to reduce emissions in buildings which can also be helpful in paving the way to net-zero carbon.

### **Retrofitting existing homes**

Improving the environmental performance of the UK's existing housing stock is the most important strand of sustainability in housing, and is therefore likely to require the sector a higher commitment of financial resources over the medium- to long-term.

Compared to new build homes, existing homes are significantly lower in environmental performance. A more energy efficient property will reduce home energy usage, saving residents money and reducing carbon produced. Lowering fuel expenditure is one of the most effective ways of reducing poverty among low-income residents.

As mentioned above, in the recently [published](#) Energy White Paper, Government set their vision around transitioning to net-zero by 2050 – in line with their official commitment – and what this will mean for us all as consumers of energy in our homes and places of work. Greening our homes will especially require higher degrees of buildings insulation, combined with a shift from gas to electricity as heating energy source.

In relation to the social rented sector, both the Social Housing and Energy White Papers set the intention to undertake a review of the Decent Homes Standard to ensure it is consistent with updated regulation around energy performance. In its current form, the Standard does not include any minimum energy efficiency target for social housing, only mentioning that 'homes should

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<sup>11</sup> Ibid, pp.18, 32.

<sup>12</sup> Gov.UK, "Monitoring and measuring research study: impact of MMC on the delivery of homes", 5<sup>th</sup> March 2021. [Monitoring and measuring research study: impact of MMC on the delivery of homes - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/research-data-and-analysis/monitoring-and-measuring-research-study-impact-of-mmc-on-the-delivery-of-homes)

provide a reasonable degree of thermal comfort and be free of excess cold. This expectation is broadly equivalent to EPC Band F.’

The reviewed Standard will likely include stricter parameters and will consider the opportunity for improved regulation around Decent Homes to better support the decarbonisation and energy performance of social homes.

### **The problem with funding**

The main sources of Government funding for retrofitting – as it currently stands – are the following:

- A ten-year, £3.8bn Social Housing Decarbonisation Fund, promised in the Conservative Party’s 2019 election manifesto. In September 2020, the Government launched a £50m Social Housing Decarbonisation Fund Demonstrator, a pilot made available to local authorities and council-led consortia, due to run until 2022. The National Housing Federation (NHF) have been lobbying the Government to deliver on their commitment of £3.8bn in support of the retrofit revolution in social housing. The future Fund is intended to be open to all social housing landlords to directly access funding.
- The £2bn Green Homes Grants scheme has been recently cancelled, after being highly criticised for long delays and a heavily bureaucratic process; however, a successor scheme might be on the way, especially since the Government announced their commitment to reduce emissions by 78% by 2035 compared to 1990 levels.

On achieving net-zero by 2050, Savills [estimates](#) suggest that HAs have got c.2,747,671 properties to tackle nationwide by 2050, or about 110,000 homes per year to be retrofitted to net-zero between 2025 and 2050, at a cost of £2.8bn pa. That means announced Government funding will likely cover only a small part of the work. We can assume the Government will release more tranches of money over the next two decades, but industry would still be required to invest a major portion of their resources.

In regard to funding from the industry, housing associations in particular will need to balance out the ambitious commitment to increased energy performance with considerations around other key priorities as social landlords. It will be important that delivering the retrofitting programme does not jeopardise the ability of social landlords to deliver on their day-to-day duties towards residents, especially in relation to regular repairs and maintenance works. And housing associations also have the moral obligation to build much needed affordable homes for people in housing need.

Furthermore, building safety remediation works will likely take up an increasing proportion of the sector’s financial resources over the medium-term, which might further limit the ability of housing associations to directly fund extensive retrofit efforts towards net-zero carbon.

## APPENDIX

### EPC and Net Zero

In September 2020, the Government launched the Energy Performance Certificates Action Plan, which set out a pathway to improve the EPC system and make it fit for net-zero. The Action Plan will help to increase the energy efficiency of the building stock by exploring ways to increase the quality of EPCs, build consumer trust and increase engagement.

In relation to measuring the environmental impact of buildings, it is important to distinguish between the 'energy cost' of a house, as currently captured by the Environmental Performance Certificates (EPCs), and other measures reporting the carbon footprint of buildings. These are two very different types of metric, with EPC using the energy cost as a proxy of the environmental efficiency of homes, whilst carbon footprint or energy intensity measures such as kWh/M2 would provide an indication of their environmental impact.

