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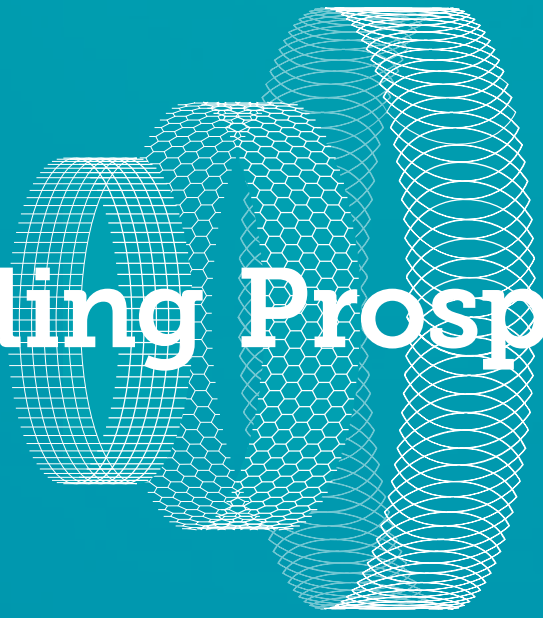

Building Prosperity

Unlocking the potential of a nature-positive, circular economy for Europe

July 2024

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About this report

This report is written for policymakers, business leaders, investors, and industry experts with a vested interest in improving the competitiveness of Europe's economy while delivering benefits to business, individuals, society, and nature. It highlights the importance of the circular economy transition for a prosperous and resilient economy and a thriving natural world. It outlines the potential benefits that are ready to be realised, and the actions that can deliver these positive outcomes now and in the long term.

In this report, the nature-positive impact and economic potential of the circular economy framework has been demonstrated through the lens of the built environment, with the report's research, analytics, and modelling focusing on the European Union. The analysis and modelling for this report have been carried out in partnership with Systemiq. For more details on the analytical approach see the Appendix on pp.98. The report has also received input from a variety of external stakeholders, for which we are grateful. Among these are the Foundation's built environment expert partners, Arup and Biomimicry 3.8.

Given that every organisation has a relationship with the built environment, whether as owners or occupiers, opportunities exist for multiple stakeholders to engage, participate, and accelerate its transformation. Specifically, this publication aims to activate key players in the built environment sector, by identifying the most impactful and nature-enhancing strategies to accelerate the transition to a nature-positive, circular economy. The report's broad recommendations for key stakeholders will help to set direction for how these strategies can be harnessed and implemented in context-specific settings, and will serve as a springboard for the Foundation's programme of activation and engagement following this publication.

This report has focused on Europe as the geographical context, which provides a starting point for further research and reflection on the built environment value chain across geographies. We also recognise that this report touches on a number of other topics relevant to the sector's transition to a nature-positive, circular economy. For example, the implication of the transition on multi-sector land use and bio-based feedstocks, or the implications on trade within and beyond Europe's borders. However, for the purposes of this study we do not explore them in depth. The economic opportunities of the circular economy extend across all sectors and systems, such as food, fashion, and plastics, and while we have touched on some of these in this study, in-depth work on these themes can be found on the Foundation's website. We encourage further research across all areas in relation to the study and the circular economy transition.

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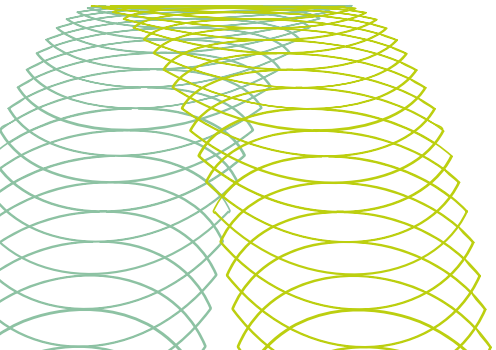

About the Ellen MacArthur Foundation

The Ellen MacArthur Foundation is an international charity that develops and promotes the circular economy in order to tackle some of the biggest challenges of our time, biodiversity loss, climate change, and waste and pollution. We work with our network of private and public sector decision makers, as well as academia, to build capacity, explore collaborative opportunities, and design and develop circular economy initiatives and solutions. Increasingly based on renewable energy, a circular economy is driven by design to eliminate waste, circulate products and materials, and regenerate nature, to create resilience and prosperity for business, the environment, and society.

Further information: www.ellenmacarthurfoundation.org @circulareconomy

About Systemiq

Systemiq, the system-change company, was founded in 2016 to drive the achievement of the Sustainable Development Goals and the Paris Agreement, by transforming markets and business models in five key systems: nature and food, materials and circularity, energy, urban areas, and sustainable finance. A certified B Corp, Systemiq combines strategic advisory with high-impact, on-the-ground work, and partners with business, finance, policymakers, and civil society to deliver system change. In 2020, Systemiq and The Pew Charitable Trusts published Breaking the Plastic Wave: a comprehensive assessment of pathways towards stopping ocean plastic pollution, an evidence-based roadmap that shows how industry and governments can radically reduce ocean plastic pollution by 2040. Systemiq has offices in Brazil, France, Germany, Indonesia, the Netherlands, and the UK.

Further information: www.systemiq.earth

About Arup

Dedicated to sustainable development, Arup is a collective of 18,000 designers, advisors, and experts working across 140 countries. Founded to strive for humanity and excellence, Arup collaborates with clients and partners, using imagination, technology, and rigour to shape a better world. Arup is a longstanding knowledge partner to the Ellen MacArthur Foundation, working together over nearly a decade to enhance recognition of the circular economy in the built environment. In 2022, Arup and the Ellen MacArthur Foundation launched the Circular Buildings Toolkit, a practical tool designed to bring the circular economy into the mainstream for real estate players, helping asset owners, developers, and investors to future-proof assets as sustainability policies redraw the industry.

Further information: www.arup.com

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Contributor organisations

The Ellen MacArthur Foundation would like to thank the organisations and individuals across policy, industry, and academia, as well as those from NGOs and think tanks, who contributed to this study with insights and constructive input. Please note that contribution to the study, or any part of it, or any reference to a third-party organisation within the study, does not indicate any kind of partnership or agency between the contributors and the Foundation, nor an endorsement by that contributor or third party of the study's conclusions or recommendations.

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World Business Council for Sustainable Development (WBCSD)

In support of this report

How many lands do you touch?

As humans, we impact the lands we build on, the farms that feed us, the working forests that house us, and the mines that supply our industries. Most reports look through the lens of risk associated with the degradation of our built world. It's time to look through the lens of opportunity, to champion and scale efforts that heal the damage and produce positive ecosystem services by design. The good news is it's already happening. This report demonstrates how nature's healthy ecosystem models are setting the standard for a nature-positive, circular economy. Using biomimicry methods, we are challenging ourselves to perform like local ecosystems to build and manage lands in ways that create positive ecosystem services. It starts with measuring the ecological benefits flowing from local wildlands, then designing to return the favour. It's how the circular economy learns from nature, for nature."

Janine Benyus, Author, Co-Founder of The Biomimicry Institute and Biomimicry 3.8

Circular economy strategies are an integral part of the European Green Deal, and go beyond materials management. As underlined in the 2020 Action Plan, circular economy initiatives contribute to delivering a clean and competitive Europe - one that is resilient, as well as climate and nature positive. The Ellen MacArthur Foundation's "Building Prosperity" report focuses on tangible solutions for the built environment sector, and highlights their economic, environmental and societal benefits. This publication is very timely, as we move into the implementation phase of the Action Plan."

Kurt Vandenberghe, Director-General – Directorate-General Climate Action (DG CLIMA)

Adopting regenerative thinking and principles in policies has the potential to create multiplier effects beyond direct control. If we identify these regenerative opportunities we can create value across economic, ecological, and social dimensions while simultaneously promoting community wellbeing."

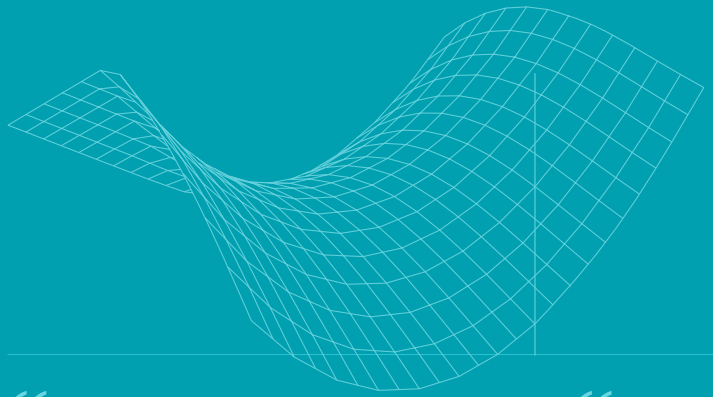
Rene Koop, Circular Economy Programme Manager, City of Amsterdam

Circular economy is the oldest concept on planet Earth. All nature is based on the principles of circularity - nothing is lost, and everything has its purpose. We humans, as part of nature, should abide by the same principles. This report is an important contribution to the transition needed. According to the recent Global Resource Outlook released by IRP, the built environment is one of human needs which are most resource intensive."

Janez Potočnik, Co-Chair of the International Resource Panel hosted by the United Nations Environment Programme, Partner at Systemiq

Nature-positive, circular economy strategies are at the core of Vitoria-Gastiez's ambition of becoming a net-zero carbon city and improving the wellbeing of our citizens. The strategies in this report are robust and align with our circular priorities, including rehabilitating old housing as well as using demolition materials and bio-based materials in new developments. As such, we welcome this report's clear and actionable set of recommendations to accelerate the transition towards a nature-positive, circular economy that benefits all stakeholders within our shared built environment.

Borja Rodriguez, Deputy Mayor of Vitoria-Gasteiz, Spain



"As a Member of the European Parliament and Globe EU board member, I firmly endorse this report's findings. It clearly demonstrates economic development and nature restoration can be harmonised through a circular economy framework. This offers a pivotal opportunity to build resilience, drive innovation, and deliver prosperity across the EU. Embracing nature-positive models will create jobs, reduce import dependence, and ensure long-term vitality of our natural resources. The path charted is encouraging and will strengthen EU competitiveness while safeguarding our natural capital."

Martin Hojsík, Member of the European Parliament and Board Member of GlobeEU

"A just, resilient, and beautiful future is possible - if we invest in it. With €575 billion of benefits on the table each year, there is a strong argument for applying our creativity and ingenuity to the challenge. At a time when Europe is under pressure from all angles, using our resources wisely through a circular economy approach in the built environment is critical. EIT Climate-KIC strongly welcomes the analysis of Ellen MacArthur Foundation and is fully supportive of bringing the circular economy principles into action."

Dr.-Ing. Mira Conci, Built Environment Lead, Climate-KIC B.V.

"In our built environment, every building, every street, every neighbourhood offers us a chance to embrace innovative circular design. From the materials we use to the assets we create and the districts we design, forward-looking regulation is emerging to help address both the climate and biodiversity crises, paving the way towards a nature-positive, circular and more resilient economy. But we will only unlock this positive change at scale through unguarded collaboration, by bringing together designers, policymakers, businesses and investors to embrace innovative value-creation models. What is abundantly clear is that nature must become a priority issue as we transition towards a regenerative built environment that balances growth with human and societal wellbeing for long-term prosperity."

Jerome Frost, Chair of Arup Group

"UNECE's 69th Commission, through a decision of all its 56 member States, officially named the circular economy as a new cross-cutting priority topic for the organisation. Since then, we have worked to position circularity as a key aspect of our norm and standards setting activities, with a view to accelerate its adoption and create markets. All the while, the UNECE has framed circularity as a way to decouple economic growth from pollution, biodiversity loss and climate impacts: for this reason, we warmly welcome the insights contained in "Building Prosperity", as they highlight the nature-positive benefits that the circular economy offers, and help create a sense of direction for a key sector that touches us all."

Dmitry Mariyasin, Deputy Executive Secretary of the UN Economic Commission for Europe

"At BIG (Bjarke Ingels Group) we believe that circularity is vital for achieving a sustainable and resilient world, unlocking immense potential for people, the planet, and prosperity. The principles surrounding circular economy set forth in the Ellen MacArthur Foundation's 'Building Prosperity' report provide a tangible foundation and set a direction for all stakeholders involved in developing projects related to the built environment. We are proud to have contributed to developing the report and recommend it as a guide for those wishing to enact positive environmental changes in the built environment.

Bjarke Ingels Group

"Now, more than ever, there is a need to unite and embrace nature, to reconnect communities with nature, and ensure economic prosperity and ecological health go hand in hand. This report underscores the clear benefits of nature-positive and circular implementation in our urban areas and the roles of policymakers at all levels to work with finance, developers and businesses."

Gino Van Begin, Secretary General, ICLEI - Local Governments for Sustainability

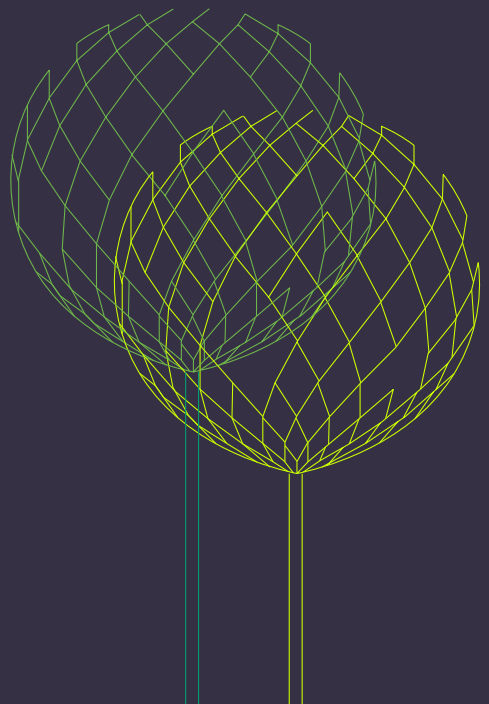
"Regenerative building is circular and nature-positive by design. It fosters systems that restore and enrich our natural and social landscapes. By transforming infrastructure into living ecosystems, we can build prosperity, enabling more resilient and vibrant cities, while advancing economic growth. As a leader in sustainable and innovative building solutions, Holcim is a proud supporter and contributor to the Ellen MacArthur Foundation's vision for the built environment."

Nollaig Forrest, Chief Sustainability Officer, Holcim

"This report reveals the need, potential, and value of merging circular economy and ecosystem services. Without nature, no life. Without life, no economy."

Kasper Guldager Jensen Co-Founder, Home.Earth, Chair for Circular Construction, European Committee for Standardization

Executive summary



Economic and societal vitality ultimately relies upon the health of nature

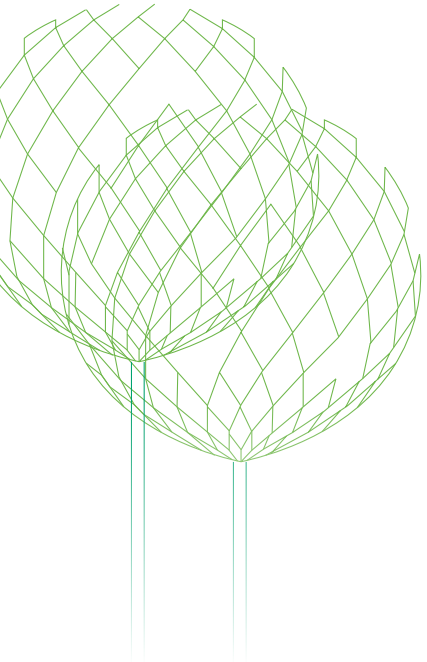
Shifting to a circular economy, which is nature-positive by design, can build prosperity while tackling climate change and other global challenges. This study shows that a targeted set of investable and scalable actions in the built environment sector represents a significant economic opportunity for Europe, increasing resilience, competitiveness, and the vibrancy of its cities. It also aims to show that circular and nature-positive strategies can be applied across sectors.

Europe's competitiveness and resilience relies upon ensuring the health of its natural ecosystems, the efficient use of resources, and the vibrancy of its cities as attractive places for people to live and work. Prevailing economic models have traditionally overlooked the value of ecosystem services, which are under unprecedented strain. In order to alleviate these pressures, it is vital that we replenish natural ecosystems by harnessing the power of the circular economy to be restorative and regenerative by design. In this way, a nature-positive, circular economy can help address some of Europe's key challenges — providing a far broader set of economic, social, and environmental benefits than the current extractive and polluting model. Yet in the face of recent external shocks and geopolitical tensions, the prioritisation of approaches aimed at reconciling economic and environmental performance are being challenged: it is therefore crucial to restate the economic rationale of circular strategies, for which a strong legislative framework has been developed in the European Union over the past ten years. This study aims to support the argument that now is the time to harness the innovation and competitiveness potential of the circular economy.

To illustrate how the benefits of a nature-positive, circular economy can be realised in a tangible, high-impact way, this study focuses on the built environment using new analysis drawn from quantitative modelling and interviews with expert practitioners. Encompassing places and spaces, the built environment comprises a wide range of systems that interact with each other and with their surroundings, including the natural environment and the biodiversity within it. Every government and business has a built environment footprint, and all of our daily lives are touched by it. As a 'system of systems', it also influences many other sectors, including mobility, retail, manufacturing, energy, and material production. The sector is strategically important to the European economy and society, not least in terms of ensuring people's health and wellbeing, and the continent's long-term economic vibrancy.

Despite being relatively efficient compared to other high-income regions, Europe's built environment is currently characterised by substantial material consumption, greenhouse gas (GHG) emissions, and the degradation of nature. Most of Europe's housing and infrastructure stock is already in place, however, millions of new homes are still to be built and the need for energy improvements, as well as widespread renovation, positions this sector on the cusp of substantial transformation. As Europe faces the next chapter in its built environment evolution, adopting a nature-positive, circular built environment enabled by new digital and material technologies could catalyse profound systemic changes and build prosperity across the bloc. By designing nature-positive solutions from the outset, capturing more value from fewer resources and enhancing efficiency, Europe can increase its built environment sector's economic potential and contribution to citizens' wellbeing.

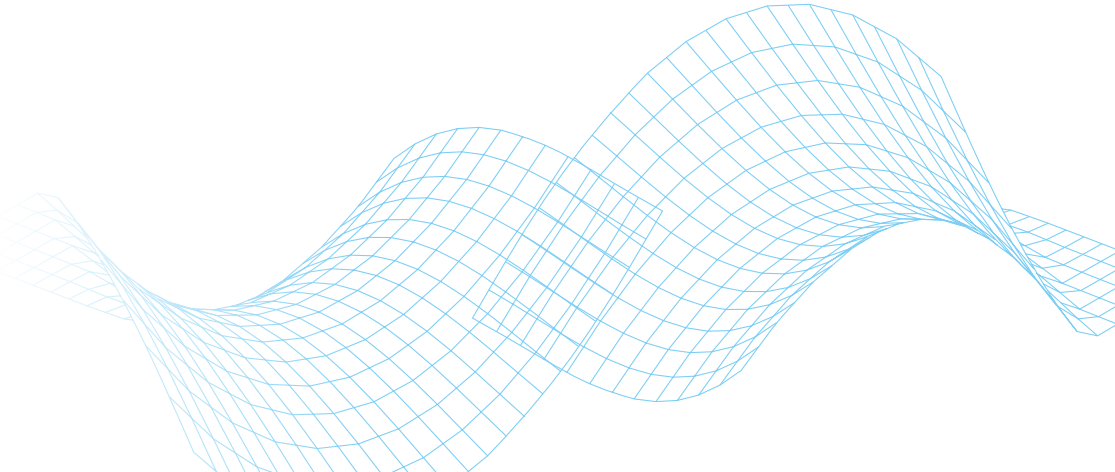
The circular built environment can propel Europe towards a prosperous and nature-positive future



Europe's built environment has sizable potential to contribute to a prosperous and resilient European economy. Europe's built environment is characterised by its rich historical architecture and contemporary urban landscapes that shape its economic vitality and cultural identity. While there is much to be celebrated about Europe's architectural legacy and many examples of cutting-edge innovation to take inspiration from, the construction sector faces pressing challenges. The sector accounts for the largest share of Europe's material footprint and over 35% of its total waste.[1] Underutilised buildings and excessive urban sprawl contribute to economic inefficiency and environmental degradation. As the fastest-warming continent on the planet, Europe's urban centres are increasingly vulnerable to extreme weather events such as heatwaves, droughts, and floods.

By highlighting tangible pathways for a nature-positive, circular built environment, this report shows how economic development and nature restoration can be mutually reinforcing. A nature-positive, circular built environment represents a transformative shift in how we conceive, plan, and build our cities. This report brings a new level of systems thinking to the debate by proposing a targeted selection of six interlocking strategies that address many of the built environment's challenges, cover the whole value chain, and apply to multiple sectors (commercial, residential, and infrastructure) and stakeholders (urban planners, designers, suppliers, constructors, businesses, asset owners, and citizens). This systems perspective can unlock short-term returns and long-term benefits by ensuring that the built environment contributes to Europe's social goals of economic opportunity, resilient urban landscapes, and nature restoration.

This study focuses on six nature-positive, circular strategies that are ripe for investment and scaling now, and can deliver substantial benefits in the built environment and beyond. Having identified c.50 potential action areas, we selected and modelled the six strategies with the greatest potential for the economy, society, and nature. These strategies are already demonstrated as viable with thriving case examples in Europe and positive underlying economics. Increasingly considered investable, scaling them up is now made possible by new digital technologies and innovation in building materials. These strategies help to realise three ambitions for a circular built environment.



SIX STRATEGIES FOR A CIRCULAR AND NATURE-POSITIVE BUILT ENVIRONMENT

Revitalise land and assets:

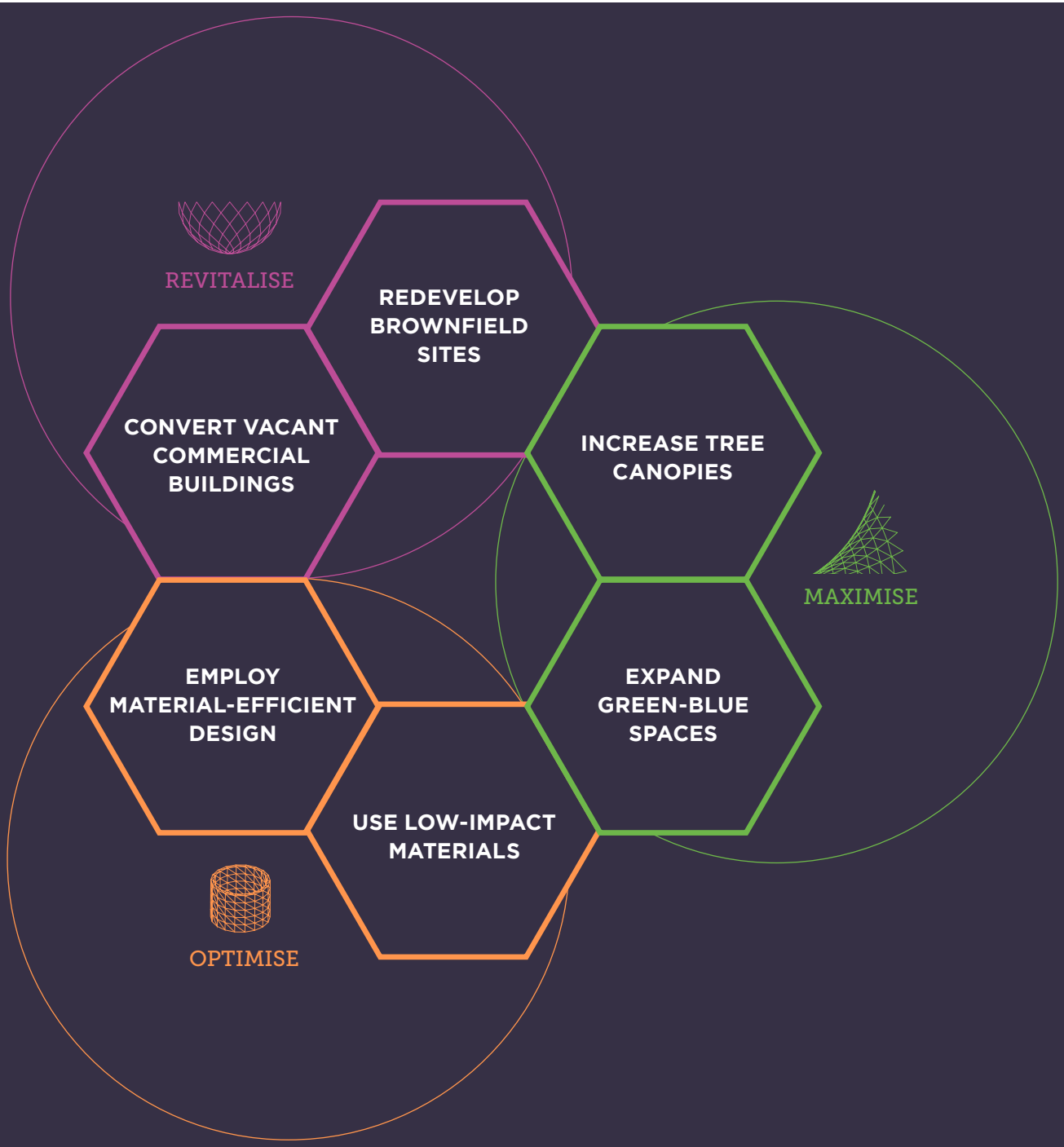
Focusing on **brownfield site redevelopment** and the **conversion of vacant commercial buildings** could help avoid 7,700km² of urban sprawl along with the associated carbon emissions and impacts on biodiversity.

Maximise nature in cities:

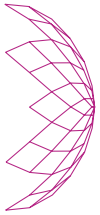
Strategically **increasing tree canopies** and **expanding green-blue spaces** by adding more areas of water and vegetation throughout the cityscape can add 8,500km² of green space to Europe's cities and increase resilience to the effects of climate change.

Optimise building design and material sourcing:

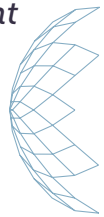
Employing **material-efficient design** and using **low-impact materials** — including reused or recycled materials, bio-based and low-carbon alternatives — can reduce land used to extract construction materials by 500km² and avoid large amounts of hard-to-abate emissions.



These six strategies can generate substantial economic, environmental, and social benefits for European businesses and citizens by 2035



Unlocking EUR ***575*** *billion revenue in the built environment value chain*



The six strategies can together unlock EUR 575 billion of potential revenue annually across the built environment value chain. In many cases, these revenue pools are ready to be realised now with low barriers to implementation, for example:

- **Revitalising brownfield sites** and **converting vacant commercial buildings** for residential development could unlock revenue for those involved in developing and repurposing these sites — from materials and component suppliers, to new buildings and site managers.
- **Maximising nature** through strategically **increasing tree canopies** and **expanding green-blue spaces** in European cities to a minimum threshold for resilience, health, and well-being over the next ten years could double the size of the landscape construction sector.
- **Optimising building design** and **material sourcing** will benefit material and component suppliers, driven by a five-fold increase in the prefabricated construction market and large demand increases for modular building systems and low-impact materials.

Wider economic benefits to business and citizens can amount to EUR 158 billion annually.

