Housing Alliance
More Social and Affordable Homes

A Guide on Innovative Solutions to Advancing Net-Zero Carbon in Social Housing

Prepared by SustainabilityWorks on behalf of The Housing Alliance
February 2026

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An Ghníomhaireacht Tithíochta
The Housing Agency

Final report on a Research Support Programme (RSP) project funded by the Housing Agency.

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The Housing Agency's purpose is to accelerate housing supply, in partnership with our key stakeholders, by providing our expertise, support and resources to deliver high-quality homes in vibrant communities. A strategic objective is to support stakeholders and policy makers by providing innovative thinking through evidence-based housing insights and data. In this vein, the Research Support Programme funds research projects which respond to key topical issues in housing and have the potential to impact on housing policy and practice. The views expressed in this report are those of the author and do not necessarily represent those of The Housing Agency.

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Foreword from the Housing Alliance Members

As Chairperson of the Housing Alliance, I am proud to introduce this Decarbonisation Guide—a landmark resource for members of the Housing Alliance, and indeed the wider social housing sector.

Climate change is no longer a distant threat; it is a lived reality for our residents, our communities, and our organisations. The Housing Alliance, representing seven of Ireland's largest Approved Housing Bodies (AHBs), recognises both the urgency of this moment and the opportunity it presents.

AHBs play a critical role in the provision of social and affordable homes across Ireland. In a time of growing societal challenges - from homelessness to climate change - AHBs sit at a vital intersection: delivering secure, quality housing while also demonstrating how the residential sector can lead the way in decarbonisation. Our sector is uniquely positioned to show how climate action and social impact can go hand in hand.

Decarbonisation is not solely about reducing emissions—it is about creating healthier homes, lowering energy costs, and building resilient communities. It is about ensuring our housing stock meets the needs of today while preparing for the challenges of tomorrow.

This guide reflects the collective wisdom and commitment of our sector. It is grounded in robust research, shaped by resident voices, and informed by the lived experience of AHBs across Ireland. It offers practical solutions, strategic insights, and a shared vision for a net-zero future.

Importantly, this guide builds on a strong foundation of collaboration between AHBs. It follows the 2023 report *Providing environmental leadership in social housing to advance Climate Action goals*, published by the Housing Alliance and supported by the Research Support Programme (RSP), funded by the Housing Agency. That report outlined nine key recommendations - many of which are already being implemented.

A central recommendation was the formation of the Climate Action Working Group, which has played a pivotal role in guiding the development of this guide. In partnership with the Irish Council for Social Housing (ICSH), the Working Group is also undertaking vital work to address the challenges of raising public finance for retrofits. Their efforts to identify and assess the full suite of potential solutions are commendable and essential to building a more sustainable future for the AHB sector.

The creation of this guide was itself a key recommendation of the 2023 report. We cannot overstate the level of collaboration required to produce a resource of this nature. I would like to sincerely thank all the AHBs, our residents, and key stakeholders who generously gave their time and insights. Their contributions are invaluable and will undoubtedly help steer the sector in the right direction. In particular, I would like to thank the ICSH for coordinating input from their members.

We invite housing bodies, policymakers, funders, and partners to join us in this journey. Together, we can lead the transformation of Ireland's social housing system—one home, one community, one innovation at a time.

Jim Miley

Chairperson, Housing Alliance

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respond building homes, improving lives

THE IVEAGH TRUST

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Executive Summary

Ireland's social housing sector is at a pivotal moment in its response to climate change. Approved Housing Bodies (AHBs), which manage over 67,000 homes, are uniquely placed to lead the transition to net-zero carbon housing. This guide provides a practical roadmap for AHBs to decarbonise their housing portfolios, drawing on policy analysis, sector surveys, resident insights, and technology reviews.

Why Decarbonisation Matters

The residential sector is responsible for 10.4% of Ireland's greenhouse gas (GHG) emissions (EPA). Climate change, energy poverty, and increasing regulatory pressure are converging to make decarbonisation an urgent priority.

Many AHB homes are ageing, inefficient, and have poor energy and carbon performance, resulting in higher emissions and energy costs for residents. This makes the sector a contributor to residential emissions but also a key stakeholder to make a positive contribution to reducing Ireland's GHG emissions, if retrofitting is implemented consistently and at scale.

Our recent engagement with 35 AHBs and nearly 3,000 residents shows strong motivation for change. Both groups are committed to doing the right thing - residents want healthier, warmer homes, and AHBs want to deliver sustainable housing. There is a clear appetite for change.

However, systemic challenges persist, including limited funding, skills gaps, fragmented delivery capacity, and the complexity of navigating retrofit and planning processes. These barriers can slow progress and increase costs if not addressed strategically.

Despite these barriers, AHBs are collaborating to share knowledge and align approaches, seeking to make decarbonisation easier and more cost-effective, such as by leveraging economies of scale in retrofit delivery, procurement, and innovation. This collective effort is a strength of the sector and must be sustained and supported to unlock the full social, environmental, and financial value of decarbonisation.

2,932 Housing Alliance residents participated in a survey to inform this report.

What This Guide Offers

This guide distils these efforts, offering clear explanations, practical solutions, and recommendations to guide the sector's next steps. It:

- Contains insights from over 2,900 residents and 35 AHBs, highlighting lived experience, readiness to act, and barriers to change.
- Provides clear explanations on the relationships between BER ratings and whole-life carbon, including embodied and operational emissions, and how an AHB can plan its decarbonisation journey.
- Is a comprehensive guide to existing and emerging low-carbon solutions across the housing value chain - from planning and materials to operations and end-of-life.
- Provides a summary of key findings, recommendations, and actions to guide the sector's next steps.

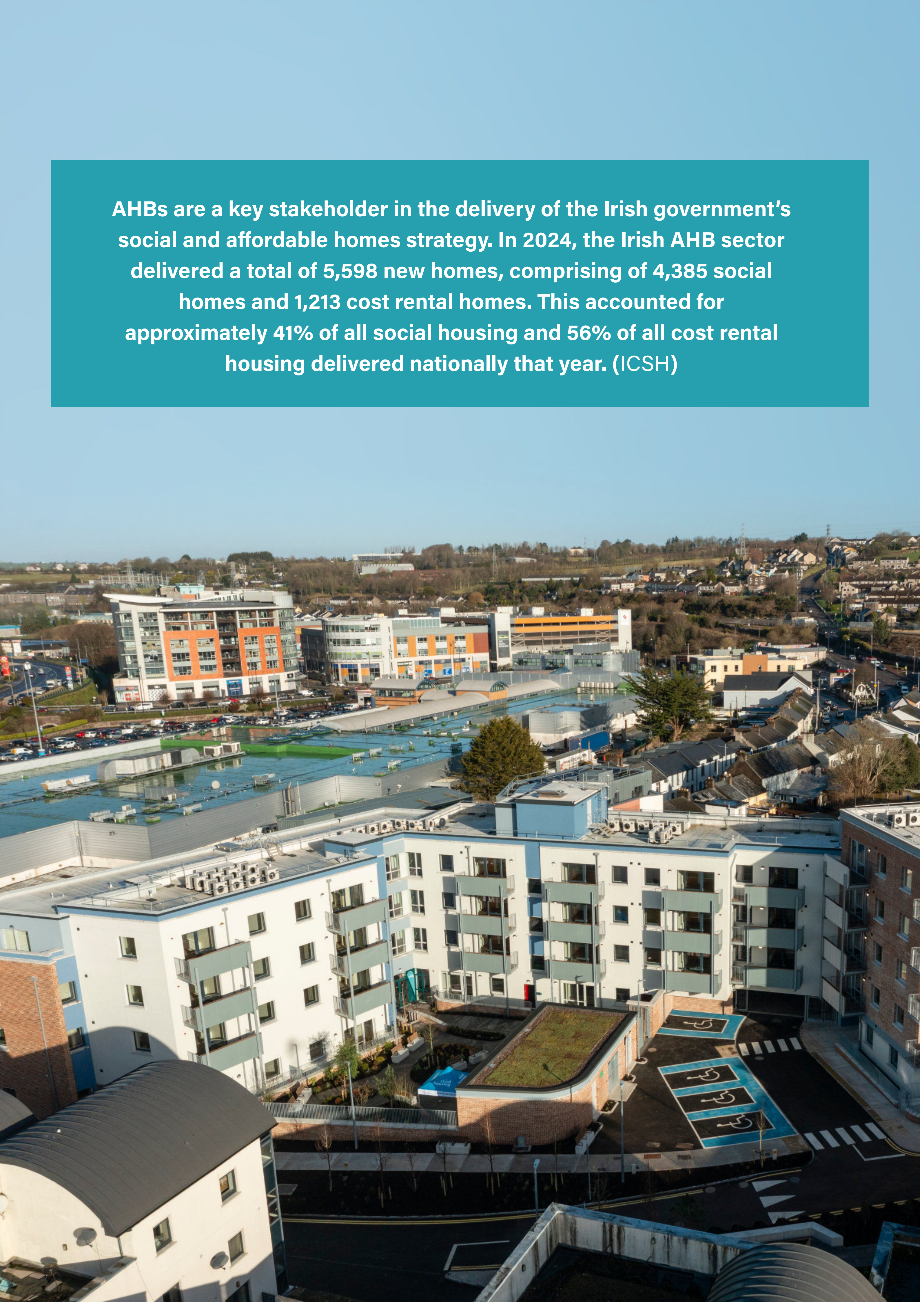
"Every small effort counts, like recycling, reducing waste, and using sustainable products. We can all make a difference together!"

- Resident

Key Recommendations for the Sector

Key findings	Recommendations	Actions
AHBs can lack structured retrofit and decarbonisation strategies that reflect binding EU and national decarbonisation targets.	Develop retrofit roadmaps aligned with the Energy Performance Building Directive (EPBD) 2024 and national targets.	➔ Develop Net Zero Whole Life Carbon Roadmap(s) for the Irish AHBs. ➔ Align with EPBD 2024 targets and national retrofit goals. ➔ Prioritise homes with poor energy performance and vulnerable residents.
Access to funding is fragmented and an administrative burden. Very often the grant funding available does not cover the full cost of the retrofit work to be completed.	Advocate for simplified, consolidated grant schemes tailored to AHBs.	➔ Introduce a "finance passport" model to support lifecycle funding. ➔ Increase grant levels to at least 90% for viability.
There is a sector-wide skills gap in retrofit planning and delivery, where some AHBs may lack technical expertise and contractor shortages further hinder implementation.	Build skills and technical capacity across the sector.	➔ Invest in carbon literacy and retrofit training across all staff levels. ➔ Support contractor upskilling and workforce planning. ➔ Create shared technical support hubs accessible to all AHBs.
Environment, Social and Governance (ESG) and climate considerations are not consistently embedded in governance, procurement, and asset management.	Embed ESG and climate governance into operations.	➔ Formalise environmental plans and the management of carbon. ➔ Continue to integrate decarbonisation and broader sustainability considerations into procurement, asset management, and board oversight.
Residents are keen to be involved in solutions; while cost-of-living is their main concern, climate change also matters to them, and they want to play an active role.	Elevate resident voice and wellbeing into retrofit programmes.	➔ Engage residents throughout the retrofit programme. ➔ Share resident training programmes across AHBs, including training on how to reduce personal carbon footprints, and so avoid duplicating programmes. ➔ Support community-led sustainability initiatives.
Innovation is rarely tested in real-world settings, and pilot data is not consistently shared to guide policy and funding.	Pilot innovation through living labs.	➔ Trial technologies and engagement models in real-world settings. ➔ Use data to inform policy, funding bids, and sector-wide learning.
Collaboration among AHBs, government, and funders should build on existing progress to unlock opportunities for shared procurement, planning, and delivery.	Coordinate sector-wide action.	➔ Establish shared frameworks for procurement, planning, and delivery. ➔ Foster collaboration across AHBs, government, and supply chains. ➔ Leverage collective scale to unlock funding and innovation.

AHBs are a key stakeholder in the delivery of the Irish government's social and affordable homes strategy. In 2024, the Irish AHB sector delivered a total of 5,598 new homes, comprising of 4,385 social homes and 1,213 cost rental homes. This accounted for approximately 41% of all social housing and 56% of all cost rental housing delivered nationally that year. (ICSH)



1. Introduction: A Call to Action for Housing Bodies

Approved Housing Bodies (AHBs) face increasing pressure to decarbonise both existing and new housing stock. This is driven by regulatory requirements, climate risks, resident expectations, and operational challenges.

1.1 The policy context

The Irish Government has set **legally binding targets** under the ***Climate Action and Low Carbon Development (Amendment) Act 2021*** (Gov), which are 51% reduction in greenhouse gas (GHG) emissions by 2030 (compared to 2018 levels) and achieve climate neutrality by 2050 (GovIrl). The built environment accounts for 37% of Ireland's total emissions (IGBC), with the residential sector alone responsible for 10.4% (EPA).

The recast Energy Performance of Buildings Directive (EPBD) will add further urgency and complexity. Many additional AHB homes may fall into the worst-performing 15% of the residential stock that will need to be tackled under the directive's Minimum Energy Performance Standards (MEPS). Section 3.2 provides more detail on the implications of (EPBD 2024).

The decarbonisation of buildings is the process of reducing and ultimately eliminating GHG emissions from both the operation (heating, cooling, lighting) and construction/renovation (embodied carbon) of buildings, with regulations such as recast EPBD aiming for full decarbonisation of buildings by 2050.

Part L of the Building Regulations already incorporates EPBD requirements for Nearly Zero Energy Buildings (NZEB) for new dwellings, so all new homes constructed for or by AHBs are built to NZEB standards, or a BER of A2 or higher.

Importantly, under the recast EPBD (Gov), embodied carbon - the carbon emissions associated with the production, transport, and installation of building materials - is now a recognised factor in the EU's strategy to decarbonise the building sector, including the residential sector.

According to the CSO's 2024 Domestic BER data, 69% of Irish homes have a BER of C or lower (CSO), highlighting the scale of the retrofit challenge. In response, the Irish Government has set ambitious targets of 500,000 homes being retrofitted to BER B2 or equivalent, and 400,000 homes using heat pumps by 2030. This ambition is central to the National Retrofit Plan, which underpins both the Climate Action Plan and the recently published Delivering Homes, Building Communities 2025-2030 Action Plan (Gov).

1.2 AHBs and the Pathway to the Decarbonisation of Social Homes

For AHBs, this means they now have a period of time to explore a range of approaches and technologies that will help them plan a decarbonisation pathway for their existing stock and develop new homes in ways that align with this ambition.

Ireland's 436 (*AHBRA, accessed Sept 2025) AHBs own and manage approximately 67,000 properties, with the Housing Alliance, a collaboration of seven of Ireland's largest AHBs – Clúid, Circle Voluntary Housing, Co-operative Housing Ireland, Oaklee, Respond, Tuath Housing, and The Iveagh Trust – owning and managing close to 68% of these properties.

In our recent survey of Irish AHBs, where 35 AHBs representing 73% of the total AHB portfolio responded, it was determined that 67% of homes surveyed achieved a BER rating of B3 or higher. In contrast, 33% were rated C1 or lower or had no BER data available. In practical terms, this means that an estimated 21,450 properties will need to be retrofitted.

Within the AHB sector, some have already started work and made considerable progress, challenging themselves to decarbonise, but there are many challenges to do so systemically and at scale. These challenges are highlighted throughout this report and include a lack of funding as well as technical issues in trying to retrofit complex building types, such as multi-unit development (MUD) and apartments.

Decarbonisation is not solely a social and environmental imperative - it is a massive value-creation opportunity. AHBs that embrace decarbonisation will build resilient portfolios, innovate in design and delivery, comply with legislation, and ensure their relevance for decades to come. Other socio-economic benefits include:

- Reduce energy poverty, increase resident comfort, contentment and stability, while also contributing to improved public health.
- Future-proof housing assets against rising energy costs and regulatory pressures.
- Create jobs and stimulate local economies.
- Enhance energy security and climate resilience.

The case for action could not be clearer. But where should housing bodies start? Where can the greatest impact be had? Which technologies and funding models can be deployed? How can housing organisations collaborate to accelerate change?

1.3 Research Project

The Housing Alliance, part-funded through the Housing Agency's Research Support Programme, engaged SustainabilityWorks to research and author a guide that could guide AHBs on their decarbonisation journey.

The objectives of this as a research project are to:

- Understand what motivates AHBs to decarbonise, including regulatory, financial, and operational drivers.
- Identify emerging technologies and methods that support low-carbon housing delivery.
- Produce a guide that provides information on approaches and solutions to decarbonise that are relevant to the needs of the AHB sector.

This guide is grounded in a three-phase research process designed to explore how AHBs can reduce the carbon footprint of both their existing and new housing stock - and to identify practical, scalable solutions to support that journey.

Phase 1 – Desk Research

This phase examined the key drivers of decarbonisation in social housing, including policy, financial, and regulatory influences shaping the net-zero agenda. It also reviewed Irish and international climate technologies, including modern methods of construction, and identified real-world case studies where these solutions have been applied in social housing contexts.

Phase 2 – Stakeholder Engagement

We engaged directly with the sector through two targeted surveys:

- One survey captured the views of AHBs on their current decarbonisation efforts, challenges, and opportunities for quick wins.
- A second survey gathered insights from AHB residents to understand their perspectives and lived experiences.

There was follow up engagement with Housing Alliance members to refine the content of this publication.

In addition, a draft version of this report was shared with sector thought leaders to gather structured feedback on whether the findings and recommendations are relevant, practical, and aligned with sector needs. The following organisations contributed their insights to the report: Cairn Homes, Dublin City Council, Glenveagh, the Irish Council for Social Housing, KSN, Philip Comerford Architect, REIL and the Sustainable Energy Authority of Ireland – across multiple engagements.

Phase 3 – Guide Development

Insights from the research were synthesised into this guide, co-developed by the research team and the Housing Alliance. The final version has been designed to be accessible, informative, and action-oriented - supporting AHBs in planning and delivering their decarbonisation strategies.

1.4 Purpose of this Guide

There is no shortage of voices warning of the climate crisis or the role that different sectors, such as residential, can play to support decarbonisation. While we agree that the case for urgent transformation must be made loud and clear, the purpose of this guide is to help housing bodies move toward practical, actionable solutions that drive real impact.

The guide is grounded in research which focuses on the sustainability of Irish social housing from a climate resilience perspective by considering current and emerging solutions to reduce carbon emissions in social housing. It acts on a recommendation of a previous research project, part-funded by the Housing Agency, which culminated in the publication, Providing environmental leadership in social housing to advance Climate Action goals.

This offers a roadmap - rooted in policy, data and lived experience - to help housing bodies lead the transition to net-zero.

This is not a report on the state of decarbonisation in housing. **It is a set of solutions**.

1.5 How to use this Guide

This guide can be read sequentially, but it doesn't need to be. It begins with an overview of the urgent need for change, the challenges faced by AHBs in decarbonising, and the opportunities available to the sector for decarbonisation and long-term value creation.

It then moves into "Where to Start", offering practical entry points for decarbonising the AHB value chain. This chapter includes simple rules of thumb for each intervention - covering potential carbon impact, investment cost, timeline, and complexity - to help AHBs prioritise action.

The "Technology Spotlight" section outlines a menu of technological solutions that AHBs can consider when developing their decarbonisation roadmaps. These options are not one-size-fits-all; some will be more relevant to certain organisations than others, depending on scale, location, and resident needs.

Importantly, this guide builds on extensive technical research already available. It does not attempt to re-quantify the carbon impact of technologies. Instead, it focuses on helping AHBs understand how the pieces fit together - especially for those at the early stages of their decarbonisation journey.

Throughout the guide, you'll find insights from resident and AHB engagement surveys — both statistics and direct quotes — highlighting why retrofit and decarbonisation are essential to building resilient, sustainable communities.

Additional features include:

- Case studies and lived experience to illustrate what works in practice.
- Structured summaries to help navigate complexity quickly.
- Links to further resources for those ready to go deeper.

In 2024, emissions from the residential sector in Ireland were 5.61 Mt CO_2eq, making up 10.4% of the country's total GHG emissions.

2. Drivers for Change

2.1 Introduction: A World at a Crossroads

We are living in a time of profound global transformation. Climate change, energy insecurity, and social inequality are no longer distant or abstract concerns - they are immediate, measurable, and deeply interconnected challenges that affect every aspect of our lives.

Globally, 2024 was the hottest year on record, with extreme weather events becoming more frequent and severe. Ireland was not spared: 2024 was the fourth warmest year ever recorded in the country, and spring was the sixth wettest on record. Storms like Éowyn, Darragh, and Isha brought hurricane-force winds, widespread flooding, and significant damage to homes, infrastructure, and agriculture. Storm Éowyn alone left 768,000 premises without power, over 200,000 without water, and more than one million people without broadband or phone coverage (CCAC, 2025).

At the same time, Irish households are grappling with the rising cost of living, particularly in relation to energy. Although wholesale energy prices have fallen significantly since the peak of the 2022 energy crisis, they remain volatile and are still well above pre-crisis levels. Notably, prices in April 2025 were 25.6% higher than in April 2024, reflecting ongoing year-on-year increases (CSO). This increase has placed a disproportionate burden on low-income households. Many residents often face the dual challenge of energy poverty (struggling to heat their homes) and climate vulnerability (as older buildings are less resilient to extreme weather).

The agricultural sector is the largest contributor to Ireland's overall GHG emissions at 38% of the total, with the transport sector the second largest contributor at 21.7%. The residential sector contributes 10.4% (EPA). GHG emissions are now 3.3% below 1990 levels, marking the first time in over 30 years that Ireland has dropped below its historical baseline (EPA).

However, per capita GHG emissions are on average 11.9 tonnes CO_2eq/person, and the EPA indicate that "per capita" emissions need to reduce ..to meet reduction targets," given that Ireland's population is projected to increase by over 1 million people by 2050. The Central Statistics Office (CSO) indicated that household GHG emissions were 23% of total GHG emissions in 2022, compared with 31% in 2010. The figure of 23% comprises of 41% from heating, 36% from transport and 21% from electricity use (CSO).

Social inequality compounds these environmental challenges. Vulnerable groups - such as those in social housing, rural communities, and the elderly - are often the least equipped to adapt to climate impacts, yet they are among the most affected. Without targeted support, the transition to a low-carbon economy risks leaving many behind.

These crises are not isolated - they are deeply intertwined. Climate action that fails to consider social equity risks deepening injustice, while efforts to reduce inequality must also address environmental sustainability. The path forward demands integrated, inclusive, and urgent action.

This report explores the practicalities of how AHBs, in collaboration with key stakeholders can play their part.

2.2 The Role of the Built Environment in Addressing Environmental and Social Challenges

The built environment, and especially the residential sector, sits at the heart of both the climate crisis and the social inequality landscape. Homes are not just places of shelter - they are central to our health, well-being, energy use, and environmental footprint. As such, they represent both a significant challenge and a powerful opportunity for transformative change.

