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DELIVERING UNCOMPROMISING PERFORMANCE

HOW GOVERNMENT AND HOMEBUYER EXPECTATIONS ARE REDEFINING HOUSEBUILDING

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CONTENTS

INTRODUCTION

The housebuilding industry is going through significant change, to raise performance standards and lower its environmental impact. New building regulations for England are set to come into force this summer and homebuyers are shifting their priorities, putting pressure on housebuilders to deliver to ever-more demanding specifications.

Navigating this new terrain will require housebuilders to adopt the same 'no compromise' approach as their customers. They will need to view the design and build of houses from the perspective of their eventual occupants – not as a commodity, but as a potential home. This will mean delivering on the qualities that homeowners truly value and ensuring that specified materials perform, in the real world, over the long-term.

Tightening regulations and the empowerment of homeowners to dispute sub-standard development will mean costly penalties for those who are unwilling to adapt. But for housebuilders ready to deliver the homes people want, there are advantages to be gained, both now and in the future.

A MATTER OF PERSPECTIVE: HOUSE OR HOME?

For those building and selling, a house is a product. Delivered to an on-paper specification, often as one of many, with similar or identical characteristics. The housebuilders' journey ends when construction is complete and the house is sold. Quantifiable factors such as size, number of bedrooms and location are as important as ever when determining the sale price, but beyond this, a home's perceived 'value' becomes a matter of perspective.

For prospective homeowners, the completion of a house is just the beginning. Specifications may be taken into account during the purchasing journey, but they can only go so far. For even the most discerning buyer, a large part of a home's 'value' is based on emotion. They're looking for a space that caters for the things they care about – keeping their families safe, enjoying time with friends and ultimately creating happy memories.

Essentially, people don't buy houses, they buy homes.

It's no surprise then, that property features which offer safety and thermal comfort, such as security systems, double glazing and underfloor heating, are among the **top fifteen** that buyers look for in a home. Even practical factors such as running costs and energy efficiency are ultimately about peace of mind for homebuyers; offering reassurance, in the knowledge that they and their loved ones have a secure place to live, for years to come.

The housebuilder and homebuyer perspectives may seem different, but both are working towards the same end goal – a space which is (thermally) comfortable, safe and sustainable.

It's widely acknowledged that a home's insulation is central to achieving this, particularly in terms of thermal comfort and energy efficiency. **The Government recommends** a 'fabric first' approach to improving the efficiency of new homes, as heat generation (regardless of the technology) can only be effective when insulation performs as designed. But insulation's role doesn't end with maintaining a home's warmth. The choice of material and quality of installation are increasingly being recognised as key factors in determining a building's acoustic, fire safety and carbon reduction credentials.

In the past, housebuilders have had to decide which of these qualities to prioritise, ultimately compromising on the rest. However, this approach is quickly becoming problematic, as right now housebuilders are not the only people paying attention to what goes into constructing a home.

UNCOMPROMISING EXPECTATIONS

Traditionally, insulation has been an 'invisible hero', with occupants largely unaware of it, as long as it performs well. However, changes in legislation, along with current events and media coverage, are bringing insulation into sharp focus for homeowners, and raising their expectations across the board.

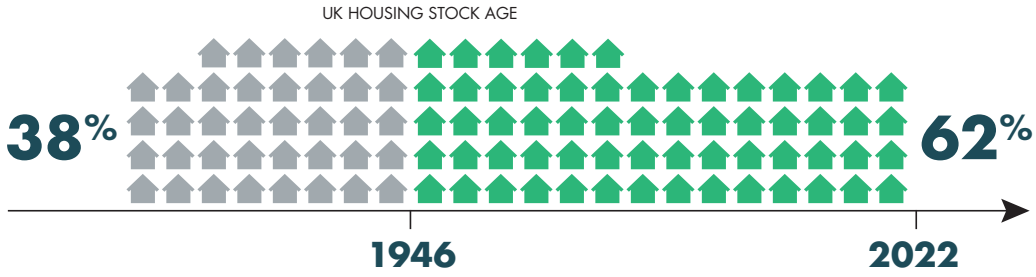
Because unlike a 'house', a 'home' doesn't need to perform on paper, it needs to perform in the real world. Specifying the best possible materials for thermal comfort, safety and sustainability means nothing to the occupants, if the reality doesn't live up to the design.

Closing that performance gap is a long-standing challenge for housebuilders, and for many, this means a second compromise – settling for 'good enough', rather than 'optimal' results. But it doesn't need to be that way. Non-combustible, high-performance insulation is readily available, and with the introduction of low-carbon options, such as Glass Mineral Wool insulation, housebuilders can also begin taking practical steps towards lowering a home's embodied carbon.

Importantly, this doesn't just benefit the buyer – it's quickly becoming the smart business decision for housebuilders as well. As legislation begins to align with market demand, soon compromise won't just be *unnecessary*, it will be *unacceptable.*

INSISTING ON THERMAL COMFORT

Maintaining a comfortable indoor temperature throughout the year is a basic requirement for any homebuyer, yet a 2020 study, conducted by smart thermostat producers Tado, found that UK homes lose heat up to three times faster than their Western European neighbours. This could be due, in part, to the fact that the UK has an older housing stock, with approx. 38% of homes dating from before 1946. It's also worth noting that 85% of UK building stock was built prior to standards for insulation and energy performance being introduced in 1990[1].



