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URBAN RETROFIT

URBAN RETROFIT: A SYSTEMATIC EVIDENCE REVIEW

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UK COLLABORATIVE CENTRE FOR HOUSING EVIDENCE

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About Urban Retrofit

Urban Retrofit is a £1.77m research project led by the UK Collaborative Centre for Housing Evidence at the University of Glasgow investigating how to scale-up place-based adaptations to the built environment through planning and development systems. The project is funded by the UKRI Economic and Social Research Council (ESRC) as part of the place-based approaches to sustainable living research portfolio (Project Reference ES/Z502728/1). The Urban Retrofit project team is based at the University of Glasgow, University of Sheffield, Cardiff University, University of the West of England, Ulster University and Dalhousie University (Canada), and is working to co-produce the research with planning, property and community partners across the UK and around the world.

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Disclaimer

All views and any errors contained in this report are the responsibility of the authors. The views expressed should not be assumed to be those of the ESRC, the UK Collaborative Centre for Housing Evidence, our Project Partners or the members of our Project Advisory Group.

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URBAN RETROFIT: A SYSTEMATIC EVIDENCE REVIEW

THE URBAN RETROFIT CHALLENGE

The built environment is a major contributor to the climate crisis. The UK Green Building Council (UKGBC) estimates that 25% of the UK's Greenhouse Gas Emissions (GHGs) come from the built environment, while the Royal Institution of Chartered Surveyors (RICS) suggests that heating homes may account for about 15% of total emissions. Beyond the UK, the European Environment Agency has calculated that buildings are responsible for more than 30% of Europe's environmental footprint. These stark statistics demand that swift action be taken to improve the energy efficiency of buildings and reduce the reliance on fossil fuels for heating and cooling them. Yet, at the same time, the emphasis on reducing emissions from buildings that is captured in these statistics obscures many other ways that urban areas contribute to global warming.

The UKGBC finds that when building emissions are combined with vehicles moving around UK towns and cities, the total contribution of the built environment rises to 42%. This underscores an urgent need to think well beyond the building envelope and identify ways to holistically plan and adapt the form and function of urban areas in ways that drive down emissions but also remain socially just and equitable.

Following Dixon and Eames[1], we call this more comprehensive approach 'urban retrofit' and define it as a multi-scalar means of repairing existing places, kerbing the outward growth of towns and cities and creating opportunities for people from all walks of life to lead more sustainable lifestyles. To be successful, urban retrofit must encompass modifications to buildings and the spaces in-between them, which can be joined up across integrated urban systems[2], implemented through place-based policy and regulatory tools and clearly evaluated to understand their impact on reducing emissions and improving quality of life.

Examples of urban retrofitting interventions and policy tools include (but are not limited to): infrastructure programmes that deliver blue-green corridors, multi-modal and affordable public transport, separated bike lanes and district energy networks; planning policies and regulations that require more energy efficient buildings, encourage dense mixed-use development and affordable homes in the right places; and community-based actions that create opportunities for urban greening, local food growing and the adaptive reuse of vacant land and buildings.

The UKGBC calculates that the built environment contributes 42% of UK GHG emissions when buildings are combined with vehicular movements.

Policy obstacles

The UK government has set an ambitious goal to achieve net zero and a 'just transition' by 2050. Yet, while the number and diversity of net zero pilot programmes and demonstration projects are increasing, mainstream planning and development continues to prioritise economic growth and housing production over place adaptation. This is because local plans have so far failed to decisively address the climate crisis[3,4]. There is also a persistent lack of funding for net zero planning initiatives[5] and politicians send conflicting signals about their commitment to net zero.

In ***Powering Up Britain – The Net Zero Growth Plan***, published by the UK Government in 2023, the urgency of net zero is tied more to energy security, the electrification of energy, road and rail infrastructure and long-term economic prosperity in the face of geopolitical tensions, than it is to adapting the built environment for climate change. More recently, emerging proposals in the **Planning and Infrastructure Bill** for England seek to speed up the delivery of new homes in ways that will inevitably accelerate development on greenfield land and add pressure to already tenuous environmental safeguards [6].

Lessons from the recent past suggest this will perpetuate more low-density, car-dependent suburbs that are likely to have high transport-related emissions and energy demands[7,8,9]. A 2024 **New Economics Foundation study** reveals that, in the past 15 years, new-build housing development in England has become increasingly car-dependent relative to existing homes and neighbourhoods. It also finds that most new homes are located in peripheral areas where public transport and active travel provisions are lacking. Furthermore, a joint **RTPI and LandTech study** found that, from 2012 to 2021, there was little to no increase in the use of public transport for accessing local facilities by the residents of new-build housing developments. Thus, by failing to challenge the logic of the growth-orientated practices shaping the built environment, a stark ***implementation gap*** exists between the ambitions of net zero policy and delivery on the ground.

Aims of Urban Retrofit

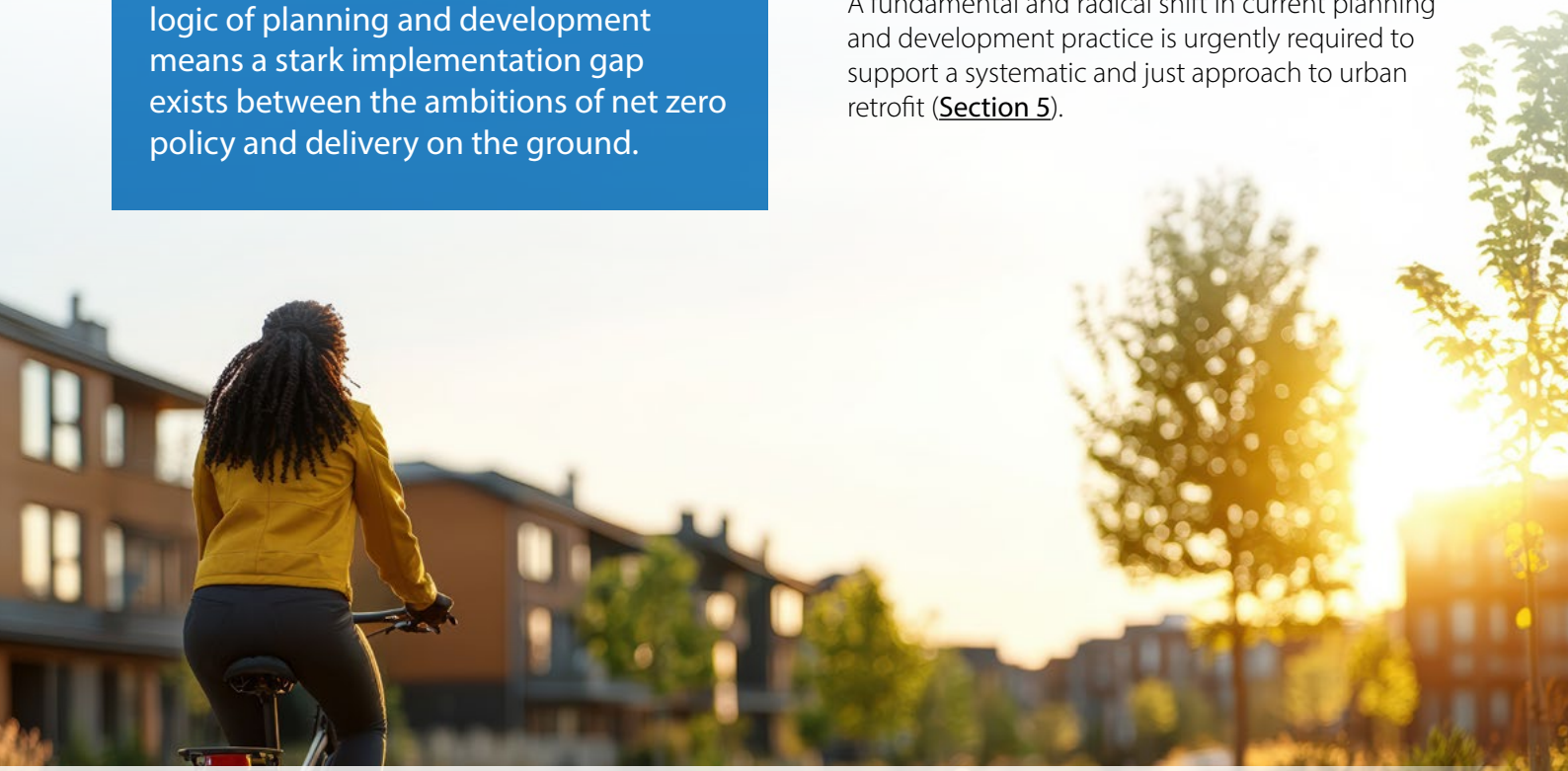
The Urban Retrofit research project seeks to identify ways of closing this implementation gap by repositioning planning as an equitable and restorative process that prioritises the repair and adaptation of the built environment over new development.

