Herefordshire Council

Carbon Neutral Housing in Herefordshire

Consider whether new houses and self-build properties are 'zero carbon ready'.

Contents

Summary

This report outlines the evolving standards and challenges in delivering Net Zero and climate-resilient homes in the UK, focusing on the transition to zero carbon-ready housing. It highlights the Future Homes Standard, set to be enforced from 2025, which mandates electric heating systems like heat pumps and improved insulation to reduce emissions. Key barriers include public awareness, installation costs, and electricity pricing.

The report also explores alternative low-carbon fuels, the limitations of retrofitting existing homes, and the strain on electricity networks. It emphasizes the importance of climate adaptation measures—such as flood resilience, passive cooling, and sustainable drainage. The final section reviews relevant national and local planning policies, including the NPPF and Herefordshire's Core Strategy and Building regulations updates.

New houses and self-build properties can be considered zero carbon ready, but only when they are designed and constructed to operate entirely on electricity. This means excluding fossil fuel-based systems (e.g. gas, LPG, oil) and instead using electric heating solutions such as heat pumps, supported where possible by on-site renewable energy like solar PV.

The UK's Future Homes Standard, due to be enforced from 2025, will mandate this approach for all new builds. Homes built to this standard will be "zero carbon ready" — meaning they will produce no direct emissions and will become fully zero carbon as the electricity grid decarbonises.

To ensure all new homes meet zero carbon ready criteria, future policy must support:

- *Strong enforcement of the Future Homes Standard*
- *Public education on low-carbon technologies*
- *Reform of energy pricing to incentivise electrification*
- *Investment in workforce training and supply chains*

New national housing targets and policies may centralize certain decision-making processes, requiring local authorities and partners to revise their existing plans and policies

Zero Carbon Ready

Zero Carbon Homes can be defined as homes without a means to burn fuels directly, typically this has:

- No gas boiler (usually no gas connection but also LPG /oil)
- No chimney or flue

In practice this means the home must be entirely electrically heated. This can be from the grid, from onsite generation (usually solar PV) or a combination of the two. The Clean Power Act[1] is looking to reduce the carbon intensity of the grid to below 50g CO_2e / kWh by 2030. Zero Carbon Homes are also often highly efficient in terms of design and materials but should not be confused with other archetypes such as 'off grid' or 'Passiv-Haus'.

The Future Homes and Building Standard[2] was consulted on at the end of 2023 and is the chance to ensure every new building in Britain is part of the solution. There are plans to enforce electric heat pumps or other non-gas alternatives as standard by 2027 with this expected to be released as policy in Autumn 2025. All new homes will then be 'zero carbon ready', meaning that they will be zero carbon once the electricity grid has been decarbonised or renewable electricity is generated or purchased by the homeowner. Typically, these new builds will see a reduction of 75% emissions,

[1] Clean Power 2030 Action Plan: A new era of clean electricity – main report - GOV.UK

[2] The Future Homes and Buildings Standards: 2023 consultation - GOV.UK

have a heat pump installed and be well insulated and have good air tightness with the right amount of ventilation.

There are several barriers that will need to be overcome before houses are zero carbon ready. One major barrier is that of cost. Another barrier is homeowners not being educated about heat pumps and their usage. Currently heat pumps are misunderstood and can be unpopular with the general public. This awareness raising will be crucial in the run up to the first phase of the gas boiler ban when the Future Homes Standard in 2025 will apply to all newly built homes, meaning new homes will not be able to connect to a gas network and will have to install low carbon heating measures. To install net zero measures, the number of appropriately skilled local installers will need to increase.

Once installed, the financial cost to operate a heat pump can be unfavourable compared to gas if installing in older homes which have not had preparatory retrofit. Costs should be comparable in new builds. The UK currently adds levies to energy bills, the majority go on the household's electricity bill, while adding a small amount on a gas bill. This makes electricity much more expensive than gas to heat homes and means the economics of heat pumps don't always stack up. Changes in the way levies are applied would help address this issue.

Finally Building Regulations Part L addresses the conservation of fuel and power in new and existing homes in England. Significant updates took place in 2022 emphasising fabric performance and renewable technologies, with the aim to significantly reduce carbon emissions from new and existing buildings. However, with 70-80% of the buildings that will be standing in 2050 are already built today, Part L may need to be revised further.