The end result is that British heating systems have to work harder to maintain a home's indoor temperature.

Combine this with ongoing media coverage of political activist groups like 'Insulate Britain' and residential energy bills rising, and the average homebuyer's awareness of thermal performance is more acute than ever.

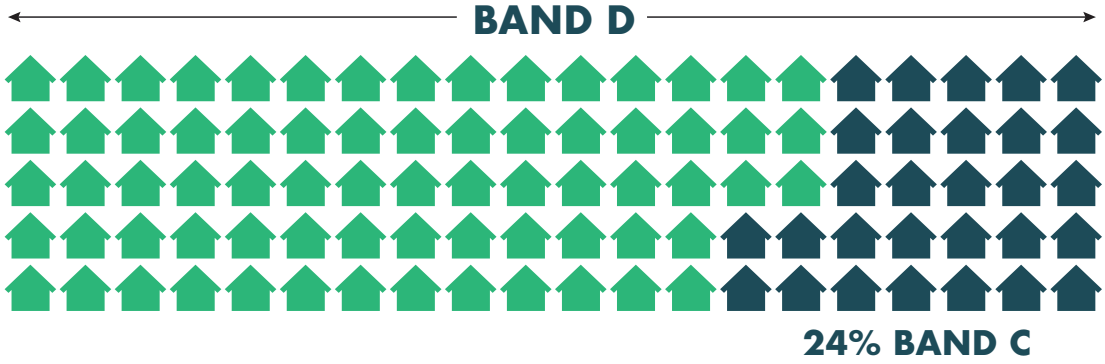
With house prices continuing to climb, and many first-time buyers struggling to enter the property market, it's no surprise that saving on the running costs of a home is of increasing importance to homebuyers. In fact, research undertaken by the Home Builders Federation and YouGov showed that more than half of 18 – 24 year olds take the running costs of a property into account when buying a home, with the same group more concerned about energy prices than whether the house has a garden.

1. House of Commons, Business, Energy and Industrial Strategy Committee, 2019, Energy efficiency building towards net zero

This increased awareness represents an opportunity for housebuilders to deliver new, well insulated homes, with better energy performance – a move which could prove to be lucrative, as suggested by a hedonistic pricing study into the private rented sector, commissioned by the Department for Business, Energy and Industrial Strategy. The study indicated that properties with a current Energy Performance Certificate (EPC) C rating were worth around 5% more than those with an EPC D rating, after controlling for other factors, such as property size and archetype. Similarly, a report by the Department of Energy and Climate Change found that property sale prices in England increased as EPC performance improved, estimating that homes rated EPC band C sold for 10% more than those rated G.

But the demand for thermal performance isn't limited to homebuyers. The Government has also turned its attention to the shortcomings of current measurements and certifications.

For example, EPCs are a notional measure of a building's energy efficiency, and don't necessarily reflect the in-use performance, once operational factors are taken into account. In 2019, a study by University College London attempted to quantify this discrepancy in the EPC ratings of 1.6 million existing dwellings in England and Wales. The results predict measurement errors that could result in dwellings being rated in the wrong EPC band, for example it was estimated that 24% of band D homes are currently rated as band C.



As a step towards greater accuracy, the Government has published its EPC Action Plan, a roadmap for transitioning from theoretical EPC ratings to a measure of actual 'in-use' performance. As a result, homes may have to work harder in future, to achieve high EPC ratings, and the asking prices that follow.

Similarly, updates to Approved Document L (ADL) of the Building Regulations for England, due to come into force in June 2022, will introduce a new level of scrutiny around quality assurance.

Housebuilders will be required to submit a new Buildings Regulations England Part L (BREL) report, to their Building Control Body. The design stage BREL report must show that the specification will meet target rates for primary energy, CO_2 emissions and fabric energy efficiency. This must then be followed by an as-built BREL report, showing whether the target rates have been met.

The as-built BREL report will also require housebuilders to supply a photographic record of key stages during construction, as evidence of thermal continuity and quality of insulation, further highlighting any discrepancy between the notional design and as-built reality.

In addition, the proposed New Homes Ombudsman will be able to issue fines of up to £50,000 per home, for sub-standard construction work, meaning it is in housebuilders' interests to choose insulation which not only performs well, but is easy to install correctly.

SPECIFYING THERMAL COMFORT

A key factor which prevents housebuilders from successfully closing the performance gap, is the fact that house designs rely on notional performance data for insulation products and assume a perfect installation.

The majority of product information is based on basic U-value calculations, which are unable to accurately account for every factor that could affect performance. Even more advanced 3D U-value calculations have limitations. Whilst they can be very good at modelling theoretical performance, they can't measure actual 'as built' performance. Designs also struggle to accurately model junctions between building elements, such as walls and roofs, increasing the risk of heat loss in the final build.