This systematic evidence review is the first major output of the Urban Retrofit project and sets the stage for a collaborative programme of data collection, analysis and lesson sharing with planning, property and community partners in some of the UK's largest core city regions, as well as cities overseas.

Based on a systematic literature mapping exercise, which examined over 300 academic papers and 200 policy documents (Appendix), the report examines existing global evidence on place-based urban retrofit. Acknowledging the complexities around contextual specificity and policy transferability, while also recognising the social and political tensions associated with certain climate change-related topics, it addresses five questions.

> The failure to challenge the growth logic of planning and development means a stark implementation gap exists between the ambitions of net zero policy and delivery on the ground.

- **What does urban retrofit mean and why does it matter?**
  Urban retrofit prioritises the adaptation of existing buildings and settlement patterns over the development of new places to reduce emissions from the built environment (Section 1).
- **Why is urban retrofitting challenging to deliver?**
  Urban retrofitting requires action across multiple sectors and faces entrenched institutional, fiscal, social and technical barriers (Section 2).
- **Who is responsible for enabling urban retrofit and what challenges do they face?**
  Planning, development and community stakeholders all have a role to play in enabling urban retrofit, but they can also disrupt it (Section 3).
- **How do we know if urban retrofitting really works?**
  Better evidence, evaluation and capacity is needed to assess whether retrofitting efforts are delivering genuine climate benefits (Section 4).
- **What kind of urban retrofitting do existing places need?**
  A fundamental and radical shift in current planning and development practice is urgently required to support a systematic and just approach to urban retrofit (Section 5).



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WHAT DOES URBAN RETROFIT MEAN AND WHY DOES IT MATTER?

This section outlines the imperative of urban retrofit as a means of focusing urgently on the existing built environment and its largely unrealised adaptability in the face of the climate crisis. The evidence finds that urban retrofit embodies a broad spectrum of policy, regulation and physical interventions which, concurrently, require the deployment of process-orientated governance tools and evaluative mechanisms to ensure successful delivery.

Mitigating and adapting to climate change

The changing climate is affecting human settlements in myriad ways as sea levels rise, the weather becomes more unpredictable and natural disasters become more severe. These very real impacts highlight the need to reduce GHGs and ***mitigate*** against climate change. More recently, however, ***adapting*** to climate change has become equally important since the very-real damage wrought by rapidly changing climate patterns can no longer be addressed through mitigation alone[10,11].

Embodied carbon

Emissions associated with materials and construction processes throughout the whole lifecycle of a building or other urban infrastructure.

Operational carbon

Emissions associated with energy used to operate a building or other urban infrastructure.

Embodied carbon vs operational carbon[12]

Embodied carbon is key to decarbonising the built environment

There is a growing consensus that the built environment will need to be decarbonised through adaptation if global climate targets are to be met. Research by the RIBA and Architects Declare highlights that climate action on the built environment can contribute significantly to wider decarbonisation efforts because the heating, cooling and operation of buildings contributes as much as 28% of energy-related GHG emissions globally. Notably, RICS published a series of reports in 2023 on decarbonisation practices around the world and found that, despite various policy measures, all of the locations studied faced similar decarbonisation implementation gaps, particularly with respect to embodied carbon.

In the UK, the challenges associated with embodied carbon persist. Further research by RICS in 2022 and 2023 found that, despite numerous policy initiatives over the years, decarbonisation in the UK is hindered by a lack of intervention on embodied carbon. In the 2022 report, in particular, they troublingly note that 'an increasingly significant part of real estate emissions is not only uncontrolled, but not even measured.'[13]

1

The curse of growth-orientated development

Mainstream planning and development practices in the UK and elsewhere are highly growth-orientated and focus on building at ever greater volumes. Continuing on such a path will exacerbate the impacts of embodied carbon generation[14]. This troubling status quo also highlights the widening gulf between envisioned climate conscious actions and the actual uptake of sustainable practices in policy formation and delivery. A 2021 research report by Localis, a not-for-profit think tank promoting 'localist' ideas, found that only 62% of English local authorities that had declared a Climate Emergency by the end of 2020 had subsequently updated their climate action plans. Research on sustainability practices in a large sample of European cities has also found that many local governments have failed to halt new 'land take' (i.e. greenfield development)[15], despite having local spatial development strategies that encourage functional mix and compactness.

With this problem in mind, academic debates in recent years have explored the ideas of 'post-growth' and 'de-growth' to challenge and critique the more optimistic notion of 'green growth'.

Proponents of green growth think it is possible to achieve economic growth and reduce climate change risks simultaneously[16]. In contrast, the post-growth coalition cautions that there is no conclusive evidence supporting the possibility of decoupling GDP growth from carbon emissions[17]. This leads them to argue that the changes delivered by current and planned climate actions will never be enough to halt climate change and that sustainability-focused actions, closely coupled with social justice and human wellbeing intentions, must be the priority – even if economic growth is negatively affected[18,19,20]. De-growth proponents go even further in their critique, contending that a deliberate reduction in consumption must occur with the burden necessarily assumed by higher-income countries[21,22].

Post-growth and de-growth theorists are right to question the logic of GDP. While GDP remains the most widely used metric for measuring the relative economic performance of countries around the world, it ignores factors such as pollution, environmental degradation and social inequality. Longstanding criticisms of GDP have led to calls for new or revised metrics that directly consider inclusivity and sustainability when comparing the relative performance of nation states. The UN's Sustainable Development Goals (SDGs), for example, identify a wide range of health and wellbeing, equality and climate concerns. The SDGs highlight the necessity of achieving a socially just transition that avoids a narrow focus on the environmental dimensions of net zero over wider socio-economic values and concerns[23], such as access to affordable housing and natural public spaces in the city.

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Writing from a post-growth perspective, Barry argues that planning should be recalibrated towards designing 'urban forms that produce high levels of human wellbeing and flourishing while using less energy and resources and where growth is a potential by-product, not the goal of planning'[24]. In a similar vein, numerous organisations, including the European Environment Agency, UKGBS, RICS and the Asian Development Bank, point out both the urgent need to prioritise the adaptation of existing buildings and promote so-called 'frugal architecture' by 'rehabilitating rather than demolishing and rebuilding new'[25]. While demolishing and building anew can be effective at reducing operational energy, refurbishing, retrofitting and reusing existing buildings is crucial for reducing embodied carbon emissions[26,27].

Retrofitting the built environment

Presently, the term 'retrofit' is most commonly associated with adapting residential and non-domestic buildings to make them more energy efficient. The London Energy Transformation Initiatives state that retrofitting encompasses 'the upgrading of a building to enable it to respond to the imperative of climate change'. Strategies typically involve improving the building envelope, replacing energy systems with renewable technologies and optimising monitoring and control[28]. The scale, focus and implementation of building retrofitting also tends to be further categorised as 'light' or 'deep', 'project-focused' or 'systematic' and 'one-off' or 'over-time'[29,30,31].

There exists notable disagreement, especially in the academic discourse, on the extent to which retrofit differs from similar terms like refurbishment, renovation and rehabilitation[32,33,34,35]. Some studies make a strong case for thinking beyond retrofitting a single building and looking at the multiple systems, scales and transformations required in the wider built environment[36,37,38,39,40]. These studies also consider wellbeing, aesthetic and other social benefits that retrofitting might precipitate, in addition to reducing the use of carbon and improving energy efficiency[41,42].