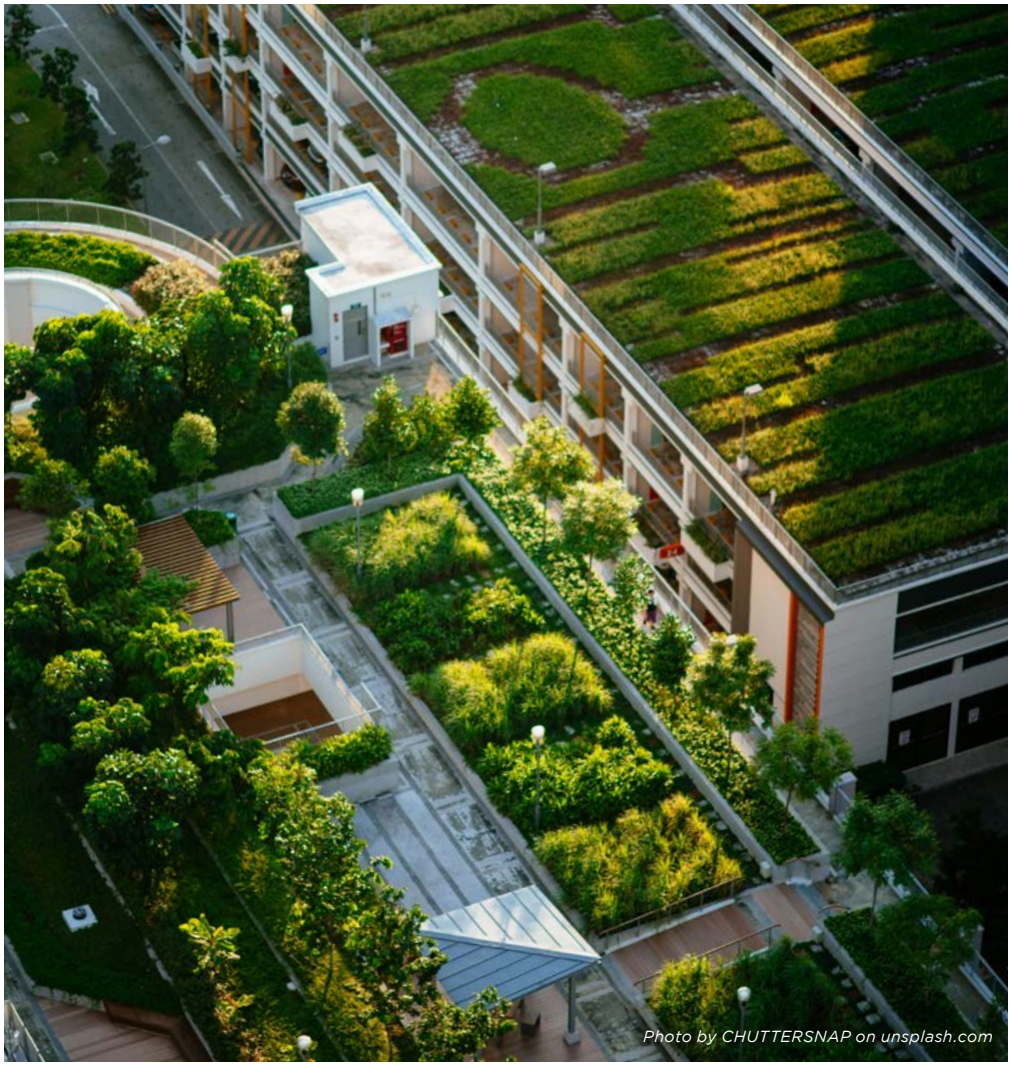
- **More vibrant and attractive cityscapes** driven by maximising green space can increase annual revenue to shops, restaurants, bars, and cafés.
- **Local economic activity boosted** by the conversion of vacant commercial buildings in Europe's city centres into high-density multi-family homes.
- **Reduced infrastructure costs** due to prioritising high-density, brownfield development.
- **Reduced energy and water charges** to households and businesses due to strategic use of green-blue spaces.
- **Improved mental health, wellbeing, and productivity** resulting from offices well integrated with nature.
- **Enhanced liveability and desirability of urban areas** by increasing green spaces and regenerated brownfield sites, leading to the creation of new businesses and amenities.

The six circular economy strategies can yield further systemic benefits in terms of resilience and competitiveness.

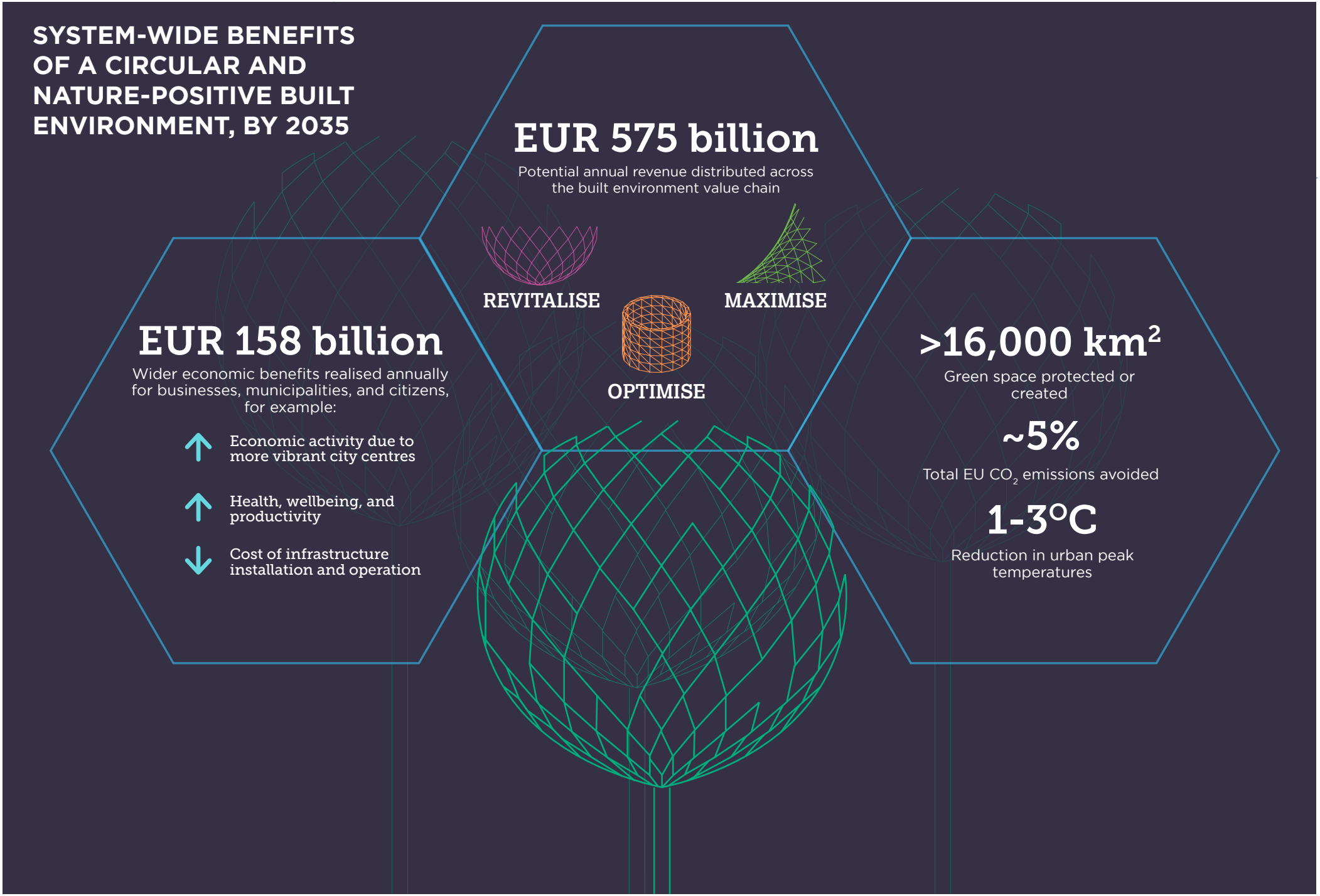
- **Resilience:** Maximising nature in cities increases the resilience of businesses and citizens to the effects of climate change. Expanding green spaces reduces urban peak temperature by 1–3°C. It also slows water flows and increases infiltration, leading to reductions in flood intensity by 10–20%.
- **Social benefits** are equally compelling, with improvements in health and wellbeing for citizens through increased access to green spaces, improved air quality, and a more attractive urban environment.
- **Competitiveness:** Scaling material-efficient, prefabricated modular construction while increasing the use of low-impact materials can reduce demand for materials by 250 million tonnes, saving developers up to 20% in material costs per building project.
- **Risk avoidance:** Employing nature-based climate adaptation strategies could safeguard EUR 632 billion of properties and businesses from loss or damage.

An ambitious scaling-up of the selected strategies could create employment opportunities across all skill levels and a range of job types. While this study did not model the impact of the six strategies on the labour market, our desk research shows that, globally, a nature-positive economy could create over 110 million jobs[2] in the building and infrastructure sector, for example:

- Brownfield redevelopment has the potential to expand opportunities in site remediation, urban planning, and nature-based design.
- Urban greening initiatives could lead to new roles in landscape design, tree maintenance, horticulture, and urban ecology.
- The push for more efficient structures and low-impact materials could increase demand for specialists in digital design and advanced construction technologies.



Maximising nature in European cities can double the size of the landscape sector.


SYSTEM-WIDE BENEFITS OF A CIRCULAR AND NATURE-POSITIVE BUILT ENVIRONMENT, BY 2035
EUR 575 billion
Potential annual revenue distributed across the built environment value chain
REVITALISE
MAXIMISE
OPTIMISE
EUR 158 billion
Wider economic benefits realised annually for businesses, municipalities, and citizens, for example:
Economic activity due to more vibrant city centres
Health, wellbeing, and productivity
Cost of infrastructure installation and operation
>16,000 km²
Green space protected or created
~5%
Total EU CO2 emissions avoided
1-3°C
Reduction in urban peak temperatures

Six key stakeholder groups can act now to advance a nature-positive, circular built environment

EU and national policymakers

- Design economic instruments that will incentivise nature-positive construction projects.
- Leverage upcoming policy revisions to strengthen the circular economy in the built environment.

City-level policymakers

- Ensure publicly funded construction projects set the standard for nature-positive outcomes.
- Establish methods to streamline, fast-track, and simplify local planning processes for nature-positive, circular initiatives.

Built environment asset owners

- Complete a horizon scan of existing portfolios to seek sites with the greatest potential.
- Integrate circular economy principles into core business strategies.

Built environment asset users

- Establish comprehensive company policies that champion circular leasing and construction practices.
- Promote circular economy awareness.

Built environment supply chain, designers, and contractors

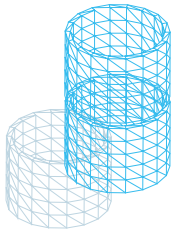
- Join or establish a coalition of practitioners to overcome industry fragmentation and deliver collective circular economy services.
- Set new industry-wide standards and ambitious expectations for circular procurement.

Financial institutions and investors

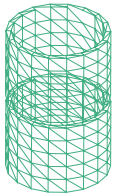
- Develop novel financial mechanisms, such as blended finance models, to capture value and de-risk proposals for nature-positive, circular solutions.
- Integrate circular economy strategies into investment decisions, adapting asset classes and funds to enable large-scale urban regeneration projects.

(see full list of recommendations for key stakeholders on p. 78)

A nature-positive, circular economy can deliver benefits across sectors



The circular economy has the potential to concurrently drive economic and nature-positive gains



The built environment is a compelling example of how deploying nature-positive, circular economy principles can promote economic opportunity, resilience, and better outcomes for people's health and wellbeing. Beyond the built environment, this report shows that comprehensively applying this solution framework to other key systems, such as food and fashion, and to industrial sectors across the economy, has the potential to concurrently drive economic and nature-positive gains. It also highlights how circular economy principles are already being mobilised, and provides guidance for businesses, policymakers, and investors to take bold action that will unlock short-term returns coupled with long-term benefits.

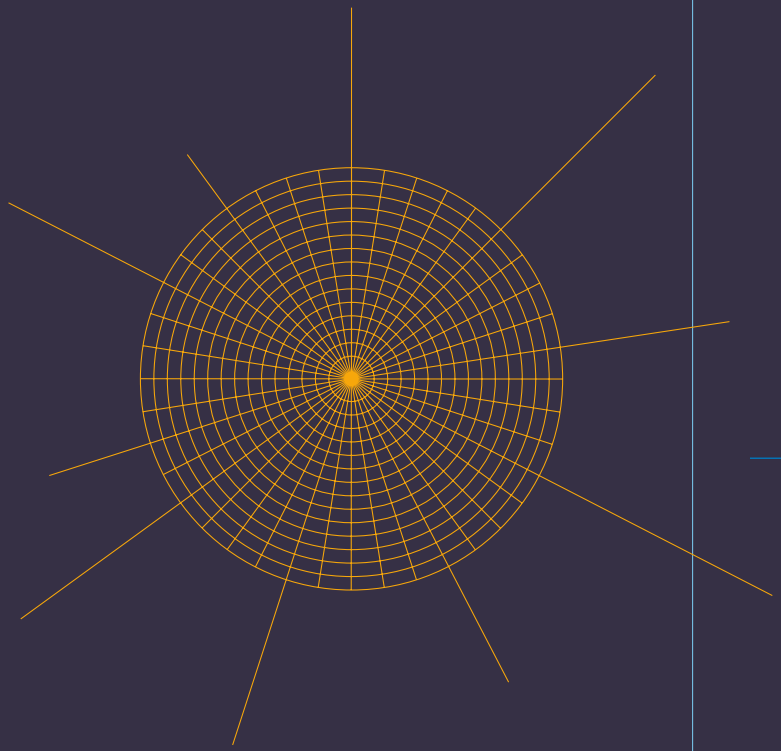
A nature-positive, circular economy delivers on key priorities for the EU: competitiveness and long-term resilience. Maximising and retaining the value of products and materials in the economy for as long as possible, and employing nature-positive strategies can boost resource productivity and offer cost-saving opportunities that strengthen the competitiveness of European companies. By increasing the use rates of assets, extending the lifespan of products and goods, and regenerating natural systems, circular economy strategies have the potential to reduce energy demand and consequently GHG emissions. They also offer new revenue streams while securing the supply of raw materials, strengthening strategic autonomy and supply chain resilience across sectors.

In the food industry, for example, applying the circular design opportunities of shifting to regenerative production and using diverse, lower impact, and upcycled ingredients can lead to higher total food output and increased profitability for farmers, alongside lowering GHG emissions and increasing biodiversity — making food production more resilient to extreme weather events.

The circular economy also offers significant contributions to wider economic and social objectives:

- **Spur job creation:** The shift towards a nature-positive, circular economy is expected to create 700,000 new jobs by 2030 in the EU[3], spanning sectors ranging from repair and remanufacturing to regenerative agriculture.
- **Increase disposable income:** Circular economy approaches can significantly reduce the costs of essential goods such as food, housing, and mobility, potentially increasing European disposable income for households by 11% by 2030.[4]
- **Improve health and wellbeing:** By reducing air and water pollution, and regenerating natural ecosystems, a nature-positive, circular economy promises substantial health benefits — reducing the incidence of diseases linked to environmental degradation.

THE CIRCULAR ECONOMY HAS PROGRESSED AT PACE OVER THE LAST TEN YEARS AND IS BUILDING MOMENTUM



The circular economy is...

INVESTABLE

USD 334 billion
of investments have gone into Circular Economy solutions up to 2023 [A]

EUR 1.5 trillion
potential value of circular markets in the EU by 2040 [B]

HAPPENING NOW

USD 119 billion
Circular business models are growing up to ten times faster than the traditional fashion market, with the second-hand apparel market increasing by 24% from 2022-2023, reaching USD 119 billion [C]

USD 31.9 billion
The global regenerative agriculture market size was estimated at USD 10.3 billion in 2023 and is projected to reach USD 31.9 billion by 2031[D]

ABLE TO DELIVER WIDESPREAD BENEFITS

EUR 0.9 trillion
increase of annual benefits for the EU economy by 2030 [E]

-9.3 billion tonnes of CO_2e
Applying circular economy strategies in five key areas (cement, aluminium, steel, plastics, and food) can avoid almost half of the emissions from the production of goods in 2050[F]

A Ellen MacArthur Foundation
B Summa Equity
C ThredUp
D Insight Ace Analytics
E Ellen MacArthur Foundation
F Ellen MacArthur Foundation

Now is the time to build on recent progress and leverage emerging technologies to scale the circular economy

The EU already has a robust nature-positive, circular economy policy framework — the focus now is on implementation. The Circular Economy Action Plan provides a solid foundation on which to realise the full potential of a nature- positive, circular economy, and upcoming revisions to key EU policy instruments present a critical opportunity to accelerate the transition. It will be paramount to close the gap between policy ambition and implementation, particularly in areas that explicitly target nature-positive approaches and upstream design. Equally, the far-reaching transformative shift that is required must be steered by clear and concrete measures to ensure a just transition inside and outside the EU.

Realising the circular economy at scale will require action from businesses, policymakers, and investors. To accelerate progress, businesses can adopt nature-positive value creation models; policymakers can tilt the playing field in favour of circular rather than linear economic activity; and investors can mobilise capital towards businesses that actively regenerate nature, circulate materials, and build resilience.

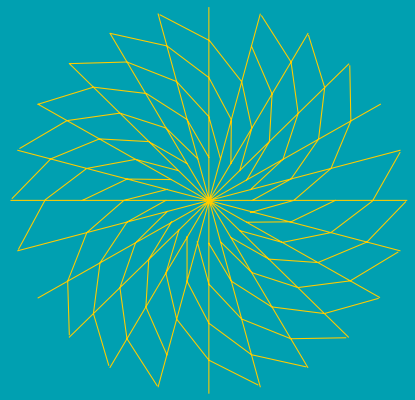
As well as creating opportunities, new digital technologies are a critical unlock to scale the circular economy. Digital innovations offer unprecedented opportunities to design products and materials to fit within a circular economy and to track, manage, and optimise resources. Advanced materials tracking, Lifecycle Management Tools, Smart Manufacturing and 3D Printing, and AI and Data Analytics, are now enabling circular practices to be implemented more efficiently and at a larger scale.

While the long-term benefits of a nature-positive, circular economy are clear, it's important to provide the necessary support for the transition process: adapting existing infrastructure, restructuring and upskilling the workforce, and shifting entrenched practices are all issues that require special attention from all stakeholders. In addition, the implementation of existing legal frameworks and new compliance requirements must be accompanied by awareness-raising. However, if all stakeholders can see the advantages and agree on a common goal, a successful transition can pave the way for longer-term prosperity and resilience.

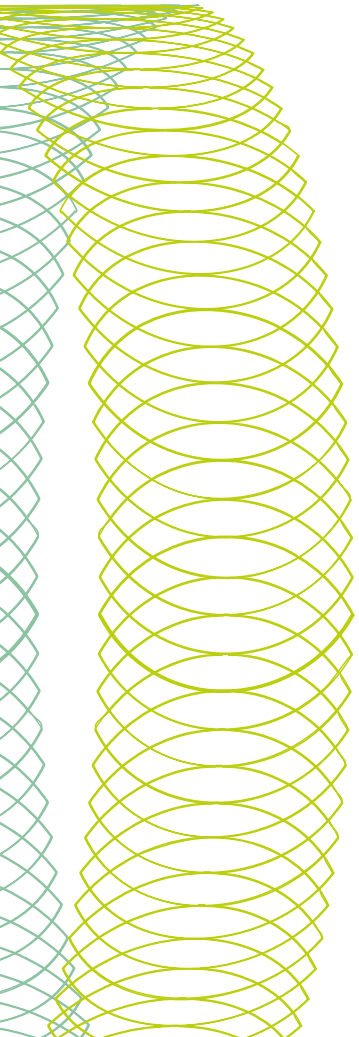
This report underscores the need for a fundamental shift in Europe's economic model towards one that is both nature-positive and circular. This transformation, which promises to enhance European competitiveness and resilience, responds to environmental and social needs, and allows us to reconcile long-term prosperity with wellbeing. With digital technologies and material innovation in place and success stories showing the way, the time is right to make the circular economy vision a reality at scale.

1

Shifting to an economy that keeps materials in circulation at their highest value, and is nature-positive by design, is central to building prosperity



Economic and societal vitality ultimately relies upon the health of nature



Our economic reliance on nature has long been undervalued

More than half the world's GDP relies on nature,[7] and 72% of businesses in the eurozone are highly dependent on at least one ecosystem service.[8] Significantly, the agriculture, food and beverage, and construction industries rely directly on natural capital to generate their collective EUR 1.68 trillion of gross value added per year in the EU.[9] But current business-as-usual practices have failed to take nature into account, leading to levels of degradation that threaten business viability and present a critical risk to the economy. Now, ecosystem collapse is considered one of the top global threats facing humanity, with effects including resource scarcity, extreme weather events, and increased supply chain disruptions.[10] To meet these challenges head-on and secure the economy's support systems, it is crucial that economic activity seeks to regenerate, rather than deplete, nature.

Meeting societal and environmental goals is dependant on nature

Nature provides the ecosystem services that underpin our survival and wellbeing. From food and clean water, through climate regulation and cultural enrichment, to ensuring physical and mental health, humanity's dependence on well-functioning ecosystems is undeniable. However, natural and human systems are being pushed to the limits of their capacity to adapt.[11] While Europe enjoys a good quality of life overall, it is also the fastest-warming continent in the world,[12] with the most vulnerable, lower-income households disproportionately affected by climate change and environmental harm. In urban areas, pollution and the urban heat island effect mainly affect the health of the poorest communities which have limited resources to adopt precautionary or avoidance measures. In rural areas, communities that depend on natural resources for their livelihoods are uniquely exposed to environmental degradation and are more likely to be impacted by the effects of climate change, such as droughts and extreme weather events, which undermine the economic foundations of these communities. Mainstreaming nature-based solutions that increase natural capital can make communities more resilient, provide cost-effective solutions for public health and wellbeing, and enhance social cohesion.

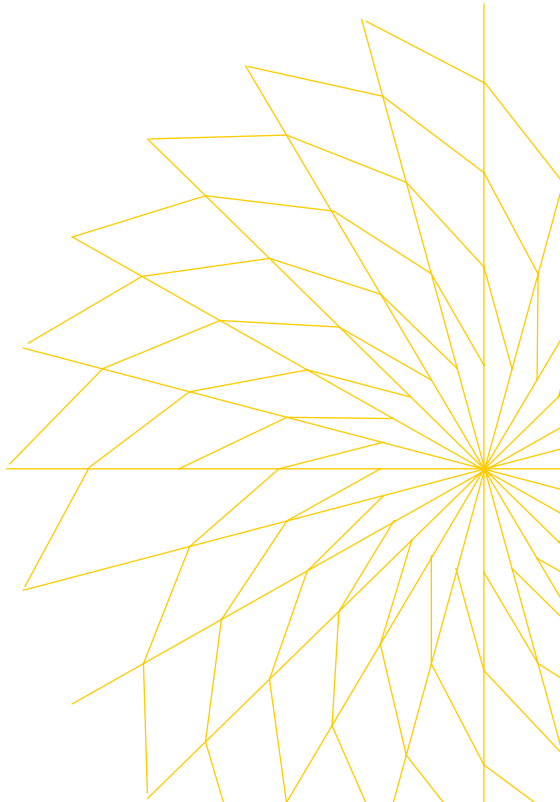
Achieving climate targets requires prioritising nature

The Intergovernmental Panel on Climate Change (IPCC), together with the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) have emphasised the importance of natural systems in absorbing and storing carbon dioxide, helping to mitigate climate change.[13] It has been estimated that nature's carbon sequestration capacity can provide over one-third (11.3 $GtCO_2e$ per year) of the greenhouse gas (GHG) mitigation needed by 2030.[14] In parallel, healthy ecosystems tend to be more resilient in the face of storms, floods, and fires, enhancing adaptation to climate change impacts.[15] These solutions can differ from region to region but are being increasingly recognised in European policies.[16] Nature and climate are two faces of the same coin and must be addressed together.

Nature-positive approaches can help address some key challenges Europe is currently facing, and directly benefit people in the here and now

Integrating nature into decision-making across business and policy can help reduce the financial burden of climate-related events. In the EU, economic losses as a result of climate-related extreme weather are increasing, and are already averaging EUR 12 billion a year.[17] Nature-based solutions can also address the EUR 1.25 billion of productivity losses that occur annually in the EU due to land degradation.[18] Ensuring that agricultural land is regenerated and remains productive will be key to avoiding further soil degradation and rising food costs, which are expected to increase by 30% over the next 25 years if nothing is done.[19] Overall, it is predicted that an economy centred on nature-based solutions could generate annually over USD 10 trillion in value for businesses and create 395 million jobs globally by 2030.[20]

Nature-positive interventions can also make a substantial contribution to easing the current pressure on health services and driving business productivity gains. Easier and more widespread access to green and blue spaces has been shown to reduce stress and anxiety, and can improve social cohesion. In this way, integrating nature-based solutions can help lower public spending, for example, reducing the cost of mental health treatment.[21] In the short-term, nature-positive approaches are already opening up new revenue streams with many sectors across Europe, such as smart technology, agriculture, and the built environment, already seeing direct benefits in new profit pools and job creation (see Built environment chapter).[22] The market for some of these sectors is set to grow rapidly, presenting major opportunities for new jobs across all skill levels.[23] It is clear that while barriers remain, there is much untapped potential in the nature-positive economy that is ready to be realised now, and by doing so Europe can progress towards a future in which economic development and environmental health remain in balance.



The linear economy is the underlying cause of biodiversity loss, climate change, and waste and pollution

Nature is declining at an unprecedented rate. Ecosystems in about a fifth of countries worldwide are currently at risk of experiencing major collapse due to the decline in biodiversity and its related services.[24] With the loss of 83% of all wild animals and 50% of plant life over the last century,[25] the Earth is experiencing its sixth mass species extinction. The five key drivers of biodiversity loss are: land and sea use changes; overexploitation of organisms; climate change; pollution; and invasive alien species.[26] Simply conserving or restoring ecosystems may have limited effects if the underlying drivers of environmental damage are not addressed. In Europe, protected areas account for 26% of land and 12% of maritime areas, yet the decline of nature continues to progress.[27] Equally, the decarbonisation of our economy is an essential part of addressing climate change but the energy transition alone will not be enough to improve environmental health if the other drivers of nature loss are not concurrently tackled.[28]

The linear 'take-make-waste' economic system is the main underlying cause of this triple planetary crisis. Over the past 70 years, the world has experienced a 13-fold increase in global economic activity.[29] However, this economic model, based on maximising the production and consumption of products, has been fuelled by the extraction of natural resources, which has increased three-fold over the last 50 years.[30] The material footprint of this extractive 'take-make-waste' system has led to a problematic rise in emissions and pollution. According to the 2024 International Resource Panel's Global Resource Outlook report, four resource-intensive value chains — the built environment, mobility, food, and energy — account for 90% of global material demand, 70% of climate impacts, and more than 80% of biodiversity and water stress.[31] This level of resource extraction has long exceeded what the Earth can renew and, from 2020, it is estimated that it would take 1.6 Earths to regenerate the biological resources that society needs.[32] Together with climate change, the alarming decline of biodiversity and the rising level of pollution present a systemic risk that puts our livelihoods and economic activities under threat.[33]

Incremental changes to business-as-usual will not suffice — dramatic and urgent action is required to transform our consumption and production models. "Goals for conserving and sustainably using nature and achieving sustainability cannot be met by current trajectories, and goals for 2030 and beyond may only be achieved through transformative changes across economic, social, political, and technological factors", the IPBES stresses.[34]

A true circular economy is nature-positive by design

The circular economy is restorative and regenerative by design. In its ideal end state, the circular economy operates like natural systems and does not create waste, as products, materials, and nutrients are kept in use and circulated in the economy or returned to the environment to support ecosystem services. The circular economy offers a strategic framework to address global challenges such as biodiversity loss, climate change, and waste and pollution. By applying the circular economy's three principles, stakeholders (individuals, businesses, and governments) can innovate in design, sourcing, production, use, and consumption while generating outcomes that are simultaneously beneficial to nature, people, and the economy.