When it comes to installation, specifications need to account for the 'human factor'. Inferior product substitutions and anything less than best practice can lead to poor installation and inefficient thermal performance. For example, if a wall's inner leaf is not perfectly flat and uniform, often rigid insulation boards will not sit flush with it. Gaps between each board also need to be taped with precision, leaving ample opportunity for human error.

In fact, a study into thermal looping in cavity walls, partially filled with insulation boards, showed that even a 6mm gap is enough to cause an increase in heat transfer of 158%[2]

Mineral Wool insulation however, is engineered to meet this challenge. It adapts to minor imperfections in a building's substrate and maintains close contact throughout any settlement or movement over the lifetime of the structure. Where individual rolls or slabs meet, the strands also 'knit' together, eliminating air gaps. Unlike rigid boards, Mineral Wool's inherent 'buildability' makes it easier to install correctly.

In fact, a 2007 study[3] suggests that, even when poorly installed, Mineral Wool insulation is less sensitive to thermal looping than poorly installed foam board.

Until recently, there was no accurate way to quantify how well these measures perform, once in-use. However, that is changing with innovations like the new sensor technology, developed by Knauf Energy Solutions. By placing sensors within a home, housebuilders can measure in-use energy efficiency in the same way as energy generation, allowing them to properly benchmark the fabric energy performance of the house.

The data produced from technologies like this will not only provide valuable information on the energy efficiency of current housing, it will also help to shape future expectations of as-built thermal performance.

2. Lecompte, J (1990) The Influence of natural convection on the thermal quality of insulated cavity construction

3. Hens, H et al (2007) Brick cavity walls: A performance analysis based on measurements and simulations

CASE STUDY: MEASURING REAL PERFORMANCE IN ECCLES

Knauf Energy Solutions' sensor technology was used to measure the in-use fabric performance of a series of 2014 new builds in Eccles, Greater Manchester.

The project:

- Twelve new homes built to Part L1A in 2014. Compact and notionally cheap to run
- Smart retrofits to fully-fill cavity wall insulation and installation of Knauf Insulation loft system, underpinned by measured real performance data

Outcomes:

- 17% average fabric efficiency improvement per home
- 28% improvement in one semi-detached home
- Moist air leakage risks corrected, preventing sustained structural deterioration

Key takeaways:

- Media attention and rising energy costs have brought thermal performance front-of-mind for both Government and homebuyers
- Industry regulations are moving in a direction of greater accuracy and accountability
- Design specifications must account for 'real world' installation and performance
- Mineral Wool insulation is engineered to minimise air gaps and maximise thermal performance

INSISTING ON FIRE SAFETY

Following the 2017 Grenfell Tower tragedy, fire safety has rightly come under scrutiny from both the Government and the public.

In an attempt to reduce risk, the proposed Building Safety Bill will introduce new requirements to ensure more products are safe, with a view to establishing a National Regulator for Construction Products, to oversee and enforce the rules.

Meanwhile, ongoing media attention around the fire safety attributes of insulation has drawn homebuyers' attention to the issue of combustibility. Alongside the obvious safety concerns, incorrect use of materials also carries a potential financial burden for homeowners. For example, according to The Guardian, failed building inspections have led to leaseholders around the UK being asked to pay hundreds of pounds to cover short-term safety measures.

Unsurprisingly, financial implications, disruption and uncertainty have led to numerous resident-led campaigns calling on the Government to 'fix the cladding and building safety crisis'. In response, The Department for Levelling Up, Housing and Communities has announced an agreement, in which the industry will contribute **£5 billion** to help fix unsafe buildings. Looking ahead, the Government plans to make the agreement legally enforceable, allowing the Secretary of State to block developers who refuse to sign up, from building and selling new homes.

While the cost of remediation work will now be supported by the Government and industry, many leaseholders are still faced with paying out for numerous other safety improvements, such as the installation of fire breaks and safety doors, as well as taking on rising insurance costs.

In fact, a survey by the Association of Residential Managing Agents found gross insurance premiums had soared from **£8 million** to **£29 million** in a year, across a sample of 143 residential blocks. For individual flats, the average premium increased by 400%.

Public attention on these issues has also increased pressure to raise the safety standards of new homes, at a local government level. For example, building regulations for England and Wales currently ban the use of combustible materials on the external walls of certain buildings over 18 metres. As of December 2022, legislation in England will also ban nearly all combustible materials on facades of residential buildings over 11m (some combustible materials will still be permitted on buildings between 11m and 18m as part of a system that has passed a large-scale test). However, the Mayor of London has already imposed rules restricting the use of combustible materials on external wall systems on all future developments on Greater London Authority owned land, irrespective of height or use.

Whether motivated by safety concerns, financial penalties, or the reputational damage caused by 'getting it wrong', this could signal the start of local authorities and housing associations insisting on tighter regulations, across the board.

SPECIFYING FIRE SAFETY

Fire safety is perhaps the most critical way in which a home's real performance must live up to its specification. Passive fire safety measures, like insulation, should be failsafe but all too often, they rely on complex system interactions, or third-party elements such as fire breaks, in order to perform correctly. As with thermal performance, any deviation from the exact design specification, such as poor installation or substituting less suitable materials, could prevent insulation from living up to its fire safety credentials, creating an unacceptable level of risk.