2.3 Carbon Impact of Residential Buildings

Residential buildings are a significant source of greenhouse gas (GHG) emissions in Ireland, accounting for approximately 10.4% of total emissions (EPA). This makes the sector a critical focus for climate action. These emissions stem from operational energy use, driven by fossil-fuel heating systems and inadequate insulation - particularly in older homes that fall short of modern energy efficiency standards. According to EPA data, residential emissions increased by about 4.9% in 2024 compared to 2023, reversing the reductions seen in 2022 and 2023. Those earlier declines were largely weather-related (milder winters) and influenced by high energy costs, rather than structural improvements.

While Ireland's greenhouse gas inventory, based on the Intergovernmental Panel on Climate Change (IPCC) guidelines, focuses on operational emissions, there is growing recognition of the importance of embodied carbon - emissions from the production, transport, and installation of building materials, as well as construction and demolition. The EPBD 2024 now encourages countries to address embodied carbon in regulations, marking a shift towards whole-life carbon accounting.

Improving the energy performance of existing homes through retrofitting, insulation, and the adoption of renewable heating systems (such as heat pumps) is essential if Ireland is to meet its climate targets. Without decisive action, the country risks falling short of its legally binding commitments under the EU Effort Sharing Regulation (EPA).

2.4 Energy Affordability and Social Equity

The recent energy crisis has highlighted deep inequalities in how households experience rising costs. In 2025, energy prices are expected to remain high, with VAT on energy set to rise from 9% to 13.5%, adding approximately €70 to annual electricity bills (GovIrl). For social housing residents, who often live in older, less efficient buildings, this means higher energy costs and a greater risk of energy poverty.

Energy poverty is not only an economic issue but also a public health concern. Cold, damp, and poorly ventilated homes contribute to respiratory illnesses and other health challenges. Addressing these issues through targeted investment in the residential sector is not only environmentally responsible but socially just.

"I would like to learn about sustainable changes that can be made in the home. An online resource for simple methods or local projects/ events would be helpful."

- Resident

2.5 Why Action Is Urgent and Necessary

While new homes are built to high energy standards, the priority must be upgrading older housing stock. **Retrofitting is not just a climate imperative - it is a strategic necessity**. Inaction exposes AHBs to reputational risks, regulatory non-compliance, and undermines resident wellbeing through fuel poverty and poor living conditions.

Long-term risks include homes becoming **stranded assets** - homes that fail to meet future energy or emissions standards may become costly to maintain and difficult to upgrade with reduced access to funding. **Climate resilience is also crucial**, as homes must be able to withstand more frequent storms, floods, and heatwaves. Retrofitting can significantly reduce emissions, helping Ireland achieve its 2030 and 2050 climate goals, while **ensuring that vulnerable households are not left behind in the transition**.

The **residential sector is uniquely positioned to deliver benefits across climate, health, and social equity**. Achieving this **will require coordinated action** among government, housing bodies, and communities to scale up retrofitting, improve standards, and **ensure no one is left behind**.

3. Value-Creating Opportunities for AHBs in Housing Decarbonisation

Decarbonisation offers both significant opportunities and real challenges for the AHB sector. As AHBs work to meet national climate targets and improve the energy efficiency of their housing stock, they face barriers such as limited funding, skills shortages, and the high cost of upgrading older homes.

The 2025 AHB climate and carbon survey conducted as part of this research highlights these pain points, underscoring the urgent need for coordinated support, strategic planning, and investment to enable a just and effective transition to net zero.

Despite these challenges, taking action now allows AHBs to become more resilient and future-ready, strengthening their position in a sector where sustainability, resident wellbeing, and regulatory compliance are increasingly linked.

Decarbonisation is not just about meeting regulations - it is a strategic opportunity to protect assets, improve resident outcomes, and unlock new sources of value. As the policy, funding, and social environment shift rapidly toward climate action, AHBs that act now will be best placed to deliver long-term impact.

We see opportunities for value creation in six key areas:

Figure 1: The value-creating opportunities for AHBs in housing decarbonisation

3.1 Financial Efficiency and Funding Access

Retrofitting is not just a cost - it's a long-term investment that reduces running costs and improves asset value. However, AHBs, as non-profit organisations, operate within a funding model that currently does not account for the costs of retrofits. This creates a structural barrier to action, leaving the sector heavily dependent on grant funding to progress energy upgrades and climate actions.

3.1.1 Funding and Financial Constraints

Financial barriers are the biggest challenge for AHBs. According to the 2025 climate and carbon survey:

- **63% of organisations** ranked finance as the main obstacle to achieving a BER B2 rating.
- **73% of respondents** identified reduced operational margins and increased borrowing as the main financial impacts of investing in net-zero carbon measures (see Figure 2).

Reduced margins limit AHBs' ability to fund essential services like tenancy support and maintenance. Other financial effects, such as delayed investment in new housing, stock rationalisation, or increased capitalisation, also present barriers.

Survey responses shared estimates suggesting that upgrading a home to BER B2 costs between **€30,000** and **€50,000 per unit**. Recent ESRI data confirms that bringing a G-rated property to B costs about **€43,000**, while upgrading a C-rated property costs just under **€30,000** (ESRI). Additionally, if the property has solid wall construction using hollow concrete blocks, retrofit costs could increase by around €10,000 per unit, according to SEAI data. The cost of deep retrofits is significant for AHBs.

To help AHBs accurately assess the scale of the retrofit challenge, it is important to prioritise knowledge sharing across the sector. Leveraging economies of scale can also be beneficial, especially since many of these homes are located together in estates.

There is a need for greater understanding of retrofit costs across the sector, and for experienced AHBs to share their knowledge with those starting their decarbonisation journey. **Strategic partnerships and clear funding pathways are essential to help AHBs plan and deliver retrofits without compromising core services.**

For a summary overview of how AHBs are funded, see the 2023 report, Providing environmental leadership in social housing to advance Climate Action goals, by SustainabilityWorks on behalf of the Housing Alliance and funded by the Housing Agency. For a more detailed version, please go to the 2023 report, Building on Success, A Financial Roadmap for the AHB Sector, by the Irish Council for Social Housing. A summary of the financial constraints is set out in Appendix I.

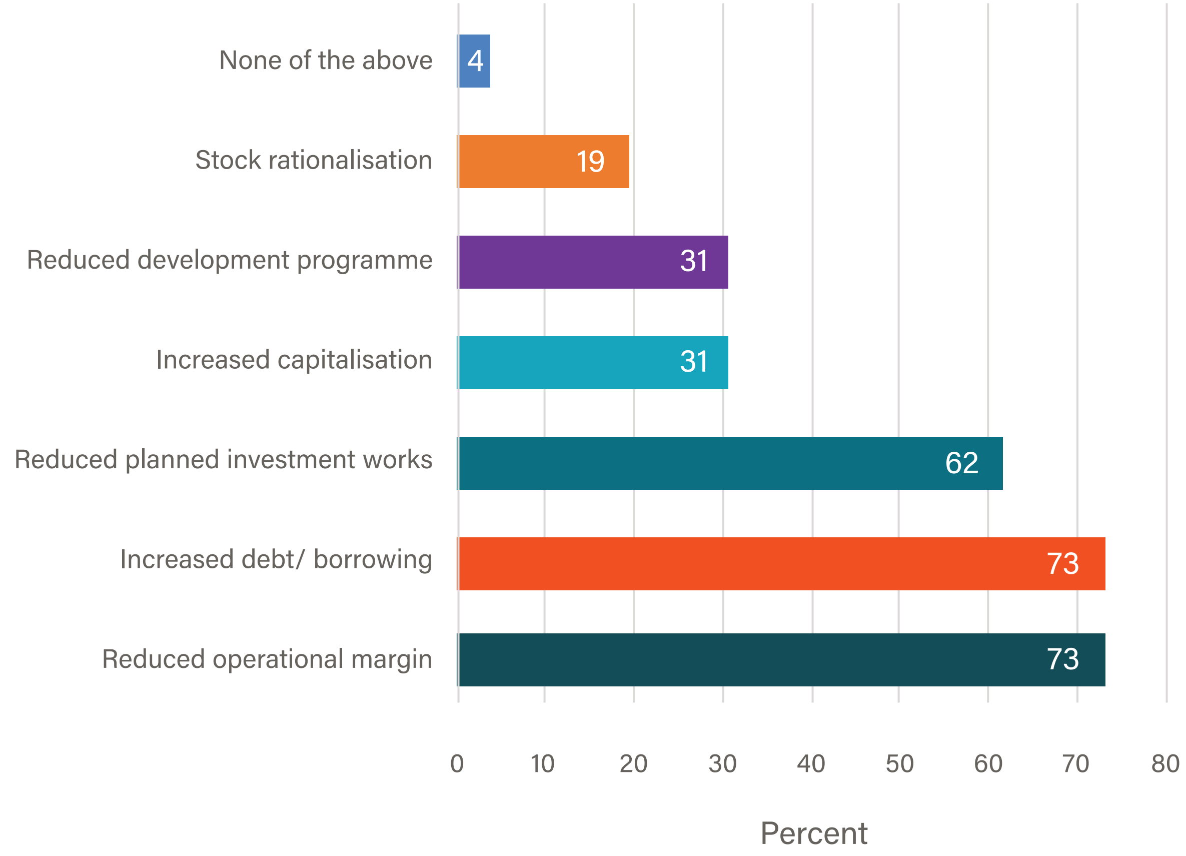


Figure 2: How the cost of decarbonising an AHB's housing portfolio will affect its overall financial position.

Despite this challenge, there are value creating opportunities to reduce financial exposure and improve asset performance by leveraging available supports and exploring innovative financing mechanisms where feasible.

3.1.2 Access to Grants and Incentives

Currently, the sector's funding model does not account for retrofit costs, leaving AHBs heavily reliant on grant funding.

- **71% of AHBs** surveyed said grants are essential for retrofits.
- **51% have accessed SEAI grants**, but **23% have not yet applied**, often due to limited capacity in smaller organisations.

AHBs can access public funding through schemes like SEAI's National Retrofit Scheme, including One-Stop-Shop supports for deep energy upgrades. It can also leverage support under the Energy Efficiency Obligation Scheme (EEOS) partnerships with obligated energy suppliers, which fund retrofit works in exchange for energy savings credits.

3.1.3 The Split Incentive

Only **9% of AHBs see the split incentive** - where residents benefit most from energy savings - **as a barrier to retrofit.**

Retrofitting homes means upgrading with energy-efficient technologies and materials to achieve a higher BER rating, such as B2 or above. These improvements enhance comfort and lower energy costs, primarily benefiting residents — a dynamic known as the split incentive. However, as not-for-profit organisations, AHBs are committed to providing secure, quality housing and supporting vulnerable groups. Retrofitting aligns with their mission by reducing energy poverty, improving resident wellbeing, and ensuring compliance with climate and regulatory standards.

3.1.4 Lower Maintenance and Improved Durability

Proactive energy-efficient upgrades mean homes need less reactive maintenance, less emergency repairs and less 'distressed' decisions. They are also more resilient to damp and mould and structural degradation, reducing long-term capital expenditure. However, these benefits depend on residents being trained to use new systems effectively, highlighting the importance of pairing retrofits with education and support.

3.1.5 Asset Value Protection and Risk Mitigation

Homes with poor BER ratings (E, F, G) risk becoming 'stranded assets' under new standards like EPBD 2024, particularly if Minimum Energy Performance Standards (MEPS) are mandated. Retrofitting protects long-term asset value, ensures compliance, and avoiding costly last-minute upgrades. It also reduces exposure to energy price volatility, which disproportionately affects low-income residents and can lead to arrears.

3.1.6 Green Finance and Investment Readiness

AHBs with clear decarbonisation strategies are better placed to secure green finance, such as sustainable bonds and loans. That said, Irish AHBs are constrained in their capacity to repay such loans under the current financing models.

Unlike many of their UK and European peers, Irish AHBs tend to rely on existing debt based mechanisms such as the Capital Advance Leasing Facility (CALF) – which offers up to 30% of capital costs as a long-term loan - and the Housing Finance Agency, which typically provides the remaining 70% for new delivery. Integrating retrofit ambitions into these funding models will be key to unlocking scale. For futher information on AHB funding models, please see Appendix I.

It is essential that those who support the AHB sector - whether through policy, funding, or programme design - recognise the financial constraints AHBs face. Support must include enabling strategic partnerships that help unlock funding pathways, clarify retrofit costs, and provide the long-term certainty needed for AHBs to plan and deliver decarbonisation without compromising core services.

3.2 Regulatory Readiness

Regulatory readiness is essential for AHBs as Ireland moves towards low-carbon housing. Early action helps ensure compliance with new standards, particularly the Minimum Energy Performance Standards (MEPS) set out in the Energy Performance of Buildings Directive (EPBD 2024). However, 23% of AHBs that responded to the carbon and climate survey cited lack of clarity on retrofit and decarbonisation standards as the third most significant constraint.

AHBs are already subject to regulations such as Part L of the Building Regulations, which require high energy performance in new builds and major renovations. These rules align with Ireland's national climate commitments including the EPBD 2018, which mandate Nearly Zero Energy Building (nZEB) standards.

3.2.1 National Climate Commitments and Retrofit Targets

Ireland's legally binding commitment to achieve net-zero GHG emissions by 2050, with a 51% reduction by 2030, is enshrined in the Climate Action and Low Carbon Development (Amendment) Act 2021 (GovIrl). The residential sector accounts for 10.4% of national emissions, making housing retrofits a central part of the strategy. National targets set out in the National Retrofit Plan, 2021 (GovIrl), supported by the Climate Action Plan 2025 (GovIrl) include:

- Retrofitting 500,000 homes to a B2 BER rating by 2030.
- Installing 600,000 heat pumps, prioritising homes reliant on fossil fuels.
- Expanding access to community energy schemes and local retrofit supports.

AHBs, as stewards of over 67,000 homes across Ireland, are well placed to support these goals. Around 21,450 AHB homes with BER C3 or lower will require upgrades to meet national and EU standards.

3.2.2 EU Directives: The EPBD 2024 and Its Implications

The revised Energy Performance of Buildings Directive (EPBD), adopted in May 2024, is a major update to EU building regulations, aiming for a zero-emission building stock by 2050. For AHBs, the directive introduces several important requirements:

Minimum Energy Performance Standards (MEPS): By 2030, the worst-performing 15% of buildings must be renovated, with priority given to homes rated E, F, or G, especially those housing vulnerable residents.

Zero-Emission Building (ZEB) Standards: All new buildings must meet zero-emission requirements by 2030, with an earlier deadline of 2028 applying to buildings owned by public bodies (Article 7). ZEBs are defined by very high energy performance and full reliance on renewable energy, with no fossil fuel emissions on-site. While social housing isn't explicitly mentioned, it likely falls under public buildings owned by entities such as local authorities. Ireland is currently transposing the directive, so detailed timelines and applicability are still being clarified. That said, AHBs will likely be expected to meet the zero-emission requirements by 2030.

Focus on Vulnerable Households: The directive requires that financial incentives and policy measures prioritise social housing, energy-poor households, and vulnerable groups. It also calls for safeguards against displacement, such as rent caps post-renovation (Article 17 (17) of EPBD 2024).

BER Disclosure and Transparency: The EPBD strengthens existing BER regulations by requiring mandatory BER disclosure in all rental contracts and tenancy agreements, as well as digital building logbooks to track BER history, renovation works, and energy usage.

Whole Life Carbon Assessments: From 2030, all new residential buildings must undergo assessments covering both operational and embodied emissions, ensuring full lifecycle accountability.

District-Level Renovation: The directive encourages integrated neighbourhood-scale retrofits to maximise cost-effectiveness and impact. AHBs managing grouped housing schemes are well-positioned to lead these efforts.

Technical Assistance: Member States must provide tailored support services, such as One-Stop Shops, to help social housing providers plan and fund retrofits.

The Irish government is currently working on how best to implement EPBD 2024, and specific details for AHBs are still being finalised.

However, it is likely that AHBs will be expected to meet these new standards by 2030.

To comply, AHBs will need to:

- Complete BER assessments and property audits.
- Develop retrofit roadmaps aligned with MEPS and ZEB targets.
- Engage residents early to minimise disruption.
- Leverage funding from SEAI and other sources.
- Collaborate with other providers for district-scale solutions.

3.2.3 Reputational and Compliance Drivers

AHBs must comply with Approved Housing Body Regulatory Authority (AHBRA) standards on asset management, tenancy management, and finance. At the same time, increasing regulatory pressure - including the Residential Tenancies (Amendment) Act 2021 and enhanced BER disclosure requirements under the EPBD - means that inaction risks non-compliance and reputational damage. Residents are also becoming more aware of sustainability and housing quality, raising expectations for AHB performance.

There are currently no retrofit or decarbonisation standards tailored to the AHB sector. As regulations evolve, AHBs must act proactively - but without clear guidance, they face complex technical decisions and compliance uncertainty. Aligning with emerging standards will future-proof housing stock and support the delivery of sustainable homes. Regulatory readiness enables AHBs to plan strategically, manage risk, and lead confidently in Ireland's decarbonisation journey.

3.3 Risk Mitigation and Compliance

Decarbonisation is both a climate imperative and a strategic risk management tool for AHBs. By upgrading housing stock and embedding sustainability into operations, AHBs can mitigate systemic, operational, and financial risks. However, technical challenges continue to limit the sector's ability to fully realise retrofit and decarbonisation benefits.

3.3.1 Energy and Affordability Risks

Energy price volatility remains a significant threat to resident wellbeing and organisational stability. Homes with poor energy performance expose residents to higher heating costs, increasing the risk of arrears and tenancy breakdown. Retrofitting to higher BER standards reduces this exposure, supporting more stable tenancies and predictable operating costs.

3.3.2 Regulatory and Asset Risks

Homes rated E–G on the BER scale risk becoming 'stranded assets' under forthcoming Minimum Energy Performance Standards (MEPS). Delaying upgrades to improve energy performance could lead to costly emergency retrofits. In addition, homes with low BERs may eventually fall short of the minimum standards required for sale, rent, or access to public funding. While there is currently no formal indication that public funding will be withdrawn, the risk grows as standards tighten, and homes continue to have poor BERs.

3.3.3 Physical Climate Risk

The built environment faces growing threats from flooding, overheating, and extreme weather. The EPA's National Climate Risk Assessment (EPA) highlights risks such as:

- **Flooding (BE03)**: Structural and water damage, mould, and electrical hazards.
- **Coastal risks (BE01)**: Sea level rise and erosion.
- **Heat (BE04)**: Overheating and material degradation.

Of the AHBs that responded to the climate and carbon survey, a small number have assessed these risks from the perspective of increasing exposure to property damage, insurance costs, resident displacement, and wider supply chain impacts. It is essential that AHBs complete climate risk assessments and put in plans in place to address any risks.

3.3.4 Supply Chain and Material Dependency

Ireland's reliance on imported construction materials, retrofit technologies and replacement parts, exposes AHBs to:

- **Global supply chain disruptions** - from pandemics or geopolitical instability - can delay access to key materials like insulation, heat pumps, and solar PV systems. This can stall retrofit timelines and increase project costs.
- **Price volatility** in key materials like insulation, timber, and heat pumps, as most materials are sourced internationally, leading to global commodity market pressures.
- **Limited domestic manufacturing** of low-carbon construction products restricts flexibility, extends lead times, and hampers responsiveness to policy or funding shifts – both from a risk and opportunity perspective.
- **Technology dependency** on proprietary or imported systems can create lock-in, reduce interoperability, limit resident choice, and complicate maintenance due to difficulties sourcing replacement parts.

This dependency creates uncertainty in procurement, budgeting, and delivery timelines. AHBs can mitigate these risks by:

- Prioritising circular and locally sourced materials where possible.
- Supporting the development of domestic supply chains through procurement strategies.
- Engage in framework agreements for goods/ services to improve cost certainty and delivery timelines.
- Exploring biobased products and modern methods of construction (MMC) that reduce reliance on imports and improve build efficiency.

By addressing these vulnerabilities, AHBs not only reduce their exposure to external shocks but also contribute to a more resilient and self-sufficient construction ecosystem in Ireland.

3.3.5 Technical challenges

37% of respondents to the climate and carbon survey cite technical limitations of existing housing stock as a major barrier to achieving BER B2.

AHBs gave insight into the practical difficulties they face – often when retrofitting older, listed, or complex building types - that make it difficult for them to decarbonise their housing stock:

Portfolio Characteristics

- ***Older Stock***: Many properties are 30–40 years old and require full retrofits.
- ***Newer Stock with Isolated Challenges***: Even newer portfolios face issues with apartments in mixed developments or protected structures.
- ***Listed and Protected Buildings***: Difficult and costly to retrofit due to heritage restrictions.
- ***Blending Old and New***: Challenges integrating modern materials and technologies with older building fabric.
- ***Apartments in Multi-Unit Developments (MUDs)***: MUDs experience a range of issues, including:
  - ***Pepper-potted ownership***: AHBs often own only one or a few units in a block, limiting control over retrofit decisions.
  - ***Owner Management Companies (OMCs)***: Lack of interest, funding, or coordination from OMCs hinders collective retrofit efforts.
  - ***Physical constraints***: Limited space, age of buildings, and shared infrastructure complicate upgrades like insulation or heat pumps.

Approximately 15% of AHB housing stock lacks BER data, often due to pre-2006 construction. For residents in place since before 2009, a BER is not required as long as the tenancy is continuous and the property is not being re-let or sold (Law Society). Regardless of these legal exemptions, this data gap underscores the need for improved BER data collection to better target supports and inform energy performance strategies.

This highlights the need for sector-specific guidance and support — ensuring that AHBs have access to practical, scalable solutions that reflect the realities of their housing stock and operational context.

3.4 Strategic Positioning

Decarbonisation presents AHBs with a strategic opportunity to enhance resilience, align with their social mission, and future-proof operations. Embedding sustainability across governance, operations, and culture strengthens credibility with funders and regulators, while building internal capacity to lead Ireland's housing sector through the climate transition.

Yet, structural and organisational challenges persist. Under the Housing for All plan, AHBs are central to delivering new social homes, reinforcing their core mission. In this context, retrofit is often viewed as a longer-term goal, competing with the urgent need to house people. Balancing these priorities is key to embedding climate action into the sector's delivery model rather than a parallel or postponed objective.

The 2025 climate and carbon survey we conducted received 35 responses, representing around 73% of the AHB housing stock - ensuring strong representation by dwelling count.

3.4.1 Strengthening Mission Alignment and ESG Governance

The survey shows that, while AHBs are advanced in social sustainability, environmental and carbon-related practices are developing:

- 17% of respondents to the survey have a formal environmental plan in place.
- Of the 35 AHBs that responded to the survey, three indicated that they had completed an organisational carbon footprint and four are in progress. Most are unfamiliar with the concept or not planning to undertake one.

This signals an opportunity to formalise environmental commitments, integrate ESG (Environmental, Social, Governance) principles into strategies, and position AHBs as leaders in climate-aligned social housing.