Eliminate waste and pollution to reduce threats to nature

In a circular economy the release of waste or pollution (e.g. hazardous chemicals, GHGs, and unnecessary single-use materials) is designed out. Achieving this means viewing waste and pollution as design flaws and embracing new business models, materials, and technologies to eliminate them. Every stage in the value chain, from production to use and post-use, must take into account the redesign of materials, products, and systems.

Circulate products and materials to leave room for nature

By circulating products and materials, society's demand for goods and materials can be met using far fewer virgin resources, therefore substantially reducing the negative impacts of extraction and processing. Loops of higher value creation, such as sharing, resale, and repair models, should be prioritised where possible as they require less processing of materials and products. Lower value loops, such as upcycling and recycling, present attractive options when recirculation is no longer possible. Realising these opportunities requires innovative business models, redesigning products for multiple use cycles, and developing infrastructure to enable circulation.

Regenerate nature for biodiversity to thrive

In a circular economy, producing food and materials using various context-dependent practices — such as regenerative agriculture, restorative aquaculture, agroecology, agroforestry, and conservation agriculture — creates the conditions to allow below- and above-ground biodiversity to thrive. Integrating nature and restoring natural processes, such as pollination, nutrient, water, and carbon cycles into the design of our built environment improve air and water quality, climate regulation, provide flood protection, and restore native landscapes. These integrations are multi-functional with several co-benefits that support improvements to biodiversity while also delivering positive impacts to the local ecosystem and community. Human health and wellbeing directly benefit from nature regeneration.

Our urgent challenge is to integrate everything we do as humans into the web of life that supports us so that we can flourish within planetary limits

Michael Pawlyn, author
Biomimicry in Architecture

Ten years of circular economy policy in the EU

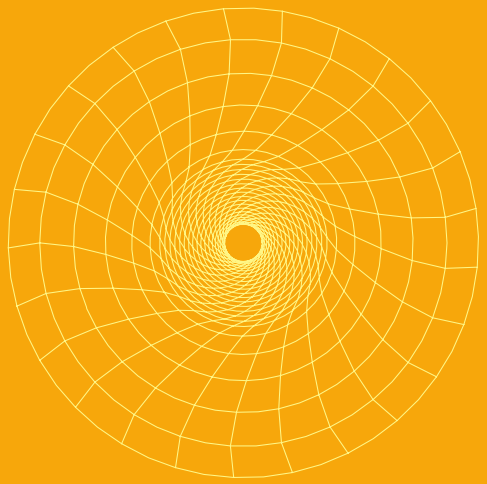
The circular economy came to prominence in EU policy circles in 2014 (through the Circular Economy Package), as an outcome of the European Resource Efficiency Platform.[35] Between the publication of the first Circular Economy Action Plan (CEAP) in 2015 and June 2022, nearly all EU member states had developed, or were in the process of developing, a national circular economy strategy. The second CEAP, released in 2020, as part of the European Green Deal (EGD), restated Europe's ambitious vision to lead the way on the global stage in fostering economic prosperity and resilience while tackling global challenges such as climate change, biodiversity loss, and waste and pollution.

Adopting a more comprehensive approach, the 2020 Action Plan aims — in line with the transformative ambitions of the EGD — to shift from a zero waste to a system change agenda. Looking at early-stage interventions, it intends to "make sustainable products the norm" in the EU, empowering consumers and public buyers. It focuses on the most resource-intensive sectors, showing the highest potential for circularity — electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water, and nutrients. The plan introduced a series of legislative and non-legislative measures, embracing a systemic approach, which promotes the circulation of materials and products through circular design, enhanced transparency, product requirements, and updated standards and definitions. The circular economy is increasingly included within other strategic initiatives in addition to the specific objectives and goals of the CEAP.

Despite progress, material use in the EU is still far beyond what is sustainable within the limits of our planet.[36] The European Environment Agency (EEA), for example, estimates the current European economy to be 11.5% circular — an estimate based on material recovery and waste reduction.[37] Although efficiency improvements have been made, they have been counteracted by rising consumption rates and the disproportionate focus on recycling, which hinder efforts to reduce energy and resource dependencies.[38] Taking the circular economy framework beyond its simple materials management dimension and also including regenerative solutions has the potential to build bridges to policy areas such as climate and biodiversity. The recent Nature Restoration Law is a decisive step in that direction. The law, which sets binding targets and obligations for EU member states, aims to restore at least 20% of the EU's land and sea areas by 2030, and all degraded ecosystems by 2050. By increasing biodiversity and harnessing the power of nature, the objective is to improve water and air quality, food security, prevent and reduce the impact of natural disasters, and help meet the Paris Agreement to limit global warming to 1.5°C.

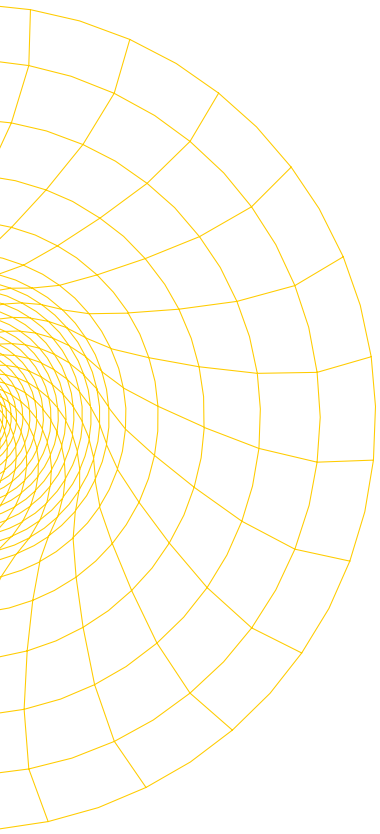
2

The circular economy is critical to achieving Europe's economic, environmental, and societal goals



The circular economy delivers on key priorities for the EU: industrial renewal, resilience, and better outcomes for citizens

The circular economy lays the foundations for a complete transformation of our production and consumption systems, from a resource-intensive model to one that gradually decouples economic activities from the consumption of finite resources. As a system approach, the circular economy can promote competitiveness, innovation, and resilience — representing a multi-trillion-dollar opportunity for Europe.[39] The circular economy also offers job creation opportunities, cheaper access to goods and services, and better health outcomes for individuals and society.



Economic and environmental benefits: A nature-positive, circular economy can boost competitiveness, foster business opportunities, and increase resilience

By boosting resource productivity, the circular economy can reduce emissions and increase Europe's competitiveness. Europe's ambition to become the world's first climate-neutral continent by 2050 cannot be achieved solely by measures focused on energy transition, energy efficiency, and transport decarbonisation: these measures, albeit essential, can only directly address 55% of global emissions. The remaining 45% derive from producing the cars, clothes, food, and other products we use every day. Recognising the role resource use plays in emissions reduction is critical if the EU is to achieve its climate objectives. The circular economy makes an important contribution here by substantially reducing demand for virgin steel, aluminium, cement, and plastics, and the emissions and energy associated with their production, through increasing the use rates of assets, extending the lifespan of products and goods, and recycling the materials used to make them. Combined with food system strategies favouring carbon sequestration and waste reduction, this translates globally into emission reductions of 9.3 billion tonnes of CO_2e by 2050 — almost half of the remaining emissions from the production of goods.[40,41] Increasing resource productivity by maximising and retaining the value of products and materials in the economy for as long as possible through circular economy interventions reduces materials and energy costs, thereby boosting the competitiveness of European companies.

The circular economy opens up new areas of business opportunities and innovation. For businesses, taking advantage of circular economy opportunities means exploring new sources of value creation. For example, in the food system, upcycling ingredients — in addition to preventing food waste — offers a profitable solution that increases material and resource productivity. It is a way to get the most value from the land, water, and inputs that go into producing food in the first place.[42] Furthermore, using regenerative practices to invest in the productive capacity of farmers' core asset — the soil — increases future returns.[43] As a source of innovation, the circular economy creates economic opportunities for European industries while supporting nature-positive economic outcomes.

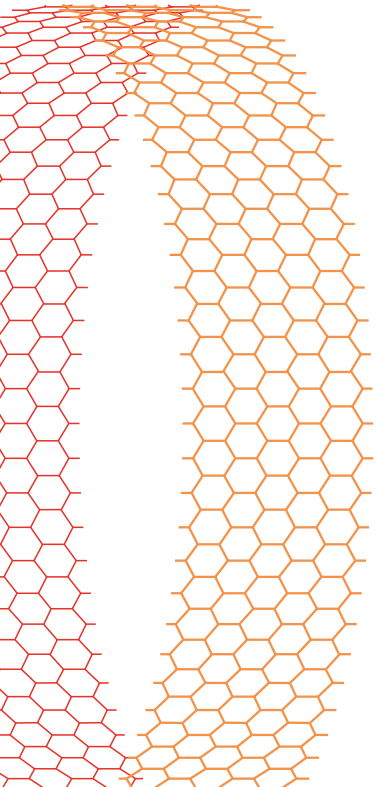
Often this innovation drive is being led by start-ups,[44] which are more agile and want to make an impact in advancing the circular economy. In the built environment, new biomaterials have started to disrupt the construction sector, offering promising solutions to address the need for reducing the environmental impact of the industry (see Built environment chapter). Drawing on information technology, new circular business models have started to become attractive: in the peer-to-peer digital marketplace for second-hand clothes, brands such as Vinted[45] or Vestiaire Collective[46] have respectively been valued at EUR 3.5 billion and EUR 1.6 billion, and are reporting high levels of environmental impact reduction. In mature sectors such as the automotive industry, Product-as-a-Service (PaaS) models and product

The circular economy opens up new areas of business opportunities and innovation

life extension strategies can improve supply chain profitability by around 1.5 times according to the World Economic Forum.[47] In the EU, businesses are already recognising the opportunities for resource productivity through the circular economy. The 2022 Flash Eurobarometer indicates that 89% of surveyed SMEs are taking such measures, including waste reduction, material savings, recycling, and reuse.[48]

The circular economy can increase Europe's strategic resilience by reducing its dependence on imported Critical Raw Materials. In the face of global supply chain uncertainty and disruptions, a circular economy approach offers opportunities to increase resilience by securing material availability and reducing exposure to price volatility. It presents a long-term approach to decouple economic growth from resource use and the supply of strategic resources. For example, the French automaker Renault has been recycling and remanufacturing car parts for a number of years, and is now aiming to be the first European automaker to also recycle batteries on an industrial scale. Given that metals account for as much as 70% of a battery cost and most of them are mined and processed outside Europe, this is of strategic importance.[49] In recognition of this resilience opportunity, the European Critical Raw Materials Act (CRMA), provides for circular economy measures, including increasing recycling capacity and product reuse, as well as minimum recycled content requirements.[50]

Other circular economy strategies that extend product lifespan offer interesting solutions. For example, when valuable raw materials are present in very small quantities in products such as cell phones, repair and refurbishment are the preferred options. To increase supply chain resilience, companies can also employ material substitution, such as replacing lithium with alternative battery technologies that do not contain critical raw materials. Transitioning to a resource-efficient circular economy in which the reliance on virgin resources is reduced by circulating materials at their highest value can play a central role in securing Europe's strategic autonomy and ensuring resilience in the face of supply shocks and disruption.



Society-wide benefits: a nature-positive, circular economy can boost disposable income, create jobs, and offer significant health gains

By reducing the cost of accessing goods and services, the circular economy can boost European citizens' disposable income. A transition to a circular economy — implemented fully with the required policy and fiscal frameworks — could reduce costs in key value chains such as mobility, housing, and food. Deploying circular business models to reduce waste across product life cycles could lower the cost of essential services. Preventing waste generation across the economy by, for example, upcycling food by-products, designing buildings to be upgraded and adaptable, and making products easier to repair or remanufacture, are proven strategies that increase resource yields and lower overall costs. Since mobility, food, and housing together consume 61% of the average European household budget,[51] a transition to a circular economy can offer Europe an opportunity to improve living standards. Under an ambitious circular economy transition, this could offer savings of 30% for food per person, 80% for passenger/km, and 30% for housing per sqm by 2050[52] — reducing the total cost of providing goods and services in these three sectors alone by EUR 535 billion a year. This would represent a saving of up to EUR 2,400 per household per year.[53]

In parallel, new circular business models, such as sharing or pay-per-use models, can provide greater affordability and flexibility for customers. For example, second-hand fashion platforms and electric car subscriptions have now become commonplace consumer habits, with technology playing a key enabling role. A circular economy thus remains relevant as a source of economic growth in the ongoing context of the cost of living challenge.

The transition to a nature-positive, circular economy can boost local job creation. There is a growing body of data on the circular economy job market and while results differ due to the lack of a comprehensive and shared definition of the circular economy, most studies report a net-positive impact. According to a recent estimate, the transition to a circular economy could create 700,000 jobs by 2030 in the EU.[54] This is largely due to the fact that activities linked to the transition, such as product life-extension strategies (i.e. reuse, repair, and remanufacture) are more labour-intensive than primary production, which can often be automated. For example, the remanufacturing of vehicle parts is expected to increase skilled labour requirements by up to 120%.[55] These jobs will also be more localised. With the increased uptake of circular business models — from reuse to end-of-life activities — companies are moving from heavy dependence on imports towards more local inputs, leading to the creation of local jobs. These activities can also provide inclusive opportunities, as is the case, for example, with the collection, repair, and resale of second-hand clothing. A study shows that in the EU, a social enterprise active in the reuse market creates on average 70 jobs per 1,000 tonnes collected while promoting the inclusion of marginalised workers.[56] With 77% of European consumers preferring to repair their goods rather than buy new ones, employment in this sector is set to grow significantly.[57]

Looking beyond finite material loops, leveraging the regenerative principle of the circular economy, which is still underexplored, holds great promise.

In fact, in the construction, food, land and ocean use systems, it could create more than 300 million new jobs globally by 2030.[58] Regenerative activities are also conducive to local job creation, with demand in cities expected to be particularly high (see Built environment chapter). A large number of sectors are involved in this transition, such as regenerative agriculture, regenerative ocean farming, the ecotourism industry, and biomaterials. A nature-positive, circular economy offers a promising opportunity for job creation across all skill levels, but within the EGD objective of a just transition, emphasis needs to be placed on the quality of these new jobs, working conditions, upskilling, and inclusivity.[59]

The transition to a circular economy can offer significant health benefits. A successful transition to a nature-positive, circular economy entails a drastic reduction in air, water, and soil pollution derived from production and consumption processes. This, in turn, can lead to long-term health benefits, particularly for the most vulnerable populations, known to be disproportionately affected by environmental impacts. For example, reducing the use of private cars through carpooling, developing public and low-carbon transport systems, and incentivising active travel, help improve air quality for citizens. It has been estimated that implementing a circular economy approach in China could reduce traffic congestion in cities by 47% and lower emissions, including harmful fine particulate matter (PM2.5) by 28% by 2040 — leading to improvements in air quality among other benefits.[60]

These benefits are extended in the food system, where circular strategies can not only reduce environmental pollution, but also reduce the use of pesticides and improve the nutritional qualities of food. This can translate into fewer cases of cancer, asthma, and depression linked to long-term exposure to pesticides, and to a reduction in diseases linked to poor diet and obesity.[61] In addition, USD 550 billion in health costs could be saved globally each year by 2050 due to lower pesticide exposure.[62] A circular economy can also reduce GHG emissions and mitigate against climate change. This can help to reduce the overall number of premature deaths due to the urban heat island effect and other exposure to extreme weather events caused by climate change. Urban populations also have a lot to gain from a transition of the built environment to a nature-positive, circular economy. Numerous scientific studies have shown that increasing and restoring green and blue infrastructure in urban spaces directly improves people's physical and mental health (see Built environment chapter).

Together, these attributes make a compelling case for adopting the circular economy as a powerful solutions framework for building prosperity, based on models that use fewer resources and offer multiple benefits for people and the planet. With digital and material technology in place and success stories showing the way, the time is right to make the circular economy vision a reality at scale.

Now is the time to build on recent progress and leverage emerging technologies to scale the circular economy

To realise the circular economy at scale, actions from key stakeholders — businesses, policymakers, and investors — form the backbone of a systemic shift. Each plays a pivotal role in transforming our current linear 'take-make-waste' model into one that is regenerative by design. To accelerate progress towards a nature-positive, circular economy, businesses can adopt nature-positive value creation models; policymakers can tilt the playing field in favour of circular rather than linear economic activity; and investors can mobilise capital towards businesses that actively regenerate nature, circulate materials, and build resilience.

Nature and the circular economy have risen up the corporate agendas, forming the basis of bolder action. In recent years, awareness of the impact of current business activities on nature has grown, and leading businesses are starting to acknowledge the commercial imperative of regenerating nature to secure supply chains and build resilience. Strengthening government regulations and changing consumer expectations have played a role in encouraging forward-thinking companies to take nature into account in their supply chains, reporting processes, and activities.[63,64] To help build a clear picture of how they interact with nature and measure their impacts, and to better inform strategy, manage risks, and realise opportunities, companies can leverage emerging frameworks such as the Science-Based Targets Network (SBTN)[65] and the Taskforce on Nature-related Financial Disclosures (TNFD).[66] However, it is clear that there is a wide range of maturity levels across the corporate landscape in relation to nature-related reporting due to industry-specific barriers, such as highly nature-exposed sectors with complex value chains.[67,68] Moreover, while many companies have started to look into risks and dependencies, too few are addressing biodiversity in depth.[69] Despite the potential benefits, integrating nature-positive actions into corporate strategies, operations, and decision-making remains uncharted territory for many companies and their management teams.[70]

The Global Biodiversity Framework (GBF),[71] which explicitly calls on signatory countries to encourage businesses to reduce their impacts on biodiversity and contribute towards nature regeneration, marks a significant new milestone.[72] However, the agreement is not legally binding and bolder action is needed. This can take the form of three main actions. The first is to fully understand how the business impacts and depends upon biodiversity across its value chain. The second is to identify circular economy opportunities that help meet biodiversity ambitions. The third is to deliver transformative change by collaborating across value chains and with other entities such as conservation organisations and universities: in short, mobilising stakeholders behind a vision of a regenerative future.[73]

The EU has a robust nature-positive, circular economy policy framework — the focus now is on implementation. In 2019, the EU Commission launched the EGD, a bold vision to steer the EU towards carbon neutrality, zero pollution, and the protection and restoration of the environment while fostering economic growth — notably by leveraging circular economy practices — and social inclusivity. Recent supply chain disruptions, climate change impacts, and energy crises underscore the need to reaffirm the EGD's vision and accelerate its adoption. Recognising the role of nature in providing ecosystem services that support food security, climate resilience, and human health, the Biodiversity Strategy is a core part of the EGD with the objective of reversing biodiversity loss by 2030.[74] The strategy emphasises the importance of including biodiversity across all policy sectors — from agriculture and fisheries to energy, infrastructure, and urban planning — through a new governance framework and targeted funding.[75] The strategy clearly sets out the critical role of nature in both climate action and economic prosperity. Within this legislative system, the recently adopted Nature Restoration Law, the first comprehensive, continent-wide law of its kind, aims to restore 20%

USD
334 *billion*
of financing and investment across asset classes has been dedicated to the circular economy globally since 2019

of the EU's land and sea by 2030, and includes targets for carbon sequestration, and for preventing and reducing the impact of natural disasters. Investing in nature restoration is estimated to yield between EUR 4 and EUR 38 worth of economic benefit for every EUR 1 invested.[76]

Despite the ambitious goals of the EGD and support from various stakeholders including businesses,[77] influential interest groups have attempted to hinder environmental and climate actions within it, leading to legislative delays and diminished safeguards. The next decade will be pivotal to ensure the ambitious implementation of both existing and forthcoming legislation. European institutions have restated their commitment to the EGD's desired objectives. For example, in its response to the European Environment Agency's (EEA's) seminal Climate Risk Assessment,[78] the European Commission acknowledges that, "Future-proofed nature-based solutions can be cost-effective and increase resilience and should be the first climate adaptation choice whenever possible."[79] Such signals are important, but to be effective and appealing to a wide range of economic actors they need to rely on solid business cases, data, and actionable insights. This report aims to contribute to this evidence base by taking the built environment as an illustration of nature-positive, circular economy opportunities (see Built environment chapter).

The comprehensive nature of the EGD framework provides a solid foundation on which to realise the full potential of an ambitious nature-positive, circular economy and upcoming revisions to key EU policy instruments, present a critical opportunity to accelerate the transition. It will be paramount to close the gap between policy ambition and implementation. The focus needs to shift towards detailed work on implementation and leveraging existing policies and structures, such as robust monitoring frameworks, to drive tangible progress. A level of economic reform will also be necessary, as the current model remains hard-wired for — and by — linearity.[80] Making the economics work is crucial to ensuring that the objectives set up under the EGD can scale (see Built environment chapter).

Investors are starting to drive nature-positive, circular solutions and can accelerate their capital deployment. An estimated USD 334 billion of financing and investment across asset classes has been dedicated to the circular economy globally since 2019. For example, the number of corporate and sovereign bonds issued with a circular economy focus increased more than 16-fold between December 2018 and December 2023, with a cumulative issuance of USD 194 billion.[81] Enabled by finance, circular economy start-ups are scaling fast and unicorns have emerged in numerous industries, including fashion and technology. Momentum is building in the financial sector to seize the multi-trillion-dollar opportunity of the circular economy.[82]

Finance is also flowing towards nature-based solutions — those that relate directly to the third circular economy principle of regenerating nature — in areas such as the protection of biodiversity, sustainable agriculture, forestry, and fishing, but numbers remain small.[83] For example, food and agribusiness corporations, alongside other private sector investors, have committed USD 2.2 billion, on top of an existing USD 2 billion already invested, to convert 160 million hectares of land to regenerative agriculture practices, and venture capital funds have invested USD 1.4 billion between 2021 and 2023 in technology start-ups that make regenerative agriculture tools.[84]

Overall, private investment into nature-based solutions remains modest, accounting for just USD 36 billion of the USD 200 billion invested per year globally in this area — far from the USD 542 billion per year needed by 2030 and the USD 111 billion needed for Europe cumulatively by 2030 to reach climate, biodiversity, and land restoration targets.[85] This suggests that while there is visible interest in the topic, the private sector investment case for nature-positive solutions is still far from mature due to, among other things, the novelty of the concept, a lack of sufficient returns, and complex measurement methodologies.

To unlock investment in a nature-positive, circular economy across industries, the sector can take two main actions. The first is to shift finance and investment flows to circular projects and companies across asset classes using the best available data on linear risks and circular opportunities. The second is to engage with policymakers on enabling policies and regulations, including the integration of high-ambition circular economy metrics into standard-setting efforts such as the EU Taxonomy, the European Sustainability Reporting Standards (ESRS), and the Global Sustainability Disclosure Standards. In the transition from a resource-extractive economy to one that is restorative and regenerative by design, financial actors will be major players.

Finance is flowing towards nature-based solutions in areas such as the protection of biodiversity, sustainable agriculture, forestry, and fishing.

Recent technological breakthroughs can help scale the circular economy

The development of digital technologies (such as the Internet of Things [IoT], 3D printing, artificial intelligence [AI], etc.) have the potential to help scale the circular economy while creating new opportunities. Moreover, they enable a critical shift from strictly end-of-life resource management to developing solutions further upstream at the design stage and throughout the product life cycle — from design to the use phase and end-of-life. Digital innovation, in particular, offers unprecedented opportunities to design products and materials to fit within a circular economy and to track, manage, and optimise resources — enabling circular practices to be implemented more efficiently and at a larger scale.

Advanced Materials Tracking and Logistics: IoT technologies and blockchain can track the journey of materials through supply chains — ensuring transparency, reducing losses, and enabling the recovery and recycling of materials at their end-of-life. This traceability is crucial for maintaining the quality and integrity of materials.

Product Design and Lifecycle Management Tools: Digital tools and software enable designers to create products with the circular economy in mind, such as modular designs that are easier to repair, upgrade, or recycle. Life Cycle Assessment (LCA) tools help evaluate the environmental impact of products at every stage, guiding more sustainable decision making.
Smart Manufacturing and 3D Printing: These technologies allow for more precise and efficient use of materials, reducing waste in the production process. 3D printing, in particular, enables on-demand production, which minimises overproduction and waste, and allows for the local manufacturing of spare parts, thereby reducing transport emissions.

AI and Data Analytics: AI and Big Data analytics can optimise resource use, predict maintenance and replacement needs, and identify circular economy opportunities within industries. This can lead to more efficient operations, reduced waste, and the innovative use of by-products.

The digital circular economy is booming and the market is expected to reach USD 6.7 billion by 2028.[86] However, leveraging these technologies to their full potential requires supportive policies, industry collaboration, and a commitment to circular principles across all sectors of the economy. In addition, the creation of partnerships between governments, businesses, and research institutions to co-create digital solutions for the circular economy will be a key factor, as will the introduction of a digital circular economy approach into educational curricula at all levels. Contributing to this ambition, the EU's digital strategy aims to empower people with new technologies, enhance competitiveness, foster resilience, and usher in a new era in manufacturing.[87]

A nature-positive, circular economy can deliver benefits across sectors: Food and Fashion

Biosphere Underwater Farming #5
Luca Locatelli for Gallerie d'Italia Torino - Intesa SanPaolo

The food and fashion sectors illustrate how reconciling economic activities with natural systems not only avoids the worst effects of climate change and biodiversity loss, but also makes a positive contribution to the economy and society. Analysis shows that a transformative shift to a nature-positive, circular economy can deliver greater benefits for nature, people, and the economy than merely remedying the symptoms of our current linear system.

Circular design for food: transforming how we design and grow food products in harmony with nature

The negative impacts[88] of our current food system are not inevitable. The food system can be fundamentally redesigned to actively tackle climate change and biodiversity loss, and promote human health, while reducing costs to society. The circular economy provides an effective blueprint for the food system that transforms how we grow and design food products.

The Ellen MacArthur Foundation's report The Big Food Redesign identifies four circular design opportunities: shifting to regenerative food production, and using diverse, lower-impact, and upcycled ingredients.[89] The study shows that adopting regenerative agriculture systems in the EU and UK presents benefits that are significantly greater than those of conventional production methods. Contrary to common perception, regenerative production, after a transition period, can lead to higher total food output and increased profitability for farmers.