1

Urban Retrofit – an interlinked and multi-dimensional concept

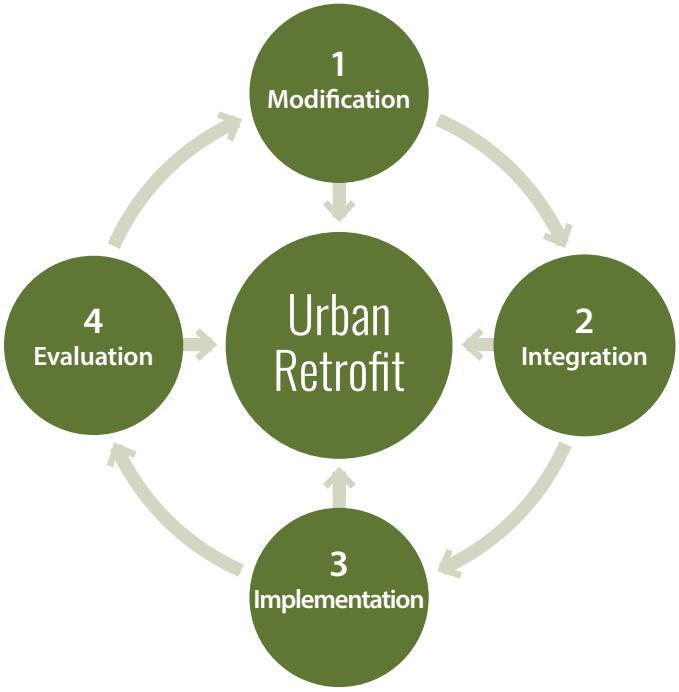
The value of looking beyond buildings and across the wider built environment is central to the conceptualisation of 'urban retrofit' in this evidence review. This serves as a reminder that an individual building can be low in both embodied and operational carbon yet still be part of a carbon-intensive built environment (e.g. a sprawling suburb). It also underscores the need to understand the planning and development processes that shape 'sustainable' interventions in the built environment and how their success is measured. The research thus adopts an interlinked conceptualisation of urban retrofit that has four action-orientated dimensions:

1. **Modification:** Interventions that improve the energy efficiency of buildings and neighbourhoods (e.g. installing insulation and heat pumps and creating district energy systems, etc.), make existing urban and suburban districts more accessible (e.g. introducing bike lanes, multi-modal public transportation, denser mixed use development and multi-tenure housing choices, etc.) and prioritise community-led and nature-based solutions across the urban-to-rural transect[43] (e.g. urban agriculture, wildlife corridors and the adaptive reuse of derelict and vacant property, etc.).

2. **Integration:** Interventions that are both appropriate for their immediate context on the rural-to-urban transect (e.g. city centre, inner city, suburb, outer suburb and rural fringe) and form part of wider urban systems (e.g. transportation routes, energy networks and green-blue corridors).

3. **Implementation:** Approaches to national, regional and local urban governance (e.g. local plans, participatory processes, design guidelines and financial mechanisms, etc.) which prioritise and actively support multi-scalar interventions that reduce carbon emissions and ensure just and equitable outcomes.

4. **Evaluation:** Applying rigorous means of quantitative and qualitative measurement (e.g. energy performance evaluation, scenario modelling and post-occupancy surveys, etc.) to ensure interventions in the built environment enhance local sustainability and slow the outward growth of existing places.



The four dimensions of Urban Retrofit

In addition to the four dimensions of urban retrofit, there are also various temporal considerations highlighted in the literature. The evidence differs on whether retrofitting interventions need to happen now or whether it is more beneficial to wait until technologies improve and market risks are reduced[44,45]. There is also a growing body of research that highlights the importance of seeing beyond the immediate short-term benefits of 'one off' retrofits and being much clearer about the long-term and knock-on benefits of scaling-up the delivery of urban retrofit across urban systems[46,47].

A scalable and multi-dimensional approach to urban retrofit has the potential to deliver a range of benefits that not only reduce carbon emissions but also improve the quality of day-to-day life[48]. This includes improving the thermal comfort of new and existing dwellings and places of work, reducing the cost of energy bills, widening accessibility to public transport and enhancing its quality and frequency, enabling industrial innovation and creativity, as well as creating opportunities for people to lead healthier and more sustainable lifestyles that improve their physical and mental health.

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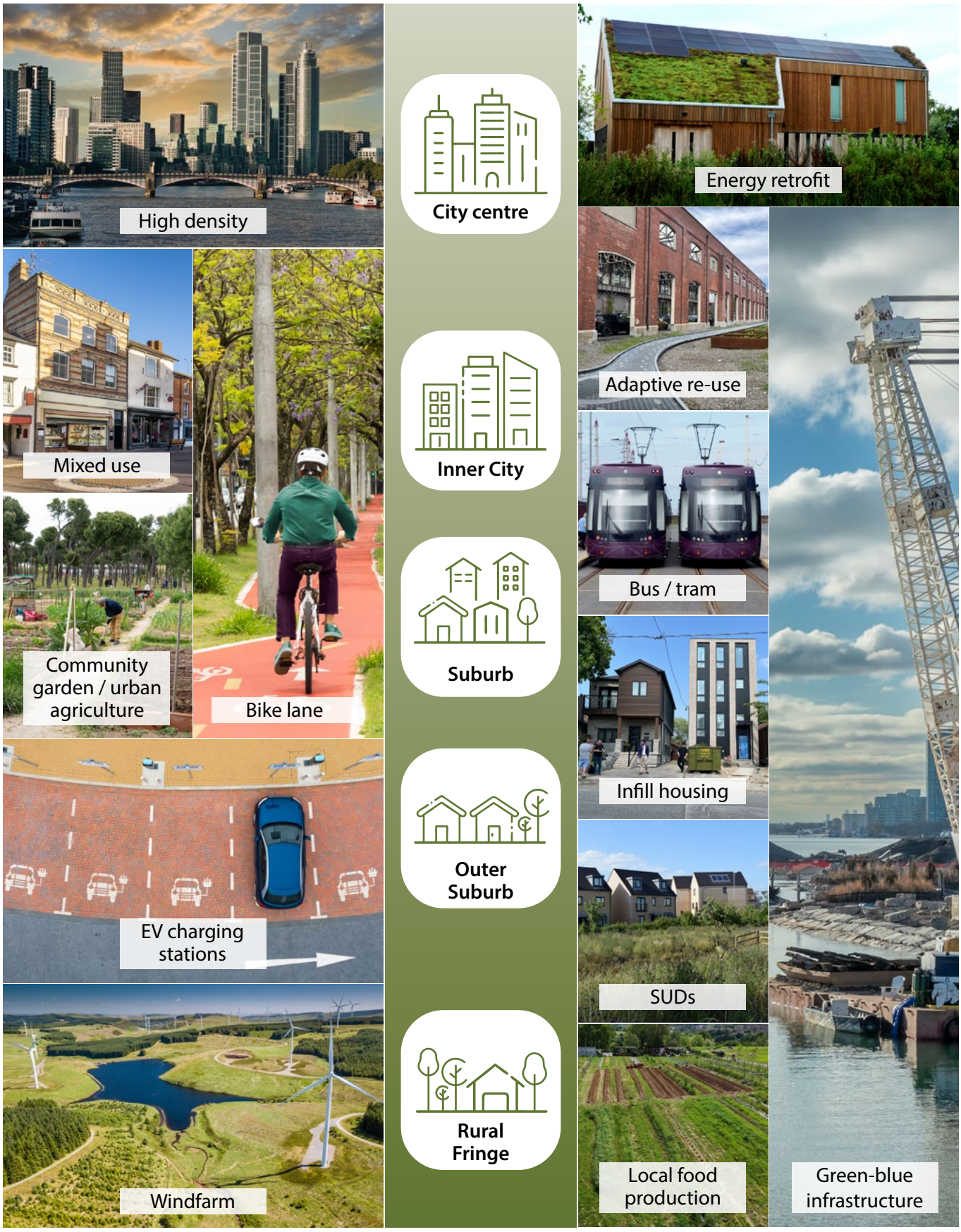

Urban Retrofit interventions across the urban-to-rural transect[19]

1

Summary: What does Urban Retrofit mean and why does it matter?