Accelerating the transition to low carbon heat is critical for the UK to meet its climate goals, with fossil fuels used for heating and hot water accounting for 96% of all emissions from residential buildings. The Climate Change Committee estimate that the percentage of UK homes with low carbon heating systems will need to increase from 9% today to 39% in the next decade, before reaching 100% by 2050.[3]

Alternative fuels

Emissions from electricity result from the generation method rather than the appliance consuming the power. Electrical appliances produce no emissions directly and so carbon reduction efforts focus on method of generation rather than consumption.

Domestic heating in the UK has long relied on burning fuel at the point of use, first wood, then coal and now gas, LPG and oil. Alternative low carbon fuel sources are available but may not satisfy the definition for zero carbon homes.

Wood fuel in the form of logs, chips and pellets produce low carbon emissions but can release soot particles that contribute to poor air quality. Availability and quality of fuel can be variable, but wood remains a viable low carbon emissions heat source for many rural properties. Individual new build homes, conversions or small developments might still aim to incorporate a chimney/flue which would be contrary to the zero carbon home definition.

[3] The Seventh Carbon Budget

While hydrogen boilers will run in broadly the same way as current gas boilers, there are still significant infrastructure costs and challenges to overcome. Hydrogen can, to a certain level, be mixed with natural gas and used in our existing gas heating systems. However more substantial system changes are required to deliver heating systems in buildings that run on 100% hydrogen. It is estimated that £22.2bn of capital expenditure is required to make the UK's existing gas network suitable for hydrogen distribution[4]. Hydrogen is likely to be in demand in other sectors and areas of the economy, including industrial processes, industrial heat, energy generation and transport, so the widespread use of hydrogen for heating buildings may not be a priority and may be subject to price volatility. At a system level, using renewably generated electricity to produce clean hydrogen that is then transported and combusted for heating is less efficient than using electricity directly for heating, particularly using clean electricity to power heat pumps.

Low emissions biogas produced via anaerobic digestion can be injected into the gas mains and contributes to an overall reduction in the carbon intensity of supply. There may be some localised applications for directly burning the biogas produced (such as to heat the anaerobic digestion (AD) plant itself) though use in heat mains or vehicle fuel is more likely. While there is significant capacity for AD growth to process agricultural, commercial and household wastes into biogas, it would fall short of the volumes required to replace fossil gas in the UK gas mains. A study by Regen[5], commissioned by the MCS Foundation charity, found that biomethane could account for only up to 18% of the UK's current gas demand by 2050. Market and technological constraints appear to limit biogas replacing tank or bottled LPG. The Climate Change Committee suggests that into the 2030s, biofuels for heating should be limited to "Biomethane produced from AD and other niche uses as part of hybrid heat pump systems in hard to treat off-gas homes, local combined heat and power systems and small-scale district heat networks."[6]

Vegetable based oils are available as a heating oil fuel replacement. These are low rather than zero emissions. There are additional emissions associated with the production and transport of the fuel and concerns regarding whether the production causes deforestation and other indirect emissions/adverse environmental consequences.

While wood, oil and LPG systems are unlikely in new build homes, it is possible that homeowners may seek to retrofit these systems in preference to electric heating systems.

As demand for LPG and oil heating systems decline, manufacturers can be expected to discontinue production. Systems manufactured outside of the UK may in future no longer be compliant with UK regulation. Skilled tradespeople and spare parts may also become scarce leading to further demand for alternative systems. Fuel distributers may discontinue supply of LPG and oil as a response to dwindling demand.

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[4] bre_decarbonising-heat-in-britain-s-buildings-report-dec-2022-1

[5] Making the most of biomethane

[6] bre_decarbonising-heat-in-britain-s-buildings-report-dec-2022-1

Electrical heating systems

Electrification of individual heating systems combined with low and zero emissions generation is the simplest market ready route to decarbonising homes at scale.

Heat pump systems are highly efficient and can produce hot water for storage in tanks, for circulation around radiators or directly produce warm air. Homes should be well insulated and may need new high-capacity radiators to effectively transfer the heat. Many heat pumps can also provide summer cooling and this is a significant step towards adapting homes to the future climate.