In addition to improving the health of natural ecosystems and reducing GHG emissions, regenerative practices help create more resilient supply networks and more secure ingredient sourcing.[90] Transitioning to regenerative agriculture systems could contribute USD 1.2 trillion to the global economy by 2030.[91]

Beyond regenerative production, there are three more elements to a circular design for food. The first is using more diverse ingredients, instead of the small selection we use today. Broadening the scope of ingredient choices in this way promotes biodiversity, enhances crop resilience, promotes food security, and increases farmers' incomes. The second is shifting to lower-impact ingredients such as using less but better-sourced animal proteins, or choosing legumes over conventional grains — all of which can reduce GHG emissions and land footprints.[92] The third ingredient element of a circular design for food is using upcycled ingredients from food by-products, which avoids GHG emissions from food being lost or wasted.[93] Analysis shows that taking advantage of all four circular design opportunities together has the potential to reduce biodiversity loss by 50%, GHG emissions by 70%, increase total food output by 50%, and farmers' profitability by USD 3,100 per hectare on average, following a transition period.[94] These circular solutions combined offer far greater benefits than simply sourcing ingredients from regenerative agriculture systems.

The aim now is to extend and normalise these practices on a large scale, which requires close collaboration across the whole food value chain. Fast-moving consumer goods (FMCG) companies and retailers will have a key role to play in catalysing this shift at scale and pace by creating the demand for nature-positive, circular solutions and by fundamentally redesigning their food product portfolios. Farmers will need technical assistance and training to engage in the transition, while the cultural challenges of changing farming practices cannot be underestimated. Redirecting subsidies and increasing finance flows will help make the economics work for farmers transitioning to regenerative production. Research and innovation policies will be important to increase knowledge, while clear definitions and measurable key performance indicators will be fundamental.

Collaborating to put nature first: LENs

The Landscape Enterprise Networks (LENs) initiative is a collaborative effort between businesses, landowners, farmers, and other organisations that share interests in a given territory. The aim is to invest in nature-based agricultural approaches to make local landscapes healthier, more productive, and resilient, in line with existing initiatives.

In 2022, Nestlé Purina and Cereal Partners Poland invested in LENs for wheat cultivation in several regions of Poland, with the support of the sustainability consultancy, 3Keel and Preferred by Nature, a global non-profit organisation working to support better land management and business practices. The focus is on regenerative practices on arable land to reduce carbon emissions, and improve soil health and fertility. The initiative aims to improve supply chain resilience and the condition of natural systems. The platform seeks to share risk, as well as all the associated costs and benefits, between farmers and those purchasing the crop.

A supportive approach

Through LENs Poland, farmers are provided with resources and expertise to implement infield agronomic practices and farmer innovation investments. The practices included switching to organic fertiliser, integrating manure, compost, and other organic soil improvements and including grain legumes in arable rotation. Investments involved establishing a mobile compost production facility that fully covers the farm's natural fertilisation needs, creating a closed-loop nutrient system, reducing GHG emissions, and minimising waste disposal costs. Overall, these measures help improve soil structure, health, and fertility, increase organic carbon content, and support soil biology — leading to better water infiltration and nutrient uptake by crops. Reducing reliance on synthetic fertilisers increases biodiversity, and reduces costs and uncertainty for farmers due to fluctuating input costs related to oil prices and global conflicts.

Fostering collaboration

In 2023, the LENs Poland community invested EUR 600,000 in 29 farms covering 2,400 hectares across the region. The expansion of the LENs model across Europe demonstrates that regenerative agriculture practices are not only good for the environment but also for farmers and related businesses. The LENs approach provides trade facilitation, technical assistance, and network coordination to support the implementation of regenerative practices.

Circular Fashion Recycle #3
Luca Locatelli for Gallerie d'Italia Torino - Intesa SanPaolo

Circular economy for fashion: Remodelling fashion to rebuild natural systems

The circular economy offers approaches to fundamentally rethink the fashion industry to evolve from a model that degrades natural systems to one that protects and rebuilds biodiversity. A circular economy for fashion ensures that products are used more, are made to be made again, and are made from safe and recycled or renewable inputs produced in regenerative ways.[95] In doing so, the sector can not only reduce the industry's demand for virgin materials, and eliminate waste and pollution, but also improve soil health, sequester carbon, and actively rebuild biodiversity. Alongside these environmental benefits, a circular economy for fashion can address the USD 500 billion of value lost annually to clothing underutilisation and the lack of recycling, while supporting the creation of safe, healthy conditions for textile workers.[96]

Extending the life of garments through circular business models is one of the most effective ways to reduce the industry's impact on nature. By leveraging business models that keep products and materials in use for longer, such as resale, rental, remaking, and repair, the negative impacts associated with the extraction of natural resources, production and processing methods, and disposal can be avoided.[97] Circular business models have the potential to offer a higher return on investment for businesses via increasing the utilisation of existing product assets.[98] These models have the potential to grow from 3.5% of the global fashion market in 2020, to 23% by 2030, representing a USD 700 billion global opportunity with the potential to provide a third of the emission reductions necessary to put the fashion industry on a 1.5°C pathway.[99]

By increasing the use of existing products and materials (through circular business models and post-consumer recycled content), the need for virgin resources is minimised. However, when virgin input is still needed it should be sourced from renewable feedstocks produced regeneratively. Producing fibres regeneratively brings a myriad of benefits such as improving ecosystems, reversing soil degradation, and minimising GHG emissions. Using these methods, in cotton cultivation, for example, is estimated to reduce GHG emissions by 50% while increasing farmers' revenue.[100]

Progress has been made by the industry to date in areas including product design, using regeneratively produced materials, and scaling textile-to-textile recycling solutions.[101] These activities are essential and must continue at pace and scale. Yet to achieve a circular economy for fashion, efforts on circular product design and post-consumer recycling must be matched by a similar ambition level across the full range of solutions, including circular business models. In order to support the environmental and economic benefits of a circular economy for fashion — in particular by keeping products in use for as long as possible — businesses must ensure they design products according to circular design principles, such as those outlined in The Jeans Redesign guidelines.[102]

This decade will see a rapid evolution in European policy to regulate and incentivise change for circular product design (via the Ecodesign for Sustainable Product Regulation) as well as the collection and recirculation of products and materials, which various Extended Producer Responsibility (EPR) schemes will seek to facilitate.

Therefore, what remains largely unaddressed is 'what happens in between' — namely the way businesses deliver their products to fashion customers and work to keep these products in use for as long as possible. The next five years are critical to accelerating the necessary systems-level action to keep products in use. Without this, the industry risks wasting the voluntary progress underway to design millions of products according to circular design principles and potentially slowing progress towards net zero commitments.

GUCCI

Transforming fashion for a nature-positive impact: Gucci

Luxury fashion brand Gucci has focused on embedding circular economy principles from the design stage and raw material sourcing, including investing in regenerative agriculture, to manufacturing and new business models to extend the life of its products and materials. A series of commitments underpin Gucci's progress, such as operationalising its parent company Kering's science-based target to align with a 1.5°C pathway. For example, the use of 100% renewable energy in its direct operations has resulted in a reduction of over 60,000 tonnes of CO_2 in 2022. Having achieved 99% traceability of its raw materials in 2023, Gucci is also working with farmers to scale up regenerative agriculture across tens of thousands of hectares of land, reviving local supply chains for silk, cotton, and wool, while regenerating nature and capturing carbon. The fashion house has invested in regenerative agriculture since 2020 and has been supporting farmers, for example, in Uruguay through the NATIVATM Regenerative Agriculture Program in collaboration with Chargeurs Luxury Fibers to provide 50 tonnes of regenerative wool annually, with the potential to replace 19% of the conventional wool in its collections.

Embedding circular principles across the value chain

Gucci has been transforming its value chain, intending to design out waste and pollution while enhancing durability, reuse, recycling, and second life. Gucci's emotional durability is complemented by product testing to ensure physical durability, and product care and repair services are provided by expert artisans through global care centres. This approach helps reduce the impacts on biodiversity associated with resource extraction, production processes, and disposal. Gucci also focuses on minimising the use of virgin natural resources by favouring recycled materials and leveraging upcycling programmes. For example, 'Gucci-Up' is a programme for recovering and upcycling leftover and deadstock fabric and leather from manufacturing. Between 2018 and 2023, 1,148 tonnes of leather manufacturing leftovers, 1,537 tonnes of leftover textiles, and 331 tonnes of metal scraps were recovered. Materials not reused in their supply chain are either returned to the marketplace or donated to NGOs and social cooperatives in Italy.

Changing practices through innovation

In February 2023, Gucci launched the Circular Hub for innovation. Starting from raw materials and design, through to production optimisation and logistics, the Circular Hub is an open innovation platform for the design and manufacturing of circular products and the scouting of new solutions. For example, Gucci's 'Denim Project' was conceived at the Circular Hub in collaboration with their supply partners in line with the company's circular design guidelines. The project combines 74% regeneratively grown cotton fibres, sourced from the Regenagri®-certified Algosur farm in Spain, with 26% post-consumer recycled (PCR) fibres collected and re-spun in Italy. The resulting denim garments better withstand material blending with PCR cotton, while enhancing durability and ensuring end-of-life recyclability. Gucci's first products developed under the 'Denim Project' will be available in 2024 and will include a digital product passport to ensure traceability, enabling customers to learn about the product's material origins and production journey as well as access information about care and repair services.

3

The circular built environment can propel Europe towards a prosperous and nature-positive future

Focusing our analysis on the built environment offers the opportunity to illustrate how the benefits of a nature-positive, circular economy can be realised in a tangible, high-impact way

From a circular economy perspective, Europe's built environment is highly relevant for three reasons:

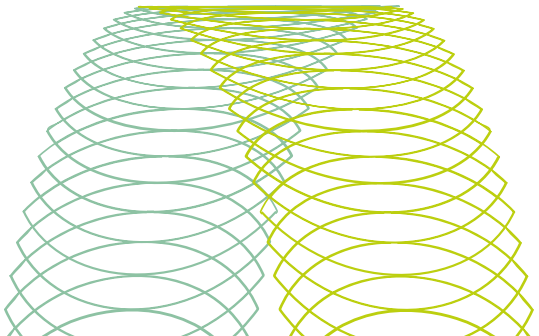
1 It has huge potential to improve efficiency and capture more value — substantially reducing material use, as well as climate and nature impact.

2 It is strategically important to the broader European economy and society, particularly in relation to meeting climate goals, ensuring long-term resilience, and enhancing health and wellbeing.

3 It is a complex 'system of systems', intricately linked with many other sectors, including mobility, retail, equipment manufacturing, energy, and material production. It is, therefore, illustrative of how taking a system change approach is essential as Europe strives to accelerate the just transition to a circular economy.

More broadly, the European built environment, distinct from other global regions, has robust foundations and a rich history but currently faces stagnation. Despite being relatively efficient compared to other high-income regions, it still has significant room for improvement in terms of resource use. Many European cities are famously vibrant and nature-rich, but there are still many across the continent, both large and small cities, that offer untapped potential for economic growth and improved wellbeing. As an advanced economy, most buildings and infrastructure are already in place. However, the sector is on the threshold of substantial transformation, spurred by the need for much-needed improvements to current building stocks including deep energy renovation on over 30 million buildings.[103] This necessitates adaptive and flexible approaches, alongside thoughtful deconstruction. Significantly, the sector's digitalisation lags behind, presenting a tremendous opportunity for advancement through cutting-edge technologies like AI and platform-based planning software. Embracing digital enablement could revolutionise European construction — propelling it towards greater efficiency and utilisation, capturing more value from fewer resources.

As Europe faces the next chapter in its built environment evolution, adopting a nature-positive, circular economy approach enabled by new digital and material technologies could catalyse profound systemic changes and build prosperity across the continent. By analysing in detail the benefits of shifting to a circular built environment, this section sheds light on the huge untapped economic potential. This section also addresses the role the built environment plays in positively impacting the current and future lives of European citizens by providing a solid foundation for the continent's future resilience, long-term livelihoods, and quality of life.



Europe's built environment requires a transformation to build resilience and address waste and resource intensity

The built environment is a major part of the European economy, but is currently highly wasteful and resource-intensive. The EU's construction industry, along with its supporting sectors, employs 25 million people and contributes to nearly 10% of the EU's GDP,[104,105] second only to retail in terms of employment and value creation. Additionally, urban centres are hubs of economic activity, and the productivity of firms is significantly influenced by the design of the built environment. Furthermore, Europe's appeal for business and tourism is closely tied to its vibrant cities and high liveability, which are in turn closely connected to a well-functioning built environment. While in the global context, the European built environment is relatively efficient with a much lower material use than, for example, North America,[106] overall it is still a large resource consumer which is at odds with Europe's stated social and climate goals. According to the 2024 Global Resources Outlook report, Europe as a region has the third largest material consumption per capita and the construction sector accounts for the highest proportion of this material footprint — equivalent to 5.5 tonnes of materials per citizen per year.[107] The extraction and processing of construction materials can significantly impact land use change, posing a direct threat to the health of natural ecosystems.[108] Even so, many of these materials are wasted, with the sector being responsible for over 35% of the EU's total waste generation.[109]

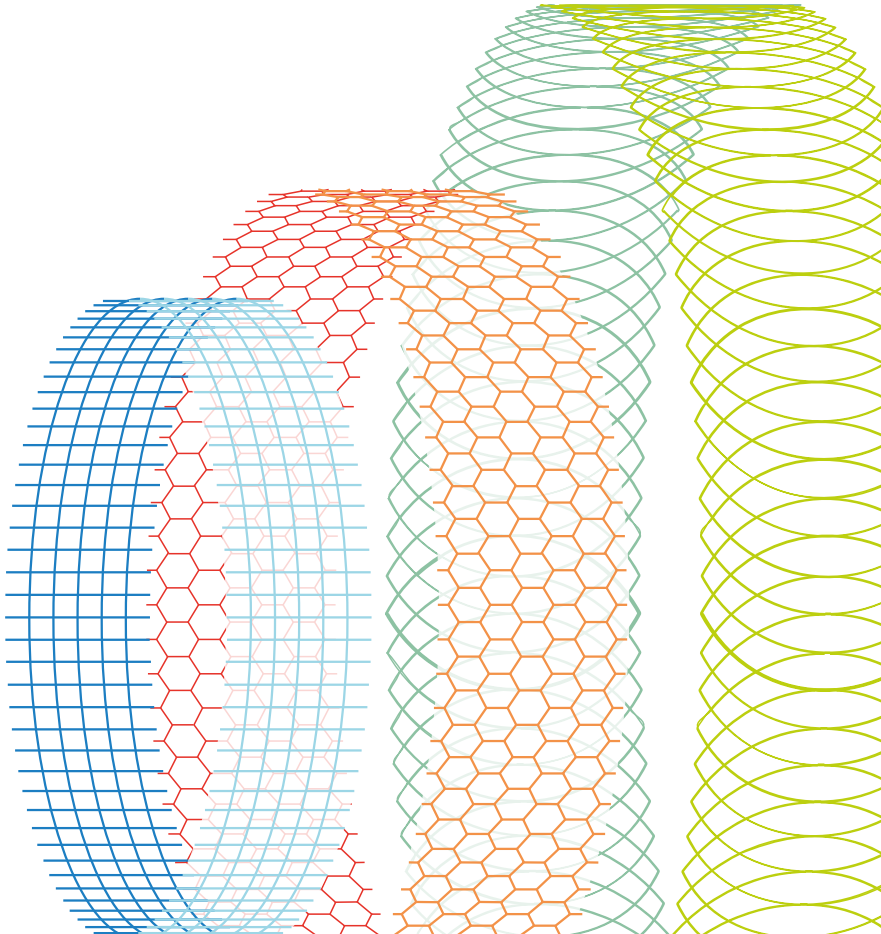
This ineffective use of resources extends to the underuse of existing buildings and the proliferation of urban sprawl. Since the onset of the Covid-19 pandemic and the rise of digital collaboration platforms, working practices have evolved, leading to 8% of European office space being permanently vacant as of 2023.[110] As well as having a vast number of unused buildings, across six EU countries more than 20,000 km^2 of brownfield sites[111] lie unused, equivalent to half the area of the Netherlands.[112] Despite the availability of these sites, around 50% of commercial and residential development takes place on greenfield or agricultural land, contributing to highly inefficient and nature-degrading urban sprawl.[113] These developments impact nature, disturbing natural habitats in many ways, including through light pollution and the altering of water cycles by sealing living, porous soil with concrete or other impermeable materials. This can lead to water pollution, due to particulate and chemical run- off, and heightens the risk of flooding. The provision of infrastructure to suburban development is also more expensive, less efficient, and contributes to excessive material and energy consumption.[114,115]

Addressing this waste and inefficiency is vital to meeting Europe's climate goals. The EU's net overall GHG emissions have fallen by 30% since 1990.[116] Despite this progress, according to the Circular Buildings Coalition, on the current trajectory, the EU27+UK's construction sector will exceed its carbon budget for limiting global warming to 1.5°C in 2026. The building industry still accounts for 36% of the EU's GHG emissions — a high proportion of which is 'embodied',[117] due to the sector's current resource-intensive model.[118,119]

Europe's built environment will play a key role for developing urban resilience and ensuring its citizens are able to adapt to climate change. Currently, 32% of European cities show high vulnerability to heatwaves, droughts, and floods with 13% of EU cities being located in river floodplains[120] — exposing citizens, homes, and properties to ever greater risks. Extreme heat will affect practically every city south of Paris to a high degree; at 2°C global warming levels, half of the European population will be at high risk of heat stress in summer.[121] It is already estimated that EUR 29 billion will need to be spent on infrastructure repair costs every year from flooding and other shocks.[122] This is in the context of a EUR 688 billion shortfall in the investment needed for energy, transport, water, and sanitation systems. Despite offering cost-effective strategies to deliver climate-adaptive infrastructure, nature-based solutions are currently underfunded.[123,124]

By shifting to a nature-positive, circular model with a systems view, we can achieve mutually reinforcing benefits across the economy, nature, and society

Europe's built environment is central to its economic vitality, yet it stands at a critical juncture, requiring immediate and concerted action. Our analysis sets out that the built environment sector's future contribution to the European economy does not have to be a choice between financial returns or nature conservation. By shifting to a nature-positive, circular model with a systems view, we can achieve mutually reinforcing benefits across the economy, nature, and society. Addressing the current wastefulness and resource-intensity of the construction sector — particularly in the underuse of existing land and buildings, and unchecked urban expansion — can allow Europe to align its built environment development plans with its ambitious climate and nature restoration goals. This transition is not just a necessity but a strategic move to unlock long-term prosperity — safeguarding Europe's architectural heritage and offering a resilient roadmap for a competitive economy now and in the future.



THE BUILT ENVIRONMENT IS VITAL FOR THE EU ECONOMY, YET IT FACES IMPORTANT CHALLENGES

SCALE

25 million
people employed

10%
of EU GDP

IMPACT

35%
of GHG emissions

1/3
of EU's material consumption

URGENCY TO ACT

30 million
existing buildings in need of renovation

32%
of European cities are highly vulnerable to climate risks

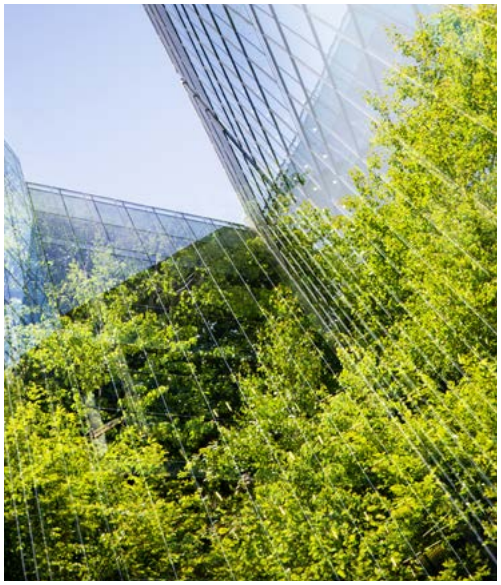
The circular economy offers enormous innovation potential for the built environment with far-reaching impacts

The built environment is everything that has been built — incorporating buildings, utilities, urban spaces, and landscapes, alongside essential networks for societal functioning, including economic, social, and digital infrastructures.[125] The built environment can be viewed as a 'system of systems' in which various components within urban and architectural spaces are interconnected and interdependent, influencing and being influenced by social, economic, environmental, and technological factors. For example, a single building is a system that includes various subsystems such as electrical, plumbing, and heating/cooling systems. When scaled up to a neighbourhood or city level, the built environment encompasses a broader range of systems, including transportation, utilities, green spaces, and more. These systems interact with each other and with their surroundings, impacting everything from the natural environment and the biodiversity within it, to the health and wellbeing of the people who live and work in these spaces.

A circular built environment takes a whole system approach and is designed to optimise resource use and positively impact nature. Underpinned by the three circular economy principles — Eliminate, Circulate, Regenerate —, a circular built environment represents a transformative shift in how we conceive, plan, construct, and use our built spaces. This shift is directionally aligned with the growing importance of the notion of avoidance and sufficiency, maintaining assets and materials at their highest value, and fostering a nature-positive and resilient urban landscape. Adopting a system view is critical for scaling a circular built environment, enabling the integration of the circular economy principles across different scales, from materials to buildings to cities; and across different domains from planning to design, manufacturing to construction and building maintenance. A system perspective can unlock short-term returns coupled with long-term benefits by looking beyond individual projects and ensuring that the design and operation of the built environment contributes to broader nature and social goals. This addresses not just waste reduction and materials efficiency, but also economic resilience, nature restoration, and social wellbeing.

Eliminate: buildings and construction processes are designed to make the most effective use of materials. Before considering new construction, priority should be given to renovating, repurposing, or optimising existing structures. When building is unavoidable, buildings and construction processes can be designed to make the most effective use of materials. Construction projects can significantly reduce resource use by adopting more material-efficient structural forms. In this way, optimising design and material sourcing can decrease the use of cement, steel, and other materials, at the same time as reducing costs and emissions.[126] To eliminate construction waste, industrial processes such as prefabricated building components, off-site construction, and 3D printing can be used. Off-site modular construction activities in a controlled environment enable manufacturers to achieve improved labour conditions, superior quality standards and productivity, and simultaneously reduce on-site waste generation.[127]

Circulate: buildings and infrastructure are designed for adaptability, keeping them in use for the longest possible time. Sufficiency measures, such as renovation, refurbishment and increased use of underutilised building spaces, are the most effective strategies to reduce material demand and emissions, while meeting our needs within planetary boundaries.[128] Buildings are often renewed, replaced, or demolished not because they have ceased to perform their intended function, but rather due to evolving market demands, changing occupant needs, or the deterioration of specific subsystems within the building. This issue can be addressed by designing for long-term use, for example, by adopting flexible and adaptable designs[129] that allow buildings to be easily modified or reconfigured to suit changing circumstances over the building's lifespan. Buildings can also be designed to be disassembled so that materials and

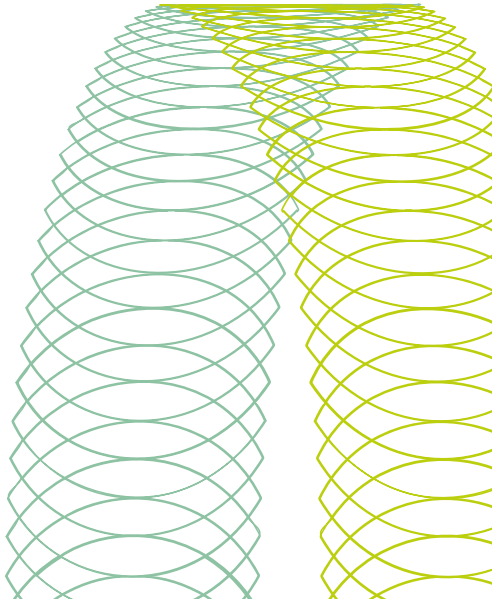


Buildings and facilities can include natural design features that enhance biodiversity, air-quality and wellbeing.

components can be easily reused or recycled in other locations. In doing so, buildings exceed their primary function and become material banks for the next generation of built assets. Building information modelling (BIM),[130] product passports, and other digital technologies allow the tracking of materials and components, enabling preventative maintenance and repair, and performance upgrades,[131] ultimately prolonging the life of a building and increasing material circulation, keeping resources in use. Business models such as shared, co-working or multi-purpose buildings, and peer-to-peer renting can also increase the utilisation rate of buildings.[132]

Regenerate: buildings and infrastructure are designed to enhance the health of ecosystems on-site and in surrounding areas. Buildings, pavements, parking areas, facilities, and other built environment assets can include features[133] that positively impact biodiversity, air quality, local water bodies, soil health, local climate, and carbon sequestration — all of which contribute to the improved health and wellbeing of building users and surrounding communities. By leveraging biomimicry design principles and emerging digitally-enabled ecosystem performance measurement methods, it is possible to design, build, refurbish, and operate buildings that have a demonstrable regenerative impact on the nature and the communities around them, by maintaining and improving the health of local ecosystems.[134] The built environment can also have a positive impact via its supply chain, through the resources and materials procured to construct or operate the buildings. The concept of 'embodied ecological impact' encompasses all ecological effects associated with the supply chain and life cycle of construction materials — from resource extraction and material processing to manufacturing, transportation, installation, and disposal. Supply chain design and procurement decisions are important mechanisms by which built environment decision makers can positively impact nature.[135,136] Both direct and embodied negative nature impacts of buildings can be designed out, contributing to the restoration and regeneration of natural systems.

Our urban landscapes are the ultimate manifestation of the built environment and where the benefits of the circular economy could be most profoundly felt. In cities, every building, street, and public space presents an opportunity to innovate, reduce waste, and contribute to nature. By integrating circular economy principles, cities can be transformed into healthy bio-regions where resources are continuously repurposed and circulated, and nature is reintegrated — all leading to a vibrant environment in which to live and work. In cities, the circular economy is not just a theoretical concept but can be a practical solutions framework to achieve economic, social, and natural prosperity.

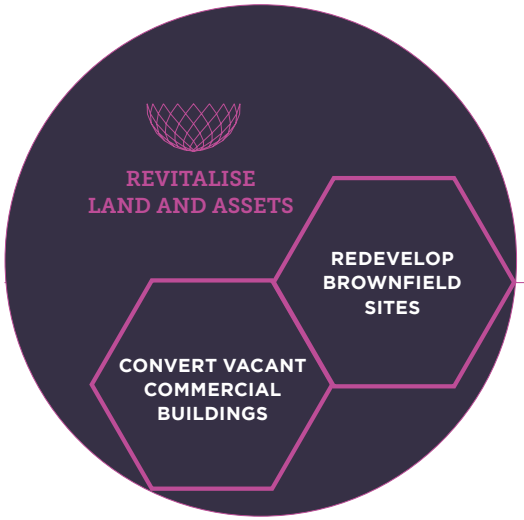


Six strategies can transform Europe's built environment by revitalising land, maximising nature, and optimising building design

For this report, six strategies have been selected based on their prominent potential to concurrently drive economic and nature-positive gains, as well as realise wider environmental and social outcomes. These six interventions, all identified as mature and scalable, were chosen for two key reasons: their outsized potential positive impact, and their ability to reinforce each other and amplify benefits when applied as an integrated system. These strategies help to realise three distinctive ambitions — revitalise, maximise, optimise — in line with the EU's vision of a modern, resource-efficient, and competitive economy that works in harmony with nature.