3.4.2 Building Internal Capacity and Skills

Organisational transformation requires investment in people and systems. The survey highlighted areas of strength in skills, while also revealing gaps:

- Carbon literacy is limited with 48% of respondents citing that non-technical staff have either no knowledge or only limited knowledge in this area. This lack of foundational understanding can hinder organisational buy-in and slow progress.
- Technical skills: 43% reported having advanced or practical technical skills to complete retrofit projects. The remainder indicated novice or no technical skills, highlighting a need for targeted upskilling - especially among AHBs that may not have dedicated sustainability staff.
- Financial planning: 46% reported practical or advanced financial skills to cost decarbonisation.
- Resident engagement: 46% have practical or advanced skills to support residents in adapting to retrofitted homes. This is a critical for successful retrofit programmes.
- While pockets of strong capability exist, some AHBs often lack dedicated sustainability staff.

AHBs are beginning to respond.

Some are investing in internal training, strategic recruitment, and collaboration with external experts.

Others are embedding sustainability into their organisational strategies or integrating ESG into procurement.

These efforts signal a shift toward more climate-literate, strategically-aligned organisations capable of delivering long-term impact. There is a clear sector-wide need for structured upskilling in carbon accounting, retrofit management, and climate literacy. Sharing knowledge and building capacity will be vital to achieving climate goals without compromising core services.

3.4.3 Strategic Positioning in the National Climate Agenda

AHBs manage a significant portion of Ireland's social housing. Their leadership in decarbonisation is essential to meeting national climate and energy targets. By aligning with policy, AHBs can:

- Secure access to strategic funding.
- Influence policy and programme design.
- Enhance their reputation as trusted delivery partners in climate and housing policy.

3.5 Resident Wellbeing and Social Impact

Empowering Change Through Resident Voices

Retrofitted homes offer greater comfort, improved indoor air quality, and better thermal performance - contributing to healthier living conditions and higher resident satisfaction. Providing residents with targeted training to enhance their energy literacy and understanding of new technologies, such as heat pumps and mechanical ventilation systems, empowers them to use these systems effectively. This not only reduces complaints and maintenance issues but also supports more efficient property management and long-term performance of retrofit measures.

3.5.1 Listening as a Catalyst for Action

The journey to decarbonise AHB housing must begin with those who live in it. The 2024 AHB Resident Survey, with 2,932 responses from Housing Alliance residents, located from across Ireland, reveals a powerful truth: residents are not only aware of the climate crisis - they are eager to be part of the solution. Their voices offer a roadmap for meaningful, people-centred decarbonisation. Over 140,000 people live in AHB owned or managed properties.

3.5.2 Residents Want to Live Sustainably — But Need Support

- **84% of residents expressed concern about climate change**
- **96% stating that energy efficiency in the home is important to them.**

The top motivations for energy-efficient homes are cost savings, improved quality of life , and environmental concern, at 34%, 19%, and 18%, respectively.

Some residents expressed dissatisfaction with the current state of their homes, citing poor insulation, energy-inefficient windows, and high heating bills. These issues were often linked to mould, damp, and health problems, reinforcing the need for retrofitting.

There is strong support among residents for retrofitting homes to higher BER standards, as they recognise the benefits of lower bills, healthier living conditions, and positive climate impact. However, deep retrofit projects often require residents to be temporarily relocated, which can present practical challenges.

While residents cannot directly undertake retrofits - this responsibility lies with the housing body - they are eager to see these projects move forward. Many do what they can within their control, such as purchasing energy-efficient appliances or adopting energy-saving habits, but financial constraints remain a significant barrier.

"Providing solar panels would greatly benefit energy efficiency and cost."

- Resident

3.5.3 Interest in Renewable Energy

30% of residents plan to switch to renewable energy providers, making it the most commonly planned sustainable action.

Residents also expressed interest in solar panels, microgeneration, and air-to-water systems, though some reported challenges with understanding or operating these systems effectively.

3.5.4 Energy Literacy and Training: An Opportunity

46% of residents feel they lack sufficient training to use their heating and ventilation systems effectively. This gap in knowledge leads to inefficient energy use, higher bills, and frustration.

87% of residents either believe they can save electricity or are open to the possibility.

Residents overwhelmingly prefer in-person training, supported by clear written guides and visual aids, underpinning the importance of the handover phase when new technologies have been installed.

"Upgrades to our homes should be made a priority to save on energy bills and reduce mould in the house. "

- Resident

3.5.5 Paying for Energy: Financial Realities and Systemic Barriers

Payment Methods and Cost Implications

The majority of residents have a **pre-pay meter installed - 30% use it for heating and 37% for electricity**. (see Figures 3 and 4). While pre-pay meters offer flexibility, they are typically more expensive, increasing the financial burden on households. Some residents pay their energy bills weekly, depending on when they have funds available, and a number stated that they are currently in arrears.

As of May 2025, approximately 301,000 households in Ireland were in arrears on their electricity bills, and an additional 175,000 domestic gas customers were also behind on payments, bringing the total number of households in energy arrears to around 476,000 (Irish Independent).

Financial Stress and Energy Insecurity

Residents frequently cited financial constraints as a barrier to sustainable living and energy efficiency. The reliance on pre-pay meters and irregular payments often results in higher overall costs, compounding the financial challenges faced by many households.

"I would like to see my AHB run awareness groups to encourage residents to be more energy and environmentally aware. Doing a workshop would be great. Also, more training on our air-to-water system would help residents be more energy efficient."

- Resident

How residents pay for heating bills

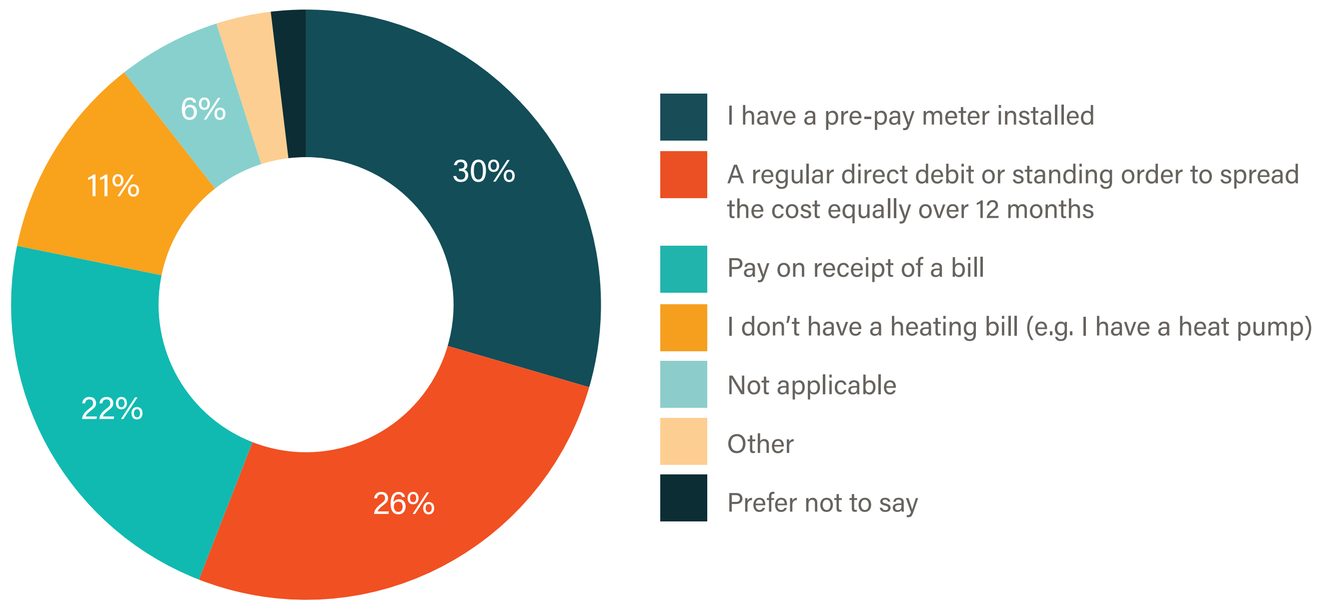


Figure 3: Snapshot of how Housing Alliance residents pay heating bills

How residents pay for electricity bills

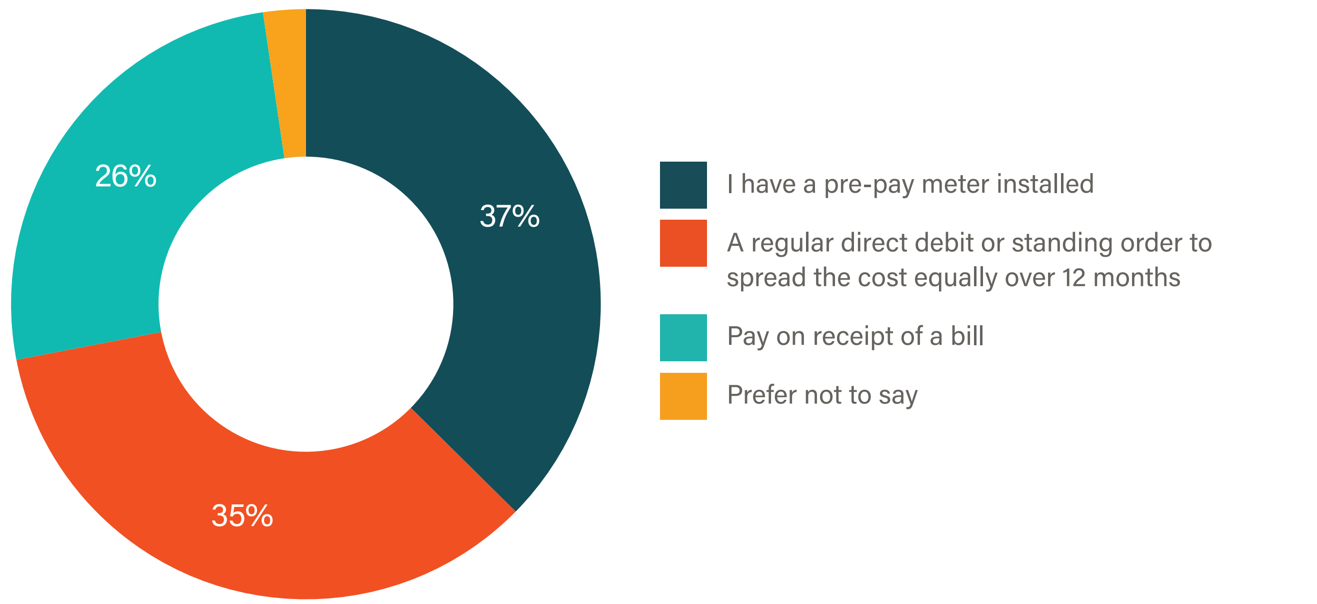


Figure 4: Snapshot of how Housing Alliance residents pay electricity bills

3.5.6 Everyday Actions, Extraordinary Potential

Residents are already taking steps to reduce their energy use:

83% dry clothes outside when possible.

71% unplug small appliances when not in use.

44% have invested in A-rated appliances, despite cost barriers.

These behaviours, and others shared in figure 5, show a readiness to act. What's needed now is structured support to scale these efforts.

3.5.7 Health, Comfort, and Dignity

Many residents linked poor insulation, inadequate ventilation, and outdated heating systems to health issues and discomfort. Decarbonisation is not just about carbon - it's about creating homes that are warm, safe, and healthy.

> **"My house and heating is perfect but my concern is the cost of the prepay meter."**
>
> **- Resident**

The Sustainable Practices Residents Have Already Adopted

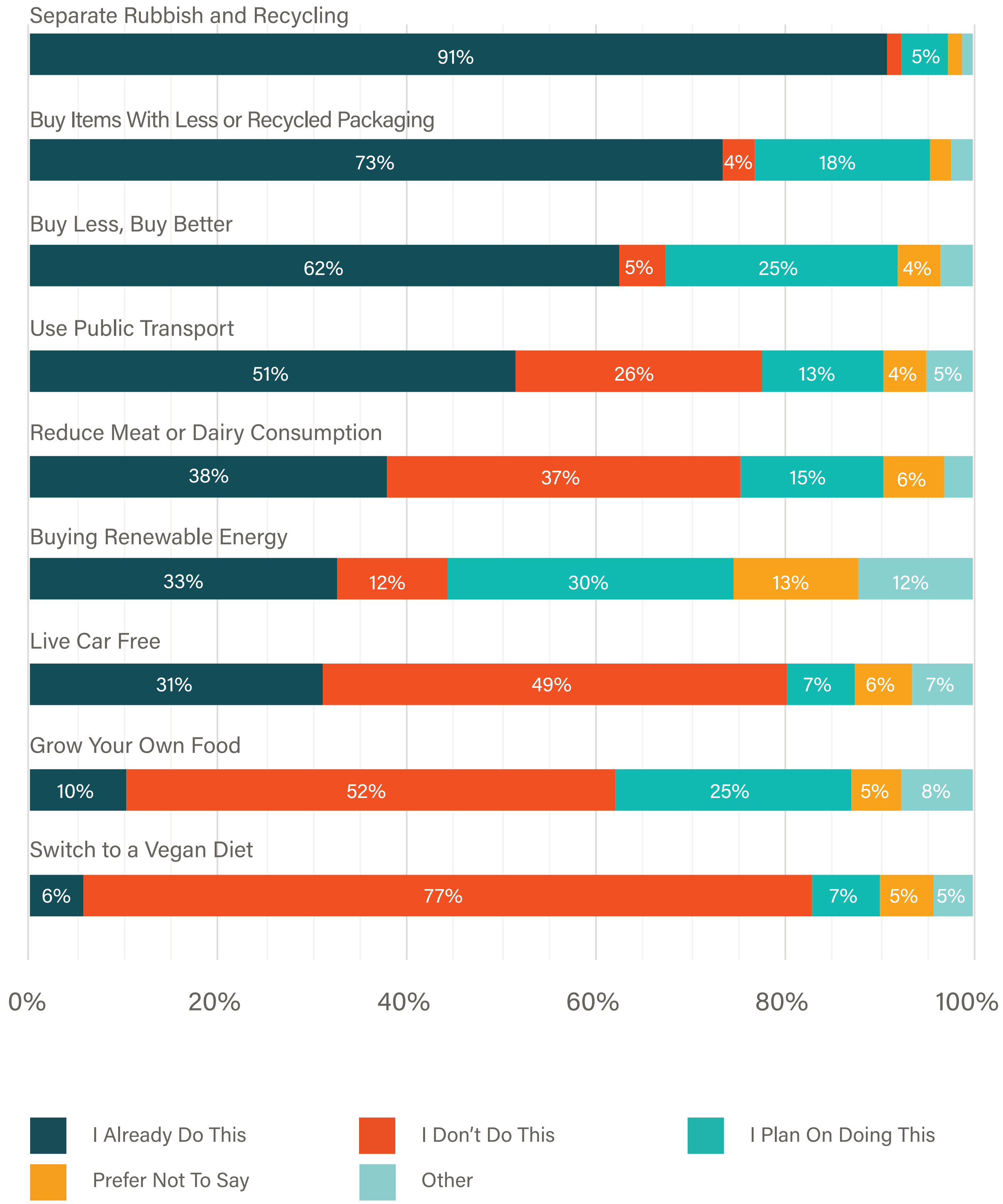


Figure 5: The sustainable practices residents have already adopted

3.5.8 Opportunities for Support and Engagement

Figure 5 sets out the sustainable practices that residents have already adopted but it also indicates the practices they plan to adopt. Understanding the sustainable practices that residents plan to adopt in the future offers valuable insight into the types of training, resources, or community initiatives that can effectively support them. For instance, as **30% of residents express interest in switching to renewable energy providers**, this presents a clear opportunity to offer guidance on how to evaluate and choose energy suppliers, including factors like cost, contract terms, and environmental impact.

Similarly, the growing enthusiasm for home food production (**25 % plan to do this**) suggests potential for community gardening initiatives. Supporting shared garden spaces could empower residents to "grow their own," fostering both sustainability and community connection.

There is also scope to explore shared **resource models**, such as tool and appliance libraries, which allow residents to borrow rather than buy infrequently used items, which aligns with their '**Buy Less, Buy Better**' approach, which **25% of respondents plan to do**. These initiatives not only reduce waste and costs but also strengthen neighbourhood ties.

By identifying these emerging interests, AHBs and community partners can proactively design supports that align with resident aspirations – helping all to build more resilient, sustainable communities.

3.5.9 Recommendations: Embedding Resident Voice in Decarbonisation

Retrofitting homes not only improves comfort, air quality, and energy efficiency for residents, but also supports long-term property performance. Empowering residents through targeted training - especially on new technologies like heat pumps and ventilation systems — ensures these benefits are fully realised and sustained. Recommendations for embedding the resident voice in the AHB decarbonisation journey, include:

- **Consult** with residents to ensure solutions meet real needs.
- **Invest in training and education**, especially in-person and tailored to specific systems.
- Empower motivated residents to become **energy champions** and enable them to promote good practices to save energy within their communities.
- Consider **use of apps** so residents can **monitor their energy** consumption and cost.
- Consider **partnering** with appliance manufacturers of **energy-efficient appliances to negotiate discounts for AHB residents**.
- **Support community-led sustainability projects** that build resilience and social cohesion.
- **Monitor and evaluate resident satisfaction** and outcomes **post-retrofit** to ensure continuous improvement.

3.6 Living Labs: Where Innovation Meets Community

AHBs are well-placed to lead housing decarbonisation through Living Labs - real-world settings where residents, providers, and partners co-create and test sustainable solutions. These initiatives drive behavioural change, strengthen community resilience, and enable scalable retrofit strategies, all while aligning with AHBs' social mission and operational realities.

AHBs already have a strong track record in this area. For example, many were early adopters of the Warmer Homes Scheme in the early 2010s and have since led the way in scaling up retrofit delivery through the One Stop Shop model. This experience positions AHBs to champion innovation and collaboration as the sector accelerates its transition to net zero.

However, residents - many of whom are vulnerable or on low incomes - must never be treated as test subjects. Innovation must be resident-centred, with clear safeguards, transparent communication, and a focus on improving comfort, affordability, and wellbeing.

3.6.1 Why Living Labs Matter for AHBs

The Living Lab model offers a practical and inclusive framework for:

- **Real-World Testing** of technologies like heat pumps or solar PV, tailored to housing type, location (urban versus rural), and resident behaviour.
- **Resident engagement**, ensuring solutions are relevant and accepted.
- **Data-Driven Decisions**, using real-time data to guide retrofit strategies, funding bids and measure performance.
- **Scaling Innovation**, by piloting new technologies and service models which can reduce risk and build confidence for wider rollout.
- **Policy and Funding Alignment**, supporting national and EU climate goals and unlocking funding opportunities.

This approach is especially relevant for AHBs managing older, complex housing stock and serving residents with financial or health vulnerabilities.

3.6.2 Resident Readiness and Appetite for Engagement

Findings from the 2024 Resident Survey show strong resident interest in sustainability:

- **96% of residents believe energy efficiency is important.**
- **83% already take action to reduce electricity use, such as drying clothes outside and unplugging appliances.**
- Residents also expressed interest in shared gardens, allotments, and awareness groups — linking sustainability with wellbeing.

These findings suggest residents are not only receptive to retrofit but eager to help shape it. Living Labs build on this appetite for engagement.

3.6.3 Organisational Interest and Innovation Potential

The 2025 AHB climate and carbon survey confirms that AHBs are open to innovation:

- 54% believe innovation can accelerate retrofit delivery, and 26% are interested in trialling new technologies.
- Technologies of interest include air source heat pumps, solar PV, smart energy systems, and prefabricated retrofit solutions.
- However, only 11% have trialled low-carbon technologies, citing barriers such as high costs and lack of funding support.

Many emerging technologies are set out in section 5.4 Technology Map, including air-to-air heat pumps or centralised heating systems, which can be useful for smaller developments, for example.

The willingness of AHBs to trial new technologies while considering the constraints they face, highlights the need for structured, well-supported innovation pathways that protect residents and ensure ethical, transparent testing.

3.6.4 What Living Labs Could Look Like in Practice

A Living Lab for AHBs could include:

- **Pilot retrofits** using innovative technologies in selected homes or estates, with full resident consent and support.
- **Resident workshops** to inform retrofit plans and identify priorities.
- **Community-led sustainability initiatives**, such as shared gardens, tool libraries, or energy awareness campaigns.
- **Monitoring and feedback loops** to track energy use, comfort, and satisfaction.
- **Partnerships** with universities, tech providers, and local authorities to support research, funding, and delivery.

This model enables AHBs to test, learn, and scale retrofit solutions in a way that is inclusive, evidence-based, and aligned with resident wellbeing.

3.6.5 Strategic Benefits of Living Labs

By adopting Living Labs, AHBs can:

- Build trust and engagement with residents.
- Generate data and insights to support funding applications and policy advocacy.
- Strengthen organisational capacity through hands-on learning and collaboration.
- Position themselves as leaders in climate innovation within the housing sector.

Living Labs are not just a pilot mechanism - they are a pathway to embedding sustainability into the culture and operations of AHBs. But they must be implemented with care, ensuring that residents are partners, not test cases, in the journey to net zero.

It’s extremely costly to live a daily life with the environment at the forefront. I wish I could do more, but I can’t financially.

- Resident

Case Study: EnergyCloud – Unlocking the Value of Curtailment for Social Housing

EnergyCloud is transforming renewable energy curtailment into a tangible benefit for households, particularly those in social housing. By redirecting surplus renewable electricity to heat water in homes, EnergyCloud delivers financial savings, improved comfort, and contributes to Ireland's decarbonisation goals under the Climate Action Plan.

How does EnergyCloud Work?

At night or during periods of low electricity demand, wind turbines often produce more electricity than the grid can use. This excess energy is usually curtailed (i.e., wasted). EnergyCloud intercepts this surplus and redirects it to homes. Participating homes are fitted with a smart immersion controller, a small device that replaces the standard immersion switch. It includes a SIM card for remote communication, internet connectivity (where available) and heat sensors on the water cylinder. When surplus electricity is available, EnergyCloud remotely activates the immersion heater in these homes, heating the water tank **at no additional cost.**

Curtailment Opportunity

Ireland experiences between 100 and 120 nights of renewable energy curtailment annually (117 nights in 2023, 99 in 2024). EnergyCloud leverages this otherwise wasted energy to provide free hot water to participating homes.

Impact Per Home

- Average energy received per curtailment night: 3 kWh.
- Annual energy delivered per home: 360 kWh.
- Equivalent to: ~120 tanks of hot water per year.
- Estimated savings: €125 per home annually (based on €0.35/kWh average tariff).

Community-Level Impact

For every 100 homes, EnergyCloud delivers:

- 36,000 kWh of clean energy
- €12,500 in collective savings
- 12,000 tanks of hot water that residents would otherwise not have heated.

Beyond Financial Savings

The most meaningful benefit is **improved comfort and wellbeing**. Many residents avoid using immersion heaters due to cost concerns, limiting access to hot water for hygiene and daily living. EnergyCloud ensures consistent hot water without increasing bills - directly addressing **energy poverty**, a key social challenge.

Additional Benefits

- **Climate Impact**: By using curtailed renewable energy, EnergyCloud avoids fossil fuel use and supports Ireland's renewable integration targets under the Climate Action Plan.
- **Grid Efficiency**: Reduces curtailment and helps balance the grid during periods of oversupply.
- **Scalable Social Impact**: Easily replicable across social housing schemes, amplifying benefits nationwide.
- **Partnership Potential**: Collaboration with housing bodies and energy providers strengthens community resilience and accelerates Ireland's transition to a low-carbon economy.

