ECONOMIST IMPACT

Radical retrofit

Adapting cities for a resilient future

Supported by JLL

Contents

JLL foreword

Cynthia Kantor
CEO, Project & Development Services, JLL

What's in a skyline? More than a backdrop to life, every building plays its part in how our cities function. From offices where we craft ideas and factories where machines make and move the goods we depend on, to hospitals where we care for one another, campuses where we share wisdom, and sports venues where we redefine what it means to be human—today's buildings make our lives possible.

But in our rapidly growing cities, many of these buildings are showing their age. We know that roughly half of all global workspace will require substantial investment soon—it could take upwards of US$1.2trn[1] in capital expenditure to bring those workplaces up to today's standards. And that's just the office sector.

Today's leaders across government, business, real estate and sustainability stand on the verge of key decisions over the real estate we see today—and the vision we hold for the spaces of tomorrow. The key question to explore: how can our built environment shape more livable cities with safe, sustainable, and climate-resilient infrastructure, while also supporting business imperatives?

In a word, retrofitting.

New research makes a powerful case for 'radical retrofitting' across the globe. Led by Economist Impact and supported by JLL, this report shows how momentum is growing for demand-driven retrofitting, but adoption is far from where it needs to be.

[1] JLL Research, "Opportunity through Obsolescence", November 18th, https://www.jll.com/en-uk/insights/opportunity-through-obsolescence 2024

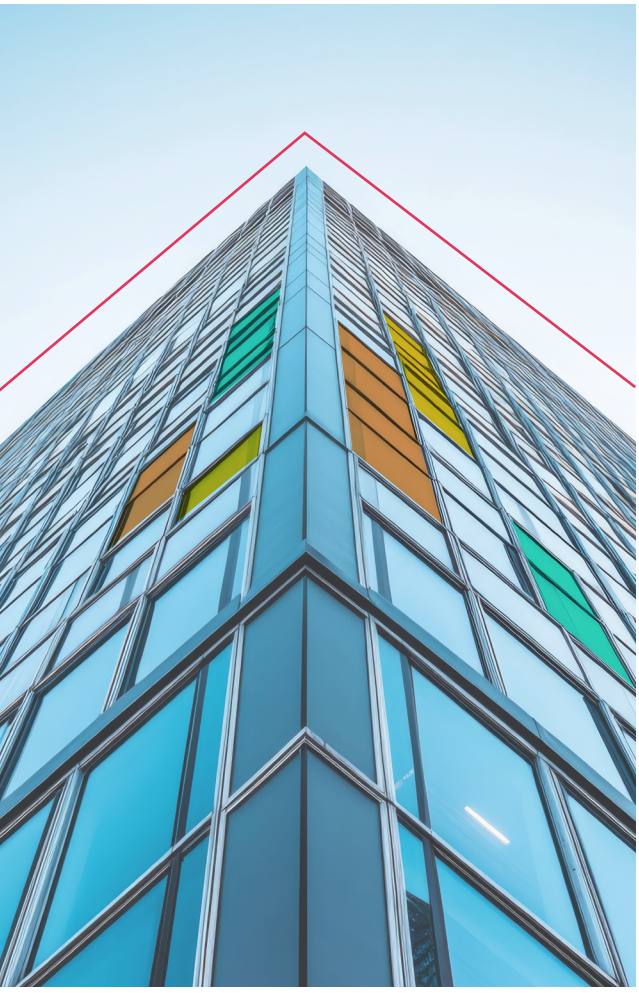
Demand for high-performance buildings consistently outpaces supply worldwide, propelled by escalating energy costs, changing building regulations, and economic forecasts pointing to higher future resource prices.

Strategic retrofitting extends asset lifespan and delivers measurable ROI. In fact, even moderate retrofits can result in energy cost reductions of between 30% and 60% along with significant rent premiums. Upgraded properties attract prize tenants and talent looking for productive environments, while awarding investors and lenders with a reduced risk profile.

Building upgrades represent not just incremental improvements but a transformation in how we conceive, value, and utilize built environments across the global economy. Entire markets have the potential to be reshaped for a more competitive and resilient urban landscape. This report chronicles momentum city by city, outlining pathways to accelerate progress over the next five years.

The skyline of the future can fuel business resilience, manage risk, and create long-term value. With the collective participation of lawmakers, investors, developers, lenders, and tenants—and US$600bn in dry powder waiting for investment globally—we have a powerful and humbling opportunity to reimagine the world's cities and co-create a brighter future, for all. Turn the page and join us.

About this research



Radical retrofit: adapting cities for a resilient future is an Economist Impact report, supported by JLL. This research is part of Economist Impact's Urban Futures initiative, which aims to empower decision-makers to lead sustainable urban transformation—tackling the climate crisis, advancing the energy transition and building cities fit for the future. The report explores how building retrofits and adaptive reuse enable cities around the world to create climate-resilient infrastructure, optimize space, create productive, experience-led workplaces, and nurture public safety and well-being. It examines the drivers and barriers to retrofitting in both leading global cities and emerging urban centers, accounting for divergent economic contexts. Retrofitting progress and gaps are examined through a multistakeholder lens, with emphasis not just on policymakers, developers and service providers, but also on tenants and owners. Assessing the gaps and exploring best practice case studies from global cities, the report concludes by identifying pathways to accelerate retrofitting progress over the next five years.

The research is based on an Economist Impact survey of 1,000 senior executives, directors and business unit heads across the built environment sectors, including construction, real estate development and management, and engineering and design in 12 cities in the Americas, Asia-Pacific, and Europe, Middle East and Africa: Berlin, Delhi, Dubai, London, Los Angeles, Mexico City, New York City, Paris, Singapore, Sydney, Tokyo and Washington, D.C. The survey insights were complemented by an expert advisory and interview program with representatives from think tanks, industry and city coalitions, as well as technology and architecture companies.

Executive summary and key findings

Cities are vital economic centers, but rapid urbanization strains infrastructure, resources and the environment. Making cities more livable demands more than new construction; it calls for reimagining their design, build and maintenance. Retrofitting—the upgrade and enhancement of buildings and built environments—is central to cutting emissions, improving energy efficiency, nurturing public safety and well-being and optimizing urban space. The benefits include lowering carbon footprints, providing robust premiums to developers and investors, and creating better spaces to live and work.

Financial returns take time to materialize—and often, newly built assets will still have higher premiums associated with them—but the long-term social and environmental dividends are substantial. With bold action and smart partnerships, cities and their built environment stakeholders, such as owners and investors, can both protect and enhance asset value over the long term, and become champions of urban livability.

Key findings:

- **Retrofitting is gaining momentum but remains far from scale**. 69% of surveyed organizations reported a shift in their business mix towards retrofitting in the past three years. Cities including Singapore, New York, Washington, D.C., Dubai, Sydney and Paris are leading in retrofit adoption. To align with climate goals, the retrofit rate must accelerate from today's 1% to around 3% annually.[1] The urgency is greatest in developed countries, where most buildings that exist today will also exist in 2050. Encouragingly, 82% of survey respondents expect moderate to significant growth in retrofitting activity in their cities over the next five years.
- **Government action is the strongest catalyst for retrofitting**. Mandatory performance standards and public financial incentives are significantly accelerating retrofits across both commercial and residential sectors. A number of cities are implementing "retrofit-first" development policies, incentivizing re-use through major planning applications requirements. Global best practice examples like Tokyo's cap-and-trade program and Washington, D.C.'s performance mandates show that regulatory pressure can drive real emissions reductions and accelerate retrofitting at scale.
- **Market forces and investor sustainability goals are boosting commercial retrofitting**. Beyond compliance, retrofitting is increasingly driven by tenant demand for sustainable, energy-efficient, experience-led spaces, and

investors' ESG goals. Retrofitted commercial properties deliver tangible value gains such as lower and more stable operational costs, enhanced tenant retention, and better talent attraction.

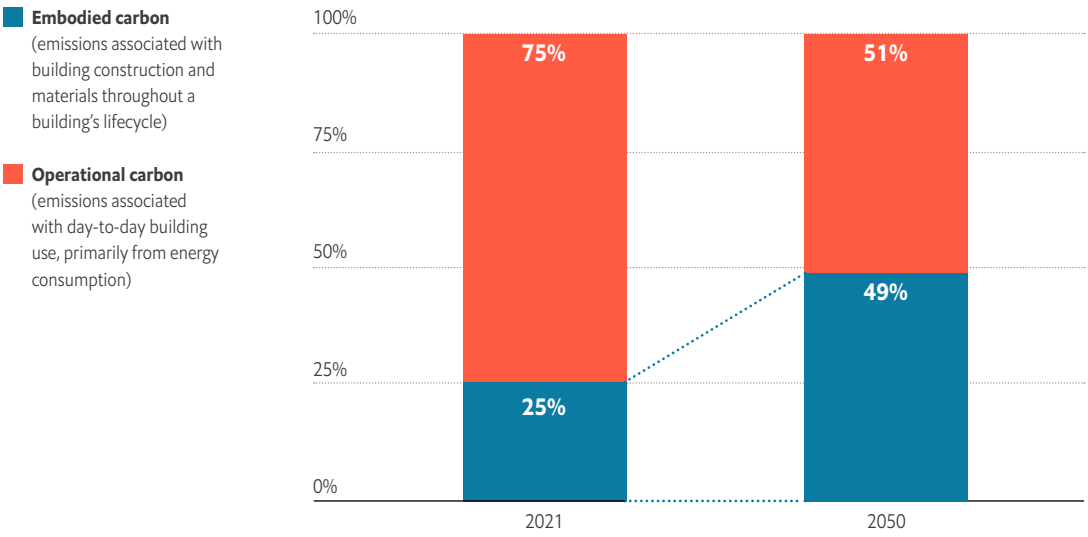
- **Building upgrades that improve insulation, access to natural light and air quality reduce health risks and boost productivity**. Increasingly, today's employees want spaces that allow for adaptability, collaboration and a sense of community. Retrofitting allows for intentional placemaking, improves health and well-being, and enhances accessibility. Nearly half of surveyed organizations prioritize tenant well-being, while 43% highlight improved employee experience as a key retrofit benefit.
- **Financial barriers and misaligned incentives are the most cited obstacles to scaling retrofits**. 61% of respondents identified owner hesitancy due to high upfront costs and uncertain returns as the top barrier, while 52% pointed to weak investor interest. Although the operational savings from deep retrofits typically outweigh the costs over the long term, the high upfront investment and long payback periods lower the perceived viability of these types of retrofits. Disruption to tenants, downtime or loss of rent during retrofits also leaves owners fearing occupancy drops.
- **Cross-sectoral collaboration between policymakers, developers, financiers, occupiers, and technology providers is critical to accelerate retrofitting progress**. The following pathways need to be activated:
  - **Generating awareness around retrofits**. Public and industry awareness initiatives that frame retrofits as strategic investments rather than technical fixes are a fundamental starting point. Governments, NGOs, and the private sector must collaborate to reframe retrofits as enablers of resilience, well-being and economic opportunity.
  - **Policy leadership, combining mandates and incentives**. Cities that integrate mandatory building standards, public sector retrofit leadership, targeted incentives, and retrofit accelerator programs, such as those in New York, Tokyo, and Singapore, are better positioned to close the retrofit gap.
  - **Impact measurement that captures the full value of retrofitting beyond energy.** Success should be quantified across a broader set of metrics—including resilience, talent retention, health outcomes and economic vibrancy—to unlock greater investment and policy support.
  - **Innovative, performance-based financing and blended public-private partnerships**. Traditional financing models alone are insufficient. Mechanisms like green bonds, energy performance contracts and shared-savings agreements, combined with stronger disclosure and valuation standards, are critical to mobilizing private capital.
  - **Technology integration and workforce development**. Artificial Intelligence (AI) and smart building technologies can radically improve retrofit outcomes, but scaling requires data and IT interoperability, clean and standardized data, tenant engagement, and public-private collaboration. Meanwhile, bridging the retrofit skills gap demands embedding retrofit-specific training in the construction and real estate sectors.