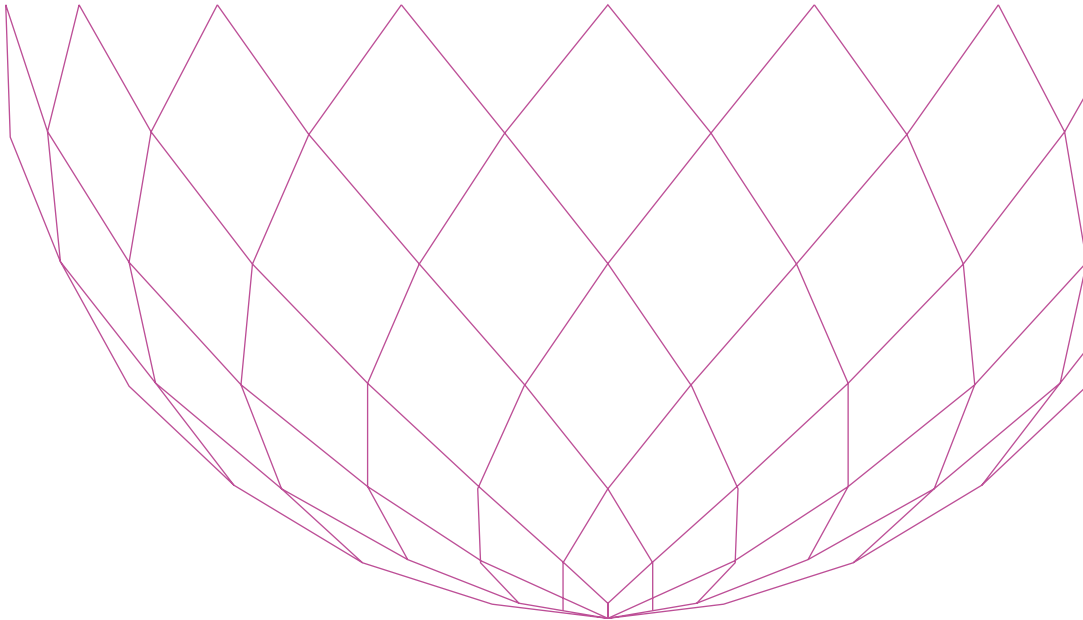
For further details on the rationale for the strategy selection, please refer to the Appendix (pp.98).

While each strategy can be implemented on its own, their potential impact and viability is amplified when planned as an integrated system. There are mutually reinforcing benefits to applying the circular strategies not individually but as a system. For example, integrating nature restoration into home building on brownfield sites can greatly improve financial flows directed to urban nature, by creating a more compelling business case. Additionally, focusing on denser redevelopment in inner-city areas, particularly brownfields and commercial properties, can achieve the necessary scale for capital expenditure investments and facilitate more advanced design strategies. These strategies enable 'design for manufacturing', lighten the material footprint of buildings, and support the scale needed for procuring innovative low-impact materials. In this way, the six strategies work powerfully as mutually reinforcing pairs to further amplify benefits.



Revitalise land and assets to minimise further pressure on nature

Revitalising Europe's abandoned plots and buildings could usher in a new wave of urban development that makes the most of the land available without encroaching further on valuable natural habitats. Focusing on **brownfield site redevelopment**[137] and the **conversion of vacant commercial buildings**,[138] can help the EU deliver on its target to halt the net loss of urban green spaces by 2030, and simultaneously address the need for housing. Repurposing land and buildings that are already well-located for infrastructure and mobility links is inherently more space- and resource-efficient compared to business-as-usual and avoids green field expansion. Revitalising brownfields also presents the opportunity to incorporate locally-attuned nature-positive design that delivers both biodiversity and human health benefits in the urban built environment. This approach fosters compact, multi-use urban centres with a wide range of associated economic benefits. While larger, more developed cities like Berlin and London already focus on brownfield development, there is huge opportunity to avoid sprawl around small and medium cities, revitalising post-industrial areas, and alleviating pressure on the housing market.



STRATEGY: REVITALISE - CONVERTING VACANT COMMERCIAL BUILDING
COUNTRY: France

Breathing new life into vacant commercial buildings: Novaxia

French metropoles are grappling with rapid urban growth, leading to a scarcity of housing and an erosion of green spaces. At the same time, commercial properties have become increasingly outdated and underused, a trend exacerbated by the Covid-19 crisis, rendering millions of square metres of office space vacant. This combination of factors highlights an opportunity to repurpose commercial structures to provide much-needed family homes, while simultaneously mitigating the impacts on nature of urban sprawl.

Novaxia - Art & Mix Conversion - Paris, 20th arr, 2020

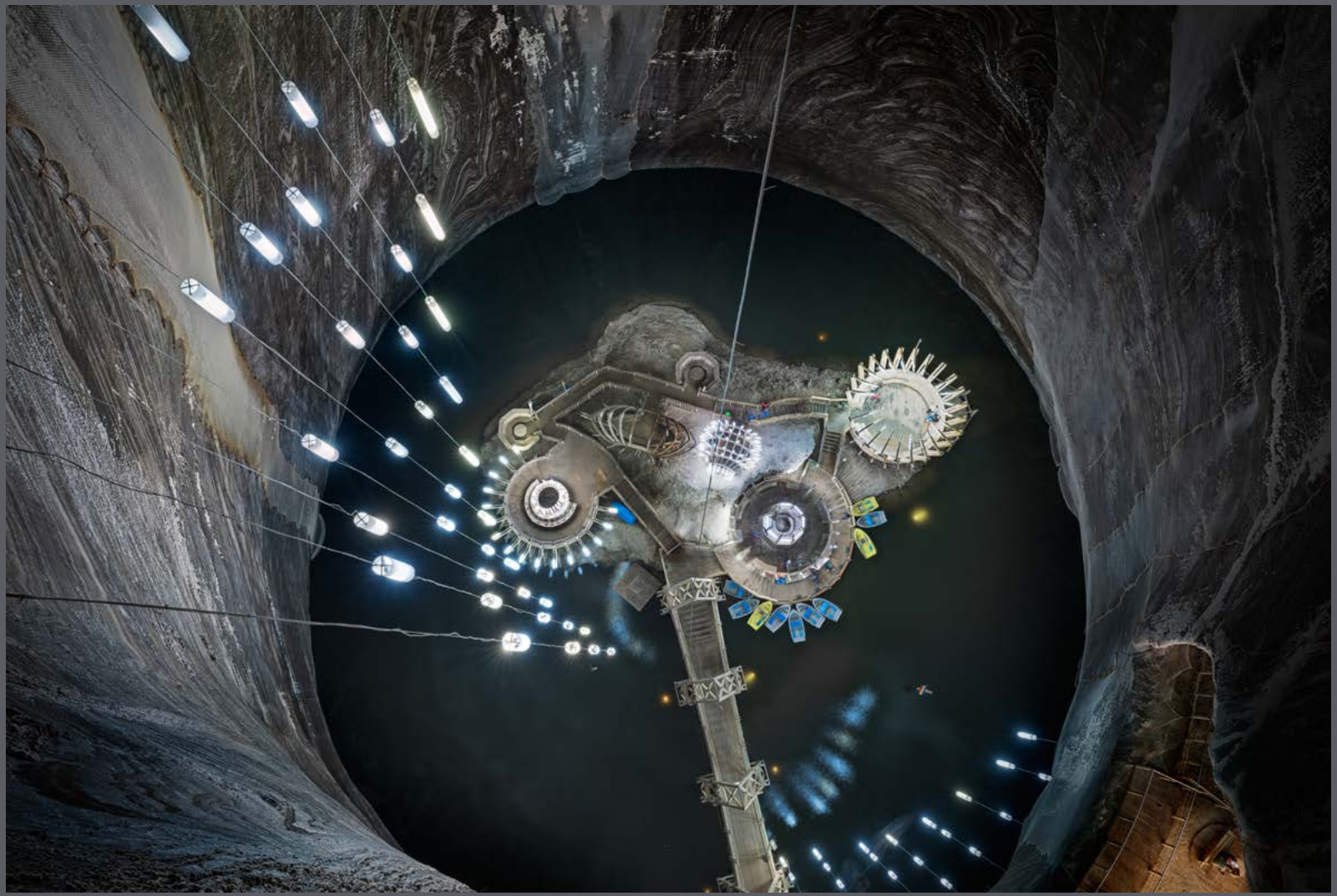
Novaxia is a mission-driven investment company with a particular focus on 'urban recycling', converting vacant commercial buildings into low-carbon residential properties and helping reduce urban sprawl. Since its inception, Novaxia has transformed numerous assets across Europe, including a notable Paris project in the 20th arrondissement which converted an art deco office into 37 housing units. Beyond buildings, Novaxia also contributes to the revitalisation of land, restoring 100,000 m^2 of open land to nature during the 17 years of its operation.

During the administrative authorisation period, Novaxia embraced the principles of a just transition by offering vacant spaces rent-free to community associations and impact-oriented groups — contributing to more inclusiveness and fostering community empowerment. Successful finance of the urban recycling process is made possible by the discount offered to Novaxia by the seller due to obsolescence of the properties, while the capital costs of development are covered by Novaxia's real estate investment funds.

Across different regions, momentum is rising for office to residential conversions, presenting a solution to Europe's interconnected housing and office vacancy challenge. In Madrid and Barcelona, some 2.5 million m^2 of convertible vacant offices could create 28,000 new homes. In the Netherlands, around 665,000 m^2 of vacant office space is viable for conversion into 11,500 residential units. Frankfurt's 2023 housing pipeline included a doubling of office-to-residential projects, comprising 16% of new supply.

Office-to-residential conversions present a promising solution to interconnected urban challenges, particularly the need for affordable housing and the issue of vacant city-centre buildings. However, poorly executed conversions that fail to provide adequate living standards can undermine the potential benefits. As cities increasingly embrace building revitalisation at scale, it is crucial to simultaneously implement robust policies and standards to ensure that converted spaces offer sufficient living space, access to natural light, essential amenities and integration with the surrounding community.

THE CIRCLE - EXPLORING NEW WAYS TO LIVE ON OUR PLANET

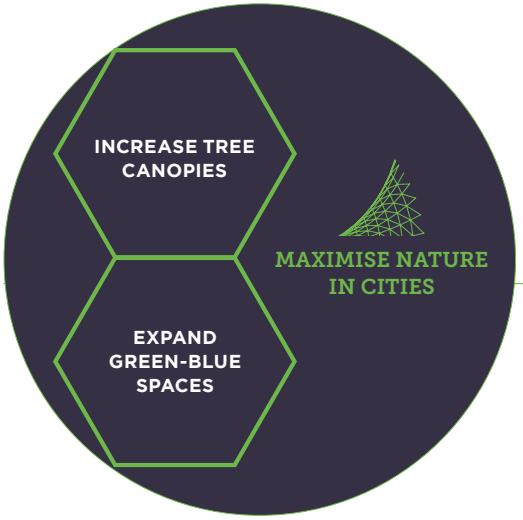


Turda Salt Mine , Amusement Park #7
Luca Locatelli for Gallerie d'Italia Torino - Intesa SanPaolo

The Circle is a photographic project narrating the revolution of possible solutions. Following a very long research project, Luca Locatelli has documented the good practices, experiments, ambitions and paths of this new utopia. His ten-year commitment to the subject is condensed in the stories commissioned by Gallerie d'Italia of Intesa Sanpaolo, presented for the first time in a unitary context.

Visitors are taken on a European journey of experimentation and sustainable industrial advancement, touching on themes such as geothermal energy, the recycling of textiles, the repurposing of abandoned industrial areas, and food. The stories portray real experiences of Nature Based Solutions, actions undertaken to protect, sustain and restore natural ecosystems, which, when applied to industrial and production models, have the potential to trigger the Cultural Transformation needed to change the course of things. Accompanied by a substantial set of infographics and explanatory texts, the images tell of experiences and realities in which the finest engineering, craftsmanship and ancestral wisdom go hand in hand to create a space where Nature can be a central issue again, and where man's knowledge and wisdom can be at the service of environmental forces in order to benefit from their power, without attempting to tame and imprison them: those Nature-Based Solutions which, more than any other, offer us the greatest chance of success. They show us how the most futuristic technology and the intuition of self-production can both contribute to the same goal - the closing of the circle, the possibility of a perpetual system.
The possibility of success.

lucalocatelli.com/thecircle



Maximise nature in cities to create resilient and vibrant urban landscapes

Numerous studies have shown that maximising nature in urban areas can contribute to better economic, social, and health outcomes.[139,140] The principal ways in which European cities can maximise nature are through strategically **increasing tree canopies** and **expanding green-blue spaces**[141] by adding more areas of native vegetation and water that are well-suited to local conditions throughout the cityscape. The potential for additional green space is even greater if we also include green roofs and walls, which are outside of this analysis but are established and proven concepts. Integrating urban nature is increasingly important for Europe's climate vulnerable regions and cities to enable cost-effective mitigation and adaptation strategies. Nature-based solutions are particularly effective for water management, temperature regulation, and carbon sequestration. These strategies are aligned with the objectives of the Nature Restoration Law and will enable EU member states to achieve the targets set by the law. The top 20 'nature-positive' EU cities have demonstrated it is possible to achieve a green cover of more than 50%.[142] However, two-thirds of Europe's cities fall below the recommended 45% threshold area of green space that has been shown to be the tipping point for a productive, resilient, and liveable city, with some regions not even reaching 20%.[143]

STRATEGY: MAXIMISE - STRATEGICALLY INCREASING TREE CANOPIES
COUNTRY: Slovenia

Rethinking the city around nature: Ljubljana

Like many cities across Europe, Ljubljana became polluted, choked with traffic, subject to intense urban heat islands, and less liveable as a result of rapid urbanisation in recent decades.

In 2007, the city published 'Ljubljana 2025', a comprehensive, interdisciplinary urban plan which centralised the expansion of green-blue spaces focusing on the use of tree canopies. Since 2010, more than 40,000 new trees have been planted across the city, and 120 hectares of new green park areas have been created, largely on former brownfield sites. Along a 34 km tree-lined avenue that encircles the city is a public orchard garden which has significantly improved liveability for citizens. A fruit tree plantation, along with an adventure trail and nectar garden, provides space for environmental conservation, physical activity, and social cohesion. The city also enhanced the Ljubljanica river's ecosystem, promoting biodiversity and creating pedestrian and cycling infrastructure. An Ecological Zone was introduced to eliminate motorised traffic in the city centre, promoting public electric transportation and a bike-sharing scheme.

The city's green initiatives have been funded through a mix of city budget, EU contributions, national funds, and public-private partnerships — demonstrating a successful collaborative financing approach for development that delivers both on social needs and environmental stewardship.

The gradual expansion of green spaces and elimination of motorised vehicles in the city centre has resulted in a green cover of 75% city-wide and a 58% reduction in carbon black air particulates. The expansion of green spaces has improved air quality, reduced temperatures, and enhanced citizen health. Ljubljana's efforts to improve liveability for citizens were recognised when it won the European Green Capital Award in 2016, reflecting its commitment to meeting high environmental standards. Ljubljana is now working to further improve the quality of living through its 2030 Climate Neutrality Action Plan, as part of the EU's 100 Climate Neutral and Smart Cities mission.

Ljubljana's nature-transformation earned the Slovenian city the European Green Capital Award in 2016

STRATEGY: MAXIMISE - EXPANDING GREEN-BLUE SPACES
COUNTRY: Romania

Harnessing blue infrastructure to meet the climate challenge: Văcărești

Located in the bustling urban environment of Bucharest, Romania, Văcărești Nature Park is an example of how nature can enable a city to be more resilient to the changing climate and its impacts. After the government's abandoned plans to build a reservoir in 1989, this 183-hectare park has naturally evolved into a flourishing urban wetland over three decades, providing cost-effective, critical ecosystem services, offering a sanctuary in which biodiversity can thrive.

Sometimes described as 'nature's kidneys', wetlands in urban parks can perform as green-blue infrastructure for water management and temperature regulation. The park's complex network of vegetation and water bodies acts as a natural water filtration system, enabling effective surface water run-off. Additionally, the park's expansive water surfaces and over 100 species of vascular plants help cool the air, providing relief from urban heat islands during hot summer months.

Furthermore, in a country prone to flooding, Văcărești Nature Park significantly bolsters flood protection. The park's marshy landscape functions as a natural sponge, absorbing and gradually releasing rainwater, which reduces flood risks by mitigating harmful peak flows. This natural process effectively replaces the need for extensive — and often overburdened — networks of pipes and culverts, providing invaluable protection against potential water damage to infrastructure and residences.

Besides its ecological benefits, the park serves as a recreational and educational hub for the citizens of Bucharest, promoting environmental awareness and offering a space for leisure and learning amidst nature. According to a 2022 Biodivercities report, wetlands and other nature based solutions are 50% more cost effective than grey infrastructure, yet in 2021 they received just 0.3% of overall spending on urban infrastructure. Văcărești Nature Park, which evolved through a combination of luck and circumstance, still represents a powerful example to investors and urban decision makers of the potential of maximising nature-based solutions.

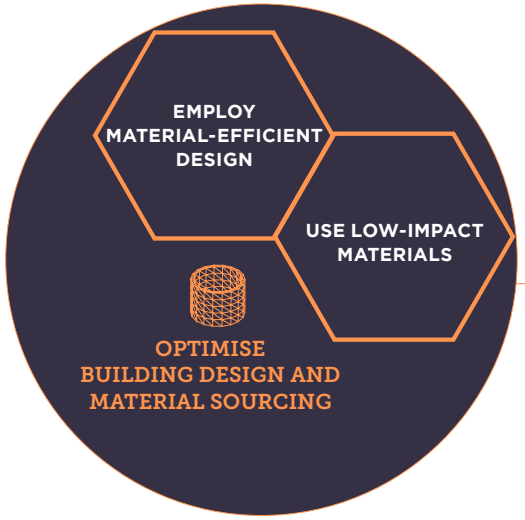
VăcărețtiNature Park plays a key role in protecting and enhancing the surrounding city of Bucharest

COME HOME AGAIN

The artist and stage designer Es Devlin explores the interconnection between the biosphere and the ethnosphere. By combining the sounds of lost languages, gospels and choirs with representations of extinct species and cultures, "COME HOME AGAIN" evokes the fragility of living things and invites us to question our relationship with our cities, our homes and their environment. Hand-drawn by Es Devlin herself, the installation depicts 234 drawings of the thousands of at-risk species that call London home.

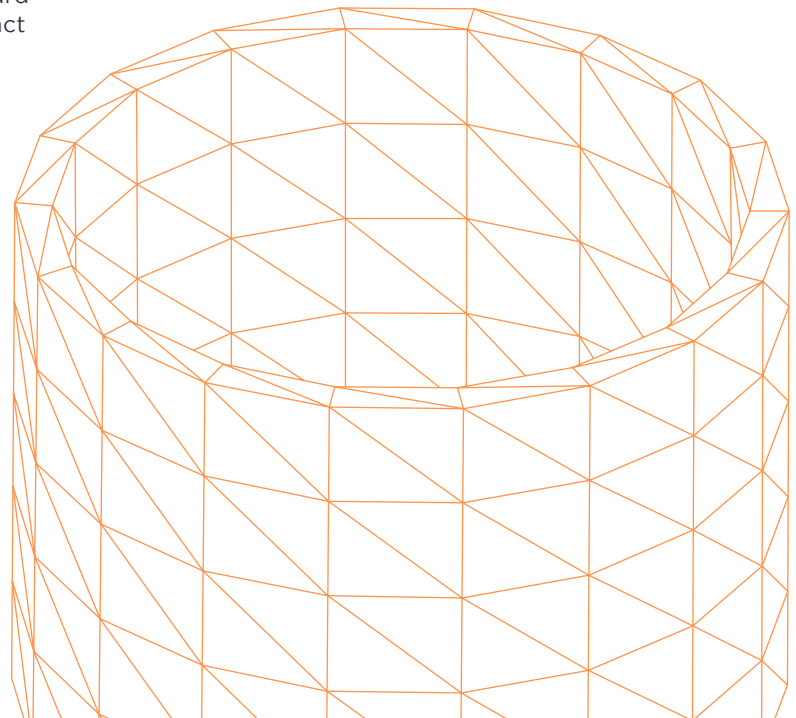
esdevlin.com

Es Devlin Studio



Optimise building design and material sourcing to capture economic value, reduce waste, and achieve climate targets

Optimising building design can positively impact nature and drive economic benefits by reducing the material and carbon footprint of Europe's future building and infrastructure construction. This can be achieved through **material-efficient design** and the use of **low-impact material** substitutes,[144] including reused or recycled materials, regeneratively sourced bio-based alternatives, and materials produced using low-carbon manufacturing processes (see Appendix item 1 for the rationale on strategy selection).[145] Material-efficient design combined with the use of low-impact material substitutes, such as engineered timber solutions and low-emission cement or steel,[146] can reduce overall material consumption in new buildings by 30%, as well as driving innovation and unlocking new revenue pools. Frontrunners in prefabricated and modular construction demonstrate these design and construction practices can be adopted widely — for example, in Sweden, 84% of new houses comprise prefabricated elements.[147] It should be noted, however, that substitution for bio-based materials requires consideration of the potential impacts on nature, biodiversity, and land use. For example, any increase in demand for timber in construction must be balanced against broader environmental impacts, such as changes to carbon sequestration that occur when trees are removed from forests, potential land use change toward plantations, and impact on longer term climate resilience.



STRATEGY: OPTIMISE - USING LOW-IMPACT MATERIALS
COUNTRY: The Netherlands

Using material substitution to reduce and capture carbon: HAUT


Team V Architecture

The Netherlands has committed to achieving climate neutrality by 2050, with Amsterdam pledging to construct at least one in five residential buildings using timber as the primary structural material from 2025. The use of timber can significantly lower embodied emissions in buildings compared to concrete and steel in three principal ways: less energy-intensive production processes, lighter structures, and direct carbon sequestration.

Completed in Amsterdam in 2022, HAUT's 21 floors positions the development as one of the tallest timber hybrid buildings in the world. The building incorporates 55 apartments, bicycle and underground car parking, a city garden, and has been certified BREEAM Outstanding, the first residential building in the Netherlands to achieve this. While the use of timber structure enhances the atmosphere and acoustics of buildings, the primary driver lies in timber's potential to significantly reduce a building's carbon footprint. By using timber, HAUT achieves a 50% reduction in carbon emissions compared to a conventional building, and the building stores approximately 1,800 tonnes of CO_2 when taking into account sequestration.

Beyond emissions reduction, timber-hybrid construction yields a wider set of social and economic benefits. The lighter floor plates enable more efficient truck loading, resulting in fewer deliveries to the building site in the centre of Amsterdam, benefiting surrounding neighbourhoods with quieter and less disruptive construction conditions. Employing off-site/prefabricated construction techniques, construction workers can operate in safer environments, both in a more controlled factory setting for the manufacturing of building components, as well as assembling the building on site using more standardised, automated, and ergonomic processes, with less exposure to hazardous materials, all contributing to fewer injuries and accidents.

While high-rise timber buildings like HAUT garner attention, experts generally believe that timber is optimally used for extensions and mid-rise constructions, as they tend to be less material-efficient and offer limited benefits to predominantly medium-density European cities. Cirerers, an eight-storey engineered timber building in Barcelona delivered by cooperative housing group Sostre Civic, offers a compelling example of how timber construction can be applied to a smaller scale of building. In contrast to HAUT, which is a luxury development, Cirerers also provides an example of a more inclusive and affordable housing model, demonstrating that all income levels can benefit from circular building construction. Ultimately, both HAUT and Cirerers showcase the potential of timber construction methods across various building types and socioeconomic contexts. However, as mentioned above, while timber buildings offer many benefits, the choice of this material must take into account the potential impact on nature, biodiversity, and land use, and limits must be imposed in terms of volume and strict compliance with sustainable forest management standards.

THE POWER OF BIOMIMICRY - EFFICIENT STRUCTURES INSPIRED BY NATURE

Exploration Architecture with Idil Yucel, photo by Kelly Hill Photography

Nature has perfected the art of optimising structural design through millions of years of evolution. In nature, materials are expensive, and shape is cheap, leading to ingenious designs that minimise material use while maximising functionality and strength. By studying and applying these principles, architects and engineers can create buildings and infrastructure that are materially optimised, more resilient, and in harmony with the natural world. From the root form of trees to the tubular structure of bamboo, the interlocking plates of sea urchins, and the struts and ties found in magpie skulls, Biomimicry offers a cornucopia of ideas for radically efficient structures, which can now be unlocked through the power of digital technology. Embracing the paradigm of "fewer materials, more design" and seeking inspiration in nature, could revolutionise architecture and contribute to a regenerative future.

SYSTEM-WIDE BENEFITS OF A CIRCULAR AND NATURE-POSITIVE BUILT ENVIRONMENT, BY 2035

EUR 575 billion

Potential annual revenue distributed across the built environment value chain

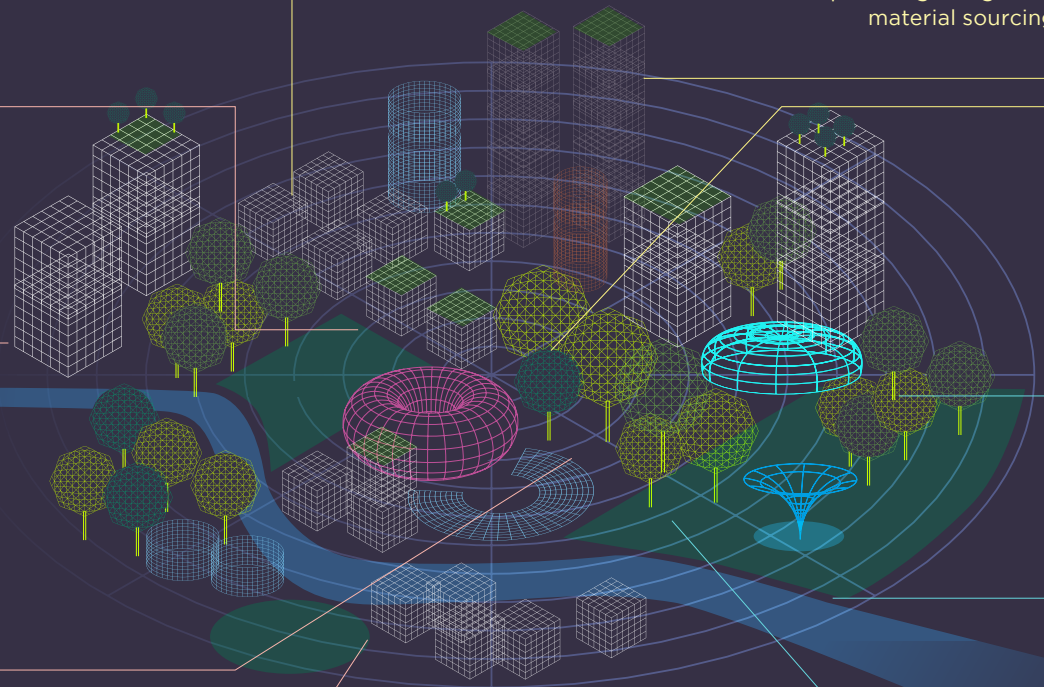
EUR 101 billion of revenue can be derived from revitalising urban land and assets

EUR 363 billion of revenue from optimising design and material sourcing

EUR 111 billion of revenue comes from maximising nature in cities

EUR 117 billion increase in annual revenue to city-centre shops, restaurants, bars, and cafés, driven by more vibrant and attractive cityscapes

EUR 22 billion of annual benefits to households and businesses from more efficient infrastructure networks and reductions in energy and water charges



EUR 632 billion of properties and business value safeguarded through maximising nature in cities and employing nature-based climate adaptation strategies

1°C - 3°C reduction in average urban peak temperatures in cities by increasing tree canopies and expanding green spaces

EUR 158 billion

Wider economic benefits realised annually for businesses, municipalities, and citizens

EUR 19 billion worth of benefits from improved health and productivity

Increased job creation potential

Properties adjacent to new green spaces and regenerated brownfield sites will benefit from improved liveability

5% reduction in EU CO_2 emissions from lower demand for carbon-intensive building materials, more compact urban centres, and expansion of green space

16,000 km² of green space in Europe created or protected by applying six circular economy strategies

Nature, climate, and social benefits

These six strategies can generate substantial economic, nature, and social benefits to businesses and citizens by 2035

Implementing a nature-positive, circular economy at scale can unlock a substantial array of economic, environmental, and social benefits. This chapter explores the upsides in depth — showing how the systematic implementation of circular economy principles in the built environment can be a catalyst to economic activity, the regeneration of nature, and improvements in the quality of life for Europe's urban residents.