This is entirely avoidable.

Arguably one of the simplest steps housebuilders can take to avoid this complex (and potentially costly) challenge of risk mitigation, is to use materials which are non-combustible[4]. Products like Mineral Wool insulation allow housebuilders to achieve thermal performance, without compromising on fire safety. Not only does this approach bring peace of mind, it can also avoid regulatory penalties, as well as disruption and remediation, further down the line.

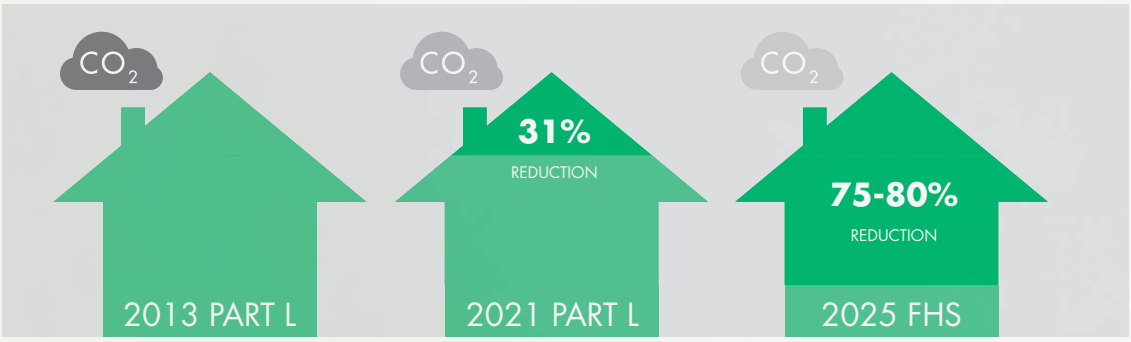
Key takeaways:

- Homebuyers are more aware than ever of the risks associated with combustible building materials
- Unsafe construction carries both safety and financial risks for developers and homeowners
- Choosing non-combustible materials, like Mineral Wool insulation, is a simple step towards risk mitigation

INSISTING ON MINIMAL ENVIRONMENTAL IMPACT

Alongside warmth and safety, a home's sustainability credentials are steadily climbing the priority list, with increased pressure from the Government, combined with rising energy costs.

ADL's 'uplift' to regulations for conservation of fuel and power, will require new builds to produce 31% less CO_2 emissions than the current regulations allow; a step towards the larger goal of a further 75% reduction by 2025, as set out by the Future Homes Standard. In fact, the Royal Institute of British Architects' 2030 Climate Challenge recommends that housebuilders adopt their 2025 target of 800 $KgCO_2e/m^2$, 'as a minimum' for new builds in design today.



ADL will also call for housebuilders to consider alternative systems to help reduce a building's carbon footprint, such as decentralised energy supply, cogeneration and heat pumps. Whilst the regulations do not yet mandate the use of systems like these, documented feasibility analysis must be provided to the local authority, signifying a direction of travel towards prioritising them in the future.

4. As set out in changes to the building regulations 2010 which bans the use of combustible materials, limiting the use of materials to those that achieve A1 or A2-s1,d0 on buildings in scope of the ban (as defined in regulation 7(4))

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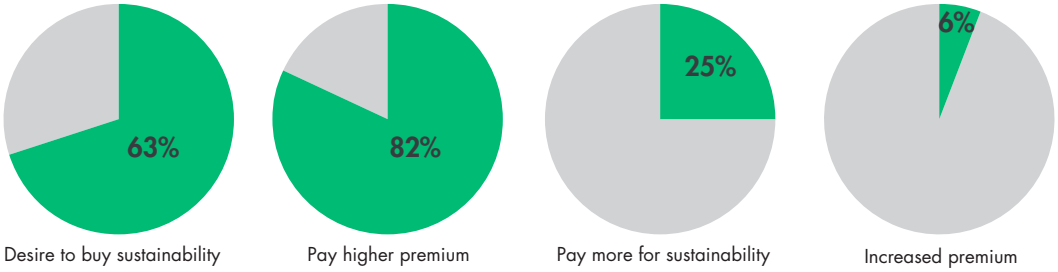
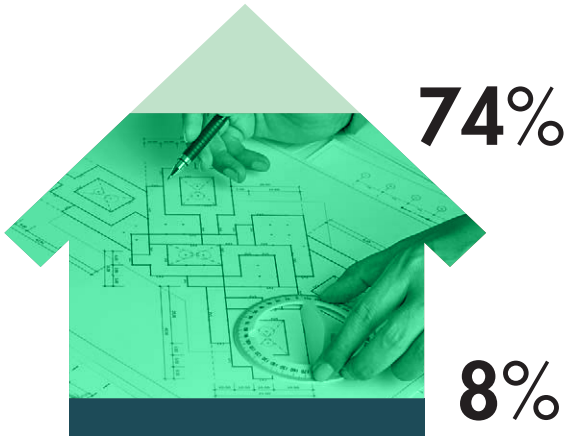
UNCOMPROMISING EXPECTATIONS

This aligns with emerging trends in the market for more sustainable purchasing decisions. In a survey by housing developer Redrow, **63%** of prospective new homebuyers indicated a desire to purchase a sustainable home. Interestingly, **82%** even said they were willing to pay more for sustainability, with over a **quarter** prepared to pay at least a **6%** premium.