- The built environment needs to be decarbonised but an implementation gap exists between policy and practice.
- Focusing on retrofitting the existing built environment, rather than creating new places, should be prioritised.
- Urban retrofit has four interlinked dimensions – modification, integration, implementation and evaluation – and extends across the urban-to-rural transect, well-beyond the building level.
- Urban retrofitting has health, wellbeing and economic benefits in addition to reducing carbon emissions.

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WHY IS URBAN RETROFITTING CHALLENGING TO DELIVER?

This section considers the complexities associated with implementing urban retrofit. It focuses on the need for a multi-stakeholder approach and considers the evidence on the technical, contextual and political challenges inherent in delivery. The section also reflects on the behaviour changes and professional skills gaps that will need to be filled to ensure place adaptation interventions are successful.

The implementation gap

The significant implementation gap between visions of sustainable development and realities on the ground is captured in various studies by professional organisations, including: the TCPA; the RIBA; the Local Government Association; the Urban Institute; and The Prince's Foundation (now The King's Foundation). It is also echoed in academic research, where the data suggests that the gap results from either a lack or a misalignment of policies, actions and financial support at different governance levels. This is exacerbated by inadequate skills and capacities across the built environment professions.

Urban retrofit is a collective endeavour

There are a wide range of manuals and guides on retrofitting buildings and cities. Although these tend to target specific audiences (e.g. architects, planners or community group, etc.), there is a consensus that retrofitting isn't possible without the collective work of a wide range of actors with different responsibilities in the planning, design and delivery of policies and projects. It is also contingent on investment from various funding sources that are not always easy to capture.

The evidence suggests that partnerships are needed across different government departments and agencies and at different levels of government, as well as between housing providers, design and construction professionals, community groups and homeowners and/or occupiers[50,51]. It is nevertheless acknowledged that collaboration may not be easy, especially given the diversity of positions, interests and motivations of stakeholders involved in urban retrofit. This includes diverging opinions about the best or most viable on-site solution, for example, or how the funds allocated to a project are distributed.

2

Urban retrofit faces technical, contextual and political challenges

Retrofitting buildings and the wider built environment is undeniably a technically challenging and complex endeavour. Houses, for example, are intrinsically hard to decarbonise for a variety of reasons, including their age, the type of construction, design features and materials. There is also the difficulty of working around occupants (especially in rented accommodation) and context-related characteristics, such as local micro-climates and grid restrictions [52,53]. Land and property ownership also creates challenges. In residential buildings where the dwelling units are rented, for example, the 'landlord/tenant dilemma' can act as a barrier to retrofitting because the property owners will not enjoy the benefits of energy cost reduction despite bearing the costs[54].

At the level of a town or city, the challenges tend to be more strategic. For instance, local authorities may be unable to implement viable mitigation and adaptation measures if they do not own a sufficient amount of land in a given area[55]. This dilemma makes it particularly difficult to retrofit low-density places. The outer suburbs, for example, 'tend to be poorly equipped in terms of management, ownership and institutional capacity for long-term thinking about planned or communal changes'[56], especially when a local authority seeks to encourage more sustainable development practices, such as densification.

Retrofitting, especially at scale, can also be hindered by a lack of, or overly restrictive, financial support (as noted above), ineffective or ill-defined policy actions and a lack of clarity on the objectives or responsibilities of different stakeholders[57,58,59]. These difficulties are compounded by the divisive politics of climate change whereby Climate Emergency declarations and urban retrofitting initiatives like the '15-Minute City' and 'Low Traffic Neighbourhoods' have been challenged on the political right and even associated with conspiracy theories[60,61].

It should also be acknowledged that urban retrofit is inherently contextual. While this review draws on international evidence and references transferable 'best practices', it is important to acknowledge that some urban retrofit practices are supported by context-specific legal, political and cultural systems and, as a consequence, cannot be applied elsewhere unproblematically.

2

Behaviour change is required to achieve a long-term sustainable transition

The UK Government's 2021 ***Net Zero Strategy: Build Back Greener*** and subsequent policy announcements place considerable emphasis on reducing emissions from all sectors of the UK economy and make clear that these reductions should be supported by 'cheap clean electricity, made in Britain'[62]. This has precipitated a built environment policy focus on installing domestic heat pumps and other low-energy heating and cooling systems, encouraging the adoption of electric vehicles and electrifying ageing diesel-powered railway infrastructure.

Much less policy attention has been paid to (re) designing and retrofitting other aspects of the built environment, with very little guidance provided on the effect of the built environment on people's use of space and their day-to-day behaviour. One example of how this might be addressed can be found in a series of briefing notes on decarbonising transport produced by the Local Government Association and the University of Leeds. These highlight the potential positive impacts of promoting bus and cycle use, devising smart parking policies and accelerating EV uptake, etc. Nevertheless, their effectiveness still hinges on people's attitudes and their appetite for changing behaviour.

Delivering urban retrofit thus requires a more sustained focus on adapting the physical built environment of towns and cities and the energy systems that serve them to make such behaviour change easier. Dixon and Eames argue that a 'socio-technical' approach is required that must address 'what changes are needed' and 'how changes can be delivered together' holistically – an approach, they contend, that embraces innovation and new tools but also actively seeks to drive implementation[63]. This, in turn, requires individual- and institutional-level social and behavioural changes. These include (but are not limited to): transforming institutional frameworks and coordinating partnerships; changing or developing new visions, mindsets and political will; and encouraging public acceptance and behaviour change[64,65,66].

Gaps in skills, knowledge and capacity exist

Delivering urban retrofit, and wider sustainable transitions, also requires that professionals obtain new skills, education and knowledge – a point highlighted in various academic and policy studies[67,68,69]. The Lincoln Institute of Land Policy and Localis highlight, for example, that a lack of knowledge and resources persists across a wide range of built environment sectors, both among policymakers and within communities. All of these actors need support to build capacity, develop networks, make informed decisions and act. To help with this, various professional bodies and organisations have produced manuals or guides for different actors involved in retrofitting, introducing principles, tools and best practices. Examples include: The London Energy Transformation Initiative's guide on retrofitting existing housing; UKGBC's guide on commercial retrofits; and Architecture & Design Scotland's Climate Action Towns key lessons and toolkit which support place-based climate actions.

2

Summary: Why is urban retrofitting challenging to deliver?

- Urban retrofit requires the collective efforts of many sectors and stakeholders who have varied interests and motivations.
- Urban retrofit faces political and contextual challenges that require solutions that go beyond technical innovation.
- Behavioural changes are needed to deliver urban retrofit and achieve long-term sustainable transitions.
- There is currently a lack of skills, resources and capacities among the actors involved in urban retrofit.

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3

WHO IS RESPONSIBLE FOR ENABLING URBAN RETROFIT AND WHAT CHALLENGES DO THEY FACE?

This section focuses on enabling urban retrofit, especially in the UK. It explores the evidence on goals and agenda setting, the role of different stakeholders in delivering retrofit on the ground and the challenges inherent in current governance practices and financing mechanisms, before considering the evidence on community-based retrofit.

Governing urban retrofit: the role of local authorities

Local authorities play a crucial role in delivering urban retrofit and advancing the broader climate agenda, but they also face multiple governance tensions and challenges. WPI Economics and the Local Government Association summarise the ways councils can unlock economic, social and environmental value through the delivery of urban retrofitting projects. They note that local authorities can use their statutory powers to embed climate goals into local plans, set energy efficiency standards and shape policy and guidelines in ways that encourage low carbon outcomes. Local authorities can also facilitate investment by securing grant funding, leveraging procurement powers and supporting innovative financing models.