EUR 575 billion of potential revenue distributed across the built environment value chain

Acting on the six strategies of this nature-positive, circular economy framework in an interconnected way can unlock EUR 575 billion of revenue across the built environment value chain from material suppliers and construction companies through to landscape contractors. In many cases, these revenue pools are ready to be realised now with low barriers to implementation, while engaging the local job market. The following section explains the constituent parts of this overall figure.

EUR 101 billion of revenue can be derived from revitalising urban land and assets. Prioritising residential development on brownfield sites and in vacant commercial plots and buildings could realise EUR 101 billion of annual revenue for those involved in developing and repurposing these sites. These benefits can be unlocked even when applying the strategies across a relatively small area, for example, this revenue pool is modelled on transforming just 4% of unused industrial land and the 8% of office buildings currently unoccupied across Europe. At the same time, these two strategies combined could theoretically address 90% of Europe's housing needs, depending on the spatial distribution of brownfield sites relative to housing demand.[148] Using centrally located sites would result in these new multi-family homes being located in commuter-friendly, efficient, mixed-use, walkable neighbourhoods that are low-carbon, convenient to residents, and conducive to economic development.

EUR 111 billion of revenue comes from maximising nature in cities. Increasing tree canopy and green-blue infrastructure to a minimum threshold of 45% overall green cover across all EU cities could generate 111 billion of potential revenue by 2035, more than half benefiting the landscape construction sector. A high proportion of the greening will target areas of cities that are both sealed and underutilised thereby providing a double benefit, not only revitalising neglected areas but also enhancing the cooling, infiltration, and other ecosystem services associated with these areas.

Besides highly beneficial strategic integration of tree canopies into streetscapes, urban planners and landscaping companies have a vast palette of potential nature interventions that can be applied in a locally-attuned way to increase ecosystem integrity depending on the local climatic context, scale, and the ecosystem function that is needed. Green infrastructure options include pocket parks or miyawaki forests,[149] green roofs, permeable parking areas and pavements, urban meadows, pollinator and habitat corridors, community farms, and living walls — all of which enhance biodiversity, improve air quality, and provide valuable green spaces for communities to enjoy. Blue infrastructure options include constructed wetlands, rain gardens, attenuation ponds, rainwater harvesting systems, bioswales, permeable pavements, green roofs with water retention features, and urban streams restoration — these are all aimed at enhancing water management, improving water quality, supporting biodiversity, and increasing urban resilience to water-related challenges.[150] Cities such as Turku in Finland and Ljubljana in Slovenia have already started employing these methods as part of their revitalisation strategies.

EUR 363 billion of revenue from optimising design and material sourcing. Our analysis shows that scaling material-efficient, prefabricated modular construction while increasing the use of lower-impact materials can reap over 60% of the overall direct economic benefits, while at the same time saving 250 million tonnes of construction materials. Developers could save up to 20% in overall construction costs per project when opting for modular construction, through a mix of material and labour cost savings due to fewer, higher-skilled construction workers. In particular, material and component suppliers will reap a significant benefit with a potential revenue pool of over EUR 250 billion — driven by a five-fold increase in the prefabricated construction market, and an increase in demand for modular building systems and lower-impact materials. As an example, the 'Am Wohnpark Nette 6' project, delivered by German modular construction company Gropyus,[151] is a nine-storey-high building that was finished in 11 weeks using industrial production and a modular timber-hybrid construction, leading to 22% fewer emissions than a conventional building.[152]

A good proportion of these revenue pools will benefit local enterprises. Brownfield site redevelopment, commercial retrofits, and expanding natural spaces in cities all require local landscaping, refurbishment, and remediation services. Compliance with building codes can be an opportunity for local manufacturers, as they are typically the most familiar with the relevant regulations. Through implementing these strategies together, building and landscaping contractors — particularly those who specialise in brownfield site remediation and the delivery of green infrastructure — could share a potential revenue pool of EUR 180 billion. For example, Riemer Park, located on the site of the former Munich-Riem airport in southern Germany, demonstrates how urban brownfield site development can create localised economic and social benefits. The project generated over EUR 4 million in revenue for local landscaping and construction companies, as well as 210 hectares of green spaces for the benefit of businesses and citizens.

Riemer Park, Germany, demonstrates how brownfield site development can create localised economic and social benefits.

STRATEGY: REVITALISING VACANT COMMERCIAL PROPERTY
COUNTRY: Switzerland

Brownfield revitalisation - an attractive opportunity for long-term investment: Ginkgo

Europe's urban landscapes bear the marks of its industrial past, with many prime-location unused spaces from various sectors. These sites offer significant development potential for housing and city revitalisation, aligning with strategies to limit urban sprawl and protect natural habitats. However, repurposing these brownfield sites is challenging due to potential contamination.

Ginkgo specialises in the remediation and regeneration of brownfield sites and abandoned built environment assets, including train depots, gas works, and more. Ginkgo is in the process of transforming 110 hectares of ex-industrial land across France, Spain, Belgium, Portugal, Italy, and the Netherlands into over 1 million m^2 of mixed-use central urban developments. One notable project is a 4.5-hectare plot in Lyon, once the 'Fagor-Brandt' factory site, now an ecodistrict with extensive building rights. Already, over 40,000 m^2 is developed as housing, featuring 35% green space and 200 trees, with plans for an additional 9,000 m^2 of greenery and an urban farm in the commercial sector. Ginkgo's Lyon project required more than EUR 7 million of initial funding for site remediation.

The profitability of large-scale brownfield development projects presents an attractive long-term opportunity for investors. Funds from institutional investors including Banque de Territoires, Allianz France, and a range of European diversified investors enable Ginkgo's projects to avoid the need for public grants or subsidies. Strategic site selection in urban areas with robust transport networks enhances the projects' profitability and competitiveness. Additionally, prioritising mixed-use developments not only diversifies the investment but also boosts community benefits and financial viability, underlining the project's economic and social value.

Ginkgo has demonstrated that revitalising brownfield sites, especially in secondary cities where land is often significantly discounted, can be very profitable for investors. Already, the project has returned more than three times the equity invested, with an internal rate of return (IRR) of over 20%. A key part of the transformation story from industrial wasteland into a vibrant eco-district hinges on 40% of the 42,000 m^2 of residential space created being set aside for social housing. Meanwhile, the project is contributing EUR 10 million to urban development taxes and infrastructures, including green spaces, roads, and schools.

Ginkgo Advisor

GROPYUS

The European construction revolution is modular, material-efficient, and delivers positive impact

The evolution of the European construction industry towards material-efficient, prefabricated, low-impact construction presents a major economic opportunity for the built environment value chain. A number of innovative European companies are at the forefront of this shift. By leveraging advanced digital technologies, these pioneering companies are tapping into a significant new pool of revenue, while delivering a host of environmental and economic benefits, such as reduced material usage, minimised waste, lower emissions, more streamlined construction, and substantial cost and time savings. The following five examples showcase innovative business models and technologies in Europe that are capitalising on this trend.

BoKlok is a joint venture between construction giant Skanska and furniture retailer IKEA, focused on delivering affordable, material-efficient housing across Europe. BoKlok creates prefabricated modular homes that streamline the construction process, reduce waste, minimise emissions, and significantly cut down on build time. There are already 12,000 BoKlok homes constructed across Sweden, Finland, and Norway, with plans underway to partner with regional housing providers for expansion into other markets, such as the UK.

GROPYUS is an innovative Austrian-German construction technology company based in Vienna and Berlin, focused on providing affordable living through modular construction. With over 300 employees, across six sites in three countries, GROPYUS has developed its own prefabricated building platform and end-to-end digital platform to optimise the real estate cycle. Recently they have partnered with automation specialist KUKA, to create an automated manufacturing facility in Richen, Germany, with a planned capacity of 3,500 apartments per year.

CREE is an Austrian start-up that has developed an innovative timber-based prefabrication system to create flexible and adaptable structures. Its patented timber-hybrid system offers numerous benefits, including up to a 50% reduction in embodied emissions and enhanced material efficiency through standardisation and prefabrication. CREE has delivered several flagship projects including the ‘EDGE Suedkreuz’ office building in Berlin (29 m, eight floors) and ‘LCT One’ office in Dornbirn (27 m, eight floors).

Hyperion Robotics is a Finnish construction technology company that is pioneering the use of robotics and 3D printing in construction. By combining industrial robots, proprietary software, and upcycled materials, Hyperion enables construction companies to produce optimised, low-carbon structures efficiently and with a much faster lead time. The company’s automated 3D printed systems can reduce material use by 75%, and the construction’s carbon emissions by 90%, offering significant cost and time savings.

Daiwa Modular House is a Japanese construction company with a strong presence in the Netherlands, renowned for material-efficient prefabricated housing solutions. In 2023, Daiwa opened a new plant in Fürstenwalde, Germany, to meet growing demand for efficient and affordable housing solutions. Daiwa Housing’s European business focuses on addressing social issues such as housing shortages and rising construction costs. The company has delivered a number of projects across Europe including 152 homes in Lelystad, the Netherlands and a 106-unit student housing complex in Essen, Germany.

EUR 158 billion realised annually in wider economic benefits for businesses, municipalities, and citizens

In addition, EUR 158 billion in annual wider economic benefits could be unlocked, in terms of cost savings, enhanced vibrancy, and increased productivity.

EUR 117 billion increase in annual revenue to city-centre shops, restaurants, bars, and cafés, driven by more vibrant and attractive cityscapes. The presence of trees in commercial areas increases vibrancy and footfall by creating a more welcoming environment including providing shade, reducing heat, and improving air quality. The increased attractiveness of these commercial zones encourages people to visit and linger longer in the area, which increases foot traffic to shops and businesses. Achieving an average urban green cover of 45% in European cities, via the two 'maximise' strategies, could result in up to EUR 37 billion in additional business for retail stores located on tree-lined streets by 2035. More significantly, revitalising commercial properties by converting them into high-density, multi-family homes could provide an even greater boost to economic activity in Europe's downtown areas. Our analysis has estimated that an ambitious office-to-residential conversion programme could counter the 10–20% Covid-related reduced foot traffic near stores located in downtown metropolitan areas, generating an additional EUR 80 billion for Europe's bricks and mortar businesses.

EUR 22 billion of annual benefits to households and businesses from more efficient infrastructure networks and reductions in energy and water charges. Prioritising brownfield over greenfield development replaces urban sprawl, with higher density, city-centre developments. The location of new residential developments in more central locations can save on infrastructure development costs, through the rehabilitation of existing roads and pipes as well as more resource-efficient networks. For our analysis, we estimated that prioritising brownfield site redevelopment could avoid EUR 16 billion in infrastructure costs compared to business-as-usual greenfield home building. From an operational perspective, households, businesses, and other owners and users of buildings located in tree-lined streets, or close to green spaces with enhanced water infiltration, could benefit from more than EUR 6 billion of economic savings through a reduction in heating, cooling, or water drainage costs. A detailed analysis for Flanders in Belgium estimated that transitioning from dispersed to densified urban growth could yield annual infrastructure savings of nearly EUR 400 million and mobility cost savings of around EUR 2 billion.[153]

EUR 19 billion worth of annual benefits from improved health and productivity. Increasing tree canopy cover and green spaces in cities can help mitigate the urban heat island effect, leading to improved health, more comfortable working conditions and lower rates of absenteeism, with an estimated EUR 11 billion in productivity benefits. Furthermore research shows that offices that are integrated with nature can have a positive impact on the health and wellbeing of the people who work in them.[154] Exposure to nature has been shown to reduce stress, improve mental health, and increase creativity and focus — leading to improved overall wellbeing, job satisfaction, and even staff retention.[155] If through the application of the maximise ambition an additional ~11% of workplaces have a view of a green space by 2035, the economic benefits from avoided sick leave could amount to EUR 8 billion. An example of this is the design of Venlo Town Hall in the Netherlands, which incorporates a massive green wall on its northern façade and includes many plants and trees in the interior of the building. Since the Town Hall's completion in 2016, the number of reported staff sick days has reduced by 2%,[156] which could provide a productivity increase equivalent to EUR 1 million annually for the Town Hall.[157]

Properties adjacent to new green spaces and regenerated brownfield sites will benefit from improved liveability. Trees and green spaces enhance the appeal of an area, making it more desirable to live or locate a business in. Additionally, green spaces offer recreational opportunities, improve air quality, contribute to noise abatement, attract more wildlife, and reduce urban heat island effects — all contributing to the overall 'liveability' of the area, i.e. making for a healthier and more enjoyable living environment. Brownfield site redevelopment transforms underused or abandoned sites into functional and attractive spaces. This revitalisation can lead to the introduction of new businesses and amenities, residential units, and green spaces — stimulating urban economies as a whole, boosting business activity, attracting higher-value industries, and increasing citizen income. Similar to the issue around revitalisation of commercial areas, it is important to acknowledge that increased liveability and desirability can lead to rising property values which, while beneficial for owners, can heighten affordability challenges for non-owners, and risk the displacement of existing residents, especially tenants. To mitigate these issues, stakeholders must proactively implement just transition policies and interventions that ensure housing affordability that protect the interests of all community members, fostering inclusive growth and reducing inequality.

In addition, these strategies can boost job creation in a nature-positive economy. This study did not model the impact of the six strategies on the labour market, however many previous studies have carried out analyses relevant to this. In 2023, a World Economic Forum report estimated that in a nature-positive economy, 117 million jobs could be created globally in the building and infrastructure sector.[158] While it is not possible to pinpoint precisely the types and number of jobs, we can speculate that certain new job areas will arise due to an ambitious scaling of our selected strategies. For example, urban greening initiatives could lead to new roles in landscape design, tree maintenance, horticulture, and urban ecology. Brownfield redevelopment might expand opportunities in site remediation, urban planning, and nature-based design. Additionally, the push for more efficient structures and lower-impact materials could increase demand for specialists in digital design, material and equipment manufacturing, circular supply chains, and advanced construction technologies.

A broad set of nature, climate, and social benefits for all stakeholders

Beyond quantifiable economic gains, the adoption of the six strategies can yield a broad range of systemic benefits. This includes a significant reduction in carbon emissions and enhanced urban resilience. Social benefits are equally compelling, with improvements in health and wellbeing for citizens, through increased access to green spaces, improved air quality, and a more sustainable and engaging urban environment.

Maximising nature in cities and employing nature-based climate adaptation strategies could safeguard EUR 632 billion of properties and business value. Greening and protecting land could deliver an additional EUR 632 billion in benefits through the avoidance of downside risk. Most of this will be through the safeguarding of property and businesses that are at risk from extreme weather (see Appendix item 5). Increasing tree canopies and expanding green spaces reduces temperature in cities as well as slowing water flows and increasing infiltration. The result is a minimum of 1°C cooling of urban peak temperatures in almost all cities, with some cities achieving 3°C or more. Additionally, more permeable surfaces could reduce flood intensity by 10–20% and help recharge groundwater aquifers, mitigating future droughts. Studies have shown that increasing tree canopies together with other nature-based solutions such as permeable pavements, sustainable urban drainage systems (SuDs), living walls, and green roofs are both more cost-effective than 'hard infrastructure' solutions, but also far more effective at building resilience to the intensifying impacts of climate change.[159]

Applying these six strategies could create new and protect existing green space in Europe totalling over 16,000 km². Maximising the integration of nature so that all EU cities achieve a threshold cover of 45% could create an additional 8,500 km² of urban green space helping to achieve the objectives for urban ecosystems set out in the Nature Restoration Law aimed at increasing wildlife, climate resilience, and public health. In the next decade, Europe needs to build millions of new homes to meet the demand of its citizens. By designing higher density, mixed-use multi-family home developments, and prioritising underused land and assets over greenfield development, European cities can curb urban sprawl and the expansion of the built environment into surrounding natural areas. This approach would safeguard land for food production, wildlife habitats and the provision of ecosystem services, which are often threatened by urban growth. This will result in the protection of an estimated 7,700 km² of natural land (primarily farmland). In total, these circular economy strategies combined could protect and create 16,000 km² of green space in Europe, the equivalent of half the size of Belgium. The built environment can also have a positive impact on nature through its material supply chain, including extraction, processing and disposal, that produces the materials used to construct buildings. By reducing demand for virgin materials and specifying lower-impact materials, such as bio-based materials produced in well-managed production areas, the supply chain impact of construction supply chain can be reduced. The impacts of these strategies are amplified when combined and applied systematically, contributing to achieving biodiversity and nature restoration goals, as well as enriching the lives of citizens through the protection of natural ecosystems.

A nature-positive built environment helps reduce GHG emissions, thereby supporting climate goals. By 2035, 131 $MtCO_2$ could be avoided or captured through a reduced demand for carbon-intensive building materials, more compact urban centres, and an expansion of green space. This combined mitigation potential is equivalent to about 5% of overall EU CO_2 emissions in 2022.[160] The majority (93 $MtCO_2$/year) is from strategies that support the optimise ambition, specifically material-efficiency measures and the specification of low-impact materials.

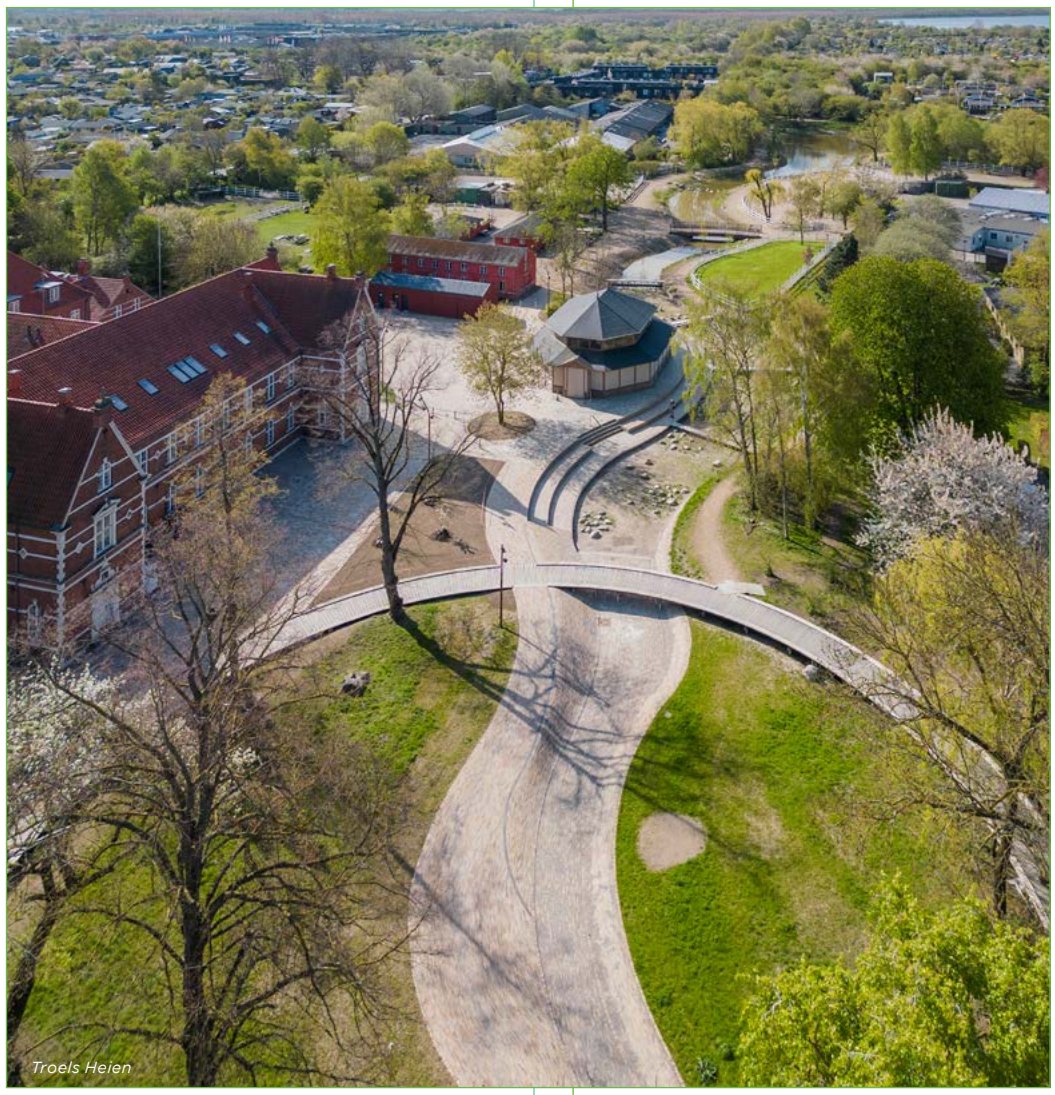
The remainder (38MtCO_2/year) is from strategies to revitalise land and assets in city centres, for example avoiding urban sprawl, allowing more compact road and pipe networks, and lowering transport emissions due to shorter commute times and less reliance on cars. Finally, incorporating more trees and green spaces in urban areas can enhance carbon sequestration, capturing it in plants, soil, and other organic matter, further mitigating carbon emissions.

European citizens can reap numerous physical and mental health improvements. Adding more trees and green spaces to urban landscapes can remove air pollutants from the atmosphere and improve air quality.[161,162] This study shows that prioritising brownfield sites and unused city-centre buildings could also contribute to cleaner air, by eliminating the need for an additional 12 million cars, thanks to denser, more public-transport-oriented city designs. It also shows that across Europe this more effective use of urban space would reduce commuting times for an additional 17 million households in city centres. There are numerous other health and social benefits associated with increased tree canopies, including stress and blood pressure reduction, fewer premature deaths, longer life expectancy, and enhanced community interaction and an enhanced sense of civic pride.[163] While not suggesting it is a panacea for all of society's challenges, clearly an increased connection with nature can make a substantive contribution to the improved future health and wellbeing of European citizens.

Offices that are integrated with nature can have a positive impact on the health and wellbeing of the people who work in them

STRATEGY: MAXIMISE - EXPANDING GREEN-BLUE INFRASTRUCTURE
COUNTRY: Denmark

Enhancing climate resilience through nature-based solutions: Copenhagen



Troels Heien

In July 2011, the city of Copenhagen experienced a 1 in 1000 year 'Cloudburst' flood, an extreme rainfall event that impacted critical infrastructure in the city, leaving 50,000 homes without heat for a week and causing around EUR 1 billion of property damage. The storm produced up to 150 mm of rainfall across the city within two hours, leading to extensive damage across the city, making it Europe's most expensive natural disaster that year. The events of this day were a wake-up call for Copenhagen, highlighting the urgent need to bolster the city's resilience against the increasing risk of extreme weather events due to climate change. In response, the city elevated climate adaptation to a top priority and developed a comprehensive Climate Adaptation Plan which prioritises the establishment of continuous green networks and the application of nature-based solutions as a key approach to urban water management for resilience.

To relieve pressure on the traditional sewage system and retain stormwater as a resource, Copenhagen maximised the city's green areas, extending permeable areas, constructed wetlands, and drainage corridors to absorb and retain run off water after extreme rainfall. This dispersed network of green spaces and waterways created new urban habitats, enhancing biodiversity, improving air/water quality. Analysis also showed surface solutions reduced mitigation costs by over USD 200 million versus conventional piping.

The delivery of the plan required a localised, collaborative effort to be established between municipalities, engineers, utility providers, citizens, and investors all sharing a common vision. Copenhagen is taking the lead in developing green urban solutions and demonstrates a multi-purpose solution that can build resilience whilst also making the city more attractive and liveable.

Inspired by Copenhagen's example, many other cities are embracing nature-based solutions for urban water management, such as New York City which has launched its own USD 400 million infrastructure programme. These pioneering cities are acknowledging that integrating nature's design principles into climate adaptation strategies not only enhances resilience but also transforms water management into a catalyst for environmental restoration, social well-being, and economic vitality. Copenhagen's pioneering example offers a replicable blueprint for harnessing the power of nature to create liveable, climate-resilient cities.

STRATEGY: MAXIMISE - EXPAND TREE CANOPIES
COUNTRY: Spain

Regenerating nature — the foundation of a healthy, vibrant, and resilient city: Vitoria-Gasteiz

The city of Vitoria-Gasteiz in northern Spain exemplifies the transformative power of urban greening. Named the 2012 European Green Capital and having received the UN's Global Green City award in 2019, Vitoria-Gasteiz has integrated extensive green infrastructure into the urban fabric, designed with accessibility as a priority to encourage active and healthy lifestyles, and boost social interaction.

The city is encircled by a 30 km 'green ring', a project designed to regenerate the city's degraded urban belt. This network of urban and peri-urban parks, which is connected by walking and cycling lanes, ensures that every citizen or visitor is now just a few minutes' walk from a green space. Vitoria-Gasteiz's 'walks for health' programme was launched in 2010 to promote the use of the green space and foster long-term social bonds. By organising a schedule of daily walks, ranging in intensity to provide the service for a diverse group of ages, citizens were encouraged to do regular physical exercise and be more informed about new routes across the city. Since 2009, the city has also developed an intermodal transport scheme, reducing pollution and noise levels, and increasing pedestrian areas by more than 64%, giving streets back to people.

The expansion of green spaces across the city is underpinned by the Green Urban Infrastructure Strategy, which was launched by the City Council of Vitoria-Gasteiz in 2012. The strategy's main objectives are to regenerate degraded areas, enhance urban biodiversity, and improve the connectivity and functionality of urban green spaces. These last two objectives refer to the way green spaces are linked together and how well they serve various ecological and social functions. Since the launch of the strategy, the city and its people have planted over 165,000 trees, well over half of its initial target of 250,000, making it the provincial capital with the highest density of green areas per inhabitant.

At the heart of Vitoria-Gasteiz's commitment to nature-positive urban development is a mindset shift which views trees and green spaces not only as added value in terms of aesthetics or biodiversity, but also as a provider of wider co-benefits. These include air temperature regulation, carbon sequestration, stormwater management, and air purification, each contributing to a healthier and more livable space for its citizens. In just over a decade, Vitoria-Gasteiz has become a dense mosaic of urban biodiversity-rich green spaces, offering a lush, habitable environment for its citizens, and setting a benchmark for cities worldwide in nature-positive urban development.

