

Building for 2050

Executive Summary: considerations for success

An evidenced-based report on the drivers and barriers involved in the large-scale construction and take-up of low cost, low carbon housing

Building for 2050 offers a snapshot of the UK's construction industry and its ability to deliver low carbon homes now¹. It identifies how best to minimise cost, improve energy efficiency, reduce carbon emissions, increase consumer demand, and accelerate industry delivery of low carbon housing. While the focus is new-build housing in England and Wales, the key findings broadly apply to all new-build housing throughout the UK.

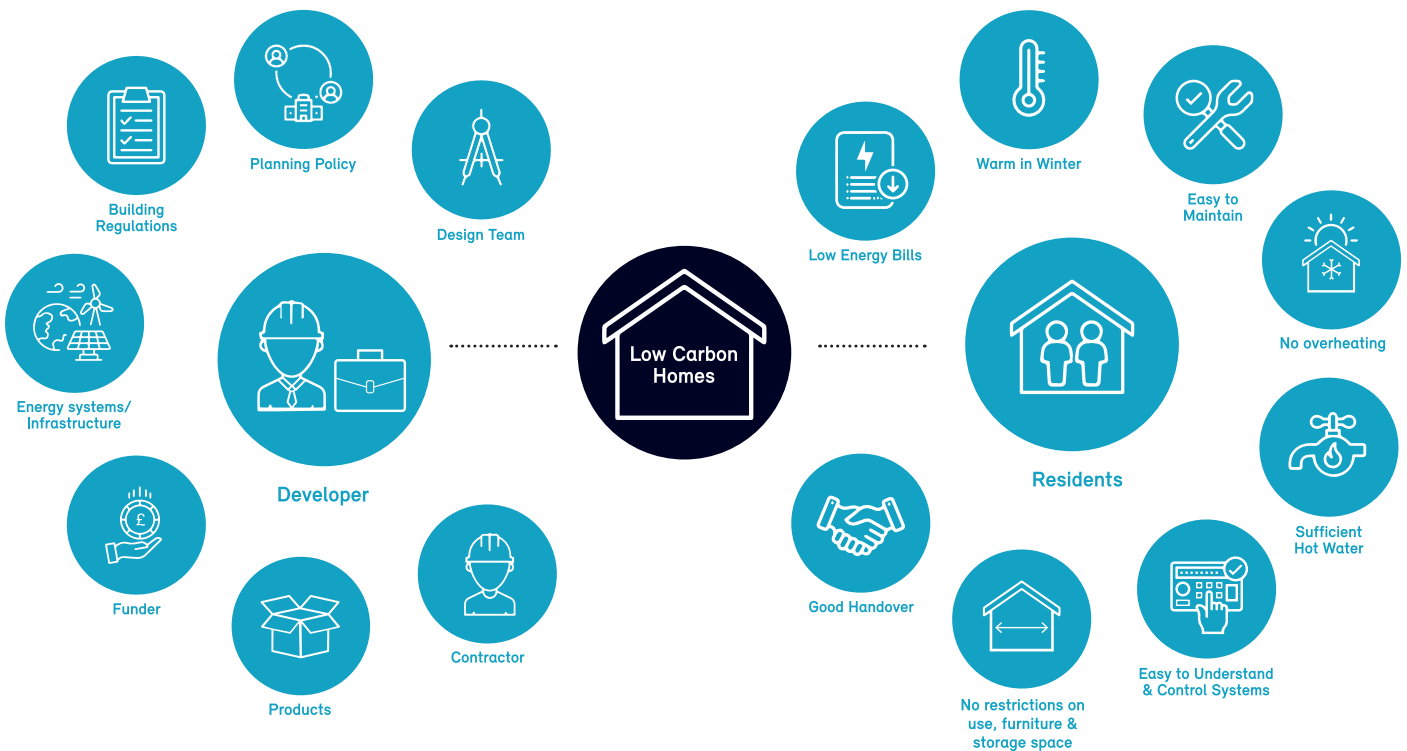
Building for 2050 is unique research. In a detailed analysis of case study projects, it identifies the barriers and opportunities to their delivery at scale and examines the impact this could have on energy demand and carbon emissions.

It provides rounded analyses of the whole process from inception to occupancy - developing, designing, constructing, and living in low cost, low carbon homes. This holistic evaluation incorporates the views of multiple stakeholders and draws upon case study homes, the wider construction industry, and the energy services sector. A wide-ranging consumer survey and a general industry survey further contributed to the findings.