As asset owners, for example, local authorities can 'lead by example' by retrofitting council-owned buildings, estates and infrastructure. As conveners, they can bring together residents, businesses and service providers to coordinate area-based retrofit programmes and facilitate knowledge exchange. One way they can do this is to set up low-carbon urban living or urban innovation labs where public-private partnerships can be formed between local authorities, research institutes, large property owners and residents to co-design, test, monitor and iterate low-carbon interventions in real urban environments[70,71]. An example of this is the Niddrie Road Tenement Retrofit project in Glasgow, where a partnership across government, housing, design and construction enabled coordinated delivery, adaptive planning as well as the integration of evaluation tools throughout the project.

Conflicting goals: growth vs. systemic decarbonisation

A key challenge for governments at all levels is how to address the tension between short-term economic growth and the long-term structural changes needed for decarbonisation[72,73], as discussed in Section 1 with respect to 'post-growth' futures. The UK Government's proposed policies currently prioritise economic growth and sideline long-term sustainability objectives. This 'growth-first' approach risks reinforcing high-carbon development patterns, delaying crucial shifts in land use, housing and infrastructure[74], while also undermining the type of local authority-led actions discussed above.

The focus on 'growth' and 'speed' by politicians at Westminster – particularly with respect to housing delivery – also has the potential to favour the construction of less complex developments on greenfield sites over more intricate retrofit initiatives on brownfield land, despite the longer-term benefits this finer-grained adaptation can yield[75]. These challenges are further complicated by short- and long-term political pressures, electoral cycles, austerity measures and local authority performance metrics[76].

Retrofitting is also increasingly framed as an economic opportunity that can drive local jobs, investment and technological innovation. This is largely because of a tendency to rely on 'green growth' principles, which assume that economic growth can be decoupled from environmental impact through technological substitution, such as electrification and grid decarbonisation. The support for Zero Emission Vehicle and large-scale battery storage are two such examples and demonstrate how the UK Government sees the energy transition as an opportunity to reshape the economy and boost growth through technological breakthroughs. However, without addressing deeper issues like resource reduction, material obsolescence and long-term underinvestment in housing and infrastructure, the focus on such initiatives risks a piecemeal response to a deeper, systemic problem[77].

3

Policy contradictions: deregulation vs. empowering planners

The planning system has a central role to play in urban retrofit, but its powers have been weakened over time. National policies continue to promote deregulation in an effort to speed up housing delivery. This includes expanding Permitted Development Rights and releasing 'grey belt' land – previously-developed land in the greenbelt – despite known social and environmental and ecological risks. Such deregulation has reduced the power and scope of planning and led to the abandonment of key zero carbon policies by some local authorities[78].

Meanwhile, local planners are tasked with delivering complex climate objectives but often lack the tools, powers or policy clarity needed to act. There is confusion around whether local planning requirements can go beyond national building regulations, for example by setting higher environmental or energy standards. As a result, many local authorities are calling for clearer guidance[79].

This tension must also be understood within the broader context of the UK's regulatory landscape. While planning and other regulatory frameworks, such as building codes, can enable technological innovation, they can also act as bottlenecks that limit experimentation and slow down efforts to scale up low-carbon solutions[80]. Although initiatives like Energy Regulation Sandboxes have been introduced to overcome these barriers, ensuring that regulatory innovation keeps pace with technological change, while also maintaining democratic accountability and social equality, remains an ongoing challenge.

Vertical disconnects: national ambition vs. local capacity

A further challenge is the vertical disconnect between national retrofit ambitions and capacity at the local level to deliver them – a key part of the wider implementation gap alluded to in Section 1. While the four UK nations have statutory targets for emissions reduction and recognise the role that planning must play in steering towns and cities towards a lower carbon future, the targets often cascade down to local authorities without sufficient funding, technical support or institutional stability. This, the evidence suggests, has created 'a system that is currently structurally incapable of delivering Net Zero'[81].

Local authorities consistently report various barriers at the local level, such as insufficient funding from government, limited staff capacity, skill shortages and political uncertainty at the national level[82]. Funding mechanisms that are fragmented, short-term and competitive present one of the biggest barriers[83] because they require time-consuming bids and detailed business cases that smaller or under-resourced local authorities struggle to produce. This contributes to what many stakeholders describe as the 'significant gap' between ambition and on-the-ground delivery[84].

Horizontal disconnects: silos across policy domains

Holistic urban retrofitting requires horizontal coordination across local authority policy domains that have climate change responsibilities, such as strategic planning, development management, regeneration and growth, transport planning, housing, environmental health and parks and landscape. However, many retrofitting and decarbonisation efforts are hampered by fragmented governance structures and a lack of cross-departmental collaboration[85]. Heat decarbonisation, for instance, spans building standards, skills training, infrastructure planning and utility regulation, but policies in these areas are rarely joined up. This 'siloisation' hinders the development of whole-place approaches[86] and also means that opportunities for coordinating financial resources and tackling large-scale retrofitting programmes are missed[87].

3

Financing urban retrofit and market failure

At the building level, green finance tools like revolving funds, state-backed investment banks and local climate finance are promoted to attract private capital to retrofit domestic buildings and local energy infrastructure[88,89]. However, the market has so-far failed to deliver building retrofit at scale, as demonstrated by past initiatives like the Green Deal. On the one hand, financial barriers remain a key obstacle—both for property owners who are discouraged by high upfront costs and long payback periods and for private capital because consumer demand remains limited and short-term returns are therefore low[90,91]. On the other hand, policy, regulation and financing options have tended to be incoherent and complex thereby limiting wider uptake[92].

Funding for retrofitting initiatives at the urban scale tends to be contingent on the market for new development and the granting of planning permission. The UK's plan-led system encourages developers to secure planning consent for the most profitable sites rather than those that directly address sustainability goals or community preferences[93,94]. In this 'developer-led' system[95], the right to develop is exchanged for community benefits delivered through planning mechanisms like Section 106 (Section 75 in Scotland) and the Community Infrastructure Levy (CIL) (England and Wales only), which planners can then use to channel developer contributions into green initiatives such as district heating and cycle lanes[96].

The problem with this approach is that planners must balance investments in urban retrofitting against other competing priorities like affordable housing. Moreover, the approach is wholly contingent on growth because local authorities rely on developer contributions to fund an increasingly wide range of local infrastructure. At the same time, investment naturally flows to those places that developers believe are most viable to develop. This means that the positive impacts from developer contributions tend to be spatially fragmented and, as discussed further below, rarely reach the places that need them most[97]. In addition, the type of development that is granted permission is frequently located on low-density greenfield sites that are cheap to develop but where poor quality place-making prevails and residents are reliant on their car to get around[98,99,100].

These systemic failures highlight the need for government to adopt a stronger and more strategic role in planning for urban retrofit. This might include new financing mechanisms, such as public investment, tax incentives and pluralist financial models, but must also address the deeper problems inherent in the developer-led planning system which deters local authorities from pursuing more ambitious climate policies[101].

3

Alternate financial models for urban retrofit

Revolving funds: create self-sustaining financing mechanisms by recycling returns from successful projects to finance future retrofits, such as the Energy Efficiency Fund in Germany.

Blended finance: derived from public-private partnerships using capital from public or philanthropic sources to de-risk private investment in retrofit projects, such as Property-Linked Finance (PLF) or Property Assessed Clean Energy (PACE).

Carbon pricing or tax: Extend beyond the energy sector, as trialled in Denmark.

The social impacts of market-led urban retrofit

As intimated above, market-driven urban retrofitting can have negative social impacts because it risks entrenching spatial inequalities between (and within) local authority areas. Wealthier councils tend to have greater capacity to secure funding, mobilise resources and capture financial contributions from developers. In contrast, under-resourced authorities struggle to secure adequate funding for retrofit investments, often because weaker land values mean they have less leverage when they negotiate with developers[102].

Inequalities are worsened by the fact that private investment tends to flow toward areas with high return-on-investment potential – both within and between local authorities – a phenomenon described by the TCPA as 'a post-code lottery of land values'[103]. This results in an uneven spatial coverage of retrofit initiatives that leaves behind lower-income communities – especially those with ageing housing stock, high fuel poverty, energy insecurity and the greatest need for retrofit[104]. Retrofitting may also drive up property prices, which further entrench existing disparities and can displace long term residents. These processes—sometimes referred to as 'green gentrification'—risk transforming urban retrofit into a vehicle for displacement, thereby undermining broader just transition goals [105,106].