Photograph: Ayuntamiento de Vitoria-Gasteiz/Quintas

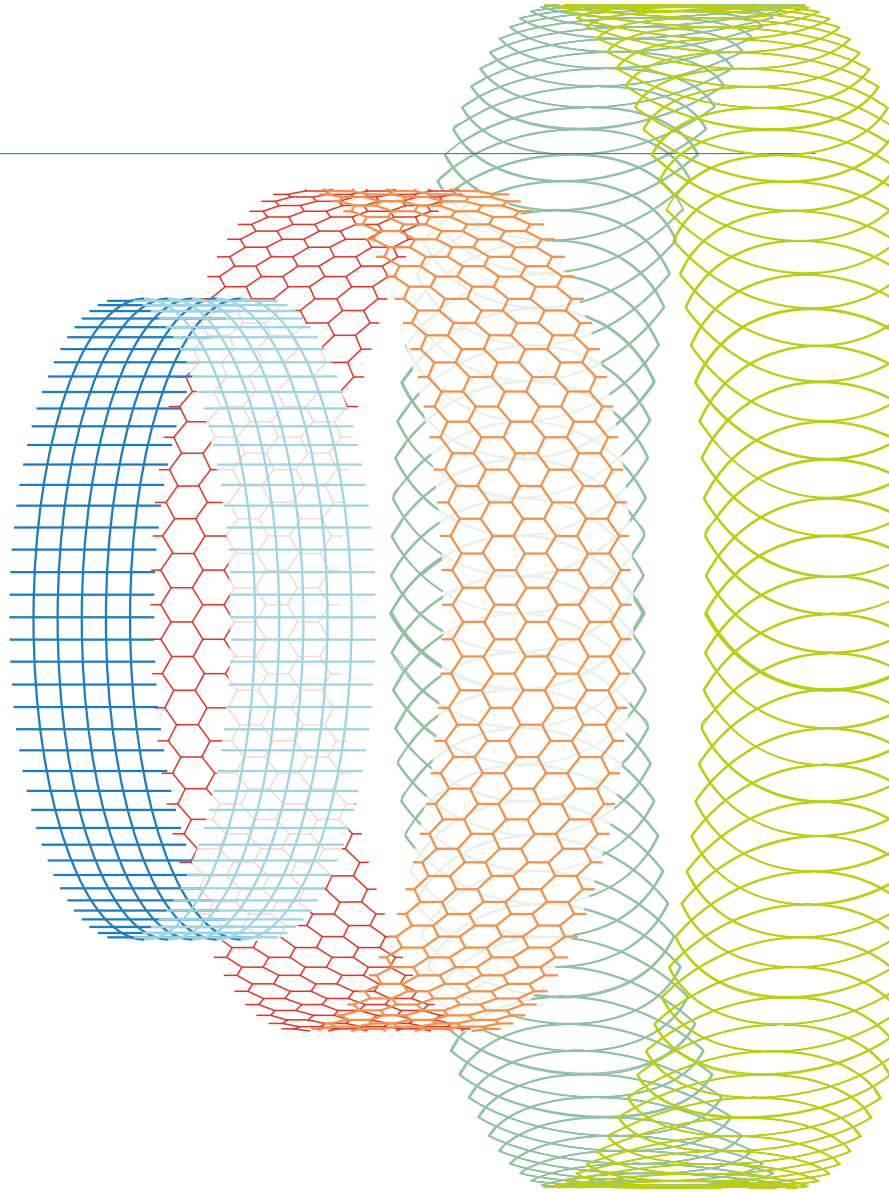
A number of key market, policy, and financial barriers hinder system-wide transformation in the built environment

Upfront costs and difficulties monetising benefits impede investment. Additional upfront costs and resources are often required for brownfield redevelopment, such as specialist consultancy services for planning permissions and site remediation, often favouring greenfield redevelopment. This misalignment poses a significant barrier to the circular economy's integration into mainstream practices and value propositions. Additionally, the transition faces practical challenges due to the limited availability and elevated costs of substitute materials, such as low-impact cement and bio-based products. These materials, essential for a circular built environment, often come at a premium due to supply chain constraints and their relative infancy in the market. Furthermore, few built environment financial frameworks adequately reflect the diverse and often indirect benefits that a nature-positive circular economy brings, including cost savings, from increased climate resilience, reduced emissions, and boosted urban productivity. This array of benefits is not always captured by investors and municipalities, in part due to the time lag between investment and returns, and in part by a lack of mechanisms to value them.

Complex planning policies and a lack of relevant standards hinder progress. The prevailing economic system is not aligned with the goals of the circular economy. In public and private procurement, for example, there is an overemphasis on initial purchase costs at the expense of considering the full life cycle and operational costs. Without a shift in this economic perspective, there is a risk that policy incentives and mechanisms may not achieve their full potential or, in the worst-case scenario, could be counterproductive. These obstacles are compounded by policies and regulations that do not always support circular approaches. For example, redeveloping brownfield sites usually encounters greater challenges compared to developing isolated buildings or vacant plots, and the revitalisation of commercial properties necessitates securing re-zoning approvals prior to initiating development.[164] Furthermore, current building codes and urban planning policies pose substantial barriers to innovative construction methods and the use of materials with lower environmental impacts.

A fragmented value chain with split incentives results in low demand for circular solutions. A lack of integration between the different stages of the value chain involved in creating and managing a building or other built asset leads to missed opportunities to incorporate circular practices, inefficient resource use, and a stifling of innovation. The issue of split incentives manifests at all scales of the built environment and implies a misalignment between the entities funding circular economy interventions and those benefiting from them. At a building level, this could mean a situation in which developers bear the costs of incorporating features such as recyclable materials and modular designs, but tenants or future owners capture the long-term environmental and economic benefits. At the system level, initiatives like green corridors necessitate city-wide collaboration and investment to fully realise their benefits, yet quantifying and attributing specific advantages like improved climate resilience or productivity at the building level is challenging, thus complicating investment decisions. The challenge of split incentives in brownfield redevelopment arises when the costs and benefits of site remediation and sustainable development are not aligned among stakeholders. Owners may hesitate to invest in clean up activities if they do not directly benefit, whereas developers benefit from such investments but may not bear the upfront costs. This misalignment hampers sustainable redevelopment, necessitating coordinated policies and financial strategies to align the interests of all parties involved.

Insufficient awareness and expertise among stakeholders about benefits and implementation strategies slows the scaling of solutions. A lack of skills, capacity, and understanding has resulted in a continued preference for linear, smaller-scale initiatives, hindering the scaling up of system-based circular interventions. This knowledge gap prevents stakeholders from fully appreciating the environmental, economic, and social benefits of circular solutions, and hampers the adoption of innovative circular practices and technologies, resulting in the overarching business case often being underestimated. The reluctance to adopt investment models, such as blended finance for urban greening projects, exemplifies this issue, with short-term narrow gains frequently prioritised over long-term system benefits. Meanwhile, there is a misconception in the industry that incorporating circular economy solutions, such as low-impact materials and prefabricated construction systems, is solely reserved for a new workforce with specialised skills. This overlooks the potential to enhance the skill sets and technological expertise of current employees as well as establishing safer and healthier working conditions for them.



Action in five focus areas can overcome these barriers and contribute towards a just transition

Despite the aforementioned barriers, Europe's built environment stands at a potential threshold, bolstered by new digital and material technologies and solutions, and an emerging number of success stories. Focusing on five key areas can unlock a positive tipping point now:

1 **Mobilise financial flows to unlock circular economy opportunities at scale.** Scaling the circular economy necessitates significant capital investment and is a responsibility shared by both public and private stakeholders. Despite the private ownership of the majority of commercial and residential real estate,[165] private investment in nature-based solutions remains modest, at just 18% of the total annual investment in this domain. There is a pressing need for mechanisms that enable investors and asset owners to fully grasp and leverage the economic benefits of the circular economy. This can be achieved by:
   - fostering innovative financial strategies, such as blended finance models;[166]
   - boosting investment in urban regeneration;
   - committing to strategic investments that generate substantial demand in the built environment value chain.

Stimulating the market in this way would increase demand from developers and encourage innovative enterprises, for example, those that manufacture low-impact material substitutes or advanced construction methods, to thrive and scale.

2 **Leverage legal and policy frameworks to enable the circular built environment to scale.** Policymakers can unlock a plethora of untapped circular economy opportunities by focusing on strategies such as:
   - redirecting economic incentives;[167]
   - revising standards and definitions;
   - updating building codes;
   - strategic zoning regulations;
   - promoting the use of low-impact materials.

The EU has established a robust foundation for a circular built environment through its existing policy framework. Leveraging this framework, along with upcoming revisions to key EU policy instruments, presents a critical opportunity to accelerate the transition towards a circular built environment. The Strategy for a Sustainable Built Environment serves as a cornerstone, aiming to increase material efficiency and reduce climate impacts through the building lifecycle.[168] It includes nature-positive elements such as soil-related initiatives to reduce soil sealing, rehabilitate abandoned or contaminated brownfields, and increase the safe and circular use of excavated soils. Complemented by initiatives like the Renovation Wave and Level(s) the Strategy provides a comprehensive approach to transforming the construction sector. Crucially, upcoming revisions to the Green Public Procurement criteria, Construction Products Regulation, and Energy Performance of Buildings Directive offer a chance to strengthen the transition. Additionally, policy frameworks that encourage the use and storage of secondary materials and foster digital innovation create the enabling conditions for a resilient and circular built environment.[169]
Furthermore, city-level reforms, such as using zoning regulations to facilitate multi-unit developments and making the planning process more efficient for the redevelopment of brownfield sites and the repurposing of commercial properties, represent significant opportunities.

3 **Establish an industry network dedicated to collective leadership and fostering the emergence of circular economy ambassadors and practitioners.** Policymakers, asset owners, businesses, and the built environment supply chain can all act as leaders in unlocking the benefits of the six strategies:
   - supply chain members can take active roles throughout project life cycles to drive innovation in low-impact solutions and modular construction;
   - Investors, the financial sector, and

economic policy can devise transition funds, support public capacity to build investable projects and private capacity to access finance, and participate in blended development schemes;
- European businesses and policymakers can leverage their influence to set precedents for nature-positive initiatives and advocate for supportive policies.

Early-stage engagement is needed to overcome fragmentation and ensure cohesion across the value chain. This is relevant to all strategies, ranging from conducting site surveys for brownfield development, drafting maintenance contracts for urban greening projects, to planning the construction sequence for low-impact materials and modular construction. Failure to do so increases the risk of complications in later design stages, and can result in circular economy interventions being reduced or even eliminated due to cost-cutting measures during the value engineering process. Public-private partnerships (PPP) provide one way to share risks and benefits, promoting a more unified approach to circular economy projects. These partnerships help overcome issues such as split incentives and siloed operations, fostering a much more integrated approach in urban planning and development.

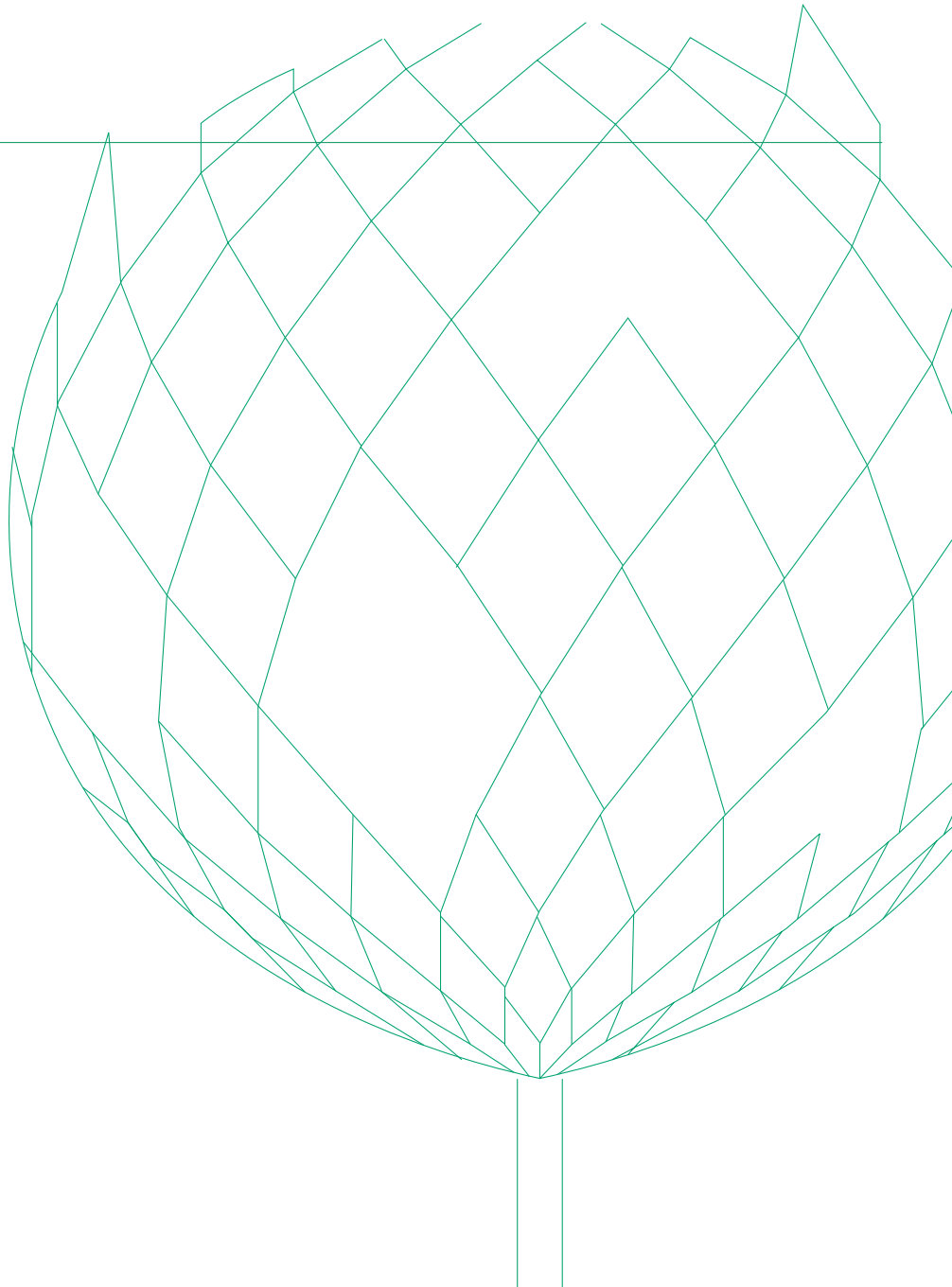
4 **Shift mindsets by raising awareness of the economic, nature, and social benefits of systems-based solutions.** Raising the awareness and capacity among Europeans, politicians, and the supply chain about the benefits of systems-based solutions and circular built environments, empowers them to challenge the underestimated business cases that currently hinder circular economy projects. Bridging knowledge, skills, and awareness gaps will unlock opportunities that currently remain untapped by:
   - encouraging asset owners and investors to recognise new revenue opportunities and the social benefits of compact, mixed-use neighbourhoods;
   - upskilling the local workforce and fostering community engagement through models such as community land trusts (CLTs) to enhance local stewardship and support sustainable land use.[170]

Collectively, these efforts can foster a cultural shift towards valuing and implementing nature-positive, circular practices across European cities — enhancing vibrancy, job opportunities, and overall well being. Ultimately recognising that regenerating nature through integrating nature-enhancing practices and interventions is essential to an effective circular economy transition.

5 **Accelerate the uptake of digital enablers to harness material, design, and construction innovation at scale.** Digital technology is a pivotal enabler, straddling all of the other focus areas, yet until now the construction sector has been a notable laggard compared to other industries.[171] The built environment sector can benefit from embracing big data approaches to enhance decision-making, improve efficiency, forecast trends, and innovate. By not fully adopting these and other advanced digital tools, the sector misses out on significant opportunities for optimisation, value capture, and competitive advantage. Until recently, the built environment sector lacked the resources to anticipate the implications of substantial changes to the status quo without facing significant financial or reputational risks. However, the latest advancements in data-driven design, AI, and other digital technologies have demonstrated their capacity to facilitate circular solutions. It is vital to accelerate the uptake of tools such as:
   - Digital urban planning software that can model cities comprehensively to enhance economic, nature, and social outcomes;[172]
   - Building Information Modelling (BIM) and the use of Digital Twins to enhance the life cycle management

of buildings, optimising resource use and enabling circular practices;[173]

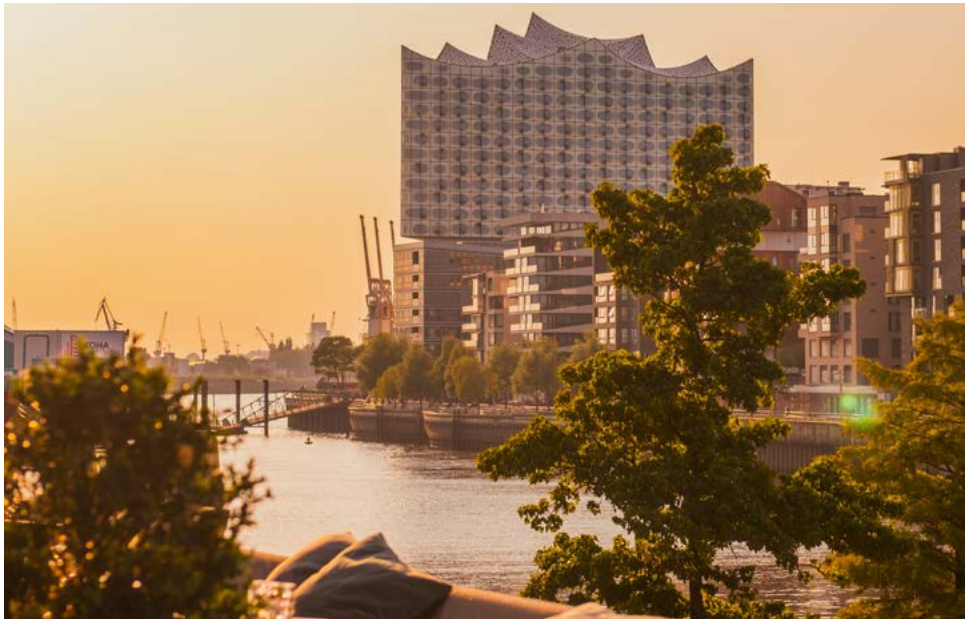
- AI to predict material reuse patterns, aiding in the efficient allocation and utilisation of resources in construction;
- Material and Digital Product Passports, providing detailed information on materials for effective recycling and reuse;
- additive manufacturing and 3D-printed materials to reduce waste and optimise construction processes.[174]



STRATEGY: REVITALISING BROWNFIELD LAND
COUNTRY: Germany

Public-private partnership unlocks nature-positive revitalisation: HafenCity

In Hamburg, the transformation of a former industrial port area stands as a pioneering model of circular and nature-positive urban development. Spanning 157 hectares, HafenCity, the new downtown area on the waterfront, has increased Hamburg's city area by 40% while avoiding green field expansion. The mixed-use, high-density development maximises the adaptive reuse of existing buildings and infrastructure. HafenCity is projected to accommodate 15,000 residents in approximately 8,000 homes, with about 25% being subsidised to promote social diversity. Additionally, the project comprises a university campus for 7,000 students and the creation of up to 45,000 jobs is anticipated.



The Elphi concert hall in HafenCity. Photo by Julia Solonina on Unsplash

As Europe's largest inner-city urban development project, HafenCiy is a test-bed for innovative, climate-friendly building solutions. A key feature of HafenCity is the commitment to public green spaces, with 25% of the area dedicated to squares, parks, and promenades, enhancing biodiversity, liveability, and reducing flood risks. Utilising the city's district heating system, the buildings are designed with high energy efficiency standards, and are all connected to a district heating system. The street layout prioritises smart mobility solutions mainly walking, cycling, and public transport, reducing the need for private car ownership.

At the heart of HafenCity's development strategy is an innovative public-private partnership model: HafenCity Hamburg GmbH. This model ensures high standards in urban design while facilitating swift and efficient project execution, avoiding the common pitfalls of public sector delays. Investment for the project was via EUR 10 billion of private funds and EUR 3 billion in public investment, the latter mostly financed through strategic land sales.

HafenCity exemplifies how visionary planning combined with robust cross-sector collaboration can transform dilapidated industrial areas into thriving, low-carbon communities integrated with nature. It provides a replicable model for inclusive, circular urban renewal.

ENABLER: EXPANDING NATURE
COUNTRY: USA

Leveraging digital enablers to harness nature-positive design: EcoMetrix Solutions Group

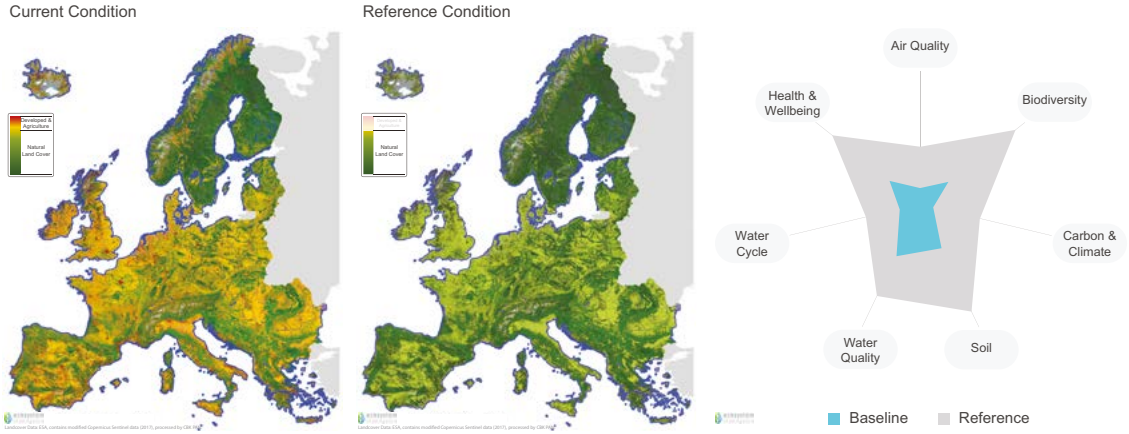
Defining 'nature-positive' is a challenge as its meaning is often based on the unique context and operating conditions of that place, therefore it is crucial to establish clear ways of measuring impacts to ensure that strategies are achieving their intended outcomes. Quantifying ecosystem performance, and contextualising that against an adjacent thriving reference habitat, provides a science based, data-driven and systems-based approach to establishing both baseline and target nature-positive performance goals. The complexity of natural systems, with intricate interactions between soil, water, carbon, biodiversity, and the atmosphere, can make holistic measurement difficult. While this complexity presents additional challenges, it also offers the potential for significant positive synergies, emphasising the need for a holistic approach to the evaluation of ecosystem performance, avoiding the pitfall of narrowly focusing on single metrics like carbon.

Leveraging digital technology and AI to analyse complex environmental datasets and interactions enables built environment stakeholders to measure nature-positive performance in a scientific and defensible way, leading to more informed design and investment decision-making. The Ecosystem Intelligence (EI) platform, developed by EcoMetrix Solutions Group, is an example of this. The platform integrates comprehensive measurement methods to help users understand and close the gap between their site's current ecological state and the desired high-performing condition of local reference habitats. By generating an 'Ecosystem Integrity' score, the EI platform quantifies the extent to which a built asset delivers ecosystem services and supports the regeneration of natural systems.

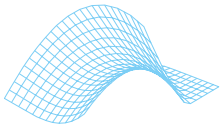
Applying this nature-based measurement approach, combined with the application of nature-inspired 'biomimetic' design principles can yield an array of nature and social nature-positive benefits. The consultancy, Biomimicry 3.8, supported the integration of biomimetic design, including using nature's performance as a benchmark, into the following projects:

- The US Coast Guard (USCG) headquarters in Washington DC retains over 1.6 million litres of rainwater through biomimetic designs that optimise the design of green roofs to improve stormwater management and water quality.
- Global carpet maker Interface renovated facilities with low-impact materials and used a biomimicry approach to harmonise and benefit local ecosystems, reducing water use by 78% and energy use by 50%.
- Microsoft's new Middenmeer data centre in the Netherlands incorporates biomimicry design guidelines into an enhanced landscape design that includes 150 native trees and 2,300 m^2 of greenery, boosting biodiversity while strengthening community ties.

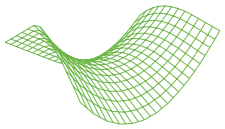
Such initiatives reinforce ecological health, provide economic benefits, and contribute to broader sustainability and regenerative goals. By leveraging biomimetic design and digital technology to rigorously measure and design for ecosystem integrity, the built environment can make defensible and quantifiable nature-positive impacts.



Ecometrix Solutions Group



It is imperative that the conditions for a just transition are put in place and prioritised



To maximise the social benefits of a circular built environment it is imperative that the conditions for a just transition are put in place and prioritised. The environmental crises of climate change, biodiversity loss, and pollution are inextricably linked with the social crises of inequality and poverty, which could lead to increased polarisation. An effective response to these interconnected challenges requires key stakeholders to address environmental, social, and economic issues together.[175] For example, strategically supporting affordability is key to ensure social fairness and continued vibrancy of places. Policymakers have the lead responsibility here through rental policies. Developers and investors can also play a role by better valuing the long-term benefit of mixed-price/mixed-income neighbourhood designs ensuring vibrancy and stable tenant demand.

To realise its ambitious climate and nature goals, the EU construction industry will require over a million additional upskilled or re-skilled workers.[176] To achieve this, a significant parallel programme of skills and knowledge development will be needed to upskill Europe's future workforce. This will entail significant investment in education and capacity-building programmes across all types of 'circular jobs', both the upskilling of the existing workforce (continuing professional development) as well as new entrants (schools and colleges). Circular building practitioners will need to be good system thinkers and collaborators with an integrated approach to planning. New skills and knowledge will include retrofitting and repurposing, circular building design, familiarity with new types of materials and component systems, as well as proficiency in digital tools such as BIM and building passports. To ensure a fair distribution of opportunities and a resilient workforce, employment creation will need to consider factors such as participatory and inclusive planning approaches, job quality support for local economies, as well as the creation of opportunities for marginalised groups.

Fair and equitable access to urban green spaces is a key consideration in the just transition. An example of inclusive green space planning policy is the '3-30-300' guideline for urban forestry adopted by cities such as Barcelona, Bristol, and Vancouver.[177] This stipulates that every home, school, or business should have a view of three trees, every neighbourhood at least 30% tree canopy, and every resident should be within 300 m of a park. The fair distribution of economic gains, in particular where investment comes from the public purse, is another important issue. This is particularly relevant in the case of property value increases in proximity to new green spaces, infrastructure, or brownfield sites. Historically, these windfalls are often skewed towards those who are already affluent. To ensure a more equitable distribution of benefits, mechanisms need to be in place for communities and neighbourhoods to engage in the planning process, allowing for a range of different income levels. A just transition strives for a fairer society, ensuring inclusivity and shared prosperity, so that no-one is left behind in the evolution to a nature-positive, circular economy.