CHAPTER 1

Introduction: retrofitting for urban resilience

Cities are engines of both economic growth and emissions. Home to 56% of the global population—a share forecast to approach 70% by 2050—they generate over 80% of global GDP.[2] But they also produce 70% of CO_2 emissions, mainly from fossil-fuelled transport, heavy industry and carbon-intensive legacy infrastructure.[3] In cities, buildings alone contribute up to 60% of total urban carbon emissions through their construction and operation.[4] While operational carbon contributes the bulk of carbon emissions from the built environment sector at present, the greater challenge in the coming years is the projected growth in embodied carbon, which is expected to rise from 25% in 2021 to 49% in 2050.[5]

Figure 1: Tackling the embodied carbon challenge
Projected carbon emissions from global new construction to 2050



Source: UN Environment Programme (UNEP) and Yale Center for Ecosystems + Architecture (Yale CEA)

Urban areas are not only contributors to climate change; they are also vulnerable to its effects. Most buildings are not resilient enough to withstand rising temperatures, flooding or storms.[6] At the same time, challenges like congestion, housing shortages, limited space for commercial development and inefficient building design reduce livability and constrain access to well-located, high-quality environments. An urgent transformation is required.

Retrofitting refers to the enhancement and improvement of built assets resulting in energy efficiency, lower emissions and greater resilience. Retrofits can play a vital role in value creation for investors and building occupiers, and can also enhance urban resilience, well-being and social cohesion. The need is global, but particularly urgent in developed countries, where most of the buildings that will exist in 2050 are already standing.[7] City leaders are taking action. In Paris, 70% of planning applications now focus on refurbishing existing structures.[8]

Shifts in how people live and work, especially the rise of hybrid and remote working, have accelerated the demand for flexible, high-performing spaces that seamlessly incorporate productivity-enhancing technology. As Theresa Backus, director, Building Innovation Hub observes, "If people have to be in the office more, they want the space to be better. People want spaces that suit their needs."

By optimizing urban space and transforming existing buildings, retrofitting reduces urban sprawl and supports more efficient city planning by creating spaces that people need and want. Almost half (45%) of Economist Impact survey respondents said retrofitting was more effective than new construction in meeting urban spatial needs.

Retrofits can drive economic growth. C40 Cities, the global mayoral initiative,[9] estimates that sustainable construction, including retrofitting, could create millions of jobs globally as well as financial savings from energy efficiency and reduced waste.[10]

CHAPTER 2

Building for resilience: what is driving retrofitting progress?

Urban areas operate within diverse economic contexts, which shape their priorities and challenges. This, in turn, influences the need for and urgency of making built assets resilient to future challenges through retrofits. Cities whose urban cores are increasingly built out, such as Paris, Washington, D.C., are seeing grassroots resistance to new growth in built environments. Citing the example of Paris, Thomas Vonier, architect and senior partner at Chesapeake Strategies, noted that the migration of light industry out of the city to peripheral areas and beyond has created opportunities for adaptive reuse of erstwhile industrial buildings for corporate office use.

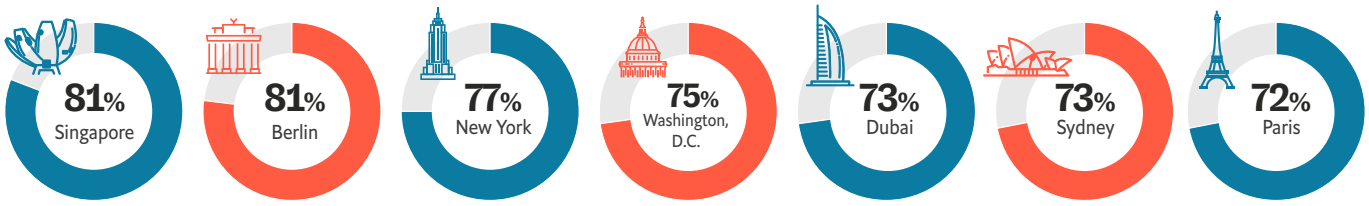
On the other hand, cities like Delhi and Mexico City, which continue to experience a high degree of urbanization and inbound migration, need more of both new construction and upgrades to existing buildings. While 16% of businesses in Delhi and 23% in Mexico City saw their share of new construction rise in the last three years, the survey found the corresponding share for mature cities like Berlin, Los Angeles and Sydney is 0%, 3% and 4%, respectively.

What do the numbers say? The business landscape for retrofits

Economist Impact's survey shows that retrofitting is emerging as a promising area for businesses: **almost 69% of respondents noted that their organization's business mix between retrofitting and new construction had shifted towards retrofitting in the last three years**. Almost 10% said retrofitting constitutes more than 60% of their organizations' business. More than half (55%) derive between 31% and 60% of their business from retrofitting. Berlin, Singapore, New York City, Washington, D.C., Dubai, Sydney and Paris lead the trend of growing retrofitting demand (see figure 2 for the leading cities).

Figure 2: Surveyed markets with strongest retrofitting momentum

Aggregate share of respondents who said that their business mix between retrofitting and new construction had significantly and moderately shifted towards retrofitting.



Source: Economist Impact construction and real estate survey 2025

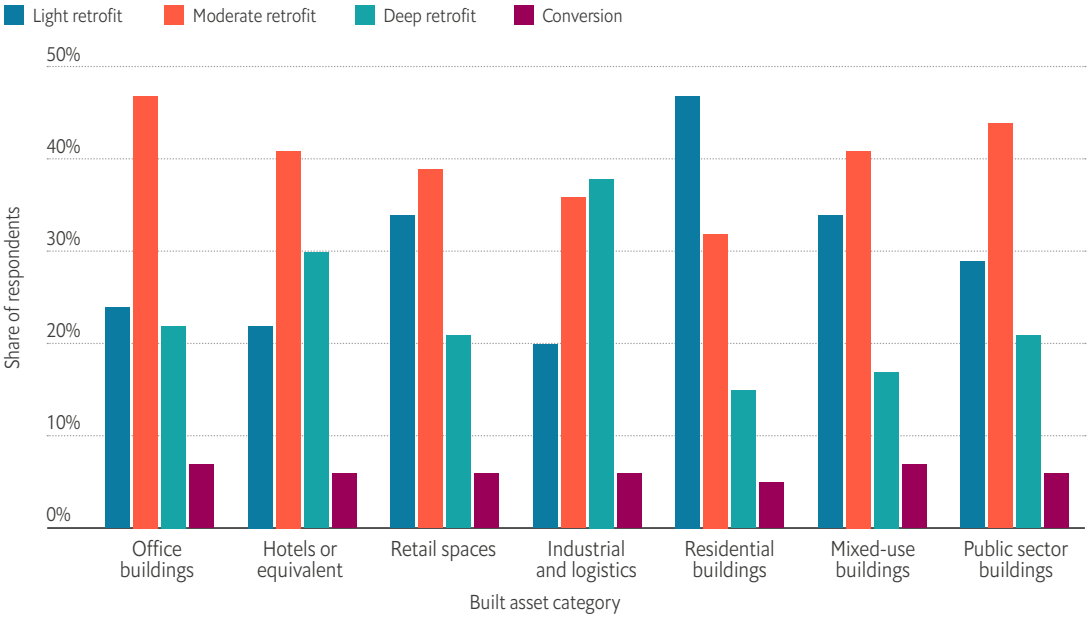
Classification of the extent of retrofitting interventions

The Economist Impact survey used the following four-type classification of retrofits as defined in JLL's research, *Opportunity through obsolescence*, based on the extent of changes involved: light, moderate, deep as well as conversions.[11]

- *Light retrofits* involve minimally invasive measures that focus on minor upgrades to a single aspect or feature of the building. These may include smart thermostat installation, improved insulation, or LED upgrades.
- *Moderate retrofits* are substantial interventions to multiple building systems. These may include heating, ventilation, and air conditioning (HVAC) upgrades, window replacements, and lighting overhauls.
- *Deep retrofits* entail extensive, transformative work that significantly changes a building's structure, systems or function. These may include renewable energy integration, upgrades to the building's envelope (its walls and roof), and upgrading electrical infrastructure.
- *Conversion* repurposes buildings entirely so they perform a different function, such as converting ageing buildings and abandoned factories into residential lofts. Adaptive reuse is typically applied to buildings of architectural or historical significance, and is a form of conversion that preserves key heritage features while enabling new uses.

Moderate retrofits represent the bulk of intervention activity across building asset types, especially office and public sector buildings, but asset-specific variations emerge from the survey (see figure 3). For example, although deep retrofits represent, on average, a quarter of aggregate retrofitting demand across asset classes, industrial and logistics buildings see a far higher share (almost 40%), compared to residential buildings (just 15%), with the high capital expenditure requirements for these retrofits lowering appetite among the latter asset class. Residential buildings see the highest share of light retrofits in the survey (48%), compared to commercial assets.