3

What role can communities play in urban retrofitting?

Community-led retrofitting has the potential to offer grounded, place-based solutions to the urban climate crisis and support broader grassroots action on climate and other local challenges, such as access to affordable housing. These efforts nevertheless face structural limitations which can hinder their impact and scalability.

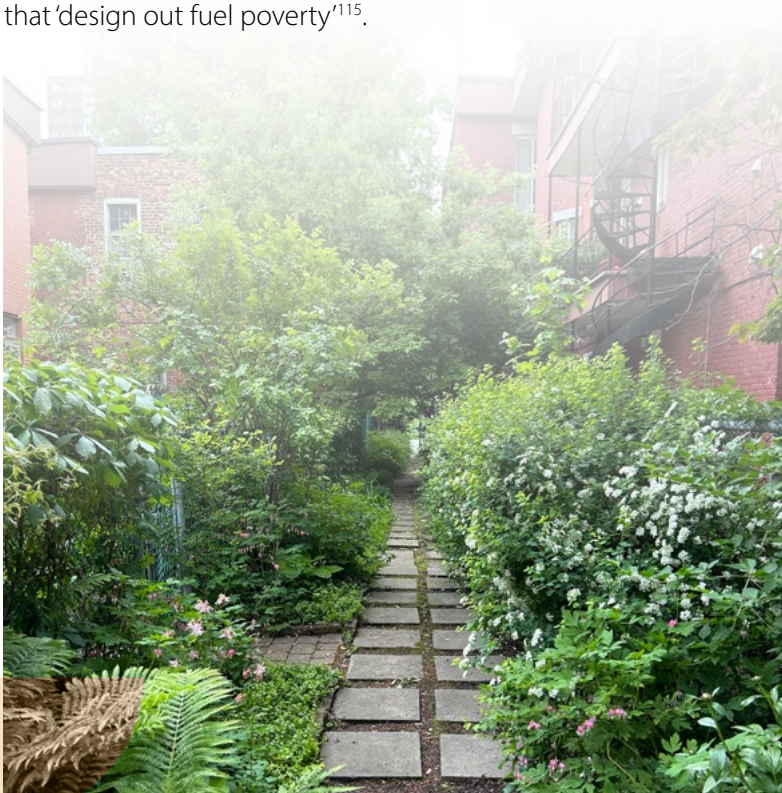
At its heart, community-led retrofit has a vital role to play in localising climate action and closing the gap between high-level policy ambitions and everyday practice[107]. These initiatives are often informal and very varied, ranging from green infrastructure and urban gardening to sustainable housing cooperatives and neighbourhood energy collectives, as well as low carbon economic activities like 25-mile food initiatives. Grassroots approaches complement top-down policies by engaging residents in urban retrofitting directly and leveraging local knowledge and experience to tailor low-impact solutions that respond to the needs of a community[108].

Community-led retrofit initiatives also create enabling conditions for energy efficiency. In shared or fragmented ownership settings, retrofit depends not only on technical solutions but also on trust, coordination and collective decision-making[109]. Community action helps align the interests of landlords, tenants and service providers, lowering transaction costs and building the social infrastructure needed for successful implementation. One example of this is the Carbon Co-op in Manchester, a member-led organisation helping to improve home energy efficiency via community retrofit, training and co-operative coordination. Such place-based strategies sit well alongside market or regulatory approaches and can enable retrofit where standard, market-dependent delivery models fall short[110].

The broader transformative potential of community-led retrofit

Beyond reducing emissions, community-led retrofitting has a transformative potential because it embeds climate action in local governance and everyday life. Through shared investment, local ownership and participatory governance, community-led initiatives can foster civic engagement, strengthen social capital and build institutional capacity at the neighbourhood scale. Through projects like co-housing, for example, citizens can reclaim power over their built environment and reimagine urban spaces as collective resources rather than commodities[111,112].

This embeddedness also offers a more socially just approach to climate action. Research suggests that community-led initiatives are less likely to trigger displacement or exacerbate housing precarity[113]. By prioritising tenure security, affordability, wellbeing and energy efficiency, grassroots alternatives can protect vulnerable residents and help households reduce their energy bills. Evidence from the Welsh Arbed scheme, an example of a large-scale warm home programme, estimated that £98 million could be saved on energy bills[114]. Community energy projects, such as a small-scale solarfarms and windfarms, can also enable reduced local utility tariffs as well as reinvestments that have wider long-term economic benefits within the community that 'design out fuel poverty'[115].



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Examples of community-led retrofit:

Green alleys: Lineal spaces developed at the initiative of citizens to increase biodiversity, promote healthy neighbourhoods and facilitate the transition to a green, circular and responsible economy, such as ruelles vertes in Canada.

Carbon cooperatives: Cooperatives that help communities to retrofit old buildings and promote citizen engagement in the energy transition, such as Mietshäuser Syndikat in Germany.

Limitations of community-led retrofit

Despite their benefits, community-led retrofitting faces structural constraints. Many community-led initiatives depend on external funding, recognition or policy support – much of which is short-term and very competitive[116]. This reliance can force community-led initiatives to align with funding criteria that might not fully suit what they want to do or even dilute their original ambitions. As a result, community-led initiatives risk becoming tools for mainstream urban retrofitting strategies rather than genuine alternatives[117].

Community-led retrofitting also depends on the civic capacity and social capital of a town, city or neighbourhood. Simply put: more affluent neighbourhoods might have greater capacity and capital to engage in community-led initiatives than poorer ones, thus reinforcing existing inequalities. Communities with limited civic infrastructure or weak social capital often struggle to mobilise resources or access the technical expertise needed to initiate an urban retrofitting project. Research evidence also highlights that some groups in society, notably renters, are not able to take ownership of retrofitting decisions while many low-income households may, understandably, seek to prioritise immediate liveability concerns over long-term environmental goals[118].

A further challenge comes from the lack of community interest or even resistance to urban retrofit. This challenge reflects the lack of public engagement of many market-led or government-funded retrofit programmes, which are widely criticised as being 'elite agendas' imposed from above[119]. This also speaks to the wider populist backlash against the UK's net zero agenda that was noted earlier in the report. Research has shown that changes in personal transport, housing and energy use have been increasingly framed by populist politicians as 'undemocratic' and responsible for driving up bills and disrupting lives[120]. All these tensions challenge the acceptance and replicability of community-led initiatives making it difficult to scale them up[121].

3

Summary: Who is responsible for enabling urban retrofit and what challenges do they face?

- Local authorities are key to urban retrofit but face significant implementation barriers due to conflicting goals, limited powers, fragmented governance, and policy silos.
- Market-led approaches dominate the UK's urban retrofit landscape, but they have largely failed to deliver systematic change at scale and often reinforce spatial and social inequalities. This highlights the need for a stronger and more strategic role for the state.
- Community-led retrofit provides place-based, socially just solutions, but its impact is limited by dependence on external support and local civic capacities, and a growing resistance from those standing in opposition to net zero policies.

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4

HOW DO WE KNOW IF URBAN RETROFITTING REALLY WORKS?

This section considers how to measure urban retrofitting. It examines evidence on the metrics available to track, assess and evaluate the impact of retrofitting across different urban scales and where the gaps in measurement exist – especially beyond the building scale.

Technical and socio-political measurement

Delivering urban retrofitting projects, as discussed in Section 2, is both a technical and socio-political challenge. The same applies to evaluating the success (or otherwise) of urban retrofitting. The technical challenges associated with evaluation relate, principally, to data collection and performance evaluation, as well as performance gaps across the different spatial scales of a town or city. In contrast, the social and political challenges associated with measuring the success of urban retrofitting are more concerned with evaluating the process of delivery, improvements in skills and capacity and the possible trade-offs that determine whether a project succeeds or fails.