Net Zero plans by 2050

Redrow Sustainability Manager, Nicola Johansen, explains:

"Our findings challenge the long-claimed, but previously under-researched, assertion within the industry that there is limited customer demand for sustainable homes… we want to build the homes our customers want to live in and this research helps us to fully appreciate what purchasers are looking for from their home and their homebuilder."

This attitude is echoed by housing associations, according to another survey from the National Housing Federation, which found that **74%** are already drawing up plans for how to make their homes 'net zero' by 2050.

The findings state that **8%** already have a fully agreed plan in place, whilst work is in progress for the remaining 66%.

One example is social housing provider Catalyst Housing, who own and operate more than 37,000 homes in London and the home counties. The association's 2020 – 2025 Sustainability Strategy, includes a pledge to build "low- carbon, resource-efficient new homes which will not require substantial investment to bring them up to higher sustainability standards in the future." The report acknowledges that this will require appropriate sustainability standards to be set for materials used in new homes and goes on to lay out plans for a zero-carbon development, to test their overall approach.

With sustainability front-of-mind for both housing associations and individual homebuyers, it is time for developers to pay closer attention to the environmental impact, not just of their houses, but of their housebuilding process.

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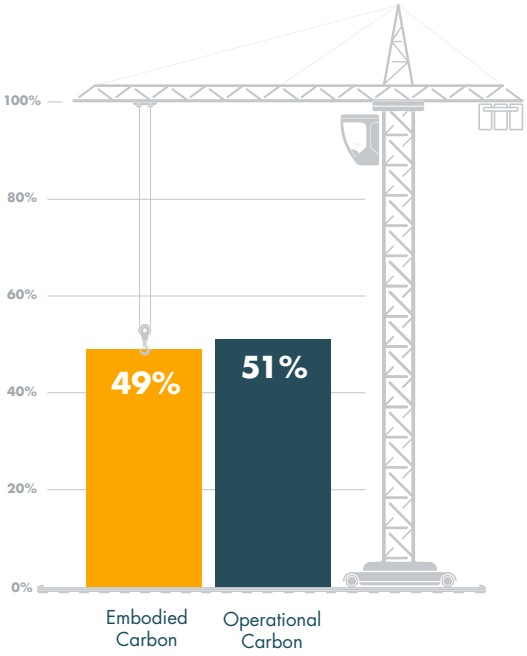
SPECIFYING MINIMAL ENVIRONMENTAL IMPACT

In recent years, a lot of attention has been paid to decreasing the operational carbon of UK homes - the emissions generated during the 'in-use' phase of a building's lifecycle. But when it comes to building houses, this is only half of the equation. For the Future Homes Standard to be feasible, housebuilders must also consider the emissions made throughout a building's entire lifecycle, from raw material extraction and construction, to eventual demolition – its 'embodied carbon'.

TOTAL CARBON EMISSIONS OF GLOBAL NEW CONSTRUCTION from 2020-2050 - business as usual projection



The Carbon Leadership Forum[5] predicts that, continuing on the current trajectory, embodied carbon emissions will make up **49%** of all carbon emissions from new construction projects between 2020 and 2050. Figures like these indicate a need for greater visibility around the true environmental impact of housebuilding – a sentiment echoed by the UK Climate Change Committee, who have called for mandatory disclosure of whole-life carbon in buildings, as soon as possible.

In order to meet the demanding targets set for the construction industry, housebuilders are beginning to set their own embodied carbon reduction strategies. Barratt Developments for example, completed a review in 2019, to investigate the embodied carbon of materials for different construction systems. They then announced their zero carbon home concept, the 'Z House', which will be occupied and monitored to assess its performance. Barratt has also announced a plan to make all of its new homes zero carbon from 2030, with the Z House leading the way.

For future homes like these to be truly sustainable, they need to use sustainable materials and this doesn't need to mean compromising on practicality. Environmentally-conscious manufacturers now provide Environmental Product Declarations (EPDs), detailing the make-up, environmental impact and 'Global Warming Potential' of each of their products. This transparent, standardised measure of embodied carbon emissions allows for direct comparison with other products on the market, empowering housebuilders to make responsible choices.

Options like Glass Mineral Wool insulation offer the thermal and fire safety performance that homebuyers have always wanted, with the added benefit of reducing a building's embodied carbon. For example, Knauf Insulation's Glass Mineral Wool products are made from up to 80% recycled content and manufactured with ECOSE® Technology, its unique bio-based binder, that contains no added formaldehyde or phenol and is 70% less energy-intensive to manufacture than traditional alternatives.

Glass Mineral Wool can also be compressed for its transportation and storage, then expand in-situ. This allows more product per pack or pallet, and more packs per truck, reducing transport related emissions. The accessibility of products like Glass Mineral Wool, along with the shift in market attitude, will likely see conventional oil-based products phased out over the coming years, in favour of more sustainable alternatives.