Figure 3: Moderate retrofits commonly undertaken relative to other interventions
Extent of retrofits across built asset categories



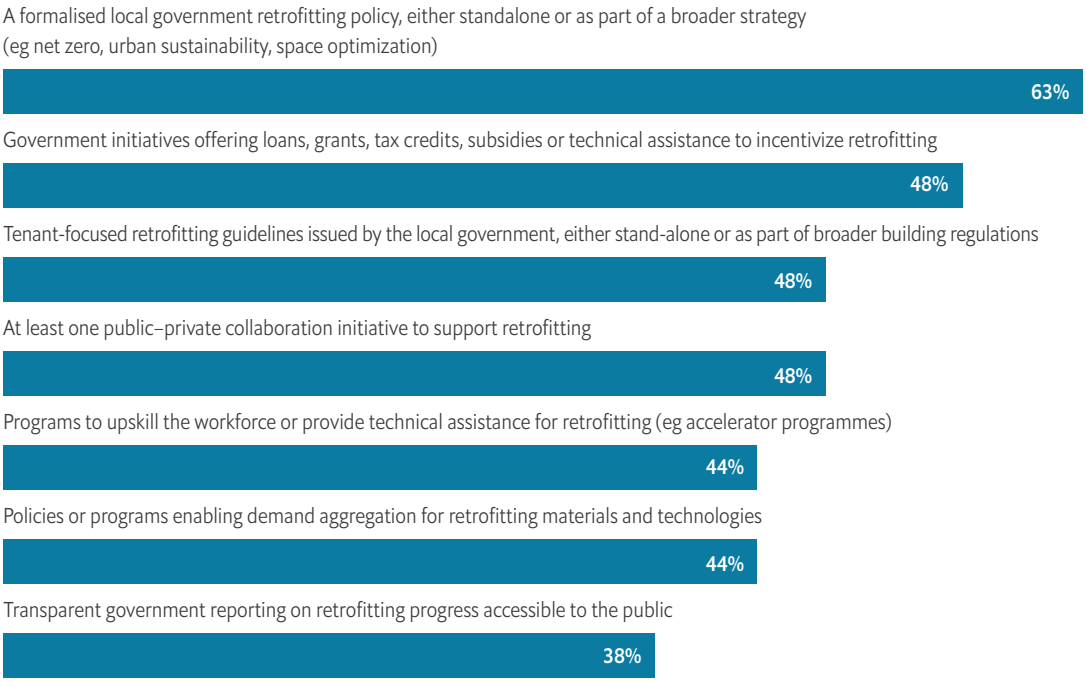
Source: Economist Impact construction and real estate survey 2025

Light and moderate retrofits can produce energy savings of 10 to 15% in commercial buildings and up to 30% in residential ones. Deep retrofits can achieve transformational energy savings of 40 to 60% in commercial and 60 to 90% in residential buildings.[12] Conversion is also crucial to optimizing space in cities. Upgrading existing buildings to meet modern needs and adapt to changing populations can preserve a city's history and heritage while meeting demand for housing, commercial needs or public services, particularly in post-industrial areas where the landscape of work may have changed significantly.

Policy interventions drive energy and net zero retrofits across the commercial and housing sectors

Policies and regulations that encourage or mandate building upgrades are the most powerful lever in accelerating retrofits (see figure 4). 63% of respondents were aware of the existence of a formal retrofitting policy, either standalone or as part of a broader strategy (such as net zero, urban sustainability or space optimization), while 56% noted public financial incentives such as grants, loans or subsidies. "Policy action and coordination at all levels—local, national and global—is needed to accelerate retrofitting progress," says Irene Skoula, director of energy and buildings at C40.

Figure 4: Policy support mechanisms play a substantial role in driving retrofitting progress
Share of respondents aware of the existence of various support mechanisms in their city of operations



Source: Economist Impact construction and real estate survey 2025

Compared to voluntary policies and programs, mandatory performance standards and regulations targeting the worst-performing buildings are vital. For instance, Tokyo's Cap-and-Trade Program came into effect in April 2010, requiring large commercial and industrial buildings to reduce their total CO2 emissions. Facility owners who failed to meet reduction targets were required to offset 1.3 times the shortfall, fined up to US$3,440[13] and had their violations publicly disclosed.[14] To date, over 90% of target facilities have exceeded their reduction targets and after four years, the Tokyo Metropolitan Government reported a 23% reduction in emissions compared to base-year levels under the program.[15]

When asked which factors will accelerate retrofitting over the next five years, respondents pointed squarely at policy; 55% chose stricter codes, and 52% backed more generous incentives. "The countries that have generally implemented policy related to retrofitting are much further ahead in terms of how they deal with building stock that is ageing out," says Scott Dunn, Asia-Pacific chair of Urban Land Institute (ULI), a real estate and land use expert network, and vice-president of AECOM. Governments are increasing these efforts. In Singapore, new rules issued by the Building and Construction Authority require the bottom 25% of buildings perform an assessment and implement energy-savings measures to avoid penalties.[16] In Japan, the government funds a third of the costs for retrofitting office buildings, providing up to US$0.32m[17] for projects that reduce a building's energy consumption by 20% or more.[18]

Drivers of commercial retrofitting

While commercial retrofits to meet regulatory mandates are compliance-driven, they are also a response to rising market demand for energy-efficient, low-carbon and resilient spaces from developers and tenants, and investor sustainability goals.[19] Poor building performance comes with rising energy bills, regulatory penalties and the risk of stranded assets.[20]

Energy-efficient buildings also command premiums in rents and sale prices for owners.[21] 55% of survey respondents cited asset value as a key benefit of retrofitting. The so-called "green premium" contrasts with a "brown discount" in which inefficient buildings lose value and become harder to let.[22]

"Increasingly, tenants demand sustainable spaces. In some markets, we have seen tenants require renewable energy provisions at market cost as a basic condition for rental agreements," says Ted Howland, vice president of group sustainability at CapitaLand Investment. "Many tenants look for certifications as an indicator of a building's sustainability features." Certifications such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), Fitwel and WELL Building Standard[23] are now essential for marketing top-tier properties.[24] Nearly 60% of respondents also cited lower utility and maintenance costs as the top benefit for tenants depending on the lease requirements to pay these costs.

Commercial retrofits are also increasingly driven by the need of asset investors to meet ESG reporting requirements. "Many big asset owners are actively working to decarbonize their portfolios in order to meet science-based targets and align with ESG frameworks like CRREM (Carbon Risk Real Estate Monitor),"

says Becci Taylor, director of Retrofit at Scale at Arup. Motivated to mitigate risk, "this investor-led push often moves faster than public policy," she notes.

Many investors are now embracing sustainability-first retrofitting approaches despite the higher initial expense. A 2024 study found that investors are still four times more likely to support pro-climate shareholder proposals, even amid the politicization of ESG, driven by a belief that clean energy and transition-aligned investments will outperform most sectors in both the short and long term.[25] Omnia Halawani, co-CEO and founder at grfn, a consultancy specializing in sustainable engineering and design, describes a shift in developers in Dubai who historically prioritized capital expenditure for new construction rather than retrofits.

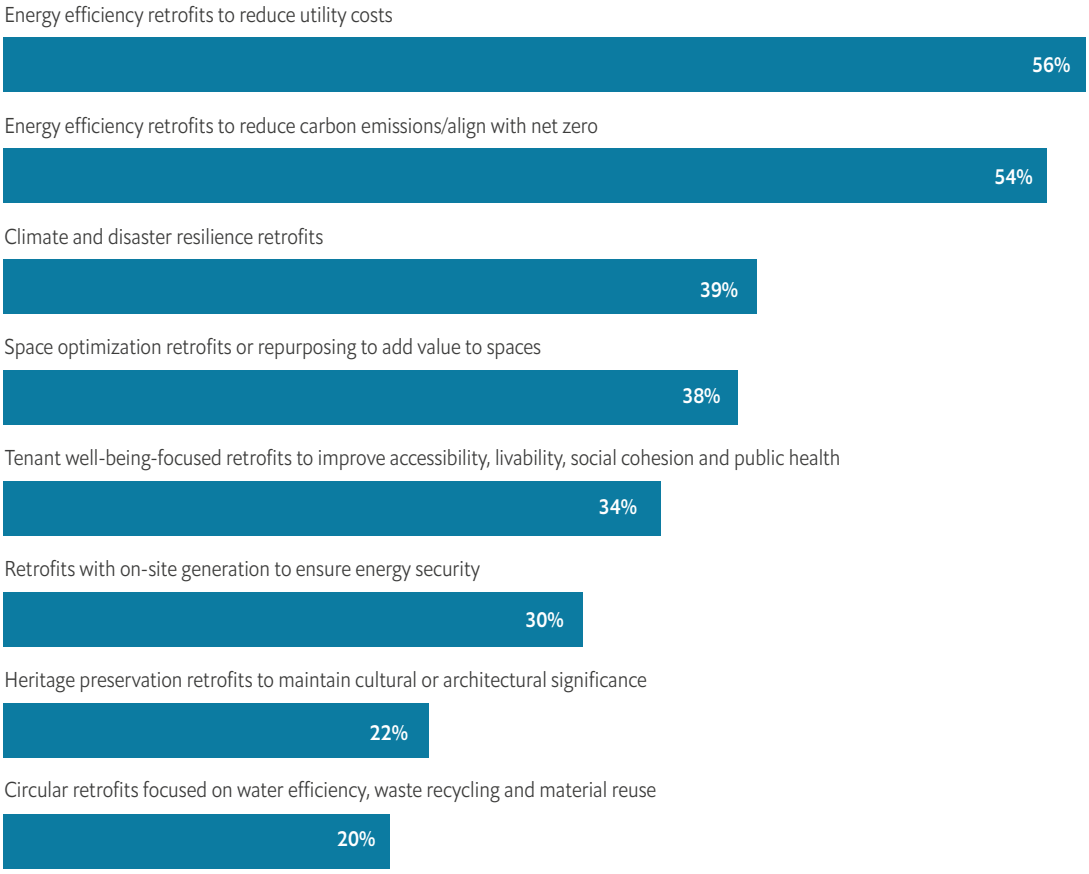
Some financial institutions are offering incentives. In the US, Commercial Property Assessed Clean Energy (C-PACE) financing provides long-term funding for energy efficiency and resilience improvements in commercial buildings, repaid through property taxes. By 2022, it operated in over 30 states and Washington, D.C., supporting more than US$4bn in investment across 2,900 projects.[26,27] Similarly, in the UK, some commercial lenders offer green loan products aimed at small to mid-sized businesses. These typically cover energy-efficient retrofitting measures such as solar panel installations, heat pumps and improved building insulation. Building owners in Sydney can receive upfront discounts from the provincial government for replacing their hot water systems with heat pumps.[28]

Beyond cutting energy use, buildings can be adapted to shield owners, investors and tenants from rising climate risks such as heat, flooding and extreme weather, all of which are becoming more frequent globally.[29] Climate and disaster resilience retrofits emerged as the

third most common type in our survey (see figure 5). Globally, South and Southeast Asian cities are most exposed to environmental and disaster risks including pollution, drought and heat stress, with some cities in the Americas like Mexico City, and Los Angeles close behind.[30] In Mexico City, three-quarters of respondents identified it as the most common retrofit focus, with similarly high shares in Los Angeles, New York City, Sydney and Tokyo. Los Angeles is confronted with an urgent need for wildfire resistance retrofits, prompting proposals for federal tax incentives.[31]