Why It Matters for AHBs

EnergyCloud demonstrates how **innovative technology and renewable integration** can deliver tangible benefits for residents while aligning with **EPBD-driven energy performance goals** and Ireland's decarbonisation strategy. For AHBs, adopting such solutions enhances resident wellbeing, reduces energy poverty, and supports compliance with sustainability objectives.

4. Decarbonisation 101 for AHBs: Making Sense of Carbon

For many, the language of carbon - BERs, carbon footprints, embodied carbon, and whole life emissions - can feel complex and overwhelming. But each concept plays a distinct role in understanding climate impact, and together they form a roadmap for action. Let's break them down using a building as our common reference point.

Building Energy Rating (BER)

What it is: A BER measures how energy-efficient a building is during its use phase - heating, lighting, ventilation, and hot water.

Why it matters: A better BER (e.g. A-rated) means lower energy use and fewer emissions from daily operations.

Technical note: BER aligns with Module B6 of the EN 15978 framework, which covers operational energy use. The framework is set out in figure 7 on page 45.

Link to decarbonisation: Improving BER is often the first step in reducing a building's operational carbon footprint — especially when fossil fuels are replaced with renewables.

Decarbonisation

What it is: A strategic process to reduce and eventually eliminate carbon emissions across the entire lifecycle of housing — from design and construction to operation and end-of-life.

Why it matters: It's the foundation of climate action and the pathway to net zero.

Link to BER: BER improvements help decarbonise the operational phase. But a lower BER does not always mean low carbon – explained further on the next page.

Link to Whole Life Carbon: Decarbonisation also targets embodied emissions (materials, construction) and end-of-life impacts.

Whole Life Carbon (WLC)

What it is: The total carbon emissions associated with a building over its entire life - from raw material extraction to demolition.

Includes:

- **Embodied carbon**: emissions from materials, manufacturing, transport, and construction.
- **Operational carbon**: emissions from energy use during occupancy.
- **End-of-life carbon**: emissions from demolition and disposal.

Why it matters: A building can have a good BER but still carry a high carbon burden from materials and construction.

Framework: EN 15978 (figure 7, page 45) breaks WLC into five stages (cradle-to-grave), allowing for comprehensive carbon accounting.

Link to decarbonisation: WLC ensures all emissions are considered, not just those from energy use.

Organisational Carbon Footprint

What it is: The total greenhouse gas emissions from an AHB's activities - including electricity and fuel use in offices, homes, landlord supply (common areas), transport, waste, purchased goods and services, supply chain etc.

Why it matters: It's a key metric for ESG reporting and climate strategy.

Scopes:

- Scope 1: Direct emissions (e.g. gas boilers, fleet vehicles).
- Scope 2: Indirect emissions from purchased electricity.
- Scope 3: All other indirect emissions - including purchased goods and services, capital goods, resident energy use, waste.

Link to BER and WLC:

- A BER is the theoretical operational energy & carbon - a valid proxy to calculate resident energy use when no metered data is available.
- WLC captures embodied carbon emissions. Methodology is evolving but likely to form part of Scope 3
- Together: a BER + WLC + carbon footprint gives a complete picture.

How They All Connect:

BER (Building Energy Rating):

Picture a single room in a house. BER measures how efficient and comfortable a space is for everyday use -covering heating, lighting, and hot water. It's about operational energy performance.

Decarbonisation:

This is the strategy for reducing that footprint. It starts with design choices, includes material selection and supply chain impacts, and looks ahead to reuse and recycling at end-of-life. It's the roadmap for making the house low-carbon.

Whole Life Carbon:

Now zoom out to the entire house. Every stage - from groundworks and materials to construction, use, and eventual demolition - has a carbon cost. Together, these make up the whole-life carbon footprint.

Organisational Carbon Footprint:

Finally, think of the whole street. You're not just looking at one house, but all the houses plus roads, transport, and services that connect them. For an AHB, this includes your office building - its energy use, heating, lighting, IT equipment - alongside your housing portfolio and supply chain. It's the big picture of emissions across your organisation.

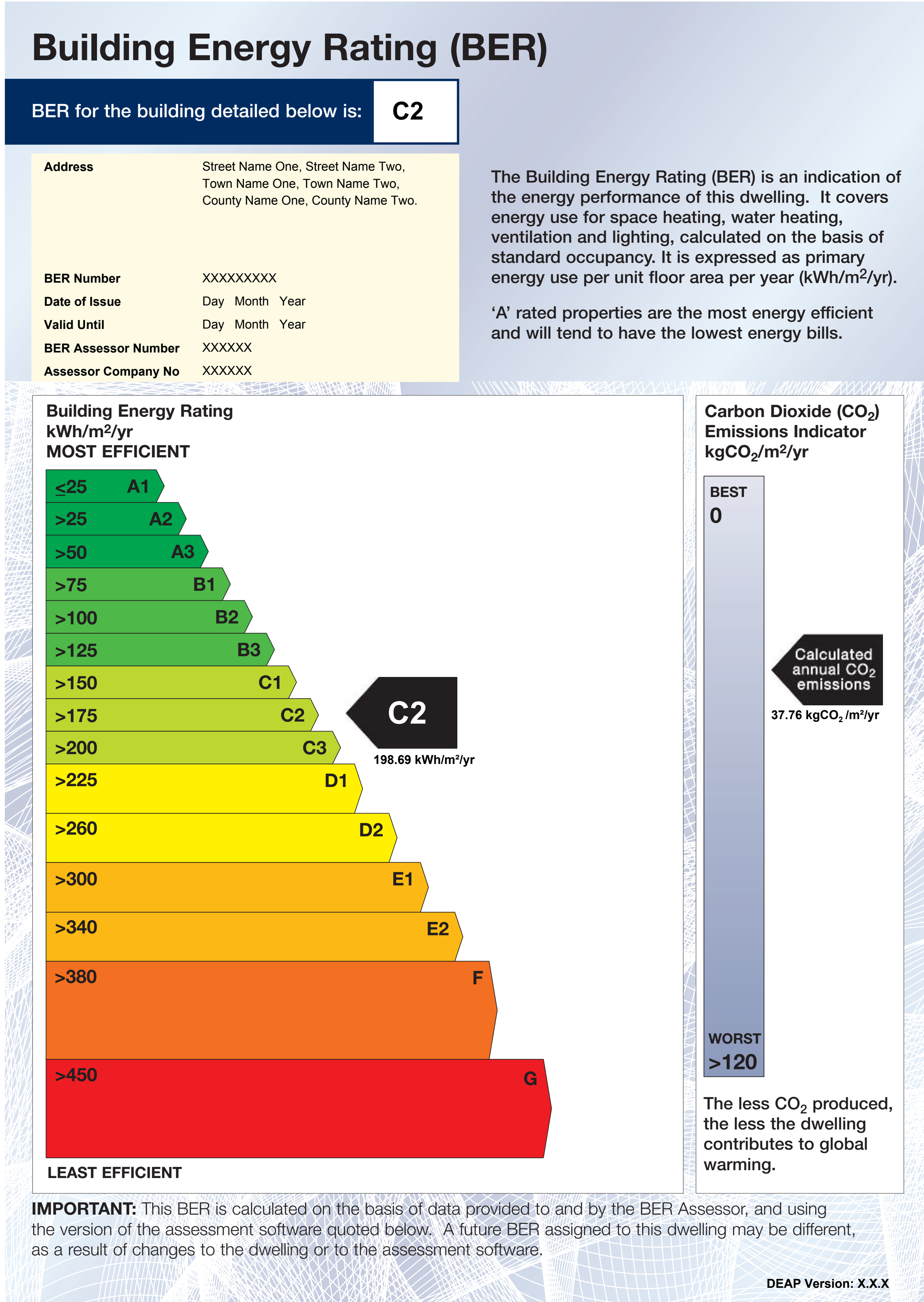


Figure 6: A sample BER certificate, with the theoretical carbon

4.1 BER: The Entry Point to Decarbonisation

For many AHBs, the Building Energy Rating (**BER**) is the most familiar starting point in understanding and improving a building's environmental performance. It provides a standardised measure of energy efficiency - rated from **A1 (most efficient)** to **G (least efficient)**.

A BER reflects the estimated energy use for space heating, water heating, ventilation, and lighting, expressed in **kWh/m²/year**. It represents theoretical energy use under standard occupancy assumptions, not actual consumption. In reality, energy use can vary significantly due to occupant behaviour, meaning that while BER is the current best indicator for energy performance, actual meter readings provide a more accurate picture—though these require tenant consent and additional resource capacity.

A BER certificate (figure 6) expresses the estimate energy efficiency rating in a simple bar chart to the left, and the carbon estimate on scale to the right.

The carbon component of a BER certificate corresponds to **Module B6 of the EN 15978 framework** (figure 7), which focuses on operational energy use during the building's use phase.

A BER rating serves as an **asset management tool**, helping AHBs prioritise retrofits and energy upgrades.

While a better BER typically indicates lower energy consumption, it also correlates with a smaller operational carbon footprint, especially when fossil fuels are replaced with renewables. That said, an A-rated home with carbon-intensive construction materials or gas boilers can still have a high carbon footprint.

Decarbonisation is not a one-off retrofit or technology upgrade — it's a strategic transformation across the full lifecycle of an AHB's housing portfolio. It includes both existing stock and new developments, and touches every aspect of housing delivery:

- Design and construction
- Operation and maintenance
- Resident engagement

I think people should know more about how to save money on electricity - like using energy-efficient appliances. There are loads of small changes that can really add up.

- Resident

Building life cycle stages and System Boundaries

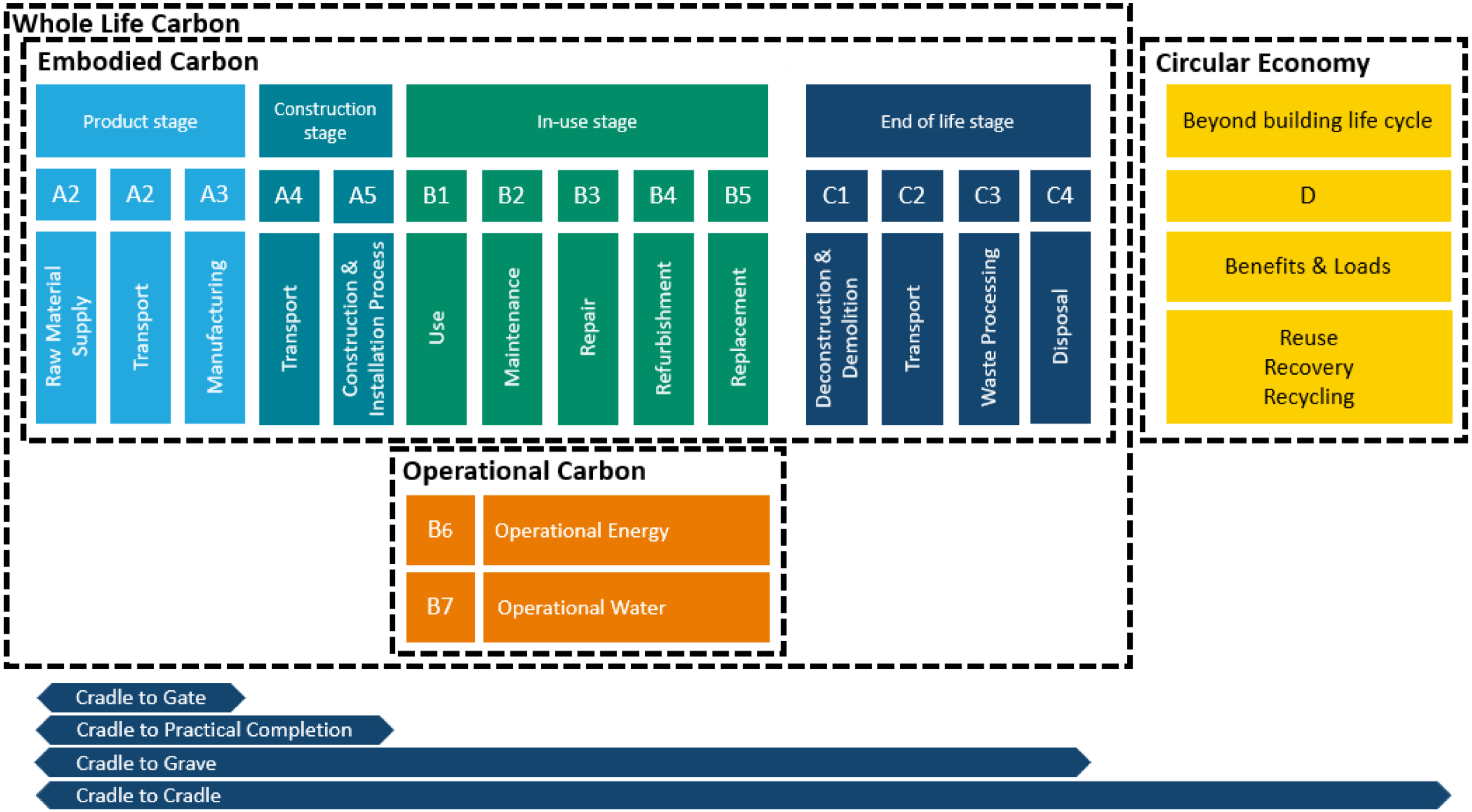


Figure 7: Building life cycle stages and System Boundaries [adapted by the IGBC from EN 15978, EN 17472, and EN 15643] (IGBC)

4.2 Decarbonisation vs Net Zero Carbon vs Whole Life Carbon

To truly decarbonise, we must look beyond operational energy and consider all emissions across a building's life. This is where **whole life carbon (WLC)** comes in.

WLC includes:

- **Embodied carbon**: emissions from the extraction, manufacture, transport, installation, maintenance, and disposal of building materials.
- **Operational carbon**: emissions from heating, cooling, lighting, appliances, and other energy uses during the building's use phase.
- **End-of-life carbon**: emissions from demolition and waste processing.

The **EN 15978:2011** standard breaks the WLC and embodied carbon into five stages, providing a structure that allows for carbon data to be collected across all five stages. If carbon data is collected across all five stages, then this is often referred to as the "cradle-to-grave" concept and is set out in figure 7 (IGBC). The stages are:

- **Product Stage** – raw material extraction and manufacturing
- **Construction Stage** – transport and on-site assembly
- **Use Stage** – operation, maintenance, and repair
- **End-of-Life Stage** – demolition and disposal
- **Beyond Life Cycle** – reuse, recycling, and recovery benefits

A Net Zero Whole Life Carbon building is one where all emissions – both embodied and operational – across all stages are minimised as far as possible, and any remaining emissions are offset. This is the gold standard for climate-aligned buildings.

To achieve net zero, **AHBs need to consider** not just operational emissions, **but also the embodied carbon in materials and construction. Life Cycle Assessment (LCA) is the practical tool that enables AHBs to measure, compare, and reduce carbon emissions across all stages of a building's life**.

The goal of **decarbonisation** is to progressively reduce these emissions, across all stages, through energy efficiency, renewable energy, low-carbon materials, and behavioural change, and making smarter choices in design, construction, and end-of-life planning.

Under the revised Energy Performance of Buildings Directive (EPBD 2024), WLC assessments will become mandatory for all new buildings from 2030, making it essential for AHBs to begin integrating this approach into their planning and procurement processes.

4.3 Organisational Carbon Footprint

While BER and WLC focus on individual buildings, the organisational carbon footprint captures the **total carbon emissions from an AHB's operations** - including electricity and fuel use in offices, homes, landlord supply (common areas), transport, waste, purchased goods and services, supply chain, etc. Carbon emissions are a type of greenhouse gas (GHG) emission, and when we measure carbon footprints, we're actually measuring all GHGs expressed as carbon dioxide equivalents (CO_2eq).

Carbon footprints are measured across three scopes (see Figure 8):

- **Scope 1**: Direct emissions from sources owned or controlled by the AHB (e.g. gas boilers, fleet vehicles).
- **Scope 2**: Indirect emissions from purchased electricity (e.g. used to power communal lighting, office buildings).
- **Scope 3**: All other indirect emissions - including purchased goods and services, capital goods, resident energy use (downstream leased assets), and waste.

Carbon footprints are typically expressed as:

- kg CO_2/m^2/year for buildings
- Total tonnes of CO_2/year for portfolios

Why It Matters:

Organisational Carbon Footprint is a key metric for sustainability/ ESG reporting and net-zero planning, based on the GHG Protocol. It does not require BER or WLC data, but these can enhance understanding:

- A BER provides a theoretical estimate of operational energy use and associated carbon emissions. For AHBs, this can help approximate operational energy use and carbon data for residents, especially when actual metered data is unavailable.
- WLC is for organisations that want to tackle embodied carbon. It measures emissions from materials and construction, which fall under Scope 3 categories such as Purchased Goods and Services, Capital Goods, Upstream Transportation, and Waste. It should be noted that the embodied carbon methodology is evolving. The GHG Protocol does not yet prescribe a calculation method, but when calculated, WLC can be integrated into Scope 3 reporting.

Together, they provide a complete picture of climate impact, enabling AHBs to set realistic targets and prioritise interventions.

Understanding your carbon footprint enables AHBs to:

- Set carbon reduction targets.
- Track progress toward net zero.
- Align with ESG reporting and funding requirements.
- Support benchmarking, comparability, and transparency across the sector.

What Are Scope 4 Emissions?

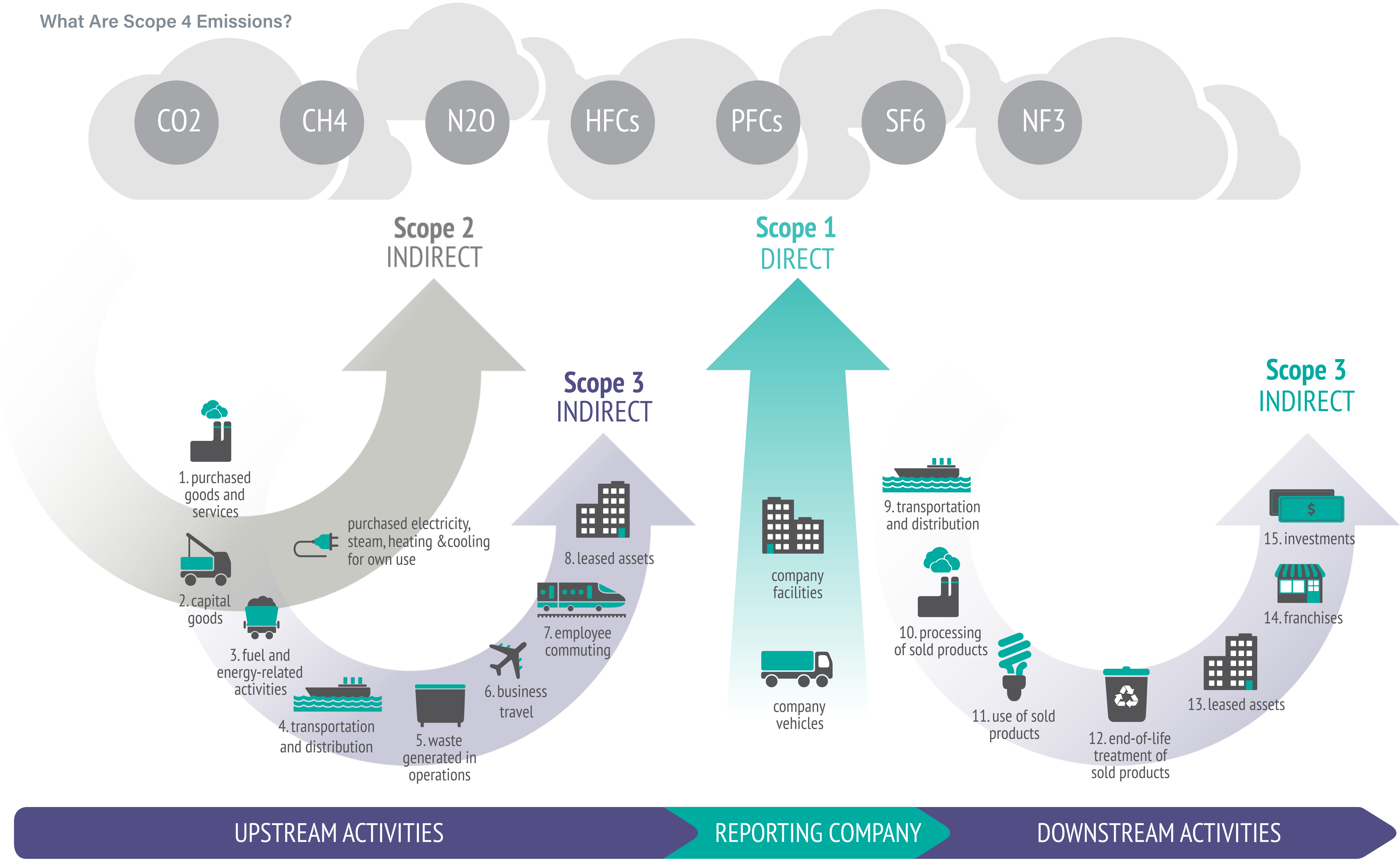


Figure 8: Carbon footprint - overview of Scopes 1, 2 and 3 (GHG Protocol)

Reduce Emissions

Reduce emissions from AHBs' offices, buildings, vehicles and resident homes.

Building retrofits

Retrofit all properties (offices and portfolio of homes) to reduce energy demand.

Energy management

Manage energy in a structured way, focusing on sustained reductions of energy from buildings and vehicles.

Embodied carbon

Reducing embodied carbon in materials and construction process (see more on embodied carbon and EPDs).

Engage residents

Engage residents in behaviour change programmes aimed at reducing energy use in their homes and their daily lives.

Accelerate electrification

Shifting from fossil fuels towards cleaner, more efficient, renewable energy systems will support the decarbonisation of AHBs.

Heating systems

Replace oil and gas boilers with heat pumps or modern storage heaters powered by renewable electricity.

Renewable electricity

Integrate on-site renewable electricity generation (e.g. solar PV), to reduce grid reliance and help with fuel poverty.

Smart technology

Using smart technology (e.g. smart meters), implement demand-side management programmes to reduce energy use.

Investment decisions

Support residents in making informed choices about energy-efficient appliances and electric vehicles over fossil-fuel alternatives.

Figure 9: The fundamental shift required by AHBs to decarbonise

4.4 The Fundamental Shift – the Decarbonisation Journey of an AHB

Up to this point, we've explained the key components of carbon - from **BERs**, which measure operational energy efficiency, to **Whole Life Carbo**n, which captures emissions across a building's entire lifecycle, and the broader **organisational carbon footprint** that reflects an AHB's total climate impact.

Now it's time to bring these pieces together.

Figure 9 offers a clear visual overview of the **decarbonisation journey** - a practical roadmap that helps AHBs move from understanding carbon to actively reducing it.