On this topic, CIBSE released a new report on 'Making SAP fit for net-zero report' (June 2021): [CIBSE - Building Services News and Policy](#), trying to address current limitations of EPCs.

#### Context

The use of EPCs has been recently at the heart of the Government's drive to improve the energy efficiency of the nation's buildings with minimum standards being set. The EPC ratings are established by inspectors who assess various aspects of the building, awarding points in accordance with the [Standard Energy Procedure](#) (SAP).

Originally, SAP<sup>13</sup> was designed with one key objective: to represent a standardised fuel cost to achieve comfort under given conditions (e.g., occupancy and location) that allows one dwelling to be compared with another and a value placed on energy improvement.

This objective had to be met by a simple methodology: the calculations needed to be possible without requiring a computer. As of today, SAP inspections are still non-invasive and take around an hour, meaning that most of the calculation inputs are based on theoretical rather than measured values.

In the last 10-15 years, SAP has become more and more embedded in planning policy and practice beyond Building Regulations, to the point that for most new residential schemes the only energy modelling done during the design process is through SAP. And it has also become a central tool for those developing, implementing and tracking policies (e.g., BEIS, MHCLG, Ofgem, Climate Change Committee, Local Authorities, National Grid).

However, there is an issue with SAP methodology which lies in the fact that many of the current uses of SAP were not among its intended purposes. The [report](#) by CIBSE (June 2021) on 'Making SAP fit for net-zero' identifies the following limitations in the methodology.

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<sup>13</sup> The Standard Assessment Procedure (SAP) is the methodology used to produce the certificate for new build homes. The Reduced Data Standard Assessment Procedure (RdSAP) is the methodology used to produce the certificate for an existing home. In this document, I refer to the general acronym SAP for simplicity.

## Key methodology issues

Key issues for Net Zero Carbon:

- **Energy cost metric.** The EPC rating generated by SAP, i.e., the main metric used in policy to drive improvements to the housing stock, is an **energy cost metric, not an energy efficiency or carbon metric**. At current energy prices, this means the use of fossil fuels can be encouraged by EPC ratings produced by SAP.

For example, as reported in an [article](#) by Kathryn Porter (January 2021), member of the Energy Expert Corner, as *'gas heating is cheaper than electric heating...despite the fact that gas heating is significantly more carbon intensive, it is encouraged by the current SAP/EPC methodology. This is inconsistent with a key aspect of the Government's net-zero ambitions: to move away from the use of traditional gas (methane) in heating towards lower carbon approaches, which are typically more expensive.'*

- **SAP does not apply a whole house approach.** Works to one element can be assessed as beneficial for regulatory compliance or EPC ratings, without considering interactions with other elements. For example, airtightness is not an input in SAP and therefore possible improvements through increased airtightness can be ignored as a retrofit option, despite being a key milestone in the route to net-zero.
- **Relative improvements metric vs absolute target.** The key output of Standard Energy Procedure (SAP) methodologies reports a relative improvement over a notional building – a model used as a proxy for buildings of similar features – rather than an absolute performance metric.

That implies that buildings are not assessed against an absolute target, which makes the current SAP methodologies inconsistent with the nature of the Net Zero Target, which is absolute by definition.

In addition, the use of a relative performance metric – rather than an absolute target – prevents evaluation of impact, tracking of progress, and benchmarking, and does not reward some important aspects of energy efficient design (e.g., building form, fabric etc).

- **No end goal on existing homes.** On existing homes in particular, SAP does not set out an end-goal compliant with Net Zero Carbon nor a coherent set of options to achieve it.

Key issues for energy efficiency and demand reduction/flexibility:

- **Energy use (in kWh) is not a key SAP output for EPC ratings.** Primary energy, cost and carbon metrics are all system-dependent rather than reflecting the building itself and cannot directly be checked post-completion.
- **Short-term focus.** SAP is using an average carbon emission factor for electricity, based on a prediction for the forthcoming 3-5 years each time SAP is updated (e.g., 2020-2024 for SAP 10). Therefore, the estimate of a dwelling's carbon emissions only reflects the short term.



The use of a short-term average is only valid for fuels with a fairly stable carbon factor. For electricity, it is not a fair representation of expected emissions over the next 20-30 years.