Retrofitting isn't just a utility cost-saving measure. It can generate financial returns through higher tenant retention, and healthier, more productive workplaces—aspects that are difficult to quantify but critical to consider. The survey results

Figure 5: Energy efficiency retrofits lead the way globally
Types of retrofits most commonly undertaken in respondents' city of operations



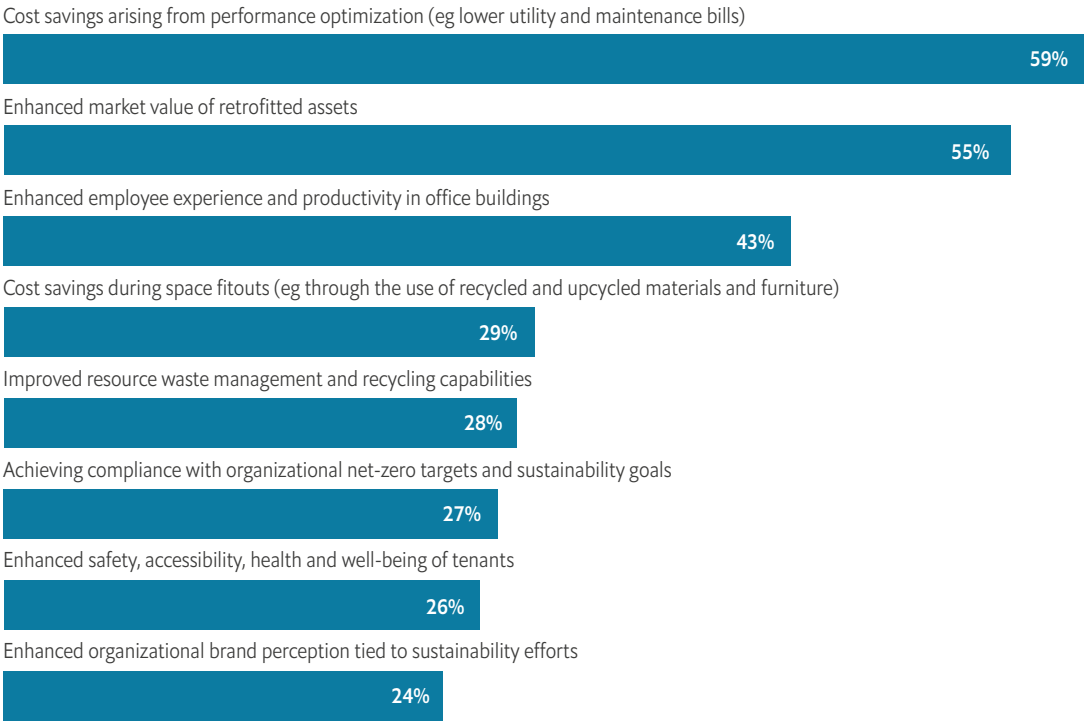
Source: Economist Impact construction and real estate survey 2025

illuminate such workplace benefits (see figure 6). Nearly half (43%) of survey respondents cited enhanced employee experience and productivity as a primary gain from retrofits, led by Sydney, Singapore and Tokyo, with the Asia-Pacific region (52%) outpacing the survey average by 9%. In other cities, respondents believe these benefits will become more important in the future. 40% of those in Berlin and 39% in Paris cite organizations' need to attract and retain future talent by offering commercial spaces with enhanced employee experience and livability as a key accelerator for retrofitting in the next five years, compared to the average of 27%.

Some organizations are beginning to quantify these effects. The Indian Green Building Council, Indian Institute of Management Ahmedabad (IIM-A) and Danish Industry (DI) jointly developed a "Green Index" to track the impact of sustainability in office buildings on well-being and performance.[32] The findings are striking: a 1% improvement in sustainability metrics corresponds to a 7% increase in employee thriving.[33,34] "Attracting employees, enhancing their health, and making them more productive directly contributes to a company's success," says S. Karthikeyan, deputy executive director of the Indian Green Building Council. As Mr Dunn, vice president at AECOM, put it, "Retrofits can reduce absenteeism, improve indoor air quality and reduce health costs. These are not secondary benefits—they are core to the business case."

Workplace expectations are also evolving. Retrofits in this context can focus on increasing exposure to daylight, greenery and natural materials or by adding wellness features like meditation rooms.[35] As businesses adapt to new ways of working, retrofitting emerges not just as a technical fix, but a strategic tool for boosting both performance and well-being.

Figure 6: Retrofitting backed by clear financial upside
Primary benefits of retrofitted buildings valued by tenants, owners and investors



Source: Economist Impact construction and real estate survey 2025

JLL PERSPECTIVE

Demand-driven retrofitting

Phil Ryan
Director of City Futures, Global Insights & Research at JLL

The growing surplus of properties no longer fit for purpose or at risk of stranding is coinciding with an acceleration of demand for quality office space, new housing, experiential retail and accommodation. Counterintuitively, the resultant gap between the built environment as it exists now and latent investment means that demand-driven retrofitting is increasingly viable for capital deployment as well as meeting the need for investible space.

Although this disparity is most visible and stark in the office market, the opportunities for conversion or upgrading other asset types due to market and regulatory forces is similarly strengthening. Retrofitting fundamentals are disproportionately strongest in North American and gateway European cities that have gone through multiple cycles of development and economic restructuring since the mid-20th century, and to a lesser extent certain markets in Asia-Pacific such as Japan, Hong Kong, Singapore and Australia.

As flight to quality and consolidation from major occupiers intensifies, nowhere is resultant correction more apparent than in the United States, where the office market is currently experiencing the most rapid contraction of its construction pipeline on record: from 2019 to Q1 2025, the amount of office space under construction across the US is down 78%. At the same time, more than 90% of inventory in key North American central business districts was built before 2020, well below the global average.

This has left a wide array of buildings underutilized or entirely vacant in prime locations, even as demand for energy-efficient, well-being-focused space is only growing. Inclusion of outdoor terraces leads to a 5.2% uplift in achievable rents, for instance, while efficiency-driven retrofits attract the more than 65% of corporate occupiers with a carbon reduction budget.[1] This is all occurring alongside acute shortfalls of housing in cities across the world and changing ways of living and working. Retrofitting will play a key part in the provision of quality office space aimed at users unable to afford premiums for new construction as well as a stock of potentially convertible assets for more pressing uses, particularly new homes, hotels and medical facilities.

Ultimately, demand-driven forces will guide the scale and type of retrofitting in cities around the world. Lower structural office vacancy in Europe and certain mature Asian cities will see same-use upgrades to maintain "investibility" and avoid regulatory stranding. On the other hand, the US will find retrofitting ageing buildings for non-commercial use to be more common, with cities such as New York, Chicago and Washington, D.C. pioneering extensive tax credits, planning reforms and other schemes to improve viability, leading to 1.3m square metres of office space being converted to other uses since 2020.[2] In all cases, though, retrofitting will be key to optimizing the built environment to meet future needs for cities.

[1] JLL Research, "Repositioning and redevelopment strategies for at-risk assets and portfolios", May 6th, 2025, https://www.jll.com/en-us/insights/repositioning-and-redevelopment-strategies-for-at-risk-assets-and-portfolios/?utm_source=economist-impact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
[2] JLL Research, "Opportunity through Obsolescence", November 18th, 2024, https://www.jll.com/en-us/insights/opportunity-through-obsolescence/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625

Drivers of residential retrofitting

Government policies, regulations and financial incentives including low-interest loans, grants and tax rebates are the most prominent drivers of retrofits in the residential sector, according to our survey. All twelve cities have at least one retrofit policy or plan at the local government level, mostly as components of broader decarbonization or climate change mitigation policies or regulations. Washington, D.C. provides a policy stimulus through the Sustainable DC policy and the Clean Energy DC plan, which sets out retrofit targets for the city.

Some cities have launched policies to support low-income households. The Sydney government provides discounted finance for home retrofits aimed at achieving energy efficiency and flood resilience.[36] Similarly, the UK obliges energy suppliers to retrofit low-income homes, upgrading insulation and heating systems, under the Energy Company Obligation scheme.[37]

While energy efficiency, lower utility costs, better net zero alignment and employee productivity represent key tenant benefits of retrofits in commercial settings, cost savings and health benefits dominate in residential settings. Better indoor environments reduce health risks, says Ms Skoula of C40. She notes that upgrades also help eliminate hazards from outdated appliances like gas stoves. In Delhi—where toxic air is a public health emergency[38] and indoor pollution from poorly ventilated stoves is widespread[39]—36% of respondents prioritized tenant well-being, well above the 26% survey average.

Smarter tools, faster retrofits: role of technology

Technology is a critical enabler for retrofitting. One third of survey respondents believe that access to advanced retrofitting technologies and low-carbon materials will drive progress in the next five years. Digital twins, AI-enabled energy management systems and building automation tools are among the 'proptech' innovations helping accelerate retrofitting.

AI is particularly important: from continuous performance optimization and predictive maintenance to automated HVAC control and emissions tracking, AI is helping lower long-term costs and carbon intensity, and strengthen regulatory compliance. These capabilities are especially valuable in cities facing pressure to decarbonize rapidly.[40] A case in point is One Congress, a one-million-square-foot Trophy office tower in Boston. The building operators use AI and predictive analytics to optimize HVAC, maintenance and operations, resulting in a 25% reduction in the energy bill.[41]

There is a growing market for commercial retrofit-specific AI solutions. These are use cases designed specifically for activities such as capital projects planning, portfolio and workplace experience management, and day-to-day building operations such as energy and utility management.[42] AI is also emerging as an enabler of sustainable asset enhancement. JLL's research *Streamline sustainable asset enhancement with AI* shows that AI can optimize up to 65% of retrofit-related tasks improving accuracy, streamlining audits, and enabling data-driven decisions across project lifecycles. From portfolio prioritization to execution and stakeholder communication, AI empowers owners and investors to decarbonize at scale while maximizing ROI and minimizing disruption.[43]

Yet adoption remains uneven. A 2024 report on the role of AI in commercial real estate found that 45% of organizations cite high upfront costs as the primary barrier to adopting AI in commercial real estate.[44] Despite this, momentum is building, particularly in cities pursuing integrated, systems-level retrofitting strategies. In our survey, nearly 44% of respondents confirmed that their cities have programs offering group purchasing of retrofitting equipment and technologies resulting in more affordable prices, such as the Solar Together program in London.[45]