In practice, this means:

New homes

- **Designing** new homes to meet zero-emission standards.
- **Reducing embodied carbon** in materials and construction.

Existing homes

- **Calculating the BER** of your existing housing stock
- **Applying for grant** funding to help with retrofit costs.
- **Retrofitting existing homes** to improve energy performance.

All homes and operations

- **Measuring** your operational carbon footprint and setting reduction targets.
- **Engaging** residents in sustainable living practices
- **Transitioning away** from fossil fuels toward clean, renewable energy.

This journey is more than a checklist of upgrades; it's a strategic shift that integrates climate action into every stage of housing delivery.

Importantly, **not everything needs to be done at once**. Planning will be key - and working with experienced service providers can help guide your journey, ensuring each step is tailored to your organisation's capacity, priorities, and impact.

Now that you understand the fundamentals of carbon and energy in housing, the next step is to identify where your organisation is on the journey. The following section provides a framework to help you assess your current position and plan your next steps.

5. The Decarbonisation and Energy Journey for AHBs

The need for urgent, industry-wide transformation to reach net zero is clear. The potential for value creation is huge. The conditions for change are favourable. This guide is a set of solutions, largely focused on existing and emerging technology solutions. Decarbonisation may not be easy, but it is possible!

AHBs across Ireland are at different stages in their sustainability journey. Some are just starting out, while others are embedding good practices or leading innovation. This guide supports every AHB, whether you are focused on new build, retrofit, or both.

Decarbonisation is a journey, not a single step. Both new build and retrofit projects require the right enablers - collaboration, funding, skills, and a clear plan. While the guide spotlights specific 'to dos' for retrofit to help simplify that journey, the following sections - 'Where to Start' and the 'Technology Map' - are equally applicable to both new build and retrofit.

No matter your starting point, you'll find practical guidance, checklists, and resources to help you move forward.

5.1 The Retrofit Journey for AHBs

The purpose of this section is to help AHBs self-assess their current position – see figure 10 for a simple overview on how to assess whether you are at the Beginner, Intermediate, or Advanced stage.

Based on this assessment, identify the most relevant actions to get started or progress, using the following checklists to help you move forward with confidence. Use them to:

- **Self-assess:** Use this framework to identify your current stage.
- **Plan for progression:** Each level builds toward the next—strategically, operationally, and culturally.
- **Track impact:** Use BER improvements, emissions reductions, and resident engagement as key metrics.
- **Stay adaptive:** Respond to evolving policy, funding, and technology landscapes.

These are AHBs that are just starting their climate journey, with limited awareness, capacity, or systems in place, so the focus is on getting the basics in place.	These are AHBs that have begun climate-related activities, often in ad hoc or project-based ways, but lack a cohesive strategy.	These are AHBs with climate action embedded across governance, operations, and housing delivery, actively leading sectoral transformation.	The end goal is to achieve net zero, with focus on achieving WLC net zero operations first, followed by WLC embodied carbon as a longer-term goal.

Figure 10: A carbon and energy framework for Irish AHBs

5.1.1 Checklist for Beginners

Just starting out, limited experience or data, need to build foundations.

Key Characteristics:

- No formal environmental or carbon strategy.
- Limited internal expertise or resources and retrofit experience.
- Limited BER data.
- No baseline data on carbon emissions.
- Reliant on grant funding but may not have applied yet.
- Reactive compliance with regulations.

Checklist of actions:

Governance and Strategy

- Appoint a sustainability lead or internal champion.
- Add decarbonisation and retrofit to board agendas.
- Start staff training on carbon literacy and retrofit basics...

Data, Baseline and Plan

- Conduct BER assessments for all properties (or as many as possible).
- Establish a baseline for monitoring improvements.
- Draft a simple climate plan - at this stage it means prioritising the properties that have the poorest energy performance (e.g.. BER C or low) as well as those that you can afford to retrofit within your existing resources.

Procurement

- Use simple, standardised procurement templates.
- Prioritise value for money (VFM) but include basic quality and expertise criteria (e.g. require evidence of previous retrofit work).
- Knowledge is key - ask for references from other AHBs or local authorities.
- Consider what economies of scale can be of benefit, e.g., multiple homes in the same estate, town.
- When specifying works, consult the Technology Map (see section 5.4) for suitable solutions and an indicative list of suppliers.

! Tip: Reach out to AHBs who have already started for advice on realistic cost estimates and lessons learned.

! Fact !

84% of AHB residents are concerned about climate change and of this 23% are very concerned.

Quick wins to get started

- Switch to green energy
- Improve recycling, reduce waste

Resident Engagement

- Inform residents early; explain benefits and process.
- Obtain their consent for energy bill monitoring.

Metric: Track resident satisfaction before and after works.

Monitoring and Metrics

- % of homes with BER B2 or above.
- Number of grant applications submitted/approved.

Finance and Grants

- Identify and apply for SEAI grants (OSS, CEG, WHS) - see Appendix III for more information.
- Get insights from AHBs who are experienced at applying for grants and retrofit experts who can help.
- "Where to Start" (section 5.3) includes a stepwise guide to grants and funding.

Who Can Help?

- Explore shared technical support hubs – such as SEAI One-Stop-Shops, peer AHBs.
- Housing Alliance, the Housing Agency and ICSH.
- "Where to Start" (section 5.3) lists support organisations and peer networks.

5.1.2 Checklist for Intermediates

Some projects underway, partial data, need to formalise and scale up.

Key Characteristics:

- May have informal sustainability goals, climate action appears in strategic plans but lacks integration.
- Partial BER data.
- Pilot projects (e.g. retrofits) are underway but ad-hoc.
- Actions are often reactive or funding-driven.
- Awareness of EPBD 2024 and national targets.
- Facing funding and skills gaps.
- Staff are engaged but need clearer direction.

Checklist of actions:

Governance and Strategy

- Embed climate/retrofit goals in strategic plans.
- Assign responsibility for tracking progress.
- Upskill staff in procurement, project management, and resident engagement.

Data, Baseline and Plan

- Complete BER assessments for all stock.
- Develop a retrofit roadmap aligned with EPBD 2024, incorporating measurable targets.
- Expand pilot projects into phased retrofit programmes.

Procurement

- Embed ESG and climate criteria into procurement and asset management.
- Use best practice procurement:
  - Score on value for money (VFM), quality, expertise, and social/environmental value.
  - Require contractors to provide references and evidence of retrofit experience.
- Consider joint procurement with other AHBs for better pricing and quality.

! Tip: Ask peer AHBs for feedback on contractors and cost benchmarks.

Quick wins to get started

- Trial solar PV, heat pumps, and battery storage - look at section 5.4 Technology Map for more ideas for technology that may be suitable for your retrofit project (or new developments) go to section 5.4.

Resident Engagement

- Engage residents to let them know what you are planning.
- Provide training on new systems.
- Set up feedback channels.

Metric: Track resident satisfaction before and after works.

Finance and Grants

- Map all available grants and funding sources. Apply for multiple grants where possible.
- "Where to Start" (section 5.3) includes a stepwise guide to grants and funding.

Monitoring and Metrics

- % of homes upgraded to BER B2 or above.
- Reduction in resident energy arrears.
- Number of staff trained in retrofit/ carbon literacy.

Who Can Help?

- SEAI, One-Stop-Shops, sector working groups, experienced AHBs, retrofit consultants.
- Housing Alliance, the Housing Agency and ICSH.

5.1.3 Checklist for Advanced

Climate action embedded, large-scale projects, sector leader.

Key Characteristics:

- Climate strategy is core to organisational mission.
- Formal environmental plans and carbon footprinting in place.
- Have BER data and carbon footprinting.
- Strong data systems and impact reporting.
- Large-scale retrofit and renewable projects underway.
- Active in sectoral collaboration and policy advocacy.
- Strong resident engagement and training programmes.
- Strategic positioning in national climate and housing agendas.

Checklist of actions:

Governance and Strategy

- Publish annual sustainability/retrofit progress reports – include case studies.
- Integrate decarbonisation KPIs into business planning and staff objectives.
- Provide climate training for all staff and advanced training for relevant teams.

Data, Baseline and Plan

- Maintain up-to-date BER and carbon data for all properties. Use digital tools for ongoing performance monitoring.
- Set targets for operations, e.g. achieve net-zero operations for offices and fleet.

Procurement

- Consider using advanced procurement frameworks that embed sustainability into decision-making. This includes:
  - Whole-life carbon requirements in tenders to ensure emissions are considered across the building lifecycle.
  - Weighted scoring for bids based on innovation, quality, social value, and carbon - not just price.
  - Performance-based contracts, i.e. linking payment to measurable energy and carbon outcomes.
  - Award marks for designs that exceed minimum standards, for example, in water efficiency, zero-emission transport, material recovery, and circularity.

! Tip: Share frameworks, lessons learned and best practices with wider AHB sector.

"It would be great if there were a central website for all in Social housing with the various supports and groups in their area that people can get involved with to work together."

- Resident

Quick wins to get started

- Consider how you integrate innovation into your projects such as integrate digital tools like BIM and digital twins for carbon optimisation – see section 5.4 for ideas on technologies to integrate.

Resident Engagement

- Empower residents as "energy champions".
- Run ongoing training and awareness campaigns.
- Use digital tools for resident feedback and energy monitoring.
- Monitor and report on health, comfort, and social outcomes.

Metric: Support resident-led climate initiatives and education.

Finance and Grants

- Leverage innovative funding models.
- Support sector advocacy for improved grant levels.

Monitoring and Metrics

- % of homes at BER B2 or above.
- Staff and resident training completion rates.
- Qualitative: resident stories, health improvements, community initiatives.

Who Can Help?

- Sector working groups, national/EU networks, technology providers, peer AHBs.
- Housing Alliance, the Housing Agency and ICSH.

! Tip: Show sectoral leadership: Mentor other AHBs, Influence policy and funding design through data-driven advocacy.

5.2 Enablers of Decarbonisation for AHBs

Achieving decarbonisation is about more than just reducing emissions. It's a shift in how homes are designed, built, and lived in. For AHBs, this means adopting new tools, materials, and ways of working that support low-carbon living, while also improving quality, resilience, and community wellbeing.

No matter your starting point, you'll need the right enablers - funding, materials, skills, and resident engagement - to succeed. The following section outlines these enablers and shows how they support your decarbonisation journey.

5.2.1 Circular Construction and Low-Carbon Technologies

To deliver on whole life carbon (WLC) goals, AHBs can adopt a range of enabling strategies:

Procurement: mandating life cycle assessment in the construction procurement process.

Circular construction: designing buildings for disassembly, reuse, and material recovery.

Embrace digital tools: using Building Information Modelling (BIM) and digital twins to track carbon impacts and optimise performance.

Biobased products: incorporating renewable materials such as timber, hempcrete, and cellulose insulation.

Modern Methods of Construction (MMC): prefabrication and modular systems that reduce waste, improve build speed, and enhance quality control.

These approaches not only reduce emissions but also mitigate supply chain risks and support local innovation.

5.2.2 Carbon Sequestration and the Role of Housing

Housing can do more than reduce emissions - it can help capture and store carbon. This can be achieved through:

- Biobased materials that lock in carbon.
- Green infrastructure such as living roofs, walls, and urban planting.
- Community land management that promotes biodiversity and soil health.

While still emerging, these strategies offer long-term potential for AHBs to contribute to climate resilience and environmental regeneration.

5.2.3 Behavioural Change and Resident Engagement

Technology alone will not deliver net zero. Resident behaviour plays a critical role in energy use and retrofit success. The 2024 Resident Survey shows:

- Strong willingness to act sustainably.
- A desire for education and training, especially face-to-face.
- Interest in community-led initiatives like shared gardens and energy awareness groups.

Behavioural change programmes should be embedded in retrofit planning, with residents treated as partners - not passive recipients - in the decarbonisation journey. AHBs should work with known advocates within the community who can act as energy champions.

5.2.4 Skills

A skilled workforce is essential for delivering high-quality, cost-effective projects, as without the right skills, even the best plans will struggle to succeed.

Upskill staff: invest in upskilling staff on retrofit, carbon literacy, and new technologies.

Plan for the future: work with other AHBs, government, and training providers to address skills shortages.

Share knowledge: learn from AHBs who have already delivered successful projects.

Address contractor capacity: support initiatives to address contractor shortages such as:

- Upskilling of existing trades.
- Attracting new entrants into the retrofit workforce.
- Coordinated workforce planning between government, training providers, and the housing sector.

5.2.5 Coordination support

A coordinated, sector-wide approach is essential to scaling up retrofit delivery across the AHB sector - particularly where some AHBs may lack the in-house technical expertise or capacity to manage complex retrofit programmes independently.

The formation of the Climate Action Working Group within the Housing Alliance Network, alongside emerging joint initiatives with the ICSH, demonstrates that collaboration is already underway. This group is engaging with funders to advocate for increased funding levels for retrofits. They are also identifying other opportunities for the sector to share knowledge and leverage efficiencies.

While some AHBs are already building internal knowledge through existing retrofit projects, those who have not yet started on their decarbonisation/ retrofit journey would benefit from increased access to a shared, multidisciplinary support structure. This could include pooled technical expertise, project management, procurement frameworks, and retrofit planning tools. Such coordination would:

- Reduce duplication of effort
- Improve consistency and quality
- Enable all AHBs to participate in retrofit delivery at scale
- Support collective learning and innovation across the sector

Potentially allowing homes to be retrofitted or getting to near or net zero in a less invasive and cheaper way – AHB

5.2.6 Alignment with Building Regulations and technical standards

AHBs must ensure that retrofit projects not only reflect best practice in decarbonisation to meet evolving energy performance regulations, such as EPBD 2024, but also design and build (both retrofit and new) to comply with Irish Building Regulations and follow Building Control Regulations to demonstrate compliance. Aligning with these regulations and recognised standards is essential for delivering high-quality, compliant retrofits and for accessing grant funding from agencies such as SEAI. To ensure quality, safety, and long-term performance, AHBs planning retrofit works should align with the following:

Irish Building Regulations: Retrofit works must comply with Parts A to M, supported by Technical Guidance Documents (TGDs), with particular focus on:

- **Part L (Conservation of Fuel and Energy):** Implements EPBD requirements for energy efficiency and carbon reduction, including BER certification and cost-optimal performance for major renovations.
- **Part F (Ventilation):** Maintains healthy indoor environments while achieving airtightness.

Building Standards

The National Standards Authority of Ireland (NSAI) provides detailed technical guidance for design, installation, and commissioning:

- **S.R. 54:** Energy Efficient Retrofit of Dwellings (whole-house approach, thermal bridging, moisture control). Sponsored by SEAI. (NSAI)
- **S.R. 50 Series:** Building services codes (heating systems, solar thermal, heat pumps). (NSAI)
- **S.R. 55:** Solar PV micro-generators. (NSAI)

These standards go beyond minimum compliance, reducing risks such as condensation, poor ventilation, or system failure, and support energy performance aligned with the EPBD.

Sustainable Energy Authority of Ireland (SEAI) Domestic Technical Standards and Specifications (DTTS)

The DTTS, published in January 2025, is a reference for contractors carrying out home energy upgrade works supported by SEAI programmes (e.g., Better Energy Homes, One Stop Shop, Warmer Homes). (SEAI)

> **Our communal lights are constantly on. Instead, they should be movement-activated and LED. Our plug sockets don't have an on/off switch, which makes it harder to switch off appliances fully.**
>
> **- Resident**

It outlines the requirement to comply with Building Regulations (especially Part L for energy efficiency and Part F for ventilation), as well as minimum performance criteria for insulation, airtightness, ventilation, heating systems, and renewable energy sources.

It further outlines expectations regarding contractor competency, warranties, and quality assurance. DTSS reference NSAI codes for technical detail.

BCAR (Building Control Amendment Regulations)

BCAR provides the compliance and certification framework to ensure works meet Building Regulations. (GovIrl)

For retrofits triggering BCAR, Assigned Certifiers must verify compliance with Part L and EPBD-driven energy targets, ensuring that design and construction achieve required energy performance and carbon outcomes.

Construction Products Regulation (CPR)

CPR mandates CE-marking and performance declarations for construction products under harmonised EU standards. (GovIrl)

CPR now aligns with EPBD sustainability goals by requiring environmental characteristics (including Global Warming Potential) in product declarations, supporting low-carbon material choices for energy-efficient retrofits.

5.2.7 Funding and Finance

Finance is a foundational enabler of decarbonisation, but for AHBs, the current funding model presents significant structural barriers. While SEAI's existing schemes are welcome, navigating three separate programmes with differing terms and conditions is complex. See section 5.2.8 for an overview of SEAI grants.

The average 50% grant level often leaves AHBs with substantial net costs, making retrofitting financially unviable. Research commissioned by the ICSH indicates that a 90% grant level is needed for viability (ICEA and 3cea).

To overcome these barriers, the financial system must become:

- **More accessible:** Simplified, consolidated grant pathways tailored to AHBs
- **More flexible:** Funding aligned with planned works, including defects remediation
- **More innovative:** Dedicated finance for renewable energy and low-carbon solutions
- **More strategic:** A "finance passport" model to support funding across the asset lifecycle

With enhanced support, AHBs could retrofit at **least 5% of their stock annually**—around 3,250 homes.

Without these enablers, retrofit targets will remain out of reach – regardless of ambition.

5.2.8 A spotlight on funding

5.2.8.1 Why Funding and Planning Matter

Accessing the right funding is essential for AHBs to deliver deep retrofits and decarbonisation at scale. The Sustainable Energy Authority of Ireland (SEAI) offers a suite of grant programmes and technical supports, but navigating these options - and understanding how to sequence them as part of a long-term retrofit strategy - can be complex. An Energy Master Plan provides the roadmap to maximise funding, coordinate works, and deliver lasting impact.

SEAI grant programmes at a glance

Scheme	Description	Benefits	Challenges	Suitability for AHBs
One Stop Shop (OSS)	Primarily designed for private homeowners but includes an AHB strand.	• Open year-round, allowing for better planning and programme management. • Supports cash flow as grants are paid per property. • AHBs retain full control over the process and have the final say in what measures to install, with the aim of achieving a minimum B2 BER. • Under EEOS, Participating Energy Suppliers (PES) can partner.	• Grants are a fixed amount per measure, which does not take into account enabling works or support measures in common areas.	Primarily designed for private homeowners but includes an AHB strand. For more information go to: https://www.seai.ie/grants/home-energy-grants/one-stop-shop/approved-housing-body
Community Energy Grants (CEG)	Designed to achieve economies of scale by bundling multiple buildings into a single retrofit programme.	• The grant applies a percentage to actual eligible costs, which can be more reflective of real project expenses, especially for larger or more complex buildings. A grant covers a range of eligible measures, i.e. heat pumps, windows, doors, insulation, radiators and enabling works (e.g. scaffolding, hoists, traffic management) for an apartment block, including both individual units and common areas. • CEG now includes a new MUD strand and innovation strand. • As it is percentage of eligible costs, rather than fixed cost/measure, AHBs should receive more overall grant funding compared to the OSS model. • Under EEOS, energy-poor homes tend to receive a higher level of support .	• Managed by a Project Coordinator, who is more often a third party. • Tight project timelines, as applications open for a period of time and work must be completed before year-end. • Milestone-based funding can make it more difficult to manage cash flow. • To receive improved EEOS support, an AHB must provide proof that the resident energy poor on the basis of the Warmer Homes Scheme definition • Grant amounts for AHB homes under the National Home Energy Upgrade Scheme (NHEUS) and CEG will be increased to around 75% of the overall cost and for fuel poor homes to around 80% of the overall cost of upgrade. Together with the support under the EEOS this could provide funding in excess of 90% of the cost of projects for AHBs. More details to be made available in Quarter 1 2026.	Flexible for multi-unit developments, but tight timelines and third-party management are challenging. For more information go to: https://www.seai.ie/grants/community-grants/overview For more information on the updates to the National Residential Retrofit Plan 2026, please go to: https://www.seai.ie/news-and-events/news/increased-grant-amounts-for-homeowners
Warmer Homes Scheme (WHS)	Offers 100% funding for energy upgrades to private homeowners receiving specific welfare payments.	• 100% funding, SEAI manages the entire process.	• Fully managed by SEAI, AHBs have no input on the depth of retrofit. i.e., will a target of a BER B2 be achieved. • Long waiting lists – up to 2 years.	Not actively promoted to AHBs due to long wait times and lack of control over retrofit depth. For more information, go to: https://www.seai.ie/grants/home-energy-grants/fully-funded-upgrades-for-eligible-homes

5.2.8.2 Clarifying the role of the Energy Master Plan (EMP)

The Energy Master Plan is a strategic planning tool that is particularly important for AHBs seeking to access SEAI's Community Energy Grant (CEG) programme. The EMP helps organisations assess their housing stock, prioritise retrofit projects, and sequence works for maximum impact - requirements that are central to a successful CEG application.

While the EMP is not required for the One Stop Shop (OSS) scheme - which is designed for individual homes or smaller portfolios and managed by OSS providers - it is highly recommended for any AHB planning multi-home or estate-wide retrofits. In summary, the EMP is essential for community-scale projects and CEG funding, but not a prerequisite for OSS applications.

5.2.8.3 Key organisations involved:

- **Sustainable Energy Authority of Ireland (SEAI):**
  The national agency for energy efficiency and decarbonisation. Provides grants, technical guidance, and sector-specific support for AHBs. https://www.seai.ie/
- **SEAI-Approved One Stop Shops (OSS):**
  Offer a "turnkey" service: home energy assessments, grant applications, contractor management, and quality assurance. Especially valuable for smaller AHBs or those with limited in-house expertise. https://www.seai.ie/grants/home-energy-grants/one-stop-shop/approved-housing-body
- **SEAI Project Coordinators:**
  Can help with CEG applications, project management, and sequencing works. https://www.seai.ie/grants/find-a-registered-professional/community-project-co-ordinator
- **BER Assessors and Retrofit Consultants:**
  Specialists in building services, energy modelling, and retrofit design. Can help scope projects, specify low-carbon technologies, and ensure compliance with regulations. https://ndber.seai.ie/Pass/assessors/search.aspx
- **Training Providers and Upskilling Networks:**
  Organisations such as SOLAS training centres and sector-specific workshops help build internal capacity for retrofit delivery and carbon literacy. https://www.solas.ie/programmes/green-skills

Figure 11: Pathway for an AHB to access One-Stop-Shop support

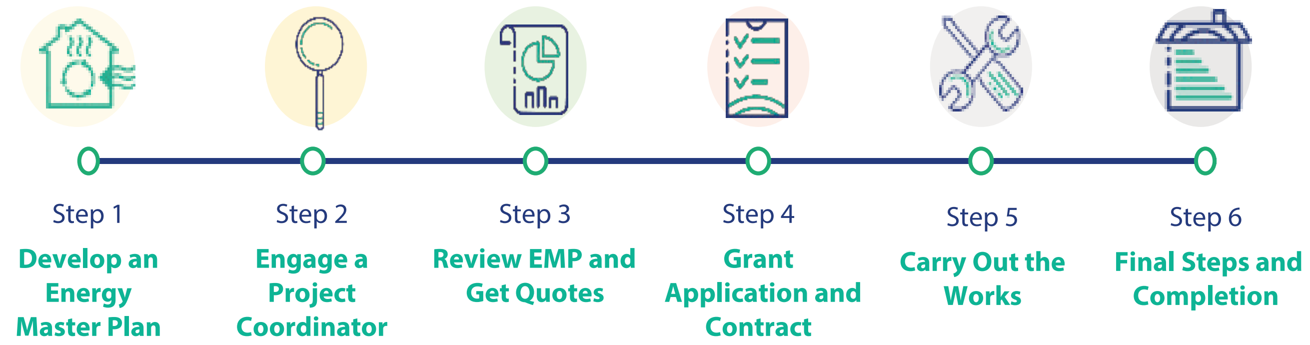


Figure 12: Pathway for an AHB to access Community Energy Grant support

5.3 Where to Start

When asking AHBs whether **technological innovation could accelerate retrofit and decarbonisation programmes, 54% of respondents agreed**, while 17% were unsure and 29% did not comment. However, **88% cited the high cost of adopting innovative solutions as a major barrier** - a valid concern given the financial constraints already facing AHBs.