If all homes constructed in future are built to a low carbon standard, there should be no need to retrofit these homes before the UK Government's net zero 2050 deadline.

The project was led by AECOM and supported by Pollard Thomas Edwards (PTE), Four Walls, and LCP Delta (incorporating Delta-EE).

¹The report defines low cost, low carbon homes as low carbon homes with a lifetime cost similar to, or lower than, standard new homes currently on the market. In terms of emissions, low carbon homes in this report are equivalent to Code for Sustainable Homes 5 or 6 (or Code 4 with a fabric first approach) or Passivhaus.



A project for


Department for
Business, Energy
& Industrial Strategy

Delivered by

Methodology

This five-year project – begun in 2017 and completed in 2022 – investigated low carbon housing to understand why and how this type of home is being built, how the residents use energy, and what their experiences are. It also set out to understand how the construction industry can deliver low cost, low carbon homes on a large scale, and asks - what are the drivers and barriers shaping this emerging sector?

The report is informed by literature and market reviews, four in-depth case studies of low carbon housing schemes across England and Wales, and surveys and interviews with technical and consumer audiences.

The case studies focused on:

- Interviews with development teams on the delivery of low carbon homes;
- Interviews with residents sharing their expectations and experiences with living in their homes. This covered energy bills, comfort, and the usability of low carbon technology;
- A design review of homes and site observations during construction and post-completion on the buildability of the designs;
- An assessment of additional low carbon capital costs;
- Post-completion testing of the thermal performance of building envelopes and mechanical ventilation systems;
- A comparison of the SAP (Standard Assessment Procedure) modelling undertaken by the development teams and by the project team;
- Monitoring of the energy and environmental performance of homes in use;
- Consideration of the operation of the homes within a changing energy system.

89 interviews



36 technical stakeholders on the production of low cost, low carbon housing

53 case study interviews

1 workshop



One in-person workshop on the challenges and solutions to deliver low carbon, low cost housing for technology providers, service providers and retailers, and development solutions providers

2,500 consumers



2,500 consumers consulted: 50% buyers and 50% renters

1 webinar



One webinar with 200 attendees

4 conferences



Participatory events with emerging findings at Futurebuild 2019, 2020, 2022, UK Construction Week 2022 and a Good Homes Alliance event

Case studies

Today, no major housebuilder is building low carbon homes at scale. For this reason, the case studies focus on low carbon projects undertaken by small and medium-sized developers. The four developers had different funding models and approaches to low carbon design. These factors, combined with the mix of tenures, provided a good range of research data.

Marmalade Lane Cohousing, Cambridge provides 42 dwellings, a mix of flats and houses, with a shared 'Common House' facility.

Active Homes, Neath, Wales provides 16 homes, a mix of houses and flats for social rent.

Etopia Homes, Corby, Northamptonshire provides 47 homes, flats and houses, for private sale.

Tallack Road, Waltham Forest, London is a private development providing a mix of 80% private and 20% affordable homes in 48 flats and two houses.



1. Marmalade Lane Cohousing, Cambridge



3. Tallack Road, Waltham Forest, London



2. Etopia Homes, Corby, Northamptonshire



4. Active Homes, Neath, Wales



Low carbon homes: What did industry say?

What is enabling and driving low cost, low carbon homes?

- An understanding of the need for a step change in low carbon performance, in part to address fuel poverty concerns;
- A local vision for low carbon homes and an increased general awareness of the climate emergency;
- A business vision - developing the brand and products to address low or zero carbon targets;
- The chance to develop the local supply chain and benefit the local economy;
- Increased demand for real estate investments that meet Environmental, Social and Governance (ESG) funding criteria;
- Available sites in areas where local planning authorities have set ambitious carbon targets to respond to local conditions such as infrastructure capacity, land values or climate change concerns;
- Grant funding for low carbon technologies or advice;
- Investment by manufacturers in low carbon technologies;
- Collaboration with low carbon stakeholders. In some cases, expert advisors, either organisations or individuals were driving the low carbon homes.

What are the challenges and barriers?

- Achieving low cost homes, whilst embracing new technologies;
- Delivering lower running costs and improved comfort as well as low carbon homes;
- A lack of certainty about future requirements, and a perception of increased capital costs and challenging market conditions;
- A reluctance within industry to change supply chains and improve designs;
- A mismatch of knowledge and skills;
- Underdeveloped energy infrastructure;
- Concerns about negative consumer attitudes to innovative technologies and homes.

Living with low carbon homes: What did the residents say?

What are the drivers?