CHAPTER 3

Behind the brick wall: why retrofitting momentum lags

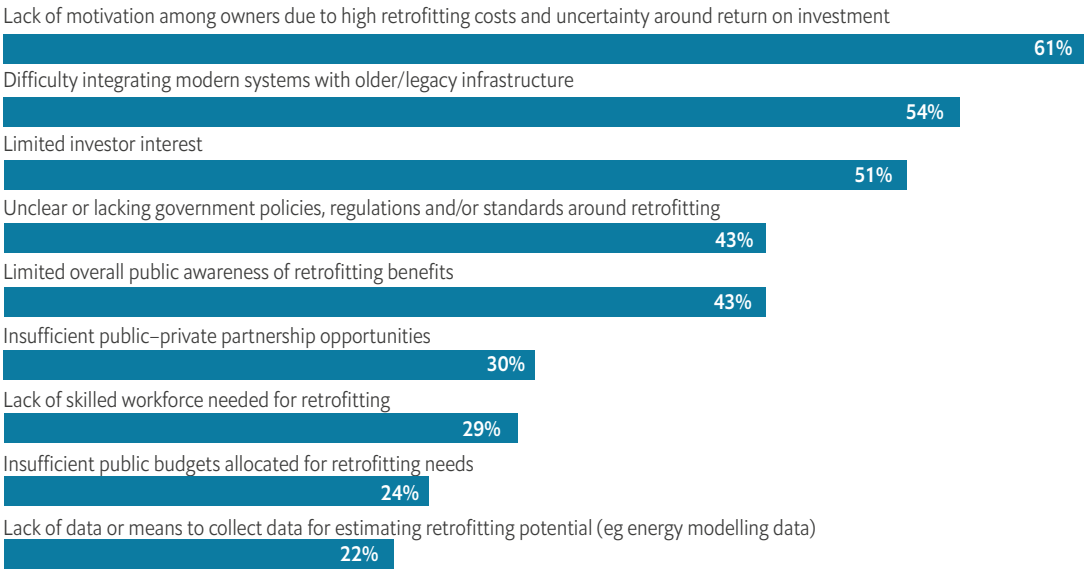
Despite clear economic, social and environmental benefits—and the enabling policy and technology drivers—retrofitting is not progressing fast enough. To meet climate goals by 2050, over 90% of existing buildings must be upgraded—implying an annual retrofit rate of 3%. Today, the rate lingers at just 1%.[46] Progress is hampered by a mix of financial, regulatory, and technical hurdles—compounded by a shortage of skilled labor. Retrofitting commercial real estate, in particular, is complex. Each type comes with its own operational needs, occupancy patterns and technical constraints such as standardization, financing and outcome measurement.

Cost challenges

The most cited obstacle to retrofitting is a lack of motivation among developers or owners (including owner-occupiers) to undertake retrofits due to the high upfront cost, coupled with uncertain returns on investment and inability to lease space at rents necessary to break even: 61% of survey respondents cited this as a top barrier (see figure 7). This challenge is particularly pronounced in Mexico City, selected by 80%.

Figure 7: Retrofitting challenges span capital, capability and clarity

Major barriers to city-level retrofitting progress



Source: Economist Impact construction and real estate survey 2025

"Building owners really need more data on costs to be able to make the case for retrofitting and anticipate their return timeline," says Theresa Backhus, director, Building Innovation Hub. Although the operational savings from deep retrofits typically outweigh the costs over the long term, the high upfront investment and long payback periods lower the viability of these types of retrofits.

The cost challenge is further complicated by factors that impact the predictability of returns, which complicates savings measurement methodologies such as the International Performance Measurement and Verification Protocol (IPMVP). For instance, heatwaves resulting in higher-than-usual HVAC use in a given year can result in underestimated returns on retrofits. In other words, since energy savings alone may not guarantee the financial viability of retrofits, the lack of a broad systems-based approach that views the returns beyond energy savings such as saved insurance costs, higher rents, risk of carbon taxes, fines and penalties, compounds the financial justification problem.

Financing solves part of the problem, but there is some way to go

Limited investor interest in retrofits emerged as a key barrier in the survey, particularly in the Americas (57%) and in APAC (52%) in comparison to Europe, the Middle East and Africa (EMEA) (44%). This is rooted in broader market uncertainties such as unclear lease events, fragmented regulations and misaligned stakeholder incentives. When investors control individual investment portions in a property, but have differing ESG priorities, it increases the probability of their early market exit.

Internal fragmentation also undermines progress. In Berlin, the top challenge for tenants (selected by 71%) is a lack of alignment among owners in multi-owner buildings, which are very common in the city. Strict regulations in Germany make retrofitting these strata title properties particularly complex.[47] Interventions must balance numerous building and design aspects such as insulation, electrification and the use of space, but the level of organization necessary to consider all these factors can be difficult to achieve. "Many organizations fail to coordinate internally on the value and implementation of retrofitting," says Nancy Gillis, former senior director, industrial decarbonization, WBCSD.

Existing financing solutions often do not span the entire retrofit process. Experts noted that funding gaps are particularly prominent in pre-retrofit stages such as conducting energy audits to determine the scope of the retrofit.

Split incentives between tenants and owners can significantly impede retrofitting efforts. This indicates the need for scaling up financing models that allow risk-sharing or shared savings among owners and executing companies such as energy savings companies (ESCOs). Green leases are also an important tool that can help owners and tenants mediate this misalignment.

Merging the old and new: technical challenges in retrofits

Legacy infrastructure poses another major challenge for retrofitting. Over half (54%) of respondents cited difficulty integrating modern systems into older buildings as a major barrier, especially in US cities such as Los Angeles, New York and Washington, D.C. Paris is ahead of the curve. Only 28% of its respondents saw legacy systems as a major issue, suggesting a stronger capability to blend modernization with heritage.

The task of retrofitting is complicated further when dealing with heritage sites which demand bespoke expertise. "There are specialized architects and engineers who focus on working within [historic buildings] regulations to preserve historic integrity while making necessary updates," says Mr Vonier. Cities without this specialized talent base are likely to struggle with the constraints imposed by historic buildings. This leaves cities with a tough trade-off between conservation and climate resilience. Experts engaged in this study emphasized that long-term planning and structured programs are essential not only for scaling retrofitting efforts, but also for developing the technical and design skills needed to do so responsibly.

Talent gaps are a less-highlighted but crucial barrier

Over a quarter (28%) of respondents cited workforce shortages as a major barrier (see figure 7). The pace of workforce development is unable to keep up with the growing demand for retrofits to meet net zero targets, and existing workers trained in traditional construction do not always have the specialized knowledge and skills needed for retrofits. The UK, for instance, does not have the skills needed to deliver on the government's home heating transition plan.[48] Similarly, cities like Los Angeles, San Francisco, and Santa Monica grapple with a critical shortage of structural engineers needed for soft-story seismic retrofits.[49] "There is also a skills gap when it comes to auditing, measurement and verification of retrofitting performance," says Ms Halawani. "There are some courses and certifications, but experience doing the practical work remains key."

The talent gap extends beyond technicians: retrofitting is not prominent in architectural education, with only 17% of students reporting it as a priority at their school, and one in eight receiving no training on the topic at all.[50]

Policy and regulatory shortfalls

Despite growing urgency, policy frameworks in many markets remain inadequate to scale retrofitting efforts. "We've seen plenty of policies for new buildings," notes Mr Harlfinger, "but governments are still hesitant to extend those rules to existing structures." 43% of respondents said unclear or insufficient regulations and standards are hindering progress. Even when financial incentives exist, uptake remains low without clear requirements or a predictable policy environment.

Inadequate recognition of retrofitting at a national level will impact the attainment of Nationally Determined Contributions (NDCs), the climate targets that countries set for themselves as part of the Paris Agreement.[51] Retrofitting remains marginal in international climate forums too. "Retrofitting isn't yet central to global discussions like COP (the Conference of Parties in the UN Climate Change Conference)," says Ms Gillis, "even though it holds enormous potential to cut emissions and create jobs."

Improving transparency is also crucial. Just over a third of all survey respondents said their city provides public access to retrofit progress reports. Washington, D.C., for instance, mandates that buildings over 10,000 square feet report energy and water performance annually.[52]

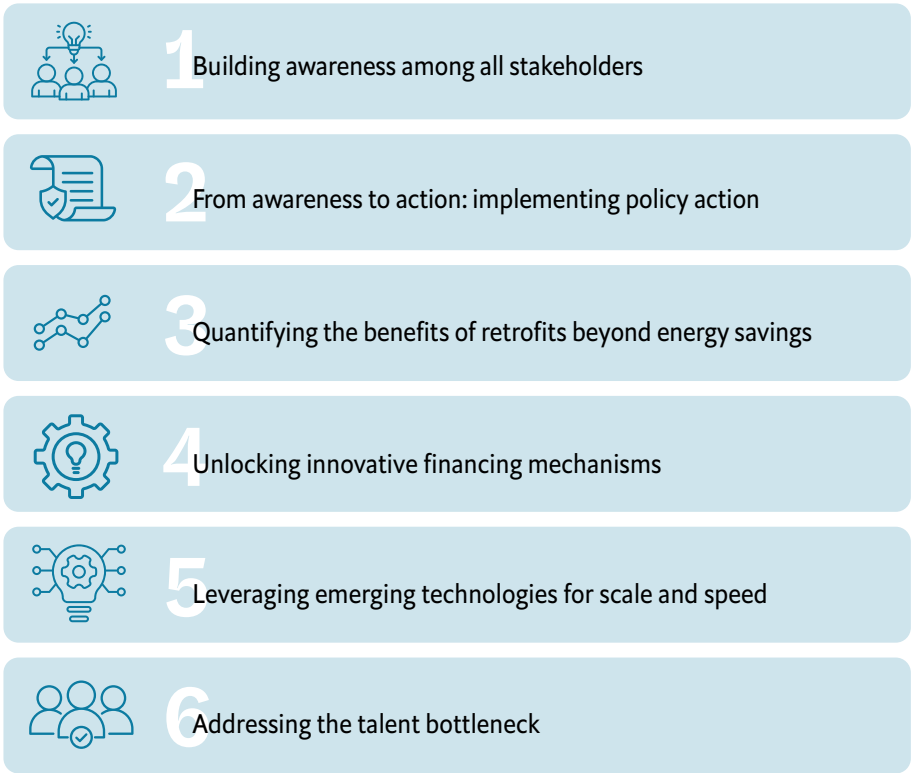
CHAPTER 4

Race to renewal: building retrofitting momentum to 2030

Around 80% of buildings in cities today will exist in 2050.[53] Without accelerated retrofitting, much of this stock risks becoming degraded, unfit for modern use and economically burdensome—leading to higher emissions and missed opportunities for creating vibrant workspaces and resilient homes.

The Economist Impact survey shows strong intent across sectors to accelerate and deepen retrofitting, but intent alone is insufficient. Scaling retrofitting demands more than ambition; it needs deep alignment within and across stakeholder groups. Using survey data and insights from the experts engaged in this study, Economist Impact identified six key pathways that need to be activated to accelerate retrofitting over the next five years.

Figure 8: Pathways to accelerate retrofitting progress in the next five years



Source: Economist Impact research

1. Building awareness across the retrofitting ecosystem

Awareness is the first and frequently overlooked step in scaling retrofitting. According to Economist Impact's survey, limited overall public understanding of retrofit benefits (43%) remains a key barrier to progress. The awareness must go beyond retrofitting's climate value and highlight the full range of benefits relevant to each stakeholder group.