A heat pump can be expected to consume only one third (or less) of the energy of an equivalent gas boiler, but electricity is 3 or 4 times the cost of gas. This, combined with the much higher installation costs act as a disincentive to uptake. There are factors that can mitigate this cost disparity, including:

- Fuel shift to heat pump may enable a householder to disconnect from the gas main entirely which would eliminate gas supply standing charges (c. £140 per year). (Replacing a gas oven may be required).
- Eliminating gas also reduces risk of carbon monoxide poisoning, fire hazard and gas leaks. This may reduce insurance premiums and be more valued in some instances like retirement accommodation.
- Some suppliers offer innovative tariffs for lower cost electricity at certain times. These can be used to bring operating costs down by heating space and water when prices are low.
- When combined with rooftop solar, some of the operating costs can be eliminated. Demand for heat usually occurs at times of lowest solar generation but maximising the use of solar provides the best financial returns. A heat pump is an efficient way to use solar power and the solar can generate all summer hot water demand.

Heat pumps require space for the appliance and outdoor space for the external fan unit (air source) or coils (ground source). Some situations such as flats may be unsuitable for individual heat pumps. However, flats could use centralised heat pump heating systems or a district heat network to supply heat directly to a number of properties.

There are various types of direct electric heating, including wall-mounted electric radiators, storage heaters, and infra-red heaters. Such heaters may still be applicable in some situations. While these do not benefit from the efficiency of heat pumps, they do not require much space and individual room heaters can be independently controlled. These may be suitable for use in new build flats or replacing gas in flats, park homes or other places where heat pumps cannot be accommodated.

Network capacity

A consequence of the fuel shift is the increased demand for electricity and the impact this has on the local distribution network. Capacity is limited and investment in overhead lines and substations is required to meet the growth in demand. The costs will be transferred to consumers at a time of already increased energy costs driven by global market forces for fossil fuels. Increased electric vehicle charging, new data centres and industrial use create further demand on the network.

This issue may be more significant in off-gas areas. These are often rural and have lower density housing. Prevalence of wood, LPG and oil-fired heating systems has previously mitigated the impact of limited electricity network capacity to date but is not in line with the Zero Carbon Homes standard.

Energy system capacity could influence desirability and deliverability of development. House builders will potentially prioritise those areas where the network has existing capacity, or lower connection costs. Some areas may become unattractive to developers as they await future network investment that would unlock the capacity they need.

The current regulations around network operation and investment have been a long-standing barrier to modernising and upgrading the network to enable low carbon generation and demand. Regulatory reform to enable network investment ahead of need and involve local democratic representation in system planning is currently emerging[7]. Market reform and increasingly smarter use of existing capacity can also help to alleviate network constraints.

Adaptation

The UK is legally required to adapt to climate change. The National Adaptation Programme[8] sets out plans to increase resilience within the built environment and mitigate the impact of climate change on public health, particularly concerning exposure to excess heat and more frequent severe weather events.

The growing frequency and severity of extreme weather events due to climate change—including flooding, storms, droughts, overheating and wildfires pose serious risks to homes and communities.

In Herefordshire, homes were impacted in at least 24 of the 41 severe weather events recorded between 2008 and 2022.The most significant impact on homes is flooding, which occurred in at least 17 of the events recorded[9].

Climate adaptation relates to actions that protect us against the impacts of climate change. This includes reacting to the changes we have seen already, as well as preparing for what will happen in the future. Housing will be on the front line of adaptation challenges.

Herefordshire Climate Change Adaptation Plan[10]

> *Ensure climate adaptation standards are considered when building new homes to high Net Zero standards, i.e., use the progress on Net Zero design to integrate adaptation measures that also help to reduce carbon.*

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The provision of climate-resilient homes is essential. The need to retrofit our existing homes to reduce emissions also offers an opportunity to address overheating and resilience concerns.

Examples of domestic adaptations include:

- Passive solar design for shading and green roofs to combat heat
- Tree planting for shading and to reduce surface temperatures
- Minimising the impact of flooding with water resistant materials
- Create gardens and permeable surfaces to manage rainwater and divert it

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[7] Strategic Planning | National Energy System Operator

[8] Third National Adaptation Programme (NAP3) - GOV.UK

[9] Severe Weather Impact Assessment for Herefordshire 2008 - 2022

[10] Herefordshire Climate Change Adaption Plan 2023 - 2028

- Making use of sustainable drainage methods

Zero Carbon Homes - a Planning perspective

There are a number of national and local planning policies. The majority of the policies found are more often associated with new builds. The following national and local policies support retrofitting and energy efficiency.