Data collection

Building retrofit evaluations are generally well-established and primarily use performance ratings and whole-life carbon assessments that capture building-level data embedded in Energy Performance Certificates (EPCs) (see, for example, RIBA research on suburban housing and Historic England research on the historic environment). Other tools used to measure the performance of domestic retrofit, in particular, include those related to thermal performance and airtightness. These are often supported by resident surveys or interviews, as well as project team audits. Some examples include the post-occupancy evaluation of the Niddrie Road demonstration project in Glasgow, and the retrofitting guide published by the Technology Strategy Board of the UK Government (now Innovate UK).

Evaluating the effectiveness of adaptation and mitigation measures tends to be based on energy consumption and/or carbon emissions data related to dwellings and transport [122]. The sustainability impacts of other interventions, such as introducing bike lanes or green infrastructure, are more difficult to gauge because there is often no readily available and regularly monitored data.

4

Evaluation and assessment

At the building level, data is rarely collected before, during and after implementation. This makes it difficult to evaluate outcomes or track progress over time[123]. In addition, and as discussed in Section 1, embodied carbon is often not taken into account when building evaluations are conducted. While many academic studies have highlighted the importance of life cycle assessment and its usefulness in modelling energy consumption scenarios, a lack of data makes this hard to achieve in practice.

The potential benefits of more complex and multi-dimensional urban retrofitting efforts, such as 20-minute neighbourhoods, green infrastructure and nature-based solutions, are widely acknowledged but rarely rigorously evaluated for their emissions reduction potential. This illustrates that, when the scope of retrofitting extends beyond a single building, it becomes more difficult to identify coherent evaluative frameworks to examine the sustainability outcomes. Without a clear understanding of what works, where and for whom, local authorities, and other stakeholders involved in delivering urban retrofit interventions may struggle to prioritise interventions, develop effective project pipelines or make the case for sustained investment in high-risk endeavours[124]. At the same time, the lack of reliable measurement tools makes it harder to anticipate and mitigate against unintended consequences, such as overheating or green gentrification.

Performance gaps

Research has suggested that retrofitting homes with new insulation as well as heating and cooling technologies can lower emissions and generate quite substantial energy savings[125,126,127]. Equally, at the urban scale, retrofitting interventions such as higher density development, greater land use mix, more public transport options and so on, can also reduce carbon emissions and lower energy use. Much of the evidence to support these interventions is based on scenario comparisons using various methods of modelling, simulation and estimation. It is therefore unclear whether the estimated benefits can be (or are) achieved[128].

In the European CONCERTO project it was reported that more than half of the retrofitted buildings captured in the database achieved 50% and above energy savings. An evaluation by Gupta et al. (2015) of a similar programme in the UK called *The Retrofit for the Future* suggests that only 3 out of 45 projects studied met the targeted 80% CO_2 reduction for whole-house, deep retrofitting of social housing[129]. A 2024 UKGBC project measuring the impact of retrofit measures on the energy efficiency of office buildings deliberately did not use real-world data, arguing that '[t]here is little consistent pre- and post-retrofit in-use operational data available'. These mixed results from project-level assessment – using different evaluation criteria – echo a wider critique of the ex-post evaluation of UK policies, which is said to be largely impossible because 'different programmes have used different metrics through the years, if they have used them at all'[130].

4

Factoring urban retrofit into decision-making: complex trade-offs

The complexities associated with context-dependent urban retrofitting interventions at different spatial scales makes it difficult to see how they might be routinely and robustly measured as part of the wider planning and development process.

On the one hand, the mismatch between the unit of data collection and the scale of decision-making means data is typically gathered at the household or building level, but planning decisions are made, more often than not, at the project level or above. This disconnect can obscure critical factors, such as variations in density, land use mix and connectivity, that undoubtedly influence how emissions and energy use play out across different spatial scales[131]. It also makes it harder to understand how retrofit interacts with broader urban systems like transportation, waste, water and energy[132].

On the other hand, while academic research increasingly explores these trade-offs—across life-cycle stages, land-use changes and retrofit-versus-rebuild options—such insights are not commonly integrated into planning decision-making or policy evaluation. Without considering carbon measures systemically by calculating embodied carbon and the interaction between emissions from building and transport, local authorities risk missing opportunities to reduce carbon more effectively through the land-use decisions they make[133]. In addition to utilising accurate technical evidence, decision-makers need to holistically consider different aspects of placemaking, demand better designed and more sustainable development – a particularly wicked problem in the UK's new build housing sector – and promote more sustainable lifestyle choices[134,135,136].

Politics of measurement

When urban retrofit is promoted as an integrated effort to repair and adapt the built environment *writ large*, it is crucial that 'success' can be clearly demonstrated to reluctant stakeholders who might then be prepared to buy-in to new modes of delivery. At present, many of the potential benefits of urban retrofitting, such as improvements in health, comfort and equity, are rarely captured or factored into development viability assessments[137,138]. This limits the ability of urban retrofitting proponents, particularly in the policy sphere, to conclusively demonstrate the wider value of urban retrofit to local politicians, property developers, investors, communities and other stakeholders[139,140,141]. It also reinforces an over-reliance on short-term economic metrics as markers of success[142].

Another unavoidable but highly contested consideration is the question of who establishes the indicators of success for urban retrofit. The evidence suggests that the contested politics of agenda setting and measurement around urban retrofitting needs to be further explored. Current learning, which comes mostly from pilot projects, primarily focuses on positive stories of connection and collaboration (i.e. best practice). Understanding what has not worked and why is equally important.

4

The skills and capacity necessary for implementation

Research by the Lincoln Institute of Land Policy conducted in 2009 claimed that 'urban planners and local decision makers generally lack the tools and means needed to make informed choices about the climate change implications of local growth and redevelopment decisions, or to measure their effects'. Over a decade later, planning and development actors still face significant skills and capacity gaps that thwart their ability to deliver complex urban retrofit programmes and measure outcomes. In the construction and building industry alone, there are well-documented skills shortages in which low carbon experts—practitioners with the skills required to build and install new technologies—are few and far between. It is calculated that 30,000 heat pump installers will be needed by 2028 to meet demand, yet in 2023 only 2,000 were accredited[143]. At the same time, demand for heat pumps and other aspects of building retrofit from householders remains tepid[144,145].

Capacity gaps and skills shortages extend into local authorities and the wider planning profession. In a recent survey conducted by APSE and TCPA, most participating local authorities reported lacking a comprehensive understanding of baseline carbon emissions. This makes it difficult for them to set and monitor progress towards targets at either the building, neighbourhood or regional level. The survey also revealed that many local authorities lack the funding, staff and technical expertise to perform climate-related planning functions, retrofit existing housing stock and implement new low-carbon technologies.

4

Summary: How do we know if urban retrofitting really works?

- Measurement and evaluation is a key dimension of urban retrofit alongside modification, intervention and implementation and needs to be better understood.
- Evaluating the effectiveness of urban retrofit relies on comprehensive data collection and assessment. Current practices need to be improved to address the multi-dimensional and temporal impacts of urban retrofit.
- Modelled outcomes of retrofit interventions remain too distant from reality and this creates a performance gap between projected impacts and real-life performance.
- Monitoring and assessing urban retrofit interventions is politically important because planning and development decision-makers have to make complex trade offs and often require 'hard data' to support resource allocations and build political buy-in.