Key takeaways:

- Housing associations and individual homebuyers are beginning to prioritise the sustainability of new homes
- Housebuilders must consider a home's embodied carbon, as well as its operational carbon emissions
- EPDs allow for comparison of the environmental impact of different products on the market
- Products like Glass Mineral Wool can help to reduce the environmental impact of a new home

5. Original data sources: Data Sources for 49% figure: UN Environment Global Status Report 2017; EIA International Energy Outlook 2017

THE ROAD AHEAD

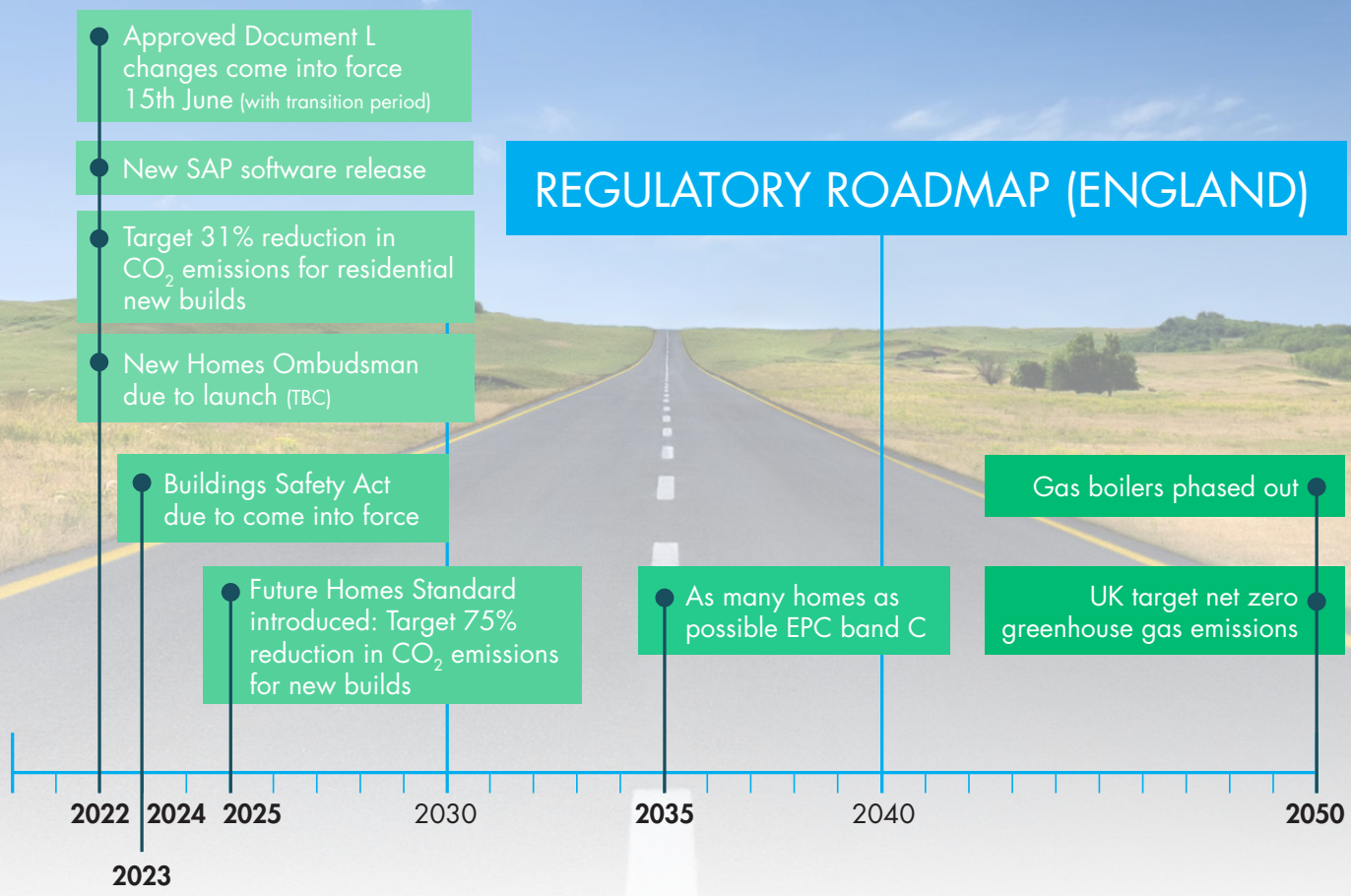
The next few decades will see some significant challenges for residential construction.

If housebuilders are to meet these challenges they must act now – or risk being left behind. The whole industry – from manufacturers, to specifiers, developers and installers, – must transition to a way of working that prioritises:

- Higher standards of products, materials and installation
- Availability of technical support and guidance
- Transparency of product data
- Real 'in-use' performance

The good news is that many manufactures are already offering this to their customers. The information and resources are available to help housebuilders identify the adjustments that will work for their business. The pace of change will be different for everyone, but with the right support, housebuilders can strike the balance between meeting the needs of today, and preparing for tomorrow.