What needs to happen starting now, and who needs to do what?

National and local governments can lead coordinated awareness campaigns that reframe retrofitting as a generator of varied benefits for building owners such as lower insurance costs, higher rent premiums, lower risk of carbon taxes and penalties in commercial settings and as a cross-cutting enabler of health, equity and resilience in residential settings.

Industry bodies and non-government organizations (NGOs) can partner with academic institutions to quantify missed opportunities from slower retrofitting progress. They can also influence policy discourse through advocacy and dissemination of research.

Educational institutions can help normalize retrofit thinking from an early age by embedding it in relevant curricula. Initiatives like Build Upon[2], led by the World Green Building Council, provide cities with frameworks to frame retrofitting through a comprehensive lens that goes beyond energy efficiency.[54]

Investors and developers can publish case studies independently or as part of government, industry and NGO retrofitting and decarbonization initiatives demonstrating the commercial benefits of retrofitting (eg tenant retention, asset valuation).

2. Translating awareness into policy action

While national governments can create an overall retrofitting mandate, local governments can then take the operational lead by anchoring awareness initiatives to high-visibility retrofit projects and integrating retrofitting into broader urban strategies, spanning climate action, public health, employee productivity and housing equity. For example, a clear opportunity in this regard involves layering decarbonization goals into existing urban renewal projects. Policy action can include a combination of mandates and incentives.

What needs to happen starting now, and who needs to do what?

National governments can set retrofit mandates and national targets with legal teeth. Table 1 (on the next page) summarizes the key policy pathways governments can activate across the retrofit process together with global best practice examples. Governments can also establish enabling regulation for retrofitting performance measurement, financing and data sharing.

Local governments can integrate retrofitting into urban renewal projects as well as use city-owned built assets to demonstrate the potential of retrofitting and attract investment.

NGOs and city networks such as C40 can support cities through technical assistance, cross-city learning platforms and pilot funding.

Table 1: Policy pathways for retrofits

Policy or regulatory lever	Best practice examples
Mandatory pre-redevelopment audits of buildings	• Sydney's local government promotes deconstruction planning (but this is not mandatory)[55]
Mandatory performance standards, building codes, certifications and disclosures to stay operational	• Building Energy Performance Standards (BEPS) in Washington, D.C.[56] • Local Law 97 in New York City[57]
Mandatory specialized retrofits (dependent on urban context–wildfires, earthquakes, extreme heat)	• City Ordinance 183893 that mandates seismic retrofits in Los Angeles for certain types of buildings
Subsidies, incentives and tax rebates (This may also include socially targeted retrofit support)	• Tokyo's Low-Carbon Building Retrofit Subsidy[58] • Singapore's Green Mark Incentive Scheme[59]
Retrofit accelerator programs or one-stop-shops that provide technical and financial assistance	• London retrofit accelerator: one each for workplaces and homes • NYC retrofit accelerator[60]
Public-first approach—retrofitting municipal and other public buildings	• Paris government's efforts to retrofit public schools[61]

Source: Economist Impact research

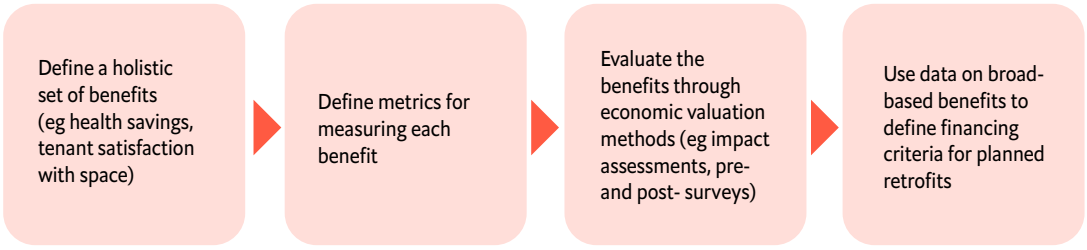
3. Quantify the full benefits of retrofitting beyond energy savings

Retrofitting struggles to attract private capital, particularly in the commercial sector, where returns are tightly scrutinized, as Mr Karthikeyan observed. Yet most retrofit initiatives, including city-level accelerator programs, remain anchored in decarbonization and energy efficiency goals. This narrow framing overlooks retrofitting's broad-based benefits to owners, tenants and investors discussed earlier, as well as to cities such as enhanced competitiveness, climate and disaster resilience, and overall livability. Economist Impact's survey echoes this; the two most common indicators used to measure retrofit project success are carbon emission reductions (58%) and energy savings (56%). Some existing certifications such as WELL and more recent versions of LEED account for broader benefits, but to promote their default adoption, governments and developers can collaborate to publish retrofit success stories to spark investor interest.

What needs to happen starting now, and who needs to do what?

Governments and standard-setting bodies can mandate broader metrics (eg, indoor air quality, heat resilience and employee productivity) in project appraisals and reporting. Figure 10 outlines a broad approach which can be customised to commercial and residential contexts.

Figure 10: Suggested baseline approach for quantifying retrofit benefits beyond energy savings



Source: Economist Impact research

Owners and developers can adopt and report on broader, non-energy metrics to attract ESG-linked capital and demonstrate retrofitting value to tenants. Similarly, investors can push for retrofit disclosure standards and require impact-aligned metrics in funding applications.

4. Unlocking innovative financing mechanisms

Financing is the most frequently cited barrier to retrofitting across cities, building types and stakeholder groups. Grants, tax breaks and upfront capital are essential for making retrofits viable, especially for large-scale or socially important projects. But policy must do more than subsidize.

What needs to happen starting now, and who needs to do what?

Governments can implement a well-designed mix of incentives, carbon pricing and mandatory targets that creates the confidence needed for long-term investment. Spain's Public Buildings Renovation Programme scheme blends EU and national funds to help municipalities upgrade public buildings and cut energy demand.[62]

Governments can also expand public-private partnerships (PPPs), which offer an effective route to mobilizing funding for retrofit programs. Nearly half (48%) of survey respondents said their city has at least one PPP supporting retrofits. This figure rises to 72% in Dubai, where PPPs form a core part of the city's retrofit strategy. One notable example is the Union 71 project, an adaptive reuse and retrofitting initiative aimed at revitalizing an old district of Dubai into a mixed-use area of residential and commercial units.[63]

Financial institutions can mainstream performance-based financing such as environmental upgrade agreements to align repayment with real-world outcomes by linking returns to energy savings, value uplift or occupancy rates.

Owners and developers can choose a financing approach by considering a mix of factors including building ownership structure, owners' and developers' risk appetite, payback periods and the extent of the retrofitting intervention. Potential approaches include:

- **Bank loans**: a standard debt financing approach providing upfront capital for retrofitting projects. Sustainability-linked loans and green bonds are a specialized type of financing linking financing criteria to green outcomes.

- **Public finance such as subsidies, grants, incentives and tax rebates**: while these are an important financing mechanism, they typically cover part of the total retrofit cost, and need to be combined with other financing methods—especially in case of commercial retrofits.
- **Energy Performance Contracts (EPCs) and Energy Savings Agreements (ESAs)**: EPCs are typically contracts between Energy Services Companies (ESCOs) and building owners in which ESCOs guarantee energy savings and are paid based on the achieved savings. ESAs are similar, but they typically do not include savings guarantees, and ESCOs are paid either a fixed fee or a share of the savings.
- **Commercial Property Assessed Clean Energy (C-PACE)**: A government-enabled financing mechanism, C-PACE financing, majorly seen in the US, involves loans that are linked to property tax assessments and not to owners.

JLL PERSPECTIVE

Unlocking green financing

Nidhi Baiswar
Senior Director, Global Sustainability & Climate Leadership at JLL

Unlocking green financing is key to scaling retrofitting efforts around the world. Between them, institutional investors, banks and private wealth have the necessary capital to make sustainable buildings commonplace but high upfront costs, long payback periods and split incentives between landlords and tenants remain significant hurdles to action.

Despite the increasingly politicized language around sustainability, investor appetite for low carbon real estate is growing–we're in a different place now to five years ago. More investors are recognizing the opportunities offered by the undersupply of sustainable buildings amid growing corporate demand for spaces that reflect and support their commitments.

There are more value add and transition funds in the market supporting brown to green conversion and delivering returns that go beyond financial to environmental and social. More generally, a growing number of funds are embedding the net zero transition into their strategies. Cross-border investment into sustainability projects, is scaling up.

Yet while there's momentum, much more needs to happen to boost retrofitting rates. Pension funds need to grow their allocation for sustainability related investments. Banks and bond-issuing institutional investors need to better incorporate transition plans for real estate. Unless a longer-term view on obsolescence is taken and better data collection processes are put in place, real estate loans will be exposed to a lot more embedded risk than is currently factored in. This is where technology, through advanced modelling capabilities, can be a game-changer.

Green finance equally needs to become more widely available. Sustainable debt issuance, for example, is starkly below levels needed to align buildings with net zero pathways. Of the US$7.1trn in sustainable debt issued over five years, only 7% was in real estate, with just 12% of green bonds going towards decarbonizing buildings. It must also evolve to become fit for purpose. Current rates on green products fail to sufficiently incentivize borrowers given the extra work involved.

Critically, financing retrofits is not just a private sector issue. Governments at a city and national level must provide clear guidance through regulations and disclosures, financial support through tax incentives and funding, and private-public partnerships to support projects that are not commercially feasible for property owners.

Financing retrofitting at the scale needed will take collaboration, innovation and determination—and this is still early days. But the opportunities for investors who drive the low carbon transition are huge and the rewards will benefit us all.

5. Leveraging emerging technologies for scale and speed

Accelerating technology use is crucial for efficiently scaling retrofitting, yet integration varies across cities and asset classes. Smart building systems, IoT sensors, AI and digital energy management tools can streamline operations and verify impact, but limited accessibility and funding, poor system interoperability, lack of trust in technology performance, data silos, and inadequate regulation have slowed retrofitting uptake.[64,65] Don McLean, founder and CEO, Integrated Environmental Solutions (IES), noted that the industry has not yet reached critical mass in technology adoption, despite a growing recognition of the critical role that advanced building performance simulation tools can play in helping to predict the impact of building retrofits, guide decision-making and mitigate risk. Tackling technology-related barriers will require stronger cross-sector collaboration between real estate developers, construction firms, technology providers and governments.

What needs to happen starting now, and who needs to do what?

National and local governments can fund pilot programs for technology integration within retrofits. They can also set relevant standards such as for data sharing and performance measurement pre- and post-technology integration.