- **Inaccuracy across different locations.** The evaluation of energy use across different geographical areas is not accurate. The need for setting consistent standards of energy evaluation across the UK has artificially reduced the accuracy of SAP measurements. For example, the location for SAP assessments in Aberdeen is currently normalised to one location (East Pennines) so that higher standards of insulation would not be required for a new house in Aberdeen compared to one in Brighton – i.e., location is standardised. Setting normalised parameters does indeed ensure that SAP can be used for regulatory purposes at the national level, and this particularly applies to the underlying assumptions (e.g., occupancy, location, etc.), which results in consistency of design and construction measures (e.g., the level of insulation required).

On the other hand, this means consistency of performance outcomes (e.g., energy use) has not been a priority. And unlike SAP assessments, Net Zero gives much greater weight to accuracy and consistency of energy performance outcomes, rather than construction or design measures – i.e., a house is or is not Net Zero Carbon (absolute target).

- **Unfit for capturing the contribution of modern technology.** Many current and emerging technologies likely to play a significant role in our homes from the mid-2020s are not adequately addressed in SAP, either through lack of available selection or insufficient configurability to represent their benefits. For example, with regards to heat pump technologies, there is now a wider range of systems available with varying features and characteristics beyond those in SAP. A reviewed SAP methodology would need to include greater options and scope for modelling heat pump technologies and their control systems, and servicing strategies.

### **Is EPC in its current form fit for net-zero?**

Looking at the next decade – the timeframe for which we've got most estimates – improved EPC ratings are associated with some reduction in average energy use, but these reductions are far from sufficient to meet the Government's objective of a 50% reduction by 2030.

CIBSE (June 2021) report cites a large study for BEIS carried out over more than 450,000 homes.

With regards to EPC ratings, findings show that:

- (1) for gas, there is a 37% reduction in mean electricity use from D to A, and 26% from D to B; and
- (2) for electricity, there is a 21% reduction in mean electricity use from D to A, and 14% from D to B.

The mean total energy use – approximated as the total of the means in gas and electricity uses – in EPC band A is 161kWh/m<sup>2</sup>/year. That is over twice the estimated goal of 73kWh/m<sup>2</sup>/year for new buildings to meet the 50% objective (GCB, 2019).

Even if the housing sector managed to retrofit the existing stock to the highest EPC A rating – and assuming they can regularly maintain buildings over time so that they do not get declassified at subsequent SAP reviews – that would not be sufficient to achieve net-zero. In other words, EPC A is not the same as net zero.

In March 2021, the Environmental Audit Committee (EAC) – which consists of MPs of all parties under the leadership of Conservative Philip Dunne – [declared](#) that *'EPCs are outdated and currently do not support energy efficiency and low carbon heating measures.'*

However, they did not advice on the adoption of any suitable alternative. In fact, the economic role of EPCs has become so relevant across the housing sector that it is unrealistic to expect that the UK Government would want to move away from this metric. As of today, EPCs are widely used for:

- driving the design, specification, procurement and construction of between 100,000 and 180,000 new dwellings a year, representing a market worth £38bn (2018) for England and Wales only;
- informing the choices of hundreds of thousands of homeowners and landlords about the retrofit of their homes, either directly or through their influence on products available on the market; and
- addressing high energy bills and fuel poverty within the social housing sector: social housing tenants spend £4.2bn a year on energy.

Recommendations have been [provided](#) by CIBSE (June 2021, page 10) on how to upgrade the EPC metric – and SAP methodologies – to make it fit for a Net Zero carbon future. However, the reviewing process might take several years – as recommendations are focused on SAP 11, due to be introduced after 2024 – and it is currently unknown to what extent the recommendations will be implemented by Government.

### **Alternatives to EPC ratings**

There are UK alternatives to explore in the meantime, mostly building on the experience of other countries:

- Passivhaus – from Germany but a few examples can be found in the UK – primarily suitable for new development (e.g., Goldsmith street in Norwich). Metrics: space heating, primary energy. Rated 'Good' by CIBSE (June 2021) with regards to ability to enable Net Zero.
- Energiesprong UK – adapted from the Netherlands and specific to existing dwellings and retrofit. Metrics: space heating, energy (lighting, cooking and plug loads). Rated 'Very Good' by CIBSE (June 2021) with regards to ability to enable Net Zero.
- Develop in-house sustainability metrics which will include both SAP methodologies and carbon footprint or energy intensity measures, such as kWh/m<sup>2</sup>.