REGULATORY ROADMAP (ENGLAND)



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HOW TO SPECIFY SUCCESS

James Hulbert, Head of Housing, Knauf Insulation

Whilst creating this paper, we've examined the shifting dynamic between the business needs of the housebuilding industry, the expectations of the homebuyer and the structures being put in place by Government, to align the two.

In order to successfully meet market demand, comply with changing regulations, and continue to grow or maintain their business, housebuilders need to find solutions which tick all three boxes.

To this end, we've identified the following key principals to keep in mind, when specifying materials for a home:

GET THE PERFORMANCE YOU'RE PAYING FOR

Choosing a product which provides the best return on investment is always a smart business decision. However, identifying those products isn't always as straight-forward as it seems. Notional performance credentials become meaningless if the product is difficult to install correctly or relies on third-party elements which may or may not work as designed. Materials which offer real performance in-situ (not just on paper) are the reliable choice and will ultimately deliver the comfortable living space homebuyers want too.

MINIMISE RISK

Living in a fire safe and secure home is a top priority for most buyers and regulations are continually evolving to reflect this. In addition to the obvious humanitarian motivation to build safe homes, from a business perspective, the potential reputational and financial cost of risk-taking is simply not worth it. Minimise fire risk, by choosing materials like non-combustible insulation, which offer performance, along with peace-of-mind.

MOVE FORWARD STRATEGICALLY

As sustainability shifts up the homebuyer's checklist and regulations edge us closer to the Future Homes Standard, it's time to take carbon reduction in new homes seriously. This will look different for every business and the important thing is to find the approach that works for you. However, it's also important to remember that lowering operational carbon is only half the battle. To further reduce a home's environmental impact, consider products which also help to reduce its carbon emissions from 'cradle to grave' - its embodied carbon.

The housebuilding landscape is changing and there are certainly challenges ahead, for everyone involved. Keeping these principals in mind will help us move forward with confidence, creating homes which benefit businesses, homeowners and the industry as a whole.

CASE STUDY: QUANTOCK HOUSE, TAUNTON

Client: TAC Projects

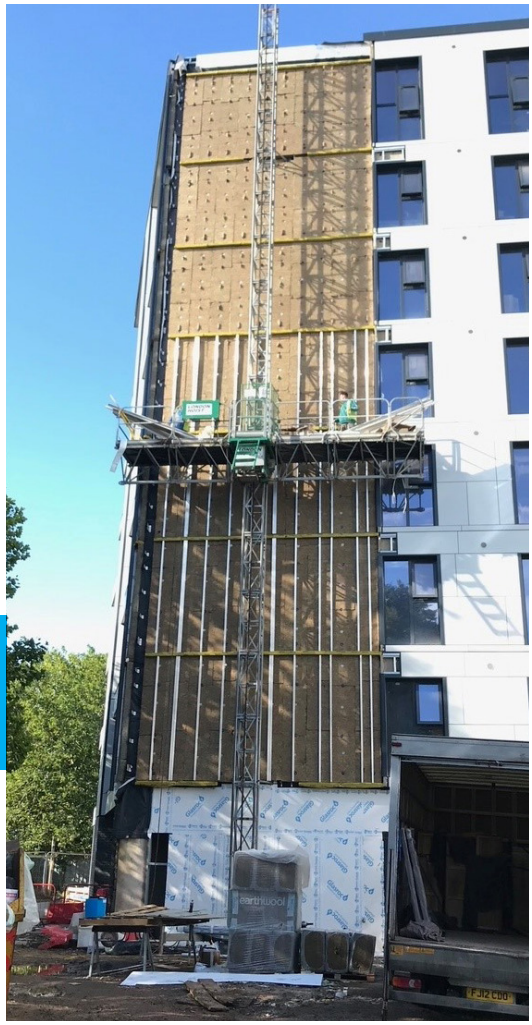
3,000m² of Knauf Insulation Rocksilk® RainScreen Slab provides essential comfort and fire safety for vulnerable residents in a new development on a challenging site.

Quantock House, Taunton is a collection of 88 assisted living apartments set over nine storeys in a prime position at the heart of Somerset's county town. It is a development from Platinum Skies, part of the Affordable Housing and Healthcare Group (AHH). Specialist contractor TAC Projects was tasked with the technical design and overall delivery of the façade.

There were two essential considerations for the insulation specification. The first was that it had to be non-combustible, with a Euroclass A1 reaction to fire classification. The second was thermal performance. The façade had to achieve a U-value of 0.18W/m²K, but with a complex design including acute angles between elevations and an undercroft car park, detailed calculations would be needed to support the specification.

Paul Mann, Sales & Pre-Construction Director, TAC Projects, explained,

"We needed extremely detailed U-value calculations, and Knauf Insulation is one of the best at supplying these."



Rocksilk® RainScreen Slab is a non-combustible Rock Mineral Wool insulation that offers exceptional thermal and acoustic performance. It achieves Euroclass A1 reaction to fire classification, and is BBA certified for the broadest range of build-ups of any rainscreen solution on the market.