Technology providers and real estate developers can collaborate on conducting real-world technology trials in retrofits across diverse building types and climates, sharing best practices and performance results. These real-world experiments can help test and refine solutions, build user confidence and lay the groundwork for a standardized set of tools that are widely trusted and ready for adoption.

Building owners and tenants can engage early in the design of smart systems, energy-efficient technologies and comfort-enhancing features to ensure usability and uptake. They can also educate occupants on how to use the technologies to manage energy and comfort.

6. Addressing the talent bottleneck

Building a skilled, retrofit-ready workforce is a prerequisite for scaling but skills shortages are a global issue. Despite the potential of retrofitting to generate high-quality, local jobs, labor shortages and a lack of specialized expertise are stalling progress in many markets. In the UK alone, 400,000 skilled retrofit workers are needed by 2050 to meet demand.[66]

What needs to happen starting now, and who needs to do what?

Education bodies can embed climate literacy and whole-life carbon thinking into architectural and engineering curricula, expanding technical apprenticeships and supporting on-the-job learning through PPPs.[67] They can also offer modular certification programs to prepare workers for retrofit-specific skills.

Industry associations and employers can create clear career pathways and run campaigns independently or in collaboration with governments to promote retrofitting as an aspirational, future-ready field. In addition, employers can embed workforce planning into large-scale retrofit programs.

Investors have an enabling role to play in advancing a retrofit-ready workforce by requiring workforce development plans as part of funding criteria for major retrofit projects.

Conclusion

Retrofitting buildings to improve resilience and sustainability is no longer optional, it is urgent, and done right, it delivers economic, environmental, and social benefits. As the world's urban centers expand and climate risks intensify, retrofitting has become a global imperative, extending far beyond the concerns of architects and environmentalists.This research underscores that radical retrofitting demands systemic change—not just better buildings, but better collaboration, more financing, better metrics and rapid workforce development.

Cities must tailor strategies to their own physical and regulatory landscapes. Historic districts, for instance, require careful planning to preserve architectural character. In places like Paris or Washington, D.C., retrofits must respect not only buildings but entire streetscapes. In fast-growing cities like Dubai, Delhi and Mexico City, retrofitting can be embedded into broader urban renewal schemes. The key pathways identified in this study need to be adapted to the individual economic contexts of cities.

- **Embed retrofitting into mainstream climate, economic, and urban planning strategies**. Governments must move beyond piecemeal incentives toward clear mandates and integrated retrofit programs, treating building upgrades as critical investments.
- **Broaden the value proposition for retrofitting**. Retrofitting must be reframed beyond energy savings to include stability, well-being, asset longevity and urban vibrancy—critical outcomes that resonate with investors, tenants, and communities.
- **Unlock finance at scale**. Blended finance models, green bonds, performance-based contracts and PPPs must be scaled to align short-term project risks with long-term societal value.
- **Leverage technology for rapid, verifiable progress**. Emerging tools must be deployed at scale, backed by data-sharing frameworks and regulatory clarity.
- **Close the retrofit skills gap**. A skilled, adaptable workforce is a prerequisite for success. Upskilling traditional construction workers, embedding retrofit literacy into education and making retrofit careers aspirational are urgent priorities.
- **Adopt systems thinking**. Retrofitting must be connected to broader city goals—linking energy systems, housing policy, public health, disaster resilience and economic opportunity.

Transparency and knowledge sharing among key stakeholders is crucial for the successful activation of these pathways. Each key stakeholder can contribute to ecosystem-

wide transparency, crucial for accelerating retrofitting efforts, and each stakeholder has a role to play. While local governments should publish data on retrofitting progress, building owners can share how retrofit strategies have enhanced asset value and delivered returns on investment. Investors and financial institutions should highlight financing mechanisms that have proven effective. Service providers must contribute by sharing successful case studies that demonstrate real-world impact and inspire replication.

Cities that succeed will treat retrofitting as a foundation for economic renewal, climate action, and urban well-being. By developing coordinated strategies, city leaders can turn retrofitting from a climate necessity into a transformative opportunity.

Acknowledgements

Economist Impact would like to thank the following experts from JLL for sharing their expertise and insights:

- **Nidhi Baiswar**, sustainability and climate leadership director
- **Elke Kornalijnslijper**, head of sustainability consulting, APAC
- **Kamya Miglani**, head of research, work dynamics, APAC
- **Phil Ryan**, director, city futures, global insights & research
- **Paulina Torres**, global research director, sustainability

Economist Impact would also like to thank the following experts for their time and insights:

- **Theresa Backhus**, director, Building Innovation Hub
- **Scott Dunn**, Asia-Pacific chair, Urban Land Institute (ULI), and vice-president, AECOM
- **Nancy Gillis,** former senior director, industrial decarbonization, World Business Council for Sustainable Development (WBCSD)
- **Omnia Halawani**, co-CEO and founder, grfn
- **Thomas Harlfinger**, partner, Drees & Sommer
- **Ted Howland**, vice president, group sustainability, CapitaLand Investment
- **S. Karthikeyan**, deputy executive director, Indian Green Building Council
- **Don McLean**, founder and CEO, Integrated Environmental Solutions (IES)
- **Ana Karen Mora**, director of sustainability, Fibra Uno Foundation
- **Irene Skoula**, director of energy and buildings, C40
- **Becci Taylor**, director, retrofit at scale, Arup
- **Thomas Vonier**, architect and senior partner, Chesapeake Strategies

The research was led by **Anjali Shukla**, senior expert and India lead, policy & insights, Economist Impact, and managed by **Anushree Sharma**, content lead, policy & insights, Economist Impact. The report was written by **Adam Green** and edited by Anjali Shukla and Anushree Sharma. Economist Impact would also like to thank **Jonathan Birdwell**, global head of Policy & Insights, and head of urban futures, Economist Impact, for his contributions.

References

1. JLL, "Retrofitting Buildings to be Future Fit," 2022, https://www.jll.de/en/trends-and-insights/research/retrofitting-buildings-to-be-future-fit/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
2. World Bank Group, Urban Development Overview, https://www.worldbank.org/en/topic/urbandevelopment/overview
3. Lwasa, S., K.C. Seto, X. Bai, H. Blanco, K.R. Gurney, Ş. Kılkış, O. Lucon, J. Murakami, J. Pan, A. Sharifi, Y. Yamagata, "Urban systems and other settlements." In IPCC, 2022: "Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change" [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)], 2022. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.010, https://www.ipcc.ch/report/ar6/wg3/chapter/chapter-8/
4. Climate Adaptation Platform, "MIT Research Reveals Insights on City Carbon Reduction Strategies," 17th October 2023, https://climateadaptationplatform.com/mit-research-insights-city-carbon-reduction-strategies/
5. UN Environment Programme (UNEP) and Yale Center for Ecosystems + Architecture (Yale CEA), "Chapter 2: Life-cycle thinking: Decarbonisation Requires a Whole Life-Cycle Approach" in "Building materials & the climate: Constructing A New Future," 2023, https://www.buildingmaterialsandclimate.com/chapte-2-life-cycle-thinking/2-1-embodied-versus-operational-carbon-emissions-in-buildings
6. Urban Land Institute, "Resilient Retrofits: Climate Upgrades for Existing Buildings," 2022, https://knowledge.uli.org/-/media/files/research-reports/2022/resilient-retrofits-climate-upgrades-for-existing-buildings.pdf?rev=36e6e8d45f0e452a868fa3855431f0e0
7. JLL, "Retrofitting Buildings to be Future-Fit," 2022, https://www.jll.de/en/trends-and-insights/research/retrofitting-buildings-to-be-future-fit/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
8. Pavillon de l'Arsenal, "Conserving Adapting Handing," 2023, https://www.pavillon-arsenal.com/en/expositions/12551-conserving-adapting-handing.html
9. C40 Cities C40 is a global network of nearly 100 mayors of the world's leading cities working together to tackle climate change. 2025, https://www.c40.org/
10. C40 Cities, "Clean construction could create millions of jobs and drive inclusive growth in cities, new C40 research shows," January 29th 2025, https://www.c40.org/news/clean-construction-jobs-growth/
11. JLL, "Opportunity through obsolescence," May 2025, https://www.jll.com/en-us/insights/repositioning-and-redevelopment-strategies-for-at-risk-assets-and-portfolios/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
12. JLL, "Retrofitting Buildings to be Future-Fit," 2022, https://www.jll.de/en/trends-and-insights/research/retrofitting-buildings-to-be-future-fit/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
13. As of May 12, 2025 the exchange rate of 1 JPY is 0.0064 USD
14. United Nations, Tokyo Cap-and-Trade Program, https://sdgs.un.org/partnerships/tokyo-cap-and-trade-program#description
15. World Green Building Council, Tokyo Cap-and-Trade Program Achieves 23% Reduction After 4th Year, https://worldgbc.org/article/tokyo-cap-and-trade-program-achieves-23-reduction-after-4th-year/
16. Singapore Building and Construction Authority, "Regulatory Requirements for New Buildings and Existing Buildings Undergoing Major Additions and Alterations," https://www1.bca.gov.sg/buildsg/sustainability/regulatory-requirements-for-new-buildings-existing-buildings-undergoing-major-aanda
17. As of May 12, 2025 the exchange rate of 1 JPY is 0.0064 USD
18. Baker McKenzie, "Incentives for green retrofit," Global Sustainable Buildings Guide: Japan, https://resourcehub.bakermckenzie.com/en/resources/global-sustainable-buildings/asia-pacific/japan/topics/incentives-for-green-retrofit
19. DC Sustainable Energy Utility, "Building Energy Performance Standards (BEPS) & Benchmarking," https://www.dcseu.com/resource-library/beps
20. IRENA, "Stranded assets and renewables: how the energy transition affects the value of energy reserves, buildings and capital stock", 2017, https://www.researchgate.net/publication/320556074_STRANDED_ASSETS_AND_RENEWABLES_How_the_energy_transition_affects_the_value_of_energy_reserves_buildings_and_capital_stock
21. Kiel Institute for the World Economy, "Energy efficiency renovations pay off in sales prices and rents," November 19th 2024, https://www.ifw-kiel.de/publications/news/energy-efficiency-renovations-pay-off-in-sales-prices-and-rents/
22. What is the value of green?, Insights Strategy and Analysis by LaSalle, September 2023, lasalle-value-of-green-sept-11-2023.pdf