Many lower-carbon materials tend to be more expensive upfront than their traditional counterparts. This is due to:

- **Smaller economies of scale** (they're not yet mass-produced at the same scale)
- **Limited supply chains** and availability
- **Higher R&D** and **certification costs**
- **Lack of familiarity** among contractors and designers, which can increase risk premiums

However, total lifecycle costs (including operational energy savings, carbon pricing, and end-of-life reuse potential) can often be lower - especially when paired with incentives.

The **cost trajectory of lower-carbon building materials mirrors the early evolution of solar PV**: initially expensive and niche, solar panels became affordable through a combination of technological innovation, economies of scale, and supportive policy. Just as solar PV transitioned from a costly alternative to a mainstream solution, low-carbon materials are poised to follow a similar path toward affordability and widespread use.

Cost parity for lower-carbon materials can be accelerated through targeted policy, growing market demand, and industry innovation. Public procurement standards and carbon pricing can shift incentives, while certification schemes, such as EPDs, build trust and enhance comparability. As production scales and supply chains mature, costs are expected to decrease, particularly with increased training and familiarity across the construction sector. Together, these factors create a feedback loop that drives affordability and wider adoption.

> **"Respecting the environment is very important, let's do it all and save our planet, earth and our health."**
>
> **- Resident**

Decarbonisation Solutions Across the Built Environment Value Chain

The following pages provide practical steps that AHBs can take to reduce their carbon footprint and help the industry achieve net zero – for a simple overview see figure 13.

Based on our research and the direction of travel of policy, the need for supply chain collaboration, and the interconnectivity of solutions, we have set out decarbonisation strategies for the AHB sector across its value chain – explaining what each solution is, why it matters, and how it can be applied. We've included simple comparisons across cost, carbon impact, timelines, and complexity to deliver. These should be considered as indicative only, as each project will have its own unique context.

Recognising that decarbonisation is a journey, this guide incorporates both innovative and traditional materials and technologies. While some traditional approaches may have a higher embodied carbon footprint, they still play a valuable role in improving energy efficiency and delivering practical outcomes.

For those seeking to go further, we've included more advanced material and technology options to help reduce embodied carbon. To support a shared understanding across the sector, we've provided clear explanations for each technology, along with examples of Irish manufacturers and providers, where available. It is not an exhaustive list, but it highlights the depth of expertise already available within the Irish supply chain.

Figure 13: In the Operation and Maintenance Section include Demand Reduction: Educating Tenants on Energy Efficiency in the home

5.3.1 Planning and Design – why it matters

Planning and design are the foundation of a low-carbon built environment. Decisions made at this early-stage lock in the majority of a building's carbon footprint—both embodied carbon (from materials and construction) and operational carbon (from energy use over time). According to the UK Green Building Council, up to 50% of a building's lifetime emissions can be attributed to embodied carbon, especially in new builds (UK GBC).

By integrating low-carbon strategies from the outset, developers and designers can reduce total emissions significant. The percent reduction will depend on the project type and ambition level. The World Green Building Council, estimates by 2030, all new buildings, infrastructure and renovations will have at least 40% less embodied carbon with significant upfront carbon reduction (World GBC).

These interventions are equally relevant for new builds and retrofits, though the strategies may differ in application.

Key Interventions in Planning and Design

Intervention	What is it	Why it matters	Application	Cost	Carbon Impact	Implementation Timeline	Complexity	Examples of technology and solutions
Passive Design	Passive design refers to a set of principles that reduce a building's energy demand by leveraging its form, orientation, and fabric rather than relying on active systems. These principles include optimising solar gain, insulation, air-tightness, shading, thermal mass, and ventilation strategies. Natural ventilation is often part of passive design, but it is not mandatory - the approach is flexible and climate-dependent.	Minimises heat loss and maintains stable indoor temperatures, reducing or eliminating the need for space heating and cooling. It improves comfort and reduces long term emissions.	Applies to both new builds and retrofits. In new builds, passive design can be fully integrated from the outset—optimising layout, glazing, and thermal mass. In retrofits, improvements like external insulation, window upgrades, and shading devices can significantly enhance performance.	Low to Medium	High (operational carbon reduction)	Short to Medium	Low to Medium	Passive solar orientation; High-performance insulation and airtightness; Triple glazing Brise-soleil shading; Mechanical Ventilation with Heat Recovery (MVHR); Passive House Standard - note: applies similar principles but requires MVHR to maintain airtightness and indoor air quality while meeting strict energy performance targets. https://phai.ie/
Low-Carbon Materials Selection	Choosing materials with a lower embodied carbon footprint, such as bio-based, recycled, and low-impact alternatives, is one of the most effective ways to reduce upfront emissions.	Reduces upfront emissions locked in during construction and supports circularity.	Applies to both new builds and retrofits—especially in structural components, insulation, and finishes.	Medium	High (operational carbon reduction)	Medium	Medium	Cross-laminated timber (CLT), low-carbon concrete (uses fly ash, slag, or calcined clay to reduce cement content), recycled steel, recycled aggregates, natural insulation (hempcrete, sheep's wool, cellulose, and cork).

Intervention	What is it	Why it matters	Application	Cost	Carbon Impact	Implementation Timeline	Complexity	Examples of technology and solutions
Whole-Life Carbon Assessments	WLC assessments quantify emissions across a building's entire lifecycle—from raw material extraction to demolition. This enables: • Informed design decisions • Material selection and optimisation during design • Trade-off analysis between embodied and operational carbon • Benchmarking and reporting for ESG and regulatory compliance	Enables informed design decisions, carbon budgeting, and compliance with emerging regulations. WLC assessments evaluate both embodied and operational carbon across a building's entire lifecycle—from material extraction to demolition. This gives a complete picture of emissions, helping designers and developers make informed, low-carbon choices.	Enables informed design decisions, carbon budgeting, and compliance with emerging regulations. New Builds: informed decisions about materials, systems, and layout to minimise both embodied and operational carbon from the outset. Retrofits: helps to compare options like replacing vs. retaining materials, upgrading systems, or improving insulation.	Low	Medium to High (depends on follow-up actions)	Short	Low	Digital Tools and Software for life cycle assessment (LCA); Passive and energy-efficient design solutions; Circular economy and end-of-life planning tools; INDICATE tool by IGBC; Refurbishment rather than demolition
Renewable Energy Integration	Designing buildings to incorporate renewable energy systems such as solar PV, heat pumps, and district or community heating from the outset.	Early integration ensures systems are optimised for performance and cost, reduces operational carbon, and supports energy independence.	Applies to both new builds and retrofits, though new builds offer more flexibility for system sizing, orientation, and infrastructure planning.	High	High (zero-carbon energy)	Medium to Long	High	Solar PV arrays, air-to-water heat pumps, geothermal loops, thermal energy storage, and district heating networks.
Digital Twins and BIM for Optimisation	Digital twins and Building Information Modelling (BIM) enable data-driven design and performance optimisation. They allow teams to simulate energy use, material choices, and carbon impacts before construction begins.	Improves energy and material efficiency, reduces waste, and supports carbon tracking.	Used in both new builds and retrofits—especially for performance modelling and retrofit planning.	Medium to High	Medium (enables optimisation)	Medium to Long	High	Digital twin technologies; BIM platforms for carbon optimisation; Carbon assessment and integration tools; IoT and smart building integration

5.3.2 Materials and Supply Chain – why it matters

The materials and supply chain stage is a critical lever for reducing embodied carbon, which can account for up to 50% of a building's total lifecycle emissions, especially in new residential developments.

These emissions are generated before a building is even occupied—through the extraction, manufacturing, transport, and assembly of materials.

Focusing on this stage enables immediate carbon savings, supports the circular economy, and reduces environmental impacts across both new builds and retrofits. It also aligns with emerging regulations and client expectations around low-carbon procurement and sustainable construction practices.

These interventions are equally relevant for new builds and retrofits, though the strategies may differ in application.

Key Interventions in Materials and Supply Chain

Intervention	What is it	Why it matters	Application	Cost	Carbon Impact	Implementation Timeline	Complexity	Examples of technology and solutions
Sustainable procurement	The practice of sourcing materials and services based on environmental and social performance. In the context of materials and supply chains, it involves embedding sustainability criteria into tenders and contracts, evaluating bids accordingly, and using these insights to guide contract awards. Regarding embodied carbon, this can include specifying low-carbon materials and requiring Life Cycle Assessments (LCAs), for example. Using such criteria helps to make informed, low-carbon decisions across projects.	It ensures that low-carbon choices are embedded in the supply chain, reducing embodied emissions and supporting responsible sourcing.	Relevant to both new builds and retrofits—especially when selecting materials for structure, insulation, finishes, and systems.	Medium	Medium to High (embodied carbon reduction)	Medium	Medium	Environmental Product Declarations (EPDs), green procurement platforms, supplier sustainability scoring.
Circular economy practices	Designing out waste and keeping materials in use through reuse, recycling, and designing for disassembly.	Reduces demand for virgin materials, cuts embodied carbon, and extends the life of building components.	Applies to both new builds (e.g. modular components) and retrofits (e.g. salvaging and reusing materials).	Medium to High	High (material reuse and waste reduction)	Medium to Long	High	Material passports, reclaimed timber and brick, reuse platforms
Green logistics and electrified transport	Reducing emissions from the transport of materials and equipment through route optimisation, low-emission vehicles, and local sourcing.	Construction logistics can contribute significantly to a project's carbon footprint, especially in urban areas.	Applies to all project types—particularly impactful in large-scale developments or retrofits in dense areas.	High	Medium (transport emissions reduction)	Long	High	Electric delivery fleets, construction logistics hubs, route optimisation software, low-emission machinery.

5.3.3 Construction – why it matters

The construction phase is a key opportunity to reduce embodied carbon through how buildings are assembled, powered, and managed on-site. While much of the carbon is embedded in materials, construction activities themselves—such as transport, machinery use, and waste—can contribute significantly to a project's footprint.

Efficient construction practices can reduce embodied emissions by 10–20% or more, depending on the project scale and methods used. These strategies apply to both new builds and retrofits, especially where site logistics, material handling, and waste management are involved.

Key Interventions in Construction

Intervention	What is it	Why it matters	Application	Cost	Carbon Impact	Timeline	Complexity	Examples of technology and solutions
Modern Methods of Construction / Efficient construction methods	Using off-site manufacturing, modular systems, or 3D printing to streamline construction and reduce waste.	Minimises material use, shortens build times, and reduces transport and on-site emissions.	Ideal for new builds, but also applicable in retrofits (e.g., prefabricated wall panels or bathroom pods).	Medium to High	High (reduced material waste and transport emissions)	Medium	Medium	Modular construction systems, 3D printing, off-site prefabrication
On-site energy management	Reducing energy use and emissions from construction site operations through clean energy and efficient equipment.	Construction sites often rely on diesel generators and inefficient machinery—switching to low-carbon alternatives cuts emissions significantly. It is therefore very important to measure success and encourage further participation.	Applies to all projects, especially large-scale or long-duration builds and retrofits.	Low to Medium	Medium (reduced temporary energy use)	Short	Low to Medium	Solar-powered site cabins, battery storage, electric diggers and cranes, energy monitoring systems.
Waste minimisation and reuse protocols	Strategies to reduce, sort, and reuse construction waste, keeping materials in circulation and out of landfill.	Construction and demolition waste is a major source of embodied carbon and resource loss.	Critical for both new builds and retrofits, particularly where demolition or strip-out is involved.	Low	Medium to High (reduced landfill and embodied carbon)	Short	Low	On-site waste segregation, reuse of bricks and timber, and digital platforms.
Low-carbon vehicles	Construction vehicles powered by biofuels, including HVO, or electricity instead of diesel. Early trials happening with hydrogen.	Cuts CO_2 emissions, improves air quality, and supports sustainability targets.	Electric/hybrid machinery on-site; low-carbon trucks for material transport.	Often higher upfront for machinery; biofuels market developing and can be expensive.	30–70% emissions reduction; quieter and cleaner operations.	Medium	Medium–High: Requires infrastructure, supplier partnerships, and training.	Multiple examples of non-road mobile machinery that can be powered by electricity or biofuels.

5.3.4 Operations and Maintenance – why it matters

The operation and maintenance phase is where buildings generate the majority of their operational carbon emissions—from heating, cooling, lighting, and appliances. In residential buildings, this can account for 50–70% of total lifecycle emissions, especially in older homes.

Improving performance during this phase is critical for achieving net-zero targets, reducing energy bills, and enhancing occupant comfort. These interventions apply to both new builds and retrofits, and they also support the long-term value and resilience of housing stock. Ultimately reducing and managing operational emissions supports the concept of energy security and can protect against long term price volatility.

Key Interventions in Operations and Maintenance

Intervention	What is it	Why it matters	Application	Cost	Carbon Impact	Implementation Timeline	Complexity	Examples of technology and solutions
Energy efficiency retrofits	Upgrading building fabric and systems to reduce energy demand.	Reduces operational carbon, improves comfort, and lowers energy bills.	Primarily for retrofits, but also relevant in new builds to exceed minimum standards.	Medium to High	High (operational carbon reduction)	Medium	Medium	LED lighting, insulation upgrades, triple-glazed windows, systems (heat pumps)
Smart building technologies	Using sensors, automation, and data analytics to monitor and optimise building performance.	Enables real-time energy savings, predictive maintenance, and better occupant control.	Suitable for both new builds and retrofits, especially multi-unit or managed residential schemes.	Low to Medium	Medium to High (efficiency gains)	Medium	High	Smart thermostats, IoT sensors, Building Management Systems (BMS), predictive maintenance platforms
Renewable energy integration	Incorporating on-site or shared renewable energy systems to supply clean power and heat.	Reduces reliance on fossil fuels and supports long-term decarbonisation.	Applies to both new builds and retrofits, though easier to integrate early in design	High	High (zero-carbon energy)	Medium to Long	High	Solar PV, wind turbines, battery storage, heat pumps
Demand management through education	Educating AHB residents and facilities teams to reduce energy use through behavior change and informed decision-making.	Empowered residents can significantly lower operational energy demand, improving the performance of their homes without major capital investment.	Training, guides, signage and digital dashboards (where relevant) on energy-efficient practices (e.g., heating, lighting, ventilation use).	Low	Moderate to High	Short	Low	Educating residents on energy efficiency in the home; Energy dashboards and feedback systems; Smart thermostats with prompts; Behavioral nudges (default settings, reminders)

5.3.5 End-of-Life and Reuse – why it matters

The end-of-life phase of buildings is often overlooked, yet it presents a major opportunity to reduce embodied carbon and support a circular economy. Construction and demolition (C&D) waste has consistently been the largest waste stream in Ireland in terms of both volume and weight, and accounts for more than a third of all waste generated in the EU (EPA).

By designing for disassembly, reusing materials, and repurposing existing buildings, we can significantly reduce the need for new materials—cutting embodied emissions by 10–20% or more. These strategies apply to both new builds (through future-proofing) and retrofits (through reuse and adaptation).

Key Interventions in End-of-Life and Reuse

Intervention	What is it	Why it matters	Application	Cost	Carbon Impact	Implementation Timeline	Complexity	Examples of technology and solutions
Deconstruction over demolition	Carefully dismantling buildings to preserve materials for reuse, rather than demolishing and sending waste to landfill.	Reduces embodied carbon, preserves valuable resources, and supports circular construction.	Primarily in retrofits and redevelopment projects, but also relevant in new builds through design for future disassembly.	Medium	High (saves embodied carbon)	Medium	Medium	Selective dismantling tools, reverse logistics platforms.
Material passports for reuse	Digital records that track the origin, composition, and reuse potential of building materials.	Enables future reuse, supports circularity, and improves transparency in material sourcing	Useful in both new builds (to future-proof materials) and retrofits (to assess reuse potential).	Medium	High (enables reuse and circularity)	Medium to Long	High	Digital material passports, BIM-based tagging.
Adaptive reuse of buildings	Repurposing existing buildings for new uses instead of demolishing and rebuilding.	Preserves embodied carbon, reduces construction waste, and maintains architectural heritage.	Primarily for retrofits, but also relevant in master planning and urban regeneration	High	High (avoids new construction emissions)	Long	High	Structural retrofitting, heritage-sensitive design, lifecycle extension tools.

5.3.6 Cross cutting enablers – why they matter

Cross-cutting enablers are the systems, policies, and tools that make decarbonisation possible at scale. While they don't directly reduce carbon like materials or energy systems, they unlock and accelerate action across the entire built environment value chain. These enablers have been outlined in section 5.3, but it is important to consider their characteristics in terms of cost, potential carbon impact, implementation timeline and complexity.

These enablers support both new builds and retrofits, and are essential for aligning stakeholders, mobilising finance, building capacity, and ensuring transparency. Without them, even the best technical solutions may fail to deliver impact.

Key Interventions in Cross Cutting Enablers

Intervention	What is it	Why it matters	Application	Cost	Carbon Impact	Implementation Timeline	Complexity	Examples of technology and solutions
Policy and Regulation	Government-led frameworks that set minimum standards and create incentives for low-carbon construction and renovation.	Drives market transformation, ensures compliance, and creates a level playing field.	Applies to all projects—new and retrofit—through planning, permitting, and performance requirements.	Low to Medium (mostly administrative and compliance costs)	High (enables systemic change and compliance)	Medium to Long (policy cycles, stakeholder engagement)	High (requires coordination across government and industry)	Building energy codes, carbon pricing, NZEB standards.
Finance and Investment	Financial mechanisms that fund low-carbon projects and reward sustainable performance.	Enables upfront investment in energy efficiency, renewables, and retrofits—often with long-term payback.	Relevant to both new builds and retrofits, especially for large-scale or portfolio-based developments.	Medium to High (depends on scale of financial instruments)	High (mobilises capital for low-carbon projects)	Medium (depends on financial structuring)	Medium to High (requires financial expertise and governance)	Green bonds, ESG-linked loans, retrofit funds; green leases
Skills and Training	Education and upskilling for professionals across the construction and property sectors.	Ensures the workforce can deliver high-performance buildings and implement new technologies.	Critical for both new and retrofit projects, from design to on-site delivery.	Medium (training programs, curriculum development)	Medium to High (enables workforce to implement solutions)	Short to Medium (training rollout and adoption)	Medium (requires curriculum design and delivery)	Passive house training, NZEB upskilling, SOLAS green skills
Data and Transparency	Platforms and systems that track, report, and optimise carbon performance across the building lifecycle.	Enables evidence-based decisions, supports compliance, and builds trust with stakeholders.	Applies to all project types — especially useful for portfolio management and ESG reporting. It is important to secure resident consent for their relevant energy data to be shared, post completion of retrofit or new build projects.	Medium (digital infrastructure and tools)	Medium to High (enables monitoring and optimisation)	Short to Medium (tool deployment and integration)	Medium (requires data standards and interoperability)	Digital twins, carbon accounting platforms, material passports.

Figure 14: Before and after photos of one renovation project

Case study: Tuath Housing Circular Reno Retrofit Pilot

Overview

Tuath Housing Association, in partnership with KORE Retrofit, is pioneering a circular renovation approach to deep retrofits in Ireland. As part of the EU-funded Circular Reno project, Tuath is retrofitting ten homes using bio-based construction materials sourced from agricultural crops, aiming to demonstrate scalable, low-carbon retrofit solutions for social housing.

Project Scope

- Homes retrofitted: Tuath is providing ten homes for upgrade to support the development of modular bio-based construction materials.
- Partners: Tuath Housing, KORE Retrofit, Interreg NWE, EU social housing providers (France, Netherlands, Germany)
- Funding: Interreg North-West Europe Programme
- Timeline: Project launched in 2023; first retrofit completed in 2024

Strategic Goals

- Demonstrate the viability of bio-based materials in Irish retrofits
- Connect the agriculture and construction sectors to build a local supply chain
- Support policy development for circular construction practices
- Build capacity among Irish housing bodies for low-carbon retrofits

Retrofit Innovations

- Materials used: Hemp, straw, miscanthus, and low-carbon Expanded Polystyrene (EPS) panels
- Construction method: Off-site manufactured modular components
- Circularity focus:
  - Materials act as carbon sinks during growth
  - Reduced embodied carbon and VOC emissions
  - End-of-life biodegradability
  - Indoor benefits: Improved air quality and thermal comfort

Outcomes and Impact

- First retrofit completed in 2024 using modular EPS panels – see figure 14 for a before and after image of one of Tuath's renovation projects.
- Knowledge exchange with EU partners on circularity and retrofit delivery
- Leadership positioning: Tuath recognised as a national leader in sustainable retrofit innovation
- Scalability potential: Learnings to inform broader retrofit programmes across Tuath's 15,000+ home portfolio

Lessons Learned

- Supply chain gaps: Limited availability of bio-based materials in Ireland
- Policy lag: Need for stronger regulatory support for circular construction
- Farmer engagement: Opportunity to diversify the agri-sector through material production
- Cross-sector collaboration: Essential for circular innovation

Relevance to other Irish AHBs

This project offers a replicable model for:

- Integrating embodied carbon reduction into retrofit planning
- Leveraging EU funding for innovation pilots
- Building cross-sectoral partnerships to support circularity
- Enhancing resident wellbeing through healthier, low-impact materials

As part of this collaboration, Kore Retrofit are leading on research into developing the Irish supply chain for agri-crop-based materials by tackling four interconnected stages (agriculture, processing, manufacturing, and construction) all working in sync while also looking at enabling the transition to bio-based construction materials within the Irish regulatory and market framework.

For more information visit: tuathhousing.ie.

Interreg North-West Europe Co-funded by the European Union CIRCULAR RENO · Tuath Housing · KORE RETROFIT

5.4 Technology Maps

Important Note Before Using the Technology Map

The products and services listed in the technology map are shown to inform and illustrate the range of innovative materials and solutions emerging to support decarbonisation.

While most products are certified for use in Ireland, some innovative materials are not yet certified under Irish Building Regulations. These are included for illustrative purposes only, as certification status is likely to evolve over time.

Why include them?