The main factors influencing home buyers and renters are location, size, design, layout, and price. Specific drivers for those seeking low carbon homes, included:

- Lower energy bills;
- A reduced environmental impact;
- Warmth, comfort and good air quality;
- New, modern and high-quality homes;
- Gas-free homes (considered to be safer as well as greener).

- A lack of availability of low carbon homes where people want to live;
- A lack of awareness of low carbon homes - it is not easy to identify these homes or their features when buying or renting homes;
- Concerns around performance, reliability and maintenance of the technologies used;
- The appearance of technologies and how much space they might take up;
- Concerns about snagging issues and completion dates slippage.

the design stage, design simplification and better co-ordination, greater on-site experience, and improved handover processes will help to mitigate this.

There were other benefits however - residents reported warm and comfortable internal environments and good air quality and ventilation in their low carbon homes.

Around half felt their homes imposed constraints on their behaviour. Getting to grips with technology, learning how to optimise controls, and then adapting how you live to suit, takes time. Some residents had to manage a daily routine around reduced availability of hot water. Early consideration of the residents, focusing on the daily operation of homes, and informed advice will help to address this in future homes.

What are the barriers?

- More than 60% (of residents and potential residents) cited cost as a main barrier;

The pros and cons of living in low carbon homes

Case study residents had an expectation of lower energy bills, although for many of them, this wasn't the case in practice. A focus on running costs at

The findings

The research has been distilled into 29 key findings (see Table 7 in the main report), which lead to the key learning points.


Around half of the findings relate to increasing the supply and demand for low cost, low carbon homes, through consideration of the drivers and barriers for housebuilders and the wider industry, and highlighting the drivers and challenges for prospective and actual residents. The remaining points are


focused on delivering low energy and carbon performance. Updated Building Regulations will drive the requirement for lower carbon homes. However, there is a risk that homes built to updated regulations will not perform in use as intended. Developers, design teams, and site-based teams need to understand why and how to ensure as-designed performance is delivered; this includes placing a greater emphasis on the end users in early thinking and on the handover process at the end. Knowledge-


sharing is also key. Achieving the UK's Net Zero Carbon commitment by 2050, and the interim 2035 target, will require a focus wider than predicted carbon emissions from regulated operational energy. The research suggests this should include embodied carbon, the assessment of performance in-use, a recognition of the dynamic carbon intensity of grid-supplied electricity, and energy infrastructure upgrades to address the demands of all-electric new homes.

Next steps: Key learning points


Building for 2050 has identified seven key learning points focused on increasing supply and demand of low energy and low carbon homes.


#1  Industry groups are requesting certainty on future requirements for low carbon homes - the scope and timing of regulatory requirements and clarity on the role of planning policy.

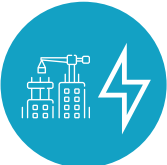
#2  Local planning policy is a key driver for lower carbon homes.

#3  The public sector can play a significant role in promoting more low carbon homes by setting clear performance requirements.


#4  In well-planned, well-constructed low carbon developments, the capital cost uplift is minimal and not a deterrent to delivery. Wider uptake would likely reduce this uplift. Highly complex designs aiming to deliver zero carbon or energy positive homes are likely to have on-costs considerably more than the market will pay for; grant funding was received by the two schemes with these more ambitious aims.


#5  Counter to consumer perceptions, the case study homes were no more costly to buy than standard homes (based on the low carbon features), but the broader issues of insufficient low carbon homes and easy-to-access information about them remain.


#6  There is likely to be an increased demand for low carbon homes if developers market them with details of features and running costs, and provide post-occupancy support to ensure they perform as promised.


#7  The construction sector and the energy services sector need to engage better. This will support delivery of low carbon homes, while avoiding significant energy infrastructure costs.


Seven further learning points have been identified, focused on the energy and carbon performance of low carbon homes.


#1  Performance in use should be improved with the adoption of simpler designs, which are easier to build and commission, and easier for residents to operate in accordance with the design intent.


#2  Industry should undertake further product development and housebuilders need to improve their knowledge of existing and emerging products and services.

#3  Developers and design teams should adopt a range of output metrics, not only low carbon targets.

#4  It is essential to ensure planned performance is delivered so that both running costs and carbon emissions are low.

#5  Developers need to focus on tailoring and resourcing the handover process for low carbon homes, so residents understand and operate their homes in an efficient manner.

#6  The interaction between dynamic energy use and the energy system should be better recognised in the Building Regulations.

#7  There is a need to upskill and improve collaboration across the industry.