23. WELL - International WELL Building Institute, 2025, https://www.wellcertified.com/
24. Guy Grainger, JLL, "For net zero cities, we need to revisit our older buildings," World Economic Forum, November 8th 2022, https://www.weforum.org/stories/2022/11/net-zero-cities-retrofit-older-buildings-cop27/
25. Michael Maslansky and Will Howard, Despite Anti-ESG Attacks, New Study Shows Investors See Climate as Critical to Business Performance, Harvard Business Review, https://hbr.org/sponsored/2024/08/despite-anti-esg-attacks-new-study-shows-investors-see-climate-as-critical-to-business-performance
26. PACE Equity, How PACE Financing Works, https://www.pace-equity.com/how-pace-financing-works/#map
27. U.S. Environmental Protection Agency, Commercial Property Assessed Clean Energy (C-PACE), https://www.epa.gov/statelocalenergy/commercial-property-assessed-clean-energy
28. New South Wales Government, "Upgrade your hot water system," https://www.energy.nsw.gov.au/households/rebates-grants-and-schemes/household-energy-saving-upgrades/upgrade-your-hot-water
29. Sumanta Das, Malini Roy Choudhury, Bhagyasree Chatterjee, Pinanki Das, Sandeep Bagri, Debashis Paul, Mahadev Bera, and Suman Dutta, "Unraveling the urban climate crisis: Exploring the nexus of urbanization, climate change, and their impacts on the environment and human well-being – A global perspective," AIMS Public Health, August 27th 2024, https://pmc.ncbi.nlm.nih.gov/articles/PMC11474320/
30. Will Nichols, "Asian cities in eye of environmental storm – global ranking," Verisk Maplecroft, May 12th 2021, https://www.maplecroft.com/insights/analysis/asian-cities-in-eye-of-environmental-storm-global-ranking/
31. Kevin Rector, "Schiff's first Senate bill proposes tax credit for hardening homes against fire, disasters," Los Angeles Times, April 8th 2025. https://www.latimes.com/california/story/2025-04-08/schiffs-first-senate-bill-proposes-tax-credit-for-hardening-homes-against-fire-disasters
32. Indian Green Building Council (IGBC) & Confederation of Danish Industry (DI). (n.d.). Sustainable workspaces: Catalysts for productivity and profitability in Indian business. https://igbc.in/frontend-assets/html_pdfs/DI-IGBC-Research-Report%20-Sustainable-Workspaces-Catalysts-for-productivity-and-profitability-in-Indian-Business.pdf
33. Confederation of Indian Industry, "Sustainable Workspaces: Catalysts for Productivity and Profitability in Indian Businesses," March 2024. https://igbc.in/frontend-assets/html_pdfs/DI-IGBC-Research-Report%20-Sustainable-Workspaces-Catalysts-for-productivity-and-profitability-in-Indian-Business.pdf
34. Thriving at work is defined as a psychological state in which employees feel both energized and feel they are continuously learning. Employees who thrive are generally in good health, exhibit positive attitudes toward their jobs, demonstrate strong organizational citizenship and approach their work with enthusiasm and vigour.
35. Michelle Ludik, "Reworking and Retrofitting Offices," New London Architecture, July 27th 2023, https://nla.london/news/reworking-and-retrofitting-offices-unlocking-the-timeless-potential-of-workspaces
36. NSW Government, "Home Retrofit | Resilient Homes Program," n.d. https://www.nsw.gov.au/departments-and-agencies/nsw-reconstruction-authority/our-work/resilient-homes-program
37. Ofgem, "Energy Company Obligation (ECO)," https://www.ofgem.gov.uk/environmental-and-social-schemes/energy-company-obligation-eco
38. Geeta Pandey and Nikita Yadav, "Expert warns of public health emergency as Delhi's toxic air returns," BBC News, December 18th 2024, https://www.bbc.co.uk/news/articles/c785mkm39ndo
39. Risha Chakraborty and Arushi Dogra, "Cook Stoves and Pollution Mortality," Yale Scientific, February 28th 2022, https://www.yalescientific.org/2022/02/cook-stoves-and-pollution-mortality/
40. Sam Ramadori and Jean-Simon Venne, AI and Retrofits: A Nod to NYC's City of Yes Initiative, New York Real Estate Journal, https://nyrej.com/ai-and-retrofits-a-nod-to-nyc-s-city-of-yes-initiative-by-sam-ramadori-and-jean-simon-venne
41. Sam Lubell, Welcome to the Age of the AI-Optimized Building, Fast Company Middle East, https://fastcompanyme.com/co-design/welcome-to-the-age-of-the-ai-optimized-building/
42. The future of AI in CRE , https://www.jll.com/en-us/insights/the-future-of-ai-in-cre/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
43. Kimberly Markiewicz and Yuehan Wang, "Streamline Sustainable Asset Enhancement with AI," JLL, November 2024, https://www.jll.com/en-us/insights/streamline-sustainable-asset-enhancement-with-ai/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
44. Townsend, J. (2025, March 20). AI in corporate real estate: Adoption gains momentum. Knight Frank. https://www.knightfrank.com/research/article/2025-03-20-ai-in-corporate-real-estate-adoption-gains-momentum
45. Solar Together, 2025, https://solartogether.co.uk/landing
46. JLL, "Retrofitting Buildings to be Future-Fit," 2022, https://www.jll.de/en/trends-and-insights/research/retrofitting-buildings-to-be-future-fit/?utm_source=economistimpact&utm_medium=spct&utm_campaign=gl-wd-cp-radical-retrofit-0625
47. WEG Wissen, "Act on the Ownership of Apartments and the Permanent Residential Right," 2022, https://www.weg-wissen.de/legal-text-en/
48. UK National Audit Office, March 2024, https://www.nao.org.uk/wp-content/uploads/2024/03/Decarbonising-home-heating-HC-581.pdf
49. Lux Construction Group, "Soft-Story Retrofit – The More You Wait, The More You'll Pay," August 2024. https://www.luxdevla.com/soft-story-retrofit-the-more-you-wait-the-more-youll-pay/#The_Shortage_of_Structural_Engineers

50. Richard Waite, "'Students told to ignore existing building' – survey reveals retrofit teaching gap," Architects Journal, December 6th 2022, https://www.architectsjournal.co.uk/news/students-told-to-ignore-existing-building-survey-reveals-retrofit-teaching-gaps
51. Nationally Determined Contributions (NDCs) are commitments submitted by countries to the United Nations Framework Convention on Climate Change (UNFCC) every five years to reduce their greenhouse gas emissions and adapt to the impacts of climate change, aiming to achieve the global goal of limiting temperature rise to well below 2°C above pre-industrial levels. https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs
52. Forbes Business Council, "19 Real Estate Investment Trends To Watch In 2025," Forbes, https://www.forbes.com/councils/forbesbusinesscouncil/2025/01/10/19-real-estate-investment-trends-to-watch-in-2025
53. Guy Grainger, JLL, "For net zero cities, we need to revisit our older buildings," World Economic Forum, November 8th 2022, https://www.weforum.org/stories/2022/11/net-zero-cities-retrofit-older-buildings-cop27/
54. World Green Building Council, BUILD UPON^2: A Tool to Deliver the Renovation Wave, https://worldgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/08/10165749/BUILD-UPON2-%E2%80%93-A-Tool-to-Deliver-the-Renovation-Wave-Download-Document.pdf
55. Construction and Demolition Waste Management Guideline, UNSW, https://www.estate.unsw.edu.au/sites/default/files/documents/Appendix%202%20-%20%20UNSW%20Construction%20and%20Demolition%20Waste%20Management%20Guideline_0.pdf
56. Building Energy Performance Standards, Department of Energy and Environment, https://doee.dc.gov/service/building-energy-performance-standards-beps
57. LL97 Greenhouse Gas Emissions Reduction, NYC Buildings, https://www.nyc.gov/site/buildings/codes/ll97-greenhouse-gas-emissions-reductions.page
58. Tokyo's Urban Cap-and-Trade Scheme Delivers Substantial Carbon Reductions, C40 Cities https://www.c40.org/case-studies/tokyo-s-urban-cap-and-trade-scheme-delivers-substantial-carbon-reductions/
59. Green Mark Incentive Scheme for Existing Buildings 2.0 (GMIS-EB 2.0), Building and Construction Authority, https://www1.bca.gov.sg/buildsg/sustainability/green-mark-incentive-schemes/green-mark-incentive-scheme-for-existing-buildings-2.0#:~:text=In%20March%202021%2C%20BCA%20launched,$25/tCO2e
60. Building a Better NYC With Energy Upgrades, NYC Accelerator, https://accelerator.nyc/
61. How Paris used energy performance contracts to retrofit schools, C40 Knowledge, https://www.c40knowledgehub.org/s/article/How-Paris-used-energy-performance-contracts-to-retrofit-schools?language=en_US
62. European Commission, "Public Buildings Rehabilitation Programme," https://commission.europa.eu/projects/public-buildings-rehabilitation-programme_en
63. Karishma Nandkeolyar, "Union 71: new Dubai neighbourhood in the works," TimeOut Dubai, December 6th 2023, https://www.timeoutdubai.com/news/union-71-dubai
64. Smart Spaces, Transforming Existing Properties: Your Guide to Retrofit Buildings with Smart Technology, https://www.smartspaces.app/blog/transforming-existing-properties-your-guide-to-retrofit-buildings-with-smart-technology/
65. World Green Building Council, Bringing Embodied Carbon Upfront, https://worldgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/09/22123951/WorldGBC_Bringing_Embodied_Carbon_Upfront.pdf
66. Retrofit Academy, The future of retrofit: what is The Retrofit Academy doing to meet demand? https://retrofitacademy.org/the-future-of-retrofit-what-is-the-retrofit-academy-doing-to-meet-demand/

ECONOMIST IMPACT

LONDON

The Adelphi
1-11 John Adam Street
London WC2N 6HT
United Kingdom
Tel: (44) 20 7830 7000
Email: london@eiu.com

INDIA

9th Floor,
Infinity Tower A,
DLF Cyber City
Gurugram 122002
Haryana, India
Tel: (91) 124 6409351

SINGAPORE

8 Cross Street
#23-01 Manulife Tower
Singapore 048424
Tel: (65) 6534 5177
Fax: (65) 6534 5077
Email: asia@economist.com

NEW YORK

750 Third Avenue
5th Floor
New York, NY 10017
United States
Tel: (1.212) 554 0600
Fax: (1.212) 586 1181/2
Email: americas@economist.com

DUBAI

Office 1301a
Aurora Tower
Dubai Media City
Dubai
Tel: (971) 4 433 4202
Fax: (971) 4 438 0224
Email: dubai@economist.com

SÃO PAULO

Rua Joaquim Floriano,
1052, Conjunto 81
Itaim Bibi, São Paulo,
SP, 04534-004,
Brasil
Tel: +5511 3073-1186
Email: americas@economist.com

HONG KONG

1301
12 Taikoo Wan Road
Taikoo Shing
Hong Kong
Tel: (852) 2585 3888
Fax: (852) 2802 7638
Email: asia@economist.com

GENEVA

Rue de l'Athénée 32
1206 Geneva
Switzerland
Tel: (41) 22 566 2470
Fax: (41) 22 346 93 47
Email: geneva@economist.com

WASHINGTON DC

1920 L street NW Suite 500
Washington DC
20002
United States
Email: americas@economist.com