Innovation is moving fast, and understanding what's coming helps AHBs plan for future opportunities. Certification processes under the Construction Products Regulation (CPR) and Irish standards will continue to adapt as new technologies enter the market. Staying informed ensures you can anticipate these changes and make strategic decisions.

Disclaimer:

The Housing Alliance, the Housing Agency, and SustainabilityWorks do not endorse, recommend, or warrant any of the suppliers, products, or services listed in the technology map. Inclusion does not imply approval or suitability for any specific project.

Before specifying or installing any product, a suitably qualified professional—such as an Architect or Building Surveyor—must confirm compliance with Irish Building Regulations and CPR requirements.

Technology Map – Structural and Site Building Materials

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Cross-Laminated Timber (CLT)	Engineered wood panels made by gluing layers of timber at right angles for strength and stability.	Renewable, stores carbon and has lower embodied emissions than concrete or steel.	Concrete and steel in walls, floors, and roofs.	Structural systems for residential and mid-rise buildings.	Need for certified sourcing, careful management of fire and acoustic performance, and limited supply chain maturity in some regions.	G-frame Cedarlan Ltd University of Galway CLT Resource: Maintains a database of approved CLT suppliers.
Glue-Laminated Timber (Glulam)	Structural beams made by bonding layers of timber with strong adhesives.	Strong, lightweight, and made from renewable materials with lower embodied carbon.	Steel or reinforced concrete beams.	Columns, beams, and curved structural elements.	Moisture sensitivity and durability; requires skilled design and detailing.	Gframe Cedarlan Ltd Glenfort
Bamboo	A fast-growing, renewable grass used as a construction material.	Rapidly renewable, strong, and carbon-sequestering.	Timber, steel, or plastic in flooring, panels, and structural elements.	Flooring, wall panels, scaffolding, and structural frames (especially in tropical regions).	Limited structural certification in Europe with supply chains and standards emerging; Requires treatment to prevent decay and pests.	None providing materials for structural use.
Low-carbon concrete	Concrete is the most consumed material in the world, second only to water, and is responsible for over 7% of annual global anthropogenic CO_2 emissions. Low carbon concrete made with reduced cement content by using alternatives like fly ash, GGBS, or calcined clay.	Cement is one of the largest sources of embodied carbon—low-carbon mixes can reduce emissions by 30–70%.	Traditional Portland cement concrete.	Foundations, slabs, walls, and structural elements.	The availability of low carbon cement is such that with early planning, supplier engagement, and clear specifications, quality and performance issues should be managed in a similar way to traditional cement.	Ecocem Concrete4Change
Low-carbon steel	Steel produced using electric arc furnaces and high recycled content, often powered by renewable energy.	Steel is carbon intensive and low-carbon steel significantly reduces emissions while maintaining strength.	Conventional blast furnace steel.	Structural frames, reinforcements, cladding, and fixings.	Higher costs, limited availability; requires carbon traceability; still more energy-intensive compared to timber alternatives.	Kingspan's LEC Structural Steel

Technology Map – External Building and Site Materials

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Modular/ Insulated Foundations	Prefabricated foundation systems that combine structural support with integrated insulation.	They reduce on-site waste and improve thermal performance from the ground up. It can often replace the need for concrete.	Traditional poured concrete foundations with separate insulation layers.	Installed as pre-formed units beneath buildings, often in MMC or passive house projects.	Higher upfront costs and limited familiarity in conventional construction can slow adoption.	Terratonics
Hempcrete	A bio-composite material made from hemp hurds and lime, used for insulation and wall construction.	It's carbon-negative, breathable, and offers excellent thermal and acoustic properties.	Concrete blocks, synthetic insulation, and gypsum-based materials.	Cast in place or used in blocks for walls, infill panels, or insulation layers.	Limited supply chain and regulatory acceptance in mainstream housing.	Hempire
Recycled aggregate	Crushed concrete, brick, or stone reused as base material in construction.	Reduces landfill waste and embodied carbon in site preparation.	Virgin quarried stone and gravel.	Used in sub-base layers, drainage systems, and landscaping.	Quality control and certification for structural applications can be barriers.	Greenstone
Recycled plastic composites	Construction materials (e.g. fence posts) made from post-consumer or industrial plastic waste.	Diverts plastic from landfill and offers durable, low-maintenance alternatives.	Timber, concrete, or metal in decking, fencing, and outdoor furniture.	Installed as boards, panels, or modular components in external landscaping.	Limited recyclability at end-of-life and concerns over microplastic release.	IFF Plastics
Timber from certified sustainable sources	Wood harvested under schemes like FSC or PEFC that ensure responsible forest management.	Supports biodiversity, reduces embodied carbon, and promotes renewable materials.	Uncertified or imported timber with unknown environmental impact.	Used in framing, cladding, fencing, and landscaping.	Supply chain traceability and cost premiums can limit uptake.	Ask for FSC or PEFC certification when purchasing.
Foam glass gravel	Lightweight insulation and drainage material made from recycled glass.	Combines thermal insulation with structural fill, reducing embodied carbon.	Stone fill and rigid insulation boards.	Installed under slabs, foundations, and landscaping features.	Limited awareness and availability in some regions.	Geocell
Recycled rubber or resin-bound surfaces	Outdoor surfacing made from recycled rubber granules bound with resin.	Reuses waste tyres and provides durable, permeable surfaces.	Concrete, asphalt, or virgin paving materials.	Used in pathways, playgrounds, driveways, and patios.	End-of-life recyclability and potential chemical leaching concerns.	PRS – Permeable Resin Surfacing

Technology Map – Modern Methods of Construction

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Volumetric (Modular) Construction	Entire rooms or building sections are constructed off-site and delivered fully assembled.	Speeds up delivery, improves quality control, and reduces on-site disruption.	Traditional on-site construction of structural elements.	Ideal for housing, schools, healthcare, and temporary accommodation.	Transport logistics, planning permissions, and integration with site infrastructure.	Cygnum CPAC Modular (Meath) The Pod Factory Vision Built Thermohouse
Panelised Systems	Pre-fabricated wall, floor, and roof panels assembled on-site.	Reduces build time and improves thermal performance.	On-site framing and blockwork.	Common in timber frame and light steel frame housing.	Requires precise site coordination and weather protection during assembly.	NUA Manufacturing Frameform Steel Systems Vision Built GreenFrame SIP Energy Campion Homes
Prefabricated Components	Individual elements like bathrooms, staircases, or facades are manufactured off-site.	Improves consistency, reduces waste, and shortens construction timelines.	On-site fabrication of complex or repetitive components.	Plug-and-play installation during construction.	Transport, craning logistics, and integration with other systems.	Terratonics ESS Modular Castle Modular
3D Printing (Additive Construction)	Uses large-scale printers to build structures layer by layer using concrete or other materials.	Reduces labour, speeds up construction, and allows for design flexibility.	Traditional blockwork or poured concrete.	Emerging use in housing and small-scale infrastructure.	Regulatory approval, material development, and scalability.	HTL.tech – delivered Ireland's first 3D printed homes in Dundalk with Louth County Council
Timber framed	Timber framed construction uses a structural framework of wood to support the building, often combined with insulation and cladding.	It offers a low-carbon alternative to concrete and steel, with faster build times and excellent thermal performance.	Traditional masonry or concrete block construction methods.	Used in residential housing for walls, floors, and roofs, often as part of prefabricated or modular systems.	Requires sustainably sourced timber; needs to meet building regulations for fire safety; Concerns around durability if exposed to moisture.	Keenan Timber Frame
Hybrid Systems	Combines multiple MMC approaches (e.g., modular pods with panelised walls).	Offers flexibility and optimised performance.	Rigid, single-method construction.	Tailored to project needs—e.g., modular bathrooms + panelised structure.	Coordination between systems and suppliers	CPAC Modular Modubuild
Adaptive Buildings	Homes/ properties designed to respond to changing environmental conditions, occupant needs, and energy demands by using smart systems and flexible layouts.	They help reduce energy use, carbon emissions, and operational costs and extend the useful life of homes.	They move beyond static, one-size-fits-all housing by replacing rigid systems with flexible, responsive design.	Ideal for apartments or mixed-use buildings, or homes that can be adapted to support older people living in their homes for longer.	Upfront costs, difficult to integrate with legacy infrastructure in existing housing, digital literacy is required, higher costs.	Arcology Systems

Technology Map – Internal Building Materials

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Magnesium Oxide (MgO) Board	A mineral-based board made from magnesium oxide, often reinforced with fibres.	Lower embodied carbon than gypsum, highly durable, fire- and mould-resistant.	Gypsum board in walls, ceilings, and wet areas.	Installed like plasterboard—cut, screwed, and finished with skim or paint; ideal for high-moisture or fire-rated applications.	Can be more expensive; quality varies by manufacturer; some products may contain additives.	Resistant Building Products Ltd
Hempcrete Panels	Precast panels made from hemp hurds and lime binder, offering insulation and breathability.	Carbon-negative during growth, breathable, and naturally insulating.	Gypsum board and cavity insulation in internal wall systems.	Installed as infill panels or internal wall linings; often used in timber frame construction or retrofits.	Thicker than gypsum, slower curing, and not suitable for load-bearing walls.	Hempbuild GráHemp Hempire Building Products
Wood Wool Panels	Boards made from long wood fibres bound with cement or lime.	Renewable content, good acoustic and thermal properties, and durable.	Gypsum board in ceilings and wall linings, especially where acoustic performance is needed.	Fixed to timber or metal studs, often left exposed or rendered; used in schools, offices, and eco-homes.	Heavier than gypsum, may require finishing layers, and less common in residential interiors.	None in Ireland
Recycled Paper Panels (Cellulose-Based Boards)	Panels made from compressed recycled paper or cellulose fibres, often with natural binders.	Uses post-consumer waste, low embodied carbon, and recyclable.	Gypsum board in dry interior applications.	Installed similarly to plasterboard; suitable for dry, internal partitions and linings.	Limited moisture resistance, may require surface treatment, and less widely available.	No Irish suppliers or manufacturers identified via desk research
Expanded Cork Panels	Rigid boards made from heated cork granules, bonded without additives.	100% natural, carbon-negative, and provides thermal and acoustic insulation.	Gypsum board in internal linings and insulation layers.	Fixed to walls or ceilings as insulation and finish; can be left exposed or rendered.	Higher cost, limited availability, and may require specialist fixings or adhesives.	Growan Cork

Technology Map – Insulation Building Materials

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Aerogel	A lightweight, highly porous material made from silica, offering exceptional thermal insulation.	Provides high thermal performance with minimal thickness, reducing material use and improving energy efficiency.	Traditional insulation like mineral wool or rigid foam boards.	High-performance wall, roof, and window insulation—especially where space is limited.	High cost, brittle handling, and limited availability.	➜ None in Ireland ➜ Energy Store offers an aerogel and EPS mix
Wood fibre insulation	Insulation boards or batts made from compressed wood fibres, often from sawmill by-products.	Renewable, carbon-storing, breathable, and offers good acoustic and thermal performance.	Mineral wool or synthetic foam; used in walls, roofs, and floors.	Internal and external wall insulation, roofs, and floors.	Heavier than alternatives, moisture-sensitive, and may have longer lead times.	➜ SOPREMA
Hempcrete	A bio-composite made from hemp hurds and lime, used for insulation and wall infill.	Carbon-negative during growth, breathable, and provides thermal mass and insulation.	Concrete blocks or cavity wall insulation; used in non-load-bearing walls and prefabricated panels.	Non-load-bearing walls, insulation infill, prefabricated panels.	Not structural, slower curing, and requires specialist installation.	➜ Hempbuild ➜ GráHemp ➜ Hempire Building Products
Cellulose (recycled paper)	Loose-fill or dense-pack insulation made from shredded, treated recycled paper.	Low embodied carbon, made from post-consumer waste, and excellent at filling voids.	Fibreglass or mineral wool; used in wall cavities, lofts, and floors.	Wall cavities, lofts, and floors.	Can settle over time, requires professional installation, and needs fire/pest treatment.	➜ Ecocel
Sheep's wool	Natural wool insulation, often treated to resist pests and fire.	Renewable, biodegradable, moisture-regulating, and safe to handle.	Fibreglass or synthetic insulation.	Roofs, walls, and floors—especially in breathable or heritage buildings.	Higher cost, limited supply, and quality control needed for durability.	➜ Sheep Wool Insulation Ltd.
Cork	A natural material harvested from cork oak bark, used in insulation and finishes.	Renewable, recyclable, and carbon-negative over its lifecycle.	Synthetic acoustic and thermal boards.	Flooring, wall panels, and insulation boards.	Higher cost, limited sourcing regions, and variable availability.	➜ Roundtower Lime
Expanded cork board	Cork granules expanded into rigid boards without added binders.	100% natural, durable, and provides both thermal and acoustic insulation.	Replaces: Rigid foam boards like EPS/XP.	External walls, roofs, and floors.	Heavier and more brittle, higher cost, and may require specialist fixings.	➜ Roundtower Lime
Insulation from recycled materials	Thermal and acoustic insulation made from recycled textiles, such as old mattresses, clothing, and polyester fibres.	This approach diverts waste from landfill and incineration, reduces the demand for virgin materials, and lowers the embodied carbon of construction products.	Traditional insulation products like: Mineral wool, Fibreglass and Foam boards (EPS/ XPS).	Can be used in the construction of new builds or retrofits.	Moisture sensitive; Needs to meet building regulations for fire safety. New solution requiring education and confidence in performance.	➜ Cirtex
Geocell	Geocell insulation is a lightweight, thermal insulating material made from recycled glass, used beneath floors and foundations.	It reduces embodied carbon, improves energy efficiency, and supports circular construction by repurposing waste glass.	It replaces traditional stone fill and rigid insulation boards, offering a sustainable and thermally efficient alternative.	Installed under slabs or foundations, Geocell acts as both insulation and drainage, ideal for low-energy and passive house builds.	Limited awareness, higher upfront costs, and supply chain availability can hinder broader adoption in mainstream residential construction.	➜ Geocell

Technology Map – Traditional Insulation Building Materials

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Glass fibre insulation/ fibre glass	Spun glass fibres forming a lightweight, flexible insulation.	Widely used, cost-effective, and offers good thermal and acoustic performance.	Older mineral-based or natural fibre insulation.	Attics, walls, floors, and ceilings.	Can irritate skin and lungs during installation; moderate embodied carbon.	Isover (Saint-Gobain Ireland)
Expanded Polystyrene (EPS)	It is a rigid, lightweight foam plastic material made from polystyrene beads that are expanded with steam.	Lightweight, moisture-resistant, cost-effective.	Older rigid board insulations.	Commonly used in external wall insulation systems and underfloor applications.	Fossil-based, flammable unless treated, low recyclability.	Kore Insulation Kingspan Unilin
Extruded Polystyrene (XPS)	Denser and more moisture-resistant than EPS.	Ideal for below-ground and high-load applications.	Replaces: EPS or PUR in demanding environments.	Used in below-grade applications like foundations and basements.	Higher embodied carbon; limited recyclability.	Unilin
Polyurethane (PUR) and Polyisocyanurate (PIR) Boards	High-performance rigid foam boards with foil facings.	Excellent thermal performance in thin profiles.	EPS, mineral wool in space-constrained areas.	Used in roofs, walls, and floors, often in cavity wall insulation.	High embodied carbon; needs to meet building regulations for fire safety.	Provided by SIG Chadwicks Energy Saver Insulations
Mineral Wool (Rock Wool or Slag Wool)	Made from volcanic rock or industrial slag.	Fire-resistant, sound-absorbing, moisture-tolerant.	Glass wool or synthetic boards in fire-sensitive areas.	Used for thermal and acoustic insulation, especially in fire-rated assemblies for walls, roofs, floors, fire barriers.	Heavier than fibreglass; moderate embodied carbon.	Rockwool Paroc (via ISOPARTNER Ireland)

Technology Map – Heating Systems

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Air Source Heat Pumps (ASHP)	Extracts heat from outside air and transfers it indoors via a refrigerant cycle which in turn heats water and indoor spaces.	Highly efficient, reduces reliance on fossil fuels andis suitable for most Irish climates.	Oil, gas, or electric resistance heating.	Suitable for both new builds and retrofits (with good insulation).	Requires well-insulated homes and correct system sizing.	Grant Engineering Unipipe
Ground Source Heat Pumps (GSHP)	Uses underground pipes to extract heat from the earth and transfer it indoors.	Very efficient and stable year-round performance.	Traditional boilers and electric heating.	Best for new builds or retrofits with outdoor space for ground loops.	High upfront cost and space requirements for installation.	Unipipe Heat Pumps Ireland
Exhaust Air Heat Pumps	Captures heat from indoor exhaust air (e.g. bathrooms, kitchens) to provide heating and hot water.	Efficient in airtight homes; combines ventilation and heating.	Electric immersion heaters and mechanical ventilation systems.	Ideal for compact, energy-efficient homes and apartments.	Less effective in poorly insulated or leaky buildings.	Unipipe Unitherm
Infrared Heating Panels	Radiant panels that heat people and objects directly, not the air.	Energy-efficient, low maintenance, and ideal for targeted heating.	Electric convection heaters and storage heaters.	Suitable for retrofits, apartments, and rooms with intermittent use.	Limited whole-house heating capacity; best in well-insulated spaces.	InfraredHeat.ie Pureheat Technologies
Electric Storage Heaters (Modern)	Heaters that store heat during off-peak hours and release it during the day.	Can reduce electricity costs when paired with night tariffs.	Older electric heaters or oil systems.	Common in apartments or homes without gas connections.	Less efficient than heat pumps; limited control over heat release.	Electric Heating Solutions Glen Dimplex
District Heating (Low-Temperature Networks)	Centralised heat generation (e.g. from biomass, waste heat, or heat pumps) distributed to multiple buildings. **	Enables large-scale decarbonisation and efficient use of renewable or waste heat.	Individual boilers and electric heating systems.	Ideal for dense urban housing, social housing schemes, and mixed-use developments.	High infrastructure cost, planning complexity, and regulatory development.	Development of a district heating scheme will require a multi-disciplinary team, so a range of firms will need to be involved.
Solar Thermal Systems	Uses solar collectors to heat water for domestic use.	Reduces demand for fossil-fuel or electric water heating.	Electric immersion or gas water heaters.	Best as a supplementary system in both new and retrofit homes.	Seasonal variability and limited contribution to space heating.	Kingspan Grant Engineering (Ireland) Senergy Innovations SEAI list of registered solar installers HERE
Biomass Systems	A biomass boiler or stove that burns renewable biological material to produce space heating and hot water.	Biomass systems offer a renewable alternative to fossil fuels, helping reduce carbon emissions and improve energy security—especially in rural or off-grid areas.	Oil boilers, LPG systems, and older solid fuel heating systems.	Individual homes, apartment blocks, and district heating schemes—particularly in rural or semi-rural developments with space for fuel storage.	Requires fuel storage, regular maintenance, and careful emissions management. Less suitable for urban areas. Burning any material is the least preferred energy recovery method but may be viable where other low-carbon options are limited.	Glennon Brothers Woodco Energy Enerpower Clearpower

**An example of industrial waste heat is the Amazon Data Centre supplying waste heat to the Tallaght District Heating Network.

Technology Map – Ventilation and cooling systems

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Mechanical Ventilation with Heat Recovery (MVHR)	A whole-house system that exchanges stale air for fresh air while recovering heat from the outgoing air.	It significantly reduces heating demand and improves indoor air quality in airtight homes.	Traditional extract-only or natural ventilation systems.	Installed in new builds or deep retrofits with high airtightness standards.	High upfront cost, complex installation, and reliance on electricity for operation.	Xpelair (Glen Dimplex) ProAir Systems
Demand-Controlled Ventilation (DCV)	A smart ventilation system that adjusts airflow based on humidity, CO_2, or occupancy sensors.	It reduces energy use by ventilating only when needed, improving efficiency.	Constant or manually operated mechanical ventilation systems.	Common in multi-unit residential buildings and retrofits.	Requires sensor calibration and may underperform if poorly maintained.	ADE Services
Positive Input Ventilation (PIV)	A system that gently introduces filtered air into the home to displace stale, moist air.	Helps prevent condensation and mould, especially in older homes.	Passive vents and extract-only systems in poorly ventilated buildings.	Typically installed in lofts or central spaces in retrofit projects.	Limited heat recovery and potential inefficiency in colder climates.	Positive Input Ventilation (PIV)
Natural Ventilation with Passive Design	Ventilation achieved through architectural features like operable windows, vents, and stack effect.	Uses no energy and supports thermal comfort when well-designed.	Mechanical systems in low-energy or climate-responsive buildings.	Integrated into building layout and orientation during design phase.	Performance depends heavily on climate, occupant behaviour, and building design.	Indoor Ventilation Solutions
Hybrid Ventilation Systems	Systems that combine natural and mechanical ventilation, switching modes based on conditions.	Offers flexibility and energy savings while maintaining air quality.	Single-mode ventilation systems that lack adaptability.	Used in larger residential developments or buildings with variable occupancy.	Complex controls and integration can increase cost and maintenance needs.	Aereco Ireland
Cooling Systems	Cooling systems regulate indoor temperatures during warmer months, using mechanical or passive methods to improve comfort.	As Ireland experiences warmer summers and homes become better insulated, overheating risks increase - making cooling more relevant for occupant health and comfort.	Passive-only ventilation or no cooling provision.	No systems in place.	Cooling demand is seasonal and currently low, making investment harder to justify. Mechanical systems can increase energy use and carbon emissions if not carefully selected.	Daikin Ireland – heat pumps with cooling functions Mitsubishi Electric Ireland – split systems and air-to-air heat pumps Unipipe – integrated climate systems

Technology Map – Control Systems

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Thermostatic Radiator Valves (TRVs)	Manual or smart valves that control the temperature of individual radiators.	Enables room-by-room temperature control without full zoning systems.	Radiators with no individual temperature control.	Both retrofits and new builds.	Less precise than full zoning; smart TRVs require connectivity.	Multiple suppliers
Smart thermostats	Wi-Fi-enabled thermostats that learn user behaviour and adjust heating schedules automatically.	Reduces energy use, improves comfort. Enables remote control and integration with other smart systems.	Manual or programmable thermostats.	Both retrofit and new builds.	Requires Wi-Fi, user engagement, and compatibility with existing heating systems.	EPH Controls Climote
Zoned Heating Controls	Systems that divide a home into separate heating zones, each with independent temperature control.	Increases comfort and reduces energy waste by heating only occupied areas.	Single-zone heating systems.	Ideal for both retrofits and new builds, especially larger or multi-storey homes.	Installation complexity in retrofits; requires compatible plumbing and controls.	EPH Controls, Heatmiser, Climote SystemLink
Weather Compensation Controls	Sensors that adjust heating output based on outdoor temperature to maintain indoor comfort efficiently.	Reduces overheating and improves boiler efficiency.	Fixed-temperature heating controls.	Both retrofit and new builds, especially with condensing boilers or heat pumps.	Requires external sensor installation and system compatibility.	Danfoss Vaillant Worcester Bosch
Load Shifting and Demand Response Systems	Smart systems that shift energy use to off-peak times or respond to grid signals to reduce demand.	Supports grid stability, reduces energy bills, and enables integration of renewables.	Static energy use patterns.	Primarily in new builds or deep retrofits with smart meters and battery storage.	Requires smart appliances, user consent, and utility participation.	Energy Cloud
Home Energy Management Systems (HEMS)	Centralised platforms that monitor and automate multiple energy systems (heating, lighting, solar, EV charging).	Provides a holistic view of energy use and enables smart optimisation.	Disconnected or manually operated systems.	Smart homes and energy-positive developments (new build and advanced retrofits).	Requires interoperability, user engagement, and sometimes custom integration.	Comeragh Controls
Building Energy Management Systems (BEMS)	Centralised systems that monitor and control energy use across a building or housing scheme.	Enables data-driven energy management, fault detection, and optimisation.	Manual monitoring and disconnected controls.	Larger residential schemes, communal heating systems, or multi-unit retrofits.	Higher upfront cost, requires technical expertise.	Cylon Controls
CO_2 monitors	Devices that measure indoor carbon dioxide levels to indicate ventilation quality.	Helps prevent poor air quality and supports healthy, energy-efficient ventilation strategies.	No direct replacement—adds a layer of indoor air quality monitoring.	Both retrofit and new builds, especially in airtight homes.	Requires user awareness and integration with ventilation systems.	Multiple suppliers
Battery Storage Management Systems	Controls to optimise when to charge/discharge home batteries based on solar generation, demand and tariffs.	Maximises self-consumption of renewable energy and reduces grid reliance.	Unmanaged or manually operated battery systems.	Homes with solar PV and battery storage (retrofit and new build).	Challenges: Higher upfront cost, system complexity, and integration with other controls.	