- National Planning Policy Framework (NPPF) [11]

> *Paragraph 164. New development should be planned for in ways that:*
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> *a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through incorporating green infrastructure and sustainable drainage systems; and*
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> *b) help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings in plans should reflect the Government's policy for national technical standards.*

Paragraph 164 relates to the sections regarding new homes. This will need to be taken in conjunction with policy SD1 of the Herefordshire Core Strategy[12] (see below).

> *Paragraph 167. Local planning authorities should also give significant weight to the need to support energy efficiency and low carbon heating improvements to existing buildings, both domestic and non-domestic (including through installation of heat pumps and solar panels where these do not already benefit from permitted development rights). Where the proposals would affect conservation areas, listed buildings or other relevant designated heritage assets, local planning authorities should also apply the policies set out in chapter 16 of this Framework.*

Paragraph 167 provides the context to retrofitting, as this is supported in terms of planning policy and legislation, see below point regarding permitted development rights. N.B. Chapter 16 of the NPPF is conserving and enhancing the historic environment.

While there are multiple policies within the NPPF that can relate to retrofit, planning colleagues consider the paragraphs provided to be of the most relevance to the paper, as these touch upon the topics related to climate change.

Further policies can be found on sustainable practices for new homes; paragraph 164 provides the appropriate national policy for climate change adaptation.

- **Local Plan Policies**

[11] National Planning Policy Framework

[12] Herefordshire Core Strategy

Policy SD1[13] *– Sustainable design and energy efficiency - Development proposals should create safe, sustainable, well integrated environments for all members of the community. In conjunction with this, all development proposals should incorporate the following requirements:*

- *ensure that proposals make efficient use of land - taking into account the local context and site characteristics;*
- *new buildings should be designed to maintain local distinctiveness through incorporating local architectural detailing and materials and respecting scale, height, proportions and massing of surrounding development, while making a positive contribution to the architectural diversity and character of the area including, where appropriate, through innovative design;*
- *safeguard residential amenity for existing and proposed residents;*
- *ensure new development does not contribute to, or suffer from, adverse impacts arising from noise, light or air contamination, land instability or cause ground water pollution;*
- *where contaminated land is present, undertake appropriate remediation where it can be demonstrated that this will be effective;*
- *ensure that distinctive features of existing buildings and their setting are safeguarded and where appropriate, restored;*
- *utilise physical sustainability measures that include, in particular, orientation of buildings, the provision of water conservation measures, storage for bicycles and waste including provision for recycling, and enabling renewable energy and energy conservation infrastructure;*
- *where possible, on-site renewable energy generation should also be incorporated;*
- *create safe and accessible environments, and that minimise opportunities for crime and anti-social behaviour by incorporating Secured by Design principles, and consider the incorporation of fire safety measures;*
- *ensuring designs can be easily adapted and accommodate new technologies to meet changing needs throughout the lifetime of the development; and*
- *utilise sustainable construction methods which minimise the use of non-renewable resources and maximise the use of recycled and sustainably sourced materials;*

All planning applications including material changes of use, will be expected to demonstrate how the above design and energy efficiency considerations have been factored into the proposal from the outset.

Policy SD1 is a local policy focused on sustainable development and energy efficiency, primarily for new homes, but also applicable to certain retrofitting activities. It can be used for retrofitting when the work exceeds the limits for Permitted Development Rights or is for interior work that doesn't change the property's external appearance. In all cases, building regulations will apply.

[13] Herefordshire Core Strategy

Building Regulations

Tighter rules on energy efficiency and building regulations reflect the government's push towards Net Zero by 2050. The regulations look to reduce energy, waste, promote lower running costs, and improve indoor comfort. These lead to improvements for residents - Improved insulation and smarter energy systems mean lower bills and healthier living environments.

The following regulations support energy efficiency and were introduced in 2022 (subject to various updates) to support the UK's Net Zero target:

Part F – Ventilation

Part L – Conservation of Fuel & Power

Part O – Overheating

Part S – Infrastructure for the Charging of Electric Vehicles

Part R – Infrastructure for Electronic Communications

The transition from Building Regulations Part L Volume 1 (2021) to the Future Homes Standard (2025)[14] marks a significant step towards achieving the UK's net-zero carbon targets.

The government announced that they are aiming to publish The Future Homes Standard by Autumn 2025. There have been consultations on the standard and it is proposed that it will bring improvements for energy efficiency.

[14] The Future Homes and Buildings Standards: 2023 consultation - GOV.UK