It is designed to be easy to install correctly. Slabs are robust enough for easy manoeuvrability, but capable of flexing to adapt to imperfections in the substrate and to interlock when butted together. This is critical as it prevents the air gaps that can occur when using other, more rigid types of insulation; gaps which can compromise thermal, fire safety or acoustic performance.

"Our business is all about trust" *continued Paul.*

"AAH is trusted by its customers to provide safe and warm homes. We're trusted by them to build non-combustible, energy-efficient façades. And in turn, we trust Knauf Insulation to give us the innovative products and service we need to do that."

Thanks to these trusted relationships, the residents at Quantock House will enjoy their new homes in warmth and comfort, with the peace of mind that comes from knowing they are built using sustainable, non-combustible materials.

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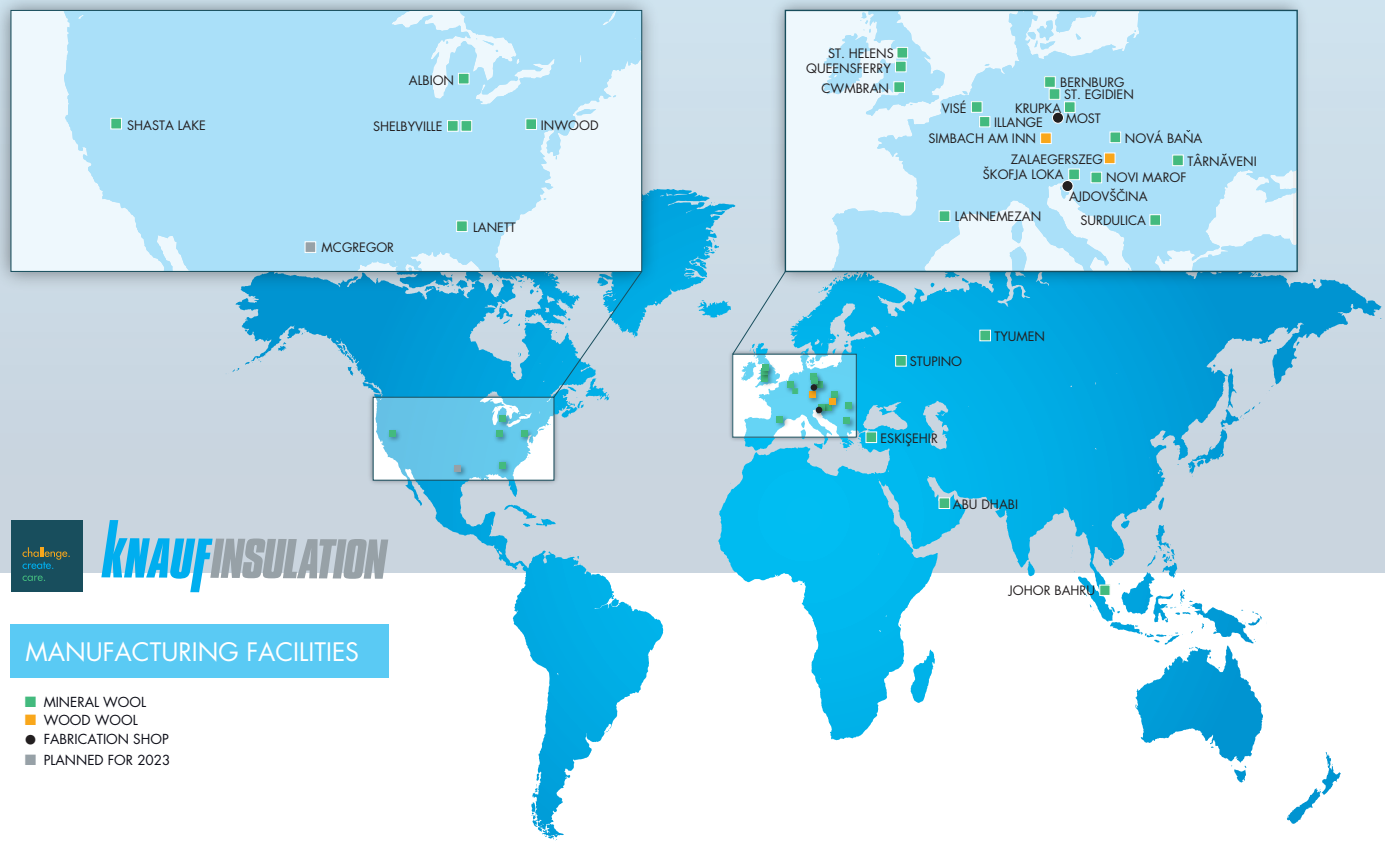
About Knauf Insulation

We are committed to helping our customers meet the increasing demand for energy efficiency and sustainability.

Drawing on 40 years of experience in the industry, we are leading the change in smarter insulation solutions, for a better world.

Our mission is to challenge conventional thinking and create innovative insulation solutions that shape the way we live and build in the future, with care for the people who make them, the people who use them and the world we all depend on.

We operate out of three UK-based manufacturing plants and we are part of the Knauf Group, a family-owned, multi-national manufacturer of building materials and construction systems.



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