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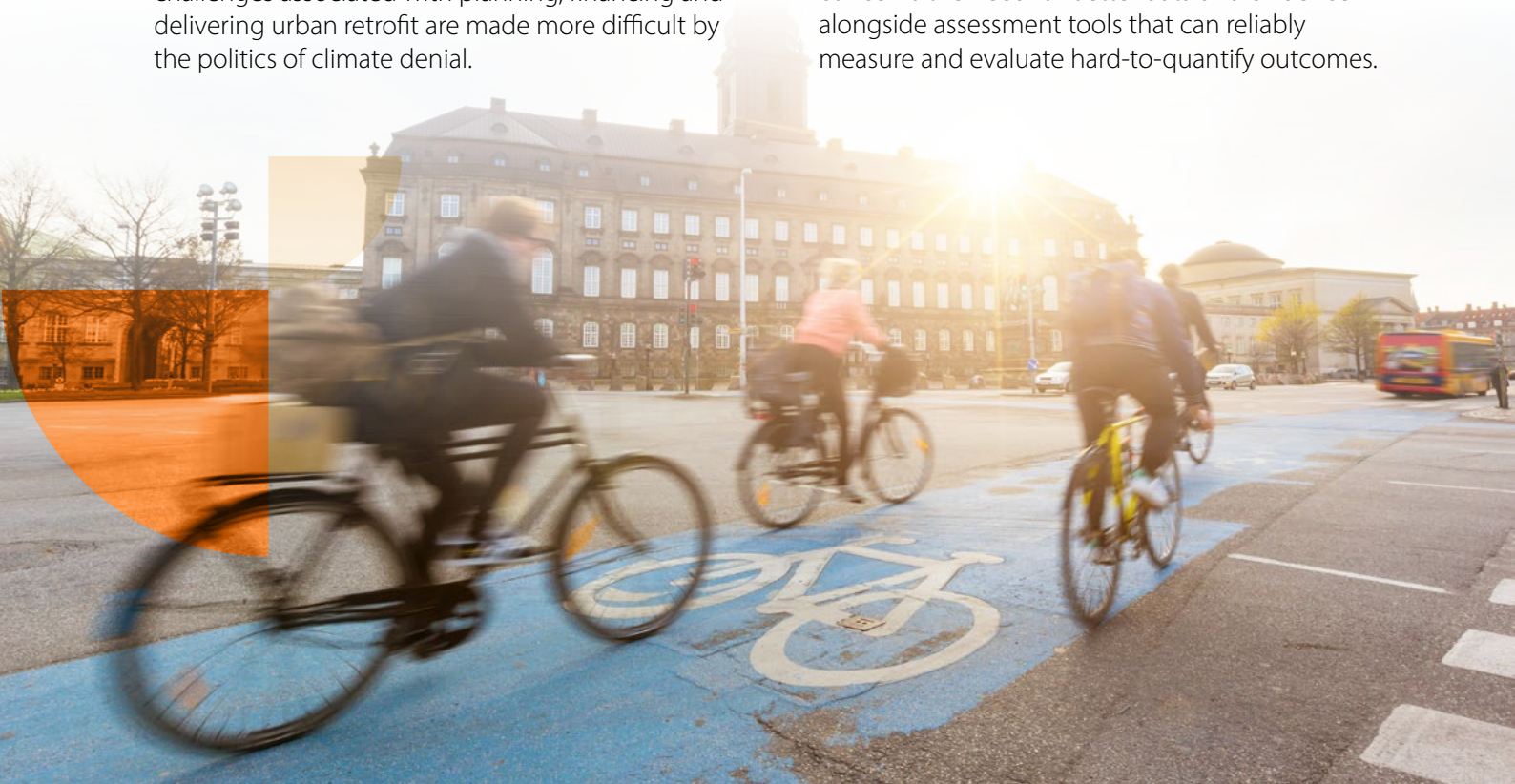
5

WHAT KIND OF URBAN RETROFITTING DO EXISTING PLACES NEED?

This final section reflects on the evidence analysed in the systematic evidence review and outlines a series of recommendations on closing the implementation gaps that hinder the progress of urban retrofit.

Reflections

- Targeting embodied carbon is a crucial part of decarbonising the built environment.
- Energy security and the need for electrification – particularly for electric vehicles – is strongly emphasised in government net zero plans, but less attention is paid to the adaptation of the wider built environment.
- Adaptation of the built environment via holistic interventions that are integrated across multiple spatial scales, including but not limited to building energy retrofits lies at the heart of urban retrofitting.
- Reducing carbon emissions from the built environment will only be possible if the over-riding growth-logic of planning and development is challenged and different solutions are found.
- Urban retrofit is not only a technical question, it is also a socio-economic and political one. The challenges associated with planning, financing and delivering urban retrofit are made more difficult by the politics of climate denial.
- Urban retrofit must be delivered equitably through the planning and development system, and planning, property and community actors can collectively shape outcomes if they work together.
- Local authorities have a particularly important role to play in brokering and guiding urban retrofit but face significant barriers because of conflicting policy objectives, skills gaps, financial pressures and policy silos.
- Market-led approaches dominate the urban retrofitting landscape and precipitate solutions that fail to address system-wide problems and reinforce spatial inequalities and social injustices.
- Community-led retrofitting can provide more place-based and socially just solutions, but capacity is limited by funding and other barriers. This includes resistance within some communities to the logic of net zero.
- A crucial matter in the success of urban retrofit concerns the need for better data and evidence alongside assessment tools that can reliably measure and evaluate hard-to-quantify outcomes.



5

Recommendations

- Introduce urban retrofit into the vocabulary of planning for sustainable development and just transitions to counter the growth-logic and urban expansionism rhetoric of policy and practice.
- Go beyond building retrofit and think holistically about urban retrofit as a multi-dimensional, socio-economic and political practice concerned with the integrated modification of existing urban areas through planning and development systems.
- Recognise that urban retrofitting is more than a technocratic fix and that it is shaped by diverse socio-economic and political contexts at the local, regional and national scale.
- Encourage national and regional governments to adopt bolder policy frameworks for net zero that have a more strategic focus on towns, cities and urban areas and embrace urban retrofitting as a means of limiting growth to within the existing built environment.
- Ensure planning polices at all levels look towards long term horizons and recognise that urban retrofitting is an essential public good which must be supported by financing and other incentives that encourage change, especially within the property development sector.
- Empower local authorities with stronger and clearer planning powers, long-term funding and cross-sector coordination tools to effectively align the local delivery of urban retrofit with national net zero and just transition imperatives.
- Unlock the full potential of community-led urban retrofit via policies and practices that offer sustained financial and institutional support for local place-based solutions, while recognising the importance of local knowledge in shaping the most appropriate urban retrofit interventions across the urban sphere.
- Build databases, knowledge platforms and other comprehensive assessment strategies that not only address the impacts of urban retrofit interventions quantitatively, but also factor in qualitative, placed-based evaluations that foreground lived experience and behaviour change.
- Promote evidence-based planning policymaking for urban sustainability that critically examines what works (and what does not), where and why – especially over time.

APPENDIX: A NOTE ON METHODOLOGY

This report is the result of a systematic evidence review. The goal was to map academic literature and policy/professional reports (grey literature) in areas relevant to urban retrofit and synthesise evidence from around the world on the design, governance, financing and community participation dimensions of place adaptation.

Between January and July 2025, the research team reviewed a total of 344 academic papers published across 122 journals, 18 edited books, and 219 policy and professional reports, all published in English since 2000. A systematic mapping of this literature, following a structured six-step process, was then conducted as follows:

- **Scoping:** Define the research aims, guiding questions and thematic areas, covering retrofit practices, planning and governance, business and financing models and community-led initiatives.
- **Search strategy:** Develop targeted search terms for academic databases (e.g. Scopus, Web of Science) and policy document databases (e.g. Policy Commons). This was supplemented by snowballing techniques and manual reviews of key journals and institutions.
- **Screening:** Initial screening of titles and abstracts using predefined inclusion/exclusion criteria.
- **Full-text review:** Detailed reviewing of selected sources and iterative refinement to ensure relevance and thematic coverage.
- **Data extraction:** Information extraction using a structured template to collect information on research aims, methods, stakeholder focus, theoretical framing and key findings.
- **Thematic synthesis:** Inductive synthesis of extracted data to identify cross-cutting themes and to structure the evidence base around the report's five questions.

While this report aims to provide a comprehensive review of the international evidence on urban retrofit, it has two limitations. First, the report draws primarily on publications in English. It may underrepresent experiences from non-English-speaking countries, particularly in parts of the Global South where distinctive policy frameworks and retrofit practices are less accessible without translation. Second, while the inclusion of a wide range of grey literature provides timely and real-world insights, many reports are commissioned or authored by advocacy groups or sectoral bodies. As such, they may reflect institutional missions, normative agendas or the financial interest of these organisations; they are also more likely to document successful policies rather than routine or failed initiatives.

An extended bibliography, organised by theme, is available. Please note that only sources directly relevant to the report or that inform its key ideas are included.

URBAN RETROFIT

September 2025

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