Technology Map – Glazing Systems

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Traditional Glazing (Double and Triple)	Two or three panes of glass separated by air or gas-filled cavities to improve insulation.	Reduces heat loss, improves comfort, and lowers energy bills.	Single glazing (now largely obsolete).	Standard in both retrofit and new build homes.	Triple glazing is heavier and more expensive; requires compatible frames.	Munster Joinery, Senator Windows, Carey Glass, Grady Joinery.
Vacuum Insulated Glazing (VIG)	Two panes of glass separated by a vacuum instead of gas, offering high insulation in a slim profile.	Delivers near triple-glazing performance in a thinner, lighter unit—ideal for heritage retrofits.	Double glazing in space-constrained or conservation settings.	Primarily in retrofit, especially in protected or older buildings.	Higher cost, limited availability, and careful handling required.	Pilkington Spacia (via Irish distributors), Carey Glass (import and install).
Solar Control Glazing	Glass with coatings that reduce solar heat gain while allowing natural light.	Prevents overheating, improves comfort, and reduces cooling demand.	Standard glazing in south- or west-facing windows.	Both new builds and retrofits, especially in energy-efficient homes.	May reduce passive solar gain in winter; requires careful specification.	Saint-Gobain Glass Carey Glass Pilkington (via distributors).
Solar Collecting Glazing (BIPV)	Glazing integrated with photovoltaic (PV) cells to generate electricity.	Combines building envelope and renewable energy generation—ideal for net-zero homes.	Standard glazing or opaque cladding in façades and skylights.	Primarily in new builds or deep retrofits with energy-positive goals.	Higher cost, lower efficiency than rooftop PV, and limited design flexibility.	Soltech Energy Solarwatt (via Irish partners), Specialist BIPV installers.

Technology Map – Energy Generation Systems

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Solar Photovoltaic (PV) Systems	Converts sunlight into electricity using rooftop or integrated panels.	Reduces electricity bills and carbon emissions; supports energy independence.	Grid-only electricity supply.	Both retrofit and new build homes.	Upfront cost, roof orientation, and shading.	SEAI list of registered solar PV installers HERE
Microcells in Solar PV	Microcells are ultra-small photovoltaic cells—often millimetres or micrometres in size—designed to be lightweight, flexible, and highly efficient.	Enables energy generation in non-traditional surfaces. Supports aesthetic and architectural flexibility. Can improve efficiency and resilience in distributed solar systems.	Are complementary rather than replacement technology.	They can be embedded into various surfaces and materials, including glass, textiles, and building façades.	Still emerging in commercial markets. Lower power output per unit area compared to conventional PV.	Nines PV
BioCELS (Biological Solar Cells)	BioCELS are a form of biological photovoltaics that use photosynthetic organisms—such as algae or cyanobacteria—to convert sunlight into electricity.	Offers a low-carbon, potentially biodegradable alternative to conventional PV.	Not a direct replacement for rooftop PV yet but could complement or substitute small-scale solar in low-power applications (e.g. sensors, wearables, off-grid devices).	Currently in research and pilot stages	Low power output compared to silicon PV. Scalability and durability are still under development.	Not commercially available
Battery Storage Systems	Stores electricity from solar PV or off-peak grid supply for later use.	Increases self-consumption and resilience; enables load shifting.	Grid reliance during peak hours.	Homes with solar PV or dynamic tariffs.	Cost, lifespan, and space requirements.	No Irish suppliers or manufacturers identified via desk research
Combined Heat and Power (CHP) Systems	Produces electricity and heat from a single fuel source (e.g. gas, biomass).	Improves overall energy efficiency in multi-unit buildings.	Separate boiler and grid electricity.	Larger residential schemes or communal heating systems.	Higher complexity, maintenance, and emissions if fossil-fuelled	No Irish suppliers or manufacturers identified via desk research
Small-Scale Wind Turbines	Generates electricity from wind, typically under 10 kW.	Useful in rural areas with consistent wind; complements solar.	Grid-only supply or diesel generators in off-grid homes.	Rural new builds or off-grid retrofits.	Planning permission, noise, and variable output.	Heverin Renewable Energies
Micro-Hydro Systems	Generates electricity from flowing water (streams or rivers).	Reliable and low-carbon where site conditions allow.	Grid or diesel generators in remote areas.	Off-grid rural homes with water access.	Site-specific, environmental impact, and planning.	Future Renewables Eco Evolution
Micro-Anaerobic Digestion systems	A compact system that converts organic waste into biogas and fertiliser through anaerobic digestion.	It helps decarbonise waste by generating biogas and digestate (a natural fertiliser), so reducing reliance on fossil fuels.	It replaces landfilling or incineration of organic waste, and Fossil fuel-based heating systems and synthetic fertilisers.	It can be used for housing, but is more suitable for centralised systems.	Limited awareness and market uptake, leading to little know-how on maintenance and use	Amu Green
Fuel Cell Systems	Converts hydrogen or natural gas into electricity and heat via electrochemical reaction.	High efficiency and low emissions; emerging tech for homes.	Grid electricity and gas boilers.	Pilot projects, high-performance or off-grid homes.	High cost, limited availability, hydrogen infrastructure.	None in Ireland

Technology Map – Digital enablers

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Digital Twin Technologies	A virtual replica of a building that simulates real-time performance using data and physics-based modelling.	Enables scenario testing, energy optimisation, and informed retrofit decisions.	Static building models and manual performance tracking.	Used to assess retrofit strategies, monitor energy use, and plan for net-zero pathways.	Requires high-quality data, integration with existing systems, and skilled interpretation.	IES
BIM Platforms for Carbon Optimisation	Building Information Modelling tools that integrate design and performance data to optimise carbon outcomes.	Supports early-stage decisions that reduce embodied and operational carbon.	Traditional CAD tools and siloed design workflows.	Used by architects and engineers to model façade performance, material choices, and energy use.	Requires training, data consistency, and integration with carbon tools.	FenestraPro
Carbon Assessment and Integration Tools	Software that calculates whole life carbon impacts across building elements and stages.	Enables transparent reporting and informed material selection for decarbonisation.	Manual carbon calculations and late-stage sustainability assessments.	Used during concept and design phases to compare material build-ups and carbon outcomes.	Data availability, integration with BIM, and evolving standards.	Carbon Designer by IGBC One Click LCA
IoT and Smart Building Integration	Internet-connected sensors and systems that monitor and control energy use, comfort, and security.	Improves energy efficiency and enables responsive building management.	Manual controls and disconnected building systems.	Used for smart heating, lighting, ventilation, and energy monitoring.	Privacy concerns, interoperability, and user engagement.	KNX Ireland Smart Homes Ireland Bespoke Integrated Solutions
Predictive Maintenance Systems	AI or sensor-based systems that anticipate equipment failures and optimise servicing.	Reduces energy waste, extends asset life, and lowers carbon from replacements.	Reactive or scheduled maintenance models.	Applied to HVAC, pumps, and other building systems to monitor performance.	Requires sensor infrastructure and data analytics capability.	Predictive Maintenance Ltd
Grid-Interactive Efficient Buildings (GEBs)	Buildings that actively manage energy use and interact with the grid using smart controls and storage.	Supports demand flexibility, renewable integration, and grid decarbonisation.	Passive energy systems with fixed consumption patterns.	Combines solar PV, battery storage, smart thermostats, and load management.	Requires coordination with utilities, regulatory support, and investment.	No Irish suppliers or manufacturers identified via desk research

Technology Map – Planning and Design Enablers

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Passive House and Low-Energy Design Specialists	Architects and engineers who design homes to Passive House or NZEB standards.	Delivers ultra-low energy homes with high comfort and low emissions.	Conventional design with higher operational energy use.	Applied in new builds and deep retrofits using PHPP and fabric-first principles.	Higher upfront design effort and need for skilled contractors.	MosArt, Passive Dynamics LE+Passive Low Energy Design,
Building Performance and Energy Modelling Consultants	Experts who simulate energy use, thermal comfort, and carbon performance.	Enables data-driven design and retrofit decisions.	Rule-of-thumb or post-construction energy assessments.	Used for BERs, DEAP, PHPP, and dynamic simulation modelling.	Requires accurate inputs and integration with design teams.	Metec Consulting Engineers Codex Energy
BIM and Digital Design Consultants	Specialists in Building Information Modelling (BIM) and digital workflows for housing.	Improves coordination, reduces waste, and supports carbon tracking.	2D CAD and siloed design processes.	Used for clash detection, carbon optimisation, and digital twins.	Requires training, software investment, and data standards.	ArcDox Digital Built Consultants BIMflo
Retrofit and MMC Advisory Firms	Firms that advise on deep retrofit strategies and modern methods of construction.	Supports scalable, low-carbon housing delivery.	Traditional, fragmented retrofit approaches.	Used for project scoping, grant applications, and MMC integration.	Skills shortages, procurement barriers, and cost uncertainty.	Retrokit BerWow Verdé
Whole Life Carbon and LCA Specialists	Consultants who assess embodied and operational carbon across a building's lifecycle.	Supports compliance with EU taxonomy, green finance, and future regulations.	Operational-only carbon focus.	Used in early design to inform material choices and carbon benchmarks.	Data availability, evolving standards, and integration with cost planning.	Lawler Sustainability KSN IGBC
Planning and Urban Design Consultants	Firms that shape sustainable neighbourhoods through masterplanning and policy alignment.	Enables compact growth, active travel, and climate-resilient communities.	Car-centric, low-density development patterns.	Used in site planning, density optimisation, and green infrastructure design.	Balancing planning policy, community needs, and viability.	MCORM Brady Shipman Martin Levitt Bernstein (UK)
Sustainability and ESG Consultants	Firms that guide organisations on climate strategy, ESG reporting, and decarbonisation planning.	They help align housing projects with climate targets, funding requirements, and stakeholder expectations.	Ad hoc or compliance-only approaches to sustainability.	Supports strategy development, carbon roadmaps, and ESG integration.	Requires cross-departmental buy-in and long-term commitment.	SustainabilityWorks Anthesis Retrokit

Technology Map – Nature Based Solutions

Solution	What this is	Why it matters...	Replaces	Used In	Challenges...	Irish providers
Green Roofs and Green Walls	Vegetated roof or wall systems that support plant growth.	Improve insulation, reduce urban heat, manage rainwater, and enhance biodiversity.	Conventional roofing and cladding materials.	Both retrofit and new builds, especially in urban or high-density housing.	Structural load, maintenance, and upfront cost.	Landtech Soils Living Roofs Ireland Moy Materials.
Sustainable Drainage Systems (SuDS)	Natural systems like swales, rain gardens, and permeable paving that manage stormwater.	Reduces flood risk, improves water quality, and supports biodiversity.	Traditional piped drainage systems.	Both new developments and retrofit landscapes.	Space requirements, maintenance, and integration with existing infrastructure.	SuDS Ireland ACO Ireland OutHaus.
Wetlands and Retention Ponds	Engineered or natural water bodies that store and filter runoff.	Manage flood risk, support biodiversity, and improve water quality.	Hard drainage infrastructure or unused green space.	Larger housing developments or adjacent green infrastructure	Land availability, safety, and long-term management.	Wetland Surveys Ireland Ecofact SuDS Ireland.
Urban Greening and Tree Planting	Planting native trees, shrubs, and wildflowers to enhance green space.	Reduces heat, improves air quality, supports biodiversity, and enhances wellbeing.	Hard landscaping or monoculture lawns.	All residential settings—retrofit and new build.	Maintenance, species selection, and soil conditions.	Landtech Soils Wild Work Connecting Nature.
Rainwater Harvesting with Natural Overflow	Collecting rainwater for reuse, with overflow directed to SuDS or rain gardens	Reduces mains water use and stormwater runoff.	Sole reliance on mains water and piped drainage.	New builds and retrofits with garden or roof space.	Installation cost, maintenance, and water quality.	Rainwater Harvesting Systems Ireland Kingspan Water Glan Agua.
Community Allotments and Shared Gardens	Shared green spaces for growing food and fostering community.	Builds resilience, improves mental health, and supports local food systems.	Underused or fenced-off green space.	New developments and retrofit estates.	Management, access, and long-term stewardship.	GIY Ireland
Green Infrastructure for Cooling	Use of vegetation and shading to reduce overheating in homes and public spaces.	Improves thermal comfort and reduces reliance on mechanical cooling.	Hard landscaping and exposed surfaces.	Urban housing, especially in heat-prone areas.	Design integration, maintenance, and performance monitoring.	No Irish suppliers or manufacturers identified via desk research
Permeable paving systems	Paving solutions that allow water to pass through the surface into the ground, reducing runoff and supporting sustainable drainage.	Helps manage stormwater on-site, reduces flood risk, and supports climate resilience — increasingly important as rainfall intensifies and urban surfaces expand.	Traditional impermeable paving (e.g. concrete, tarmac) that channels water into drainage systems.	Driveways, patios, paths, parking areas, and shared surfaces in residential developments.	Requires proper sub-base design for effective drainage; Needs regular maintenance to prevent clogging; upfront costs;	Roadstone Kilsaran

Case study: Carbery Housing – Red Wolf Project

RED WoLF (Rethink Electricity Distribution Without Load Following) is an EU-funded Interreg North-West Europe project aimed at reducing carbon emissions from residential housing by improving how renewable energy is stored and used. The project addresses the mismatch between renewable energy generation and household energy demand—particularly in homes without gas connections.

Carbery Housing Association (CHA) was one of the Irish partners in the project, contributing to one of six pilot sites across Ireland, the UK, and France. CHA retrofitted homes with Hybrid Storage Systems (HSS) that combine:

- Solar PV panels
- Battery storage
- Smart storage heaters

These systems allow homes to:

- Store solar energy for local use
- Draw low-carbon electricity from the grid during off-peak times
- Reduce reliance on carbon-intensive "load-following" power plants

The HSS is managed by a smart control system that optimises energy use based on:

- Local demand
- Electricity prices
- Weather forecasts
- Grid carbon intensity

The project demonstrated how combining existing technologies—solar PV, batteries, and thermal storage—can create affordable, scalable solutions for low-carbon heating and energy use in social housing. CHA's involvement highlights the potential for community-led climate action and innovation in Ireland's housing sector.

To find out more go to: https://www.carberyhousing.eu/european

Conclusion

The decarbonisation of Ireland's social housing stock is not a distant ambition - it is a present-day imperative. For AHBs, this journey is complex but achievable, and the rewards are significant: healthier homes, lower energy bills, stronger communities, and a more resilient housing system.

This guide has outlined the practical steps, technologies, and enablers that can support AHBs in delivering on their climate commitments. From passive design to renewable energy, from circular construction to resident engagement, the solutions are here—and so is the opportunity.

But no single organisation can do this alone. Decarbonising Ireland's AHB housing portfolio will require coordinated action across the sector, supported by policy, funding, skills, and innovation. It will require listening to residents, investing in people, and embracing new ways of working.

The path forward is clear. The time to act is now.

Appendices

Appendix I: The Retrofit Finance Challenge for AHBs

For a summary overview of how AHBs are funded, see the 2023 report, Environmental Leadership in Ireland's Social Housing Sector, by SustainabilityWorks on behalf of the Housing Alliance and funded by the Housing Agency. For a more detailed version, please go to the 2023 report, Building on Success, A Financial Roadmap for the AHB Sector, by the ICSH.

AHBs face significant challenges in funding retrofits due to structural issues in their funding landscape, including:

- **Lack of Cash Flow from Older Homes:** Many older homes were financed under older schemes like the Capital Loan and Subsidy Scheme (CLSS) or Capital Assistance Scheme (CAS), which provide insufficient income (e.g., differential or economic rents) to cover ongoing management, maintenance, and retrofit costs. Differential rents, for example, are income-related while economic rents are capped by resident affordability and are insufficient to cover the increasing costs of management, maintenance and lifecycle. These homes often have negative cash flow, making it difficult to allocate funds for retrofitting.
- **Ringfenced Cash Reserves:** Cash reserves in AHB balance sheets are often legally or practically ringfenced for specific purposes, such as repaying CALF loans or covering lifecycle costs for homes financed under newer schemes. These reserves cannot be redirected to fund retrofits for older stock.
- **Debt Covenants and Financial Viability:** AHBs are subject to strict company law, accounting standards, and debt covenants. Boards must ensure long-term financial viability and cannot cross-subsidise retrofits with funds raised for other purposes.
- **Split Incentive Issue:** AHBs bear the cost of retrofit works, but residents benefit from lower energy bills. This split incentive makes it challenging to justify the investment without additional revenue streams.
- **Limited Access to Private Finance for Retrofits:** While private investors and lenders show interest in funding the delivery of new BER A-rated social housing, retrofits are less viable for new loans due to cash flow and gearing issues.
- **Partial Grant Funding:** Unlike local authorities, which receive 100% funding for social housing retrofits, AHBs only receive partial grants. So, while grants are available, they often result in significant net losses for AHBs. The grants, while welcome, are available across three different grant programmes, making it complex and challenging to navigate and the average level of grant funding received by AHBs at c.50% of project costs is below the 90% grant required for project viability (see 3cea research commissioned by the ICSH in 2021).

Appendix II: Definitions

- **Building Energy Rating (BER):** a standardised measure of a building's energy efficiency, rated from A1 (most efficient) to G (least efficient), expressed in kWh/m^2/year.
- **Building Life Cycle** stages are defined as per EN 15978:2011. It categorises the building life cycle into five key stages, aligned with a cradle-to-grave approach, and is set out in Figure 6.
- **Carbon Literacy:** awareness and understanding of climate change and carbon emissions, enabling informed decision-making and behaviour change.
- **Circular Construction:** design and building practices that prioritise reuse, recycling, and material recovery to minimise waste and embodied carbon.
- **Decarbonisation:** the process of reducing and ultimately eliminating greenhouse gas emissions from buildings, including both operational and embodied carbon.
- **Digital Twin:** a virtual replica of a building that simulates real-time performance using data and modelling to optimise energy and carbon outcomes.
- **District Heating:** a centralised system that distributes heat to multiple buildings from a single source, often using renewable or waste heat.
- **Embodied Carbon:** emissions associated with the production, transport, and installation of building materials.
- **Energy Poverty:** when households struggle to afford adequate heating and energy services, often linked to poor insulation and inefficient systems.
- **Environmental Product Declarations (EPDs):** verified documents that provide data on the environmental impact of construction products, used to inform material choices.
- **Greenhouse gases (GHG):** GHGs are gases that trap heat in the atmosphere and are called greenhouse gases. These include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and fluorinated gases (e.g., HFCs, PFCs, SF_6, NF_3). Each of these gases varies in how long it stays in the atmosphere and how strongly it absorbs energy. Their impact is often measured using Global Warming Potential (GWP), which compares their warming effect to that of CO_2.
- **Living Labs:** real-world environments where housing providers and residents co-create and test sustainable solutions, fostering innovation and community engagement.
- **Minimum Energy Performance Standards (MEPS):** regulatory thresholds under EPBD 2024 requiring upgrades to the worst-performing 15% of buildings by 2030.
- **Modern Methods of Construction (MMC):** innovative building techniques such as modular, prefabricated, and digitally enabled construction that improve efficiency and reduce carbon.
- **Net-Zero Carbon:** a state where the total carbon emissions associated with a building or portfolio are balanced by carbon removal or offsetting, ideally through direct reductions.
- **Net Zero Embodied Carbon:** A net zero embodied carbon asset (building) is one where the sum total of GHG emissions and removals over an asset's life cycle (A1-A5, B1-B5 and C1-C4) are minimised, meets local carbon targets (e.g. kgCO2e/m2), and with additional 'offsets', equals zero. (CIBSE/ LETI)
- **Net Zero WLC:** A net zero WLC asset (building) is one where the sum total of all asset related GHG emissions, both embodied and operational, over the asset's life cycle (modules A1-A5, B1 – B7(plus B8 and B9 for infrastructure only), C1-C4) are minimised, meet local carbon, energy and water targets, and with residual 'offsets', equals zero. (CIBSE/ LETI)
- **Operational Carbon:** emissions from energy used during the building's operation, such as heating, cooling, lighting, and appliances.
- **Passive Design:** architectural strategies that maximise natural light, ventilation, and thermal stability to reduce reliance on mechanical systems.
- **Scopes 1, 2, and 3 Emissions:** categories of emissions used in carbon footprinting: Scope 1 (direct), Scope 2 (indirect from purchased energy), Scope 3 (all other indirect emissions, including supply chain and resident use).
- **Smart Building Technologies:** systems that use sensors and automation to monitor and optimise energy use, comfort, and maintenance.
- **Whole Life Carbon (WLC):** is the total carbon footprint of a building over its entire life cycle, including operational carbon (emissions from heating, cooling, lighting, and appliances) and embodied carbon (emissions from the extraction, manufacture, transport, installation, maintenance, and disposal of building materials).

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Housing Alliance
More Social and Affordable Homes

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An Ghníomhaireacht Tithíochta
The Housing Agency

Final report on a Research Support Programme (RSP) project funded by the Housing Agency.

The Housing Agency's purpose is to accelerate housing supply, in partnership with our key stakeholders, by providing our expertise, support and resources to deliver high-quality homes in vibrant communities. A strategic objective is to support stakeholders and policy makers by providing innovative thinking through evidence-based housing insights and data. In this vein, the Research Support Programme funds research projects which respond to key topical issues in housing and have the potential to impact on housing policy and practice. The views expressed in this report are those of the author and do not necessarily represent those of The Housing Agency.

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