Six key stakeholder groups can act now to advance a nature-positive, circular built environment

EU and national policymakers	City-level policymakers	Asset owners	Businesses and asset occupiers	Industry supply chain, designers, and contractors	Financial institutions and investors
Enablers and leaders		**Influencers and market builders**		**Practitioners**	**Catalysers**
1) Continue to encourage the broader application of well-designed economic instruments that will incentivise nature-positive construction projects in the long term. **Mobilise finance** 2) Ensure further interventions accelerate the transition by expanding the scope of targets within the existing policy framework beyond waste collection and recycling. **Leverage policy** 3) Invest public funds in research, development, and innovation for systemic solutions. **Accelerate digital** 4) Allocate funding to help cities and stakeholders develop innovative finance models to scale implementation. **Mobilise finance** 5) Leverage upcoming policy revisions to strengthen the circular economy in the built environment. **Leverage policy**	1) Ensure publicly funded construction projects set the standard for nature-positive outcomes. **Mobilise finance** 2) Embed nature-positive and circular criterion in city-owned land management. **Leverage policy** 3) Establish methods to streamline, fast-track, and simplify local planning processes for nature-positive initiatives. **Leverage policy** 4) Map urban ecosystems and tree canopies to help maximise nature in cities **Leverage policy** 5) Work with local industry to strengthen secondary material value chains. **Establish networks**	1) Complete a horizon scan of existing portfolios to seek sites with the greatest potential. **Mobilise finance** 2) Integrate circular principles into core business strategies. **Shift mindsets** 3) Play an active role in urban stewardship Leverage policy	1) Establish comprehensive company policies that champion circular leasing and construction practices. **Leverage policy** 2) Promote circular economy awareness. **Shift mindsets** 3) Optimise current building portfolios to reduce the need for new construction and advocate for more green spaces. **Shift mindsets**	1) Join or establish a coalition of practitioners within the built environment to overcome industry fragmentation and deliver collective circular economy services. **Establish networks** 2) Set new industry-wide standards and ambitious targets for circular procurement and purchasing. **Leverage policy** 3) Capture the quantitative benefits of circular economy practices and share them with other stakeholders. **Establish networks**	1) Embrace the general concepts of natural capital and biodiversity, and understand how they apply to the specific market conditions. **Shift mindsets** 2) Integrate circular economy strategies into investment decisions, adapting asset classes and funds to enable large-scale urban regeneration projects. **Mobilise finance** 3) Commit to investing in technological innovation and upskilling the current workforce to spur a critical mass of built environment value chain providers across the six strategies. **Accelerate digital**

Policymakers at every level can create the necessary frameworks, make the economics work, and stimulate innovation

Policymakers at every government level play a crucial role in facilitating the transition to a circular economy by creating the necessary legal framework, endorsing innovative projects, determining financial structures that steer and redistribute capital towards circular initiatives, fostering workforce development, and backing research and emerging technological innovation. On a local scale, city-level policymakers are instrumental in implementing these policies within their jurisdictions and leading by example through demonstrator projects on public lands.

EU and national policymakers

1 **Continue to encourage the broader application of well-designed economic instruments that will incentivise nature-positive construction projects in the long term.**
Existing economic policies are hardwired for and by the linear economy. Resetting the playing field so that nature-positive, circular economy decisions become the norm is crucial. Policymakers can create these conditions through aligning economic policy measures with nature-positive, circular economy principles. This can include the adaptation of existing policies and removal of barriers. For example, aligning taxation with nature-positive, circular economy outcomes, reforming subsidies, reviewing competition policy to foster collaboration, and adapting intellectual property rights and accounting rules. The European Semester process[178] provides an important political mechanism for better coordination of policies with an economic focus.[179]

2 **Ensure further interventions accelerate the transition by expanding the scope of targets within the existing policy framework beyond waste collection and recycling.**
To underpin new targets, robust and responsive monitoring frameworks, such as the EU Circular Economy Monitoring Framework, are required at every level. This would accelerate the implementation of a circular economy through measurable outcomes. In addition, the development and application of precise data and metrics are indispensable to facilitate the monitoring process and highlight connections between circular economy practices and critical environmental challenges, such as climate change and biodiversity loss. The principles of the Bellagio Declaration on monitoring the circular economy could provide an overall framework for the development of metrics and a monitoring framework.

3 **Invest public funds in research, development, and innovation for systemic solutions.**
Although a wide range of nature-positive and nature-based technologies already exist for the buildings sector, there remains a significant need for further innovation. Public funds such as Horizon Europe can support a wide range of research areas including materials, building techniques, material recovery of construction and demolition waste, data collection for whole-life carbon approaches, nature-based solutions, and demonstration pilots that showcase new materials and technologies. Public knowledge and innovation platforms such as the European Biodiversity Partnership, the BiodivClim Knowledge Hub, and NetworkNature can be used to target research, development, and innovation for specific challenges identified by either the public or private sectors. As the circular economy is a systems solution framework, it will also be important to encourage multi- and interdisciplinary research to deepen understanding and insights of systemic challenges in the buildings sector.

4 Allocate funding to help cities and stakeholders develop innovative finance models to scale implementation.
The innovative essence of nature-positive initiatives means they are often appraised and categorised as high-risk investments. Public funding, sourced from entities, like the European Investment Bank (EIB), and development agencies such as the Finnish Innovation Fund Sitra, can pave the way for establishing proof-of-concept for such innovations. This foundational step can then attract private investment or assist developers in expanding and enhancing promising pilot projects. A variety of financial strategies — such as grants, risk underwriting, match funding, and blended finance solutions that leverage growth capital to reduce investor risks — may be deployed to bridge financing gaps for projects that are challenging to fund. Additionally, development finance can offer vital technical assistance, including guidance on project structuring, risk mitigation, and strategies to crowd in further private capital, providing financial support to bring these projects to scale and maturity.

5 Leverage upcoming policy revisions to strengthen circular economy in the built environment.
Undergoing revisions to key EU policies — the Construction Products Regulation (CPR), Green Public Procurement (GPP) criteria, and Energy Performance of Buildings Directive (EPBD) — offer critical opportunities to further embed circular economy principles in the built environment policy framework. It would be crucial to involve all levels of government and industry in consultation processes to align updated regulations with diverse industry needs and governmental capacities.

City-level policymakers

1 **Ensure publicly funded construction projects set the standard for nature-positive outcomes.**
Green public procurement has been a longstanding priority of the EU Commission as a means to support the EGD. Revised Green Public Procuement (GPP) criteria for buildings expected to be adopted by the end of 2024 will be decisive in helping leverage the large purchasing power of local governments in Europe. Already recognising the role that public procurement can play in the circular economy transition, the City of Venlo included nature positive requirements in the tender for its new city hall, and many cities are currently utilising commercial certification schemes to embed nature-positive requirements into public procurement - with for example, the City of Copenhagen using the German Sustainable Building Council (DGNB) gold certification for all municipally owned developments and Eskilstuna requiring all municipal buildings to have Sweden Green Building Council 4.0 Silver certification.

2 **Embed nature-positive and circular criterion in city-owned land management.**
City governments can embed nature-positive and circular criteria to prescribe how city-owned land is used. This could include setting disassembly instructions, influencing circular design and material choices, and specifying a percentage of green space. One model that can achieve this is using leasehold agreements. Leasehold agreements can have nature-positive, circular requirements attached to them and the length could be dated based on the lifespan of any circular structures that are built, as is the case for shorter 'meanwhile use' strategies. The municipality of Schiedam in the Netherlands is already championing such nature-positive leaseholds.

3 **Establish methods to streamline, fast-track, and simplify local planning processes for nature-positive initiatives.**
Because of the innovative aspects of nature-positive developments — involving new materials, technologies, and building methods — it may take longer for city governments to assess planning applications. To overcome this, city governments can ring-fence planning staff's time and establish specific application processes for nature-positive developments. City governments can also innovate ways to prioritise nature-positive developments over business-as-usual developments. For example, by undertaking proactive market outreach to promote the preference for nature-positive construction or by establishing specific application processes for nature-positive developments which commit to activities such as material passporting or working towards acceptable third-party certifications such as DGNB or others endorsed by the World Green Building Council.

4 **Map urban ecosystems and tree canopies to help maximise nature in cities.**
City governments can initiate comprehensive mapping of urban ecosystem areas and tree canopies to support Member States in the requirements of newly adopted Nature Restoration Law. This would provide crucial data for monitoring and enhancing urban green spaces and tree cover. Regular mapping would enable cities to assess current coverage, identify areas below thresholds, track progress, and pinpoint opportunities for green space integration. This data-driven approach would enable cities to contribute effectively to national environmental goals and support evidence-based policymaking.

5 **Work with local industry to strengthen secondary material value chains.**
Cities can foster partnerships with local industries to develop secondary material value chains and supporting infrastructure. Local material banks and recycling facilities would support the processing and storage of reclaimed building materials. Creating digital platforms and enable product passports to track and trade secondary materials to enhance the use of recycled and reclaimed materials in new construction and renovation projects. Cities could also focus on developing skills training programs for the local workforce in circular construction practices and material recovery.

Businesses and asset owners can integrate circular principles into their strategies and drive demand for circular solutions

As key urban stakeholders, businesses, asset owners, and asset occupiers inherently influence urban dynamics. They play a crucial role in shaping the built environment, turning innovative policy and investment opportunities into real-world projects that not only benefit themselves but also the wider community and public spaces. Building owners and developers are already making notable progress in leveraging circular building design to achieve climate targets, with an increasing focus on embodied emissions, as high uptake of renewables and energy efficiency has significantly reduced operational emissions. Through public-private partnerships and leveraging technological advancements, developers can deliver projects with lower risk[180] and higher quality, while profiting from more climate-resilient assets and market-adaptable assets.

Asset owners

1 **Complete a horizon scan of existing portfolios to seek sites with the greatest potential.**
Asset owners can conduct a thorough review and analysis of current property and land holdings to identify opportunities for applying circular economy principles. Evaluating the potential for retrofitting existing buildings, repurposing unused spaces, or redeveloping sites to enhance their nature-positive impacts can also play an important role. The aim is to pinpoint properties that offer the greatest potential for transformation and innovation, leading to impactful circular economy projects.

2 **Integrate circular principles into core business strategies.**
Embedding circular economy principles into decision-making processes, to ensure operations and investment contribute to a nature-positive, circular future will be key. For the planning of new buildings and facilities, this could mean setting minimum standards for longevity, adaptability, and resource efficiency; adopting clear and measurable targets for whole-life carbon assessments and setting threshold levels in line with SBTi guidance. Building developers could also incentivise delivery partners to adopt innovative manufacturing processes that enable circular approaches, including prefabricated or modular systems, as well as digital enabling technology, such as material and product passports.

3 **Play an active role in urban stewardship.**
Asset owners play a key role in shaping the urban environment. By collaborating with local municipality stakeholders and investors, they can create mutually beneficial opportunities for urban greening projects. Engaging with community members to understand their needs and aspirations ensures that the projects enhance local liveability and biodiversity.
Asset owners can also advocate for policies and practices that support nature-positive urban development. By doing so, asset owners can become pioneers in the realm of responsible urban stewardship.

Businesses and asset occupiers

1 **Establish comprehensive company policies that champion circular leasing and construction practices.** Businesses can drive change by implementing internal policies that require new office leases to meet specific circular economy criteria. This could include prioritising buildings located in brownfield redevelopment over undeveloped, greenfield sites. Businesses can go further by extending these policies to include minimum standards for material efficiency and the use of low-impact materials in the construction of future leased buildings. Businesses and asset occupiers can play a role in advocating for construction practices that apply circular principles, such as flexible design, predictive maintenance, and the adoption of PaaS business models for systems such as air conditioning and lighting. They can also incentivise the adoption of material and product passports to enhance the traceability and recyclability of resources.

2 **Promote circular economy awareness.** Businesses can advocate for the circular economy within the industry and among other businesses and occupiers. Implementing circular principles to urban spaces will result in more attractive, more comfortable, safer, and healthier spaces to work in, due to improved air quality, cooler temperatures, and increased footfall traffic. Reduced staff sick days and increased motivation for face-to-face working environments are potential benefits of implementing circular economy principles to urban environments and can enhance inner-city vibrancy, allowing it to bounce back to pre-pandemic levels. Create compelling narratives that highlight the benefits of operating in nature-positive, circular spaces — such as increased employee wellbeing, enhanced productivity, and more appealing work environments. Sharing detailed success stories can be a powerful tool to persuade decision makers to integrate nature into buildings and commercial areas.

3 **Optimise current building portfolios to reduce the need for new construction and advocate for more green spaces.** Tenants or occupiers can lobby landlords, asset owners, and developers to increase greening projects in and around the buildings they occupy. This could involve advocating for green roofs, vertical gardens, or the integration of public green spaces that benefit both the environment and the community. Promoting these initiatives helps create a demand for more green infrastructure in urban developments. Aggregating underutilised spaces within current portfolios reduces the demand for new construction. Shared and flexible office spaces, subletting for off-peak periods, and multi-tenant agreements can nall be applied to suit varying demands.

The industry supply chain, designers, and contractors can collaborate around a common vision and leverage digital solutions

Designers, engineers, and material suppliers, through to construction firms and their workers, and digital solution providers, can be circular economy practitioners and build a strong evidence base by creating tangible, scalable outcomes that capitalise on new economic and upskilling opportunities. The collective efforts of these players are integral to building a solid evidence base of tangible outcomes that demonstrate the value of circular economy projects to endorse policy reforms and attract more investment. Furthermore, they play an important role in bolstering proof of concepts for emerging material and digital innovation, through testing on pilot projects.

The supply chain yields positive impacts in return that extend beyond project completion, with significant economic opportunities emerging from advancements in prefabricated construction, landscaping, and environmental site remediation. The majority of this could benefit local enterprises as brownfield redevelopment, commercial retrofit, and integrating nature into cities will require local landscaping services and brownfield redevelopment construction. By adopting innovative approaches, the supply chain can foster multi-functional, low-impact, and community-integrated urban development.

Industry supply chain, designers, and contractors

1 **Join or establish a coalition of practitioners within the built environment to overcome industry fragmentation and deliver collective circular economy services.** All members of the built environment supply chain have a role to play in building a strong evidence base, and the benefits can be exemplified via synergistic relationships. Urban planners can embed nature-based solutions by taking active roles in early-stage design feasibility workshops. Façade contractors can contribute to keeping assets in perpetuity and engaging the local workforce by facilitating on-site refurbishment. Digital providers and demolition contractors can contribute to the sharing economy by leveraging the growing secondary material market. As an example, the Circular Building Coalition brings together stakeholders from across the built environment to collaboratively overcome barriers and drive the adoption of innovative circular economy practices, such as PaaS, insurance for reused materials, and building passports.[183]

2 **Set new industry-wide standards and ambitious targets for circular procurement, production, and purchasing.** Procurement can extend beyond the point of purchase to the transactions that occur throughout and beyond the entire building life cycle.[184] As members of the industry supply chain, designers and contractors can leverage purchasing power and service offerings to steer investors, building owners, and occupiers towards circular decision-making. Designers can set minimum requirements for ambitious environmental and circular economy credentials as part of design briefs, and advocate for clients to do the same. Construction product manufacturers can reformulate product portfolios, production processes and sales channels to adopt circular economy principles, including the elimination of toxic substances, the increased use of bio-based materials and business models that extend the life of products. Suppliers can integrate the principles of the emerging Ecodesign for Sustainable Products Regulation to strategically position themselves as favourable material and product providers for circular projects. Contractors can establish circular economy business models as part of their service offerings, such as performance-based and design-build-operate-maintain (DBOM) contracts.[185]

3 **Capture the quantitative benefits of circular economy practices and share them with other stakeholders.** Designers and suppliers can utilise existing digital tools, frameworks, and precedents to implement circular strategies into projects. They can then share these insights with policymakers, investors, and fellow built environment supply chain players to promote further adoption of circular economy practices. Frameworks such as the Circular Buildings Toolkit give designers, contractors, and the industry supply chain the strategies, case studies, and tools they need to adopt circular economy principles in buildings across their entire life cycle.

Financial institutions and investors can mobilise capital flows towards nature-positive, circular solutions

By strategically investing in public-private partnerships and stimulating a critical mass of demand for the built environment value chain, financial institutions and investors have the power to unlock impactful circular economy projects at scale, including large-scale urban regeneration projects. Their role extends beyond mere funding; they are also instrumental in pioneering and validating new value-capture models and providing technical assistance to support assessment criteria to highlight the economic viability and environmental benefits of circular practices.

A commitment to circular economy principles is increasingly crucial for financial institutions and investors as the interconnectedness between the financial sector and the built environment intensifies, with environmental risks and opportunities becoming more pronounced. Financing and Investment trends, influenced by frameworks such as TNFD, CSRD, and SFDR,[181] are pushing investors towards a deeper understanding of circular economy benefits and risks. By aligning financing, support, and investments with circular economy principles, financial institutions and investors not only contribute to circular economy development but also position themselves to capitalise on emerging opportunities, setting new benchmarks in value creation that go beyond traditional financial returns to encompass environmental and societal gains.

Financial institutions and investors

1 **Embrace the general concepts of natural capital and biodiversity, and understand how they apply to the specific market conditions.**
Financial institutions and investors can pilot innovative financial mechanisms, such as blended finance models, to capture value and mitigate risks in proposals for nature-positive, circular solutions. Additionally, they can refine these mechanisms with real-world data, implement thorough risk assessment strategies, and collaborate with a range of stakeholders — including policymakers, financial analysts, and experts — to gain wider perspectives. Success in pilot projects can lead to scaling and replicating successful mechanisms. This approach encourages investment by mitigating risks and enhancing the viability of projects focusing on environmental resilience and the circular economy.

2 **Integrate circular economy strategies into investment decisions, adapting asset classes and funds to enable large-scale urban regeneration projects.**
Financial institutions and investors can integrate natural capital considerations into decision-making processes by developing, using, and disclosing metrics and accounting practices that reflect the economic value of natural assets and their future benefits in urban projects.[182] This integration helps in identifying and managing risks associated with the depletion and degradation of these resources and in harnessing opportunities for investments that contribute to their regenerative use and conservation.

3 **Commit to investing in technological innovation and upskilling the current workforce to spur a critical mass of built environment value chain providers across the six strategies.**
Financial institutions and investors can drive regenerative innovation by channelling funds into start-ups and companies that are developing construction technologies which deliver nature-positive outcomes, and by supporting research and training in advanced areas like AI and IoT for optimising building designs. Encouraging a critical mass of providers through collaboration, incentives for regenerative practices, and impact investing can also play a key role. Such strategic investments not only foster the revitalisation of land and assets, maximise the integration of nature, and optimise design and material sourcing, but also align financial returns with long-term environmental resilience.

Glossary

Glossary

Agroecology - A holistic and integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of sustainable agriculture and food systems.[1]

Agroforestry - The deliberate integration of trees and shrubs into farming systems. This can be any combination of trees and shrubs that support a function, from providing shade and shelter and capturing carbon to delivering products like fruit or timber.[2]

Biodiversity - The variety of life, such as animals, plants, fungi, and microorganisms like bacteria, in different areas that make up our natural world. Each of these species and organisms work together in a web of ecosystems to maintain balance and support life. Biodiversity supports everything in nature that we need to survive: food, clean water, medicine, and shelter.[3]

Biomaterials - A material derived from, or produced by, biological organisms like plants, animals, bacteria, fungi, and other life forms.

Biomimicry - The practice of emulating nature's strategies and processes in human design, is one of the schools of thought that originally inspired the development of the concept of a circular economy, an economy that ideally would function as a natural system.[4]

Blue infrastructure - A water-based natural area or natural feature, or a system or feature designed to protect, mimic, or enhance a natural function, that absorbs and filters pollutants; attenuates shoreline erosion; protects communities from flooding or storm surge; reduces erosion; or sequesters carbon.[5]

Brownfield Site - Land within the urban area on which development has previously taken place.[6]

Built Environment - Human-made structures, features, and facilities viewed collectively as an environment in which people live and work. This includes all forms of buildings, civil engineering infrastructure both above and below ground, and managed landscapes in between and around buildings.[8]

Carbon Sequestration - A natural or artificial process that removes carbon from the atmosphere storing in soils, living matter, or engineered structures. Carbon sequestration plays a crucial role in stabilising the Earth's climate system.

Critical Raw Materials - Under the act Critical Raw Materials Act (CRMA), the European Union has identified a list of 34 critical raw materials, which are important for the EU economy and face a risk of disruption, of which 17 are designated "strategic" because of their importance and global demand/supply imbalances. The strategic materials include base metals aluminium, copper, and nickel, along with key battery material lithium and rare earth elements used in permanent magnets for wind turbines or in electric vehicles.[9]

Decarbonisation - Reducing the carbon emissions produced by a manufacturing process, an industrial sector, or even a larger economic system.

Digital Product Passport (DPP) - A structured collection of product-related data across a product's lifecycle, sharing information for every product placed on the EU market across the entire value chain.[10]

Ecosystem - A dynamic, complex system of living (biotic) organisms, including plant, animal, and micro-organism communities; and their non-living (abiotic) environment comprising elements such as water, soil, sunlight, and nutrients. These biotic and abiotic components are intricately linked and function together as a cohesive unit.[11] Ecosystems can vary greatly in size and complexity, ranging from small, localised communities to vast, global-scale systems.

Ecosystem Services - When trees regulate climate, wetland reeds filter water, or bees pollinate, they are investing in the health of the ecosystem through mutual value creation. These direct and indirect contributions of ecosystems (and their biodiversity) to human wellbeing — such as climate regulation, clean water, pollination, and more — are called ecosystem services. They are an excellent proxy for the health of ecosystem functioning, supporting the quantitative assessment of nature-positive impact.[12]

Extended Producer Responsibility (EPR) - A mandatory, fee-based policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle, shifting the responsibility of waste management upstream to the producer and away from municipalities. Under EPR legislation, businesses that place products on the market become responsible for managing their products when these are discarded by consumers.[13]

Green Cover - Natural or planted vegetation covering a certain area of terrain, functioning as protection against soil erosion, protecting the fauna, and balancing the temperature.[14]

Greenfield Site - Land on which no urban development has previously taken place; usually on the periphery of an existing built-up area.[15]

Green Infrastructure - This term relates to a network of green spaces and other natural features that can provide a wide range of environmental, economic, health, and wellbeing benefits for nature, the climate, and local and wider communities. Green infrastructure comprises different kinds of components (for example, parks, green roofs, urban forests, and road verges) which can be classified according to several parameters (e.g. spatial scale, dimension, location).[16]

Green Roofs - A vegetative layer grown on a rooftop providing shade, remove heat from the air, and reduce temperatures of the roof surface and surrounding air. Using green roofs in cities or other built environments with limited vegetation can moderate the heat island effect, particularly during the day.[17]

Green Spaces - A plot of vegetated land separating or surrounding areas of intensive residential or industrial use and devoted to recreation or park uses.[18]

Just Transition - A set of principles, processes and practices that encompass a range of social interventions needed to secure workers' rights and livelihoods when economies are shifting to sustainable production, primarily combating climate change and protecting biodiversity. While definitions vary across thematic and geographic contexts, a just transition ensures the whole of society — all communities, all workers, all social groups — and places, sectors, countries or regions are brought along in the pivot to a net zero, and a nature-positive future.[19]

Land Footprint - An indicator used to assist the analysis of global land use — the human use of a specific area for a certain purpose (such as residential, agriculture, recreation, industrial, etc.)[21] — related to consumption of a country or region and to monitor land use.[22]

Material-Efficiency - Activities designed to reduce the use of material resources during production and consumption, as well as measures to improve the reusability, recyclability, and durability of products, components, and materials.[23]

Material Footprint - A consumption-based indicator of the total amount of raw materials extracted to meet final consumption demands.[24]

Modular Building System - A process in which a building's components are constructed off-site under controlled factory conditions, using the same materials and designing to the same codes and standards as conventionally built facilities.[25] In a modular system, the individual components are produced as standardised 'modules' allowing for flexibility in the configuration of the building as well as facilitating the reuse of modules in future buildings. Modular buildings systems are a type of pre-fabrication, but are differentiated by the standardised, repeating modules.[26]

Natural Capital - Refers to the elements of the natural environment that provide valuable goods and services to society. It applies an economic lens to the world's stocks of natural assets — like forests, rivers, and soil — and how society and businesses rely on them to function.[27]

Nature-Based Solutions - These involve working with nature, as part of nature, to address societal challenges, supporting human wellbeing and biodiversity locally. They include the protection, restoration, or management of natural and semi-natural ecosystems; the management of aquatic systems and working lands; and integration of nature in and around our cities.[28]

Nature-Positive - Human activities that contribute to the restoration and regeneration of natural habitats and ecosystems, as well as local communities.[29]

Prefabrication - An approach to construction where structural components are manufactured offsite under factory conditions. These components are then delivered to site and are assembled to form the final building or facility.[30]

Product-as-a-Service (PaaS) - A subscription-based business model offering products as a service instead of product ownership as a way to support efficient resource use. Through renting or leasing, groups of consumers can achieve a product's desired result without owning the equipment or product itself.[31]

Regenerative Agriculture - A broad set of food production methods with two clear and complementary outcomes: the production of high quality food and the improvement of the surrounding natural ecosystem. It borrows from an older pre-industrial form of cultivation, updated and improved based on a better scientific understanding of soil, water, and the relationships that exist in natural ecosystems. Its overall ambition is a radical shift from extractive, linear thinking that prioritises high yields above all else, to establishing cycles of regeneration.[32]

Regenerative Production - An approach to managing agroecosystems that provides food and materials in ways that create positive outcomes for nature. These outcomes include, but are not limited to, healthy and stable soils, improved local biodiversity, improved water and air quality, and higher levels of carbon sequestration. They can be achieved through a variety of context-dependent practices — such as regenerative agriculture, restorative aquaculture, agroecology, agroforestry, and conservation agriculture — and can together help regenerate degraded ecosystems and build resilience on farms and in surrounding landscapes.

Site Remediation - The process of removing polluted or contaminated soil, sediment, surface water, or groundwater, to reduce the impact on people or the environment.[33]

Triple Planetary Crisis - The United Nations system refers to three interlinked global environmental crises: climate change, biodiversity loss, and pollution. Acting on this triple crisis lies at the core of the strategy of the United Nations Environmental Programme (UNEP). Unsustainable patterns of consumption and production are identified as the common thread of this triple crisis.[34]

Urban Ecology - The study of biodiversity (trees, rivers, wildlife, and open spaces) in cities and urban areas to understand the extent of those resources and the way they are affected by urbanisation and environmental risks.[35]

Urban Greening - Urban greening is the incorporation of green spaces and elements into urban environments and infrastructure, such as streets, cities, roofs, and walls. Following the principles of biophilic design, urban greening techniques make up a part of green infrastructure.[36]

Urban Heat Island Effect - A phenomenon where urban areas experience higher temperatures than outlying areas due to a combination of diminishing green cover, heat gain and thermal properties of the materials commonly used in urban surfaces, as well as waste heat from human activities (such as industrial processes, transport, and air conditioning).[37]

Urban Landscape - An outdoor environment that is dominated and influenced by both man-made and natural elements found in an urban area such as buildings, roadways, parks, and other elements that are present in a city or town. The type of urban landscape depends on the city or town that it is located in and the amount of space that is available. For example, some urban landscapes may include modern architecture and high rise buildings, while others may focus on green spaces and parks.[38]

Urban Regeneration - Private or public investment in areas with unemployment, poor quality services, housing, and decaying streets and public spaces to bring back underutilised assets and redistribute opportunities, increasing urban prosperity and quality of life.[39]

Urban Sprawl - The decentralisation of the urban core through the unlimited outward extension of dispersed development beyond the urban fringe, where low density residential and commercial development worsens fragmentation of powers over land use.[40]

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Endnotes

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Appendices

1 Analytical approach and rationale for selecting the circular built environment strategies with nature-positive impact potential

2 Overview of analysis: Three Ambitions, Six Circular Strategies

3 Long-list of identified circular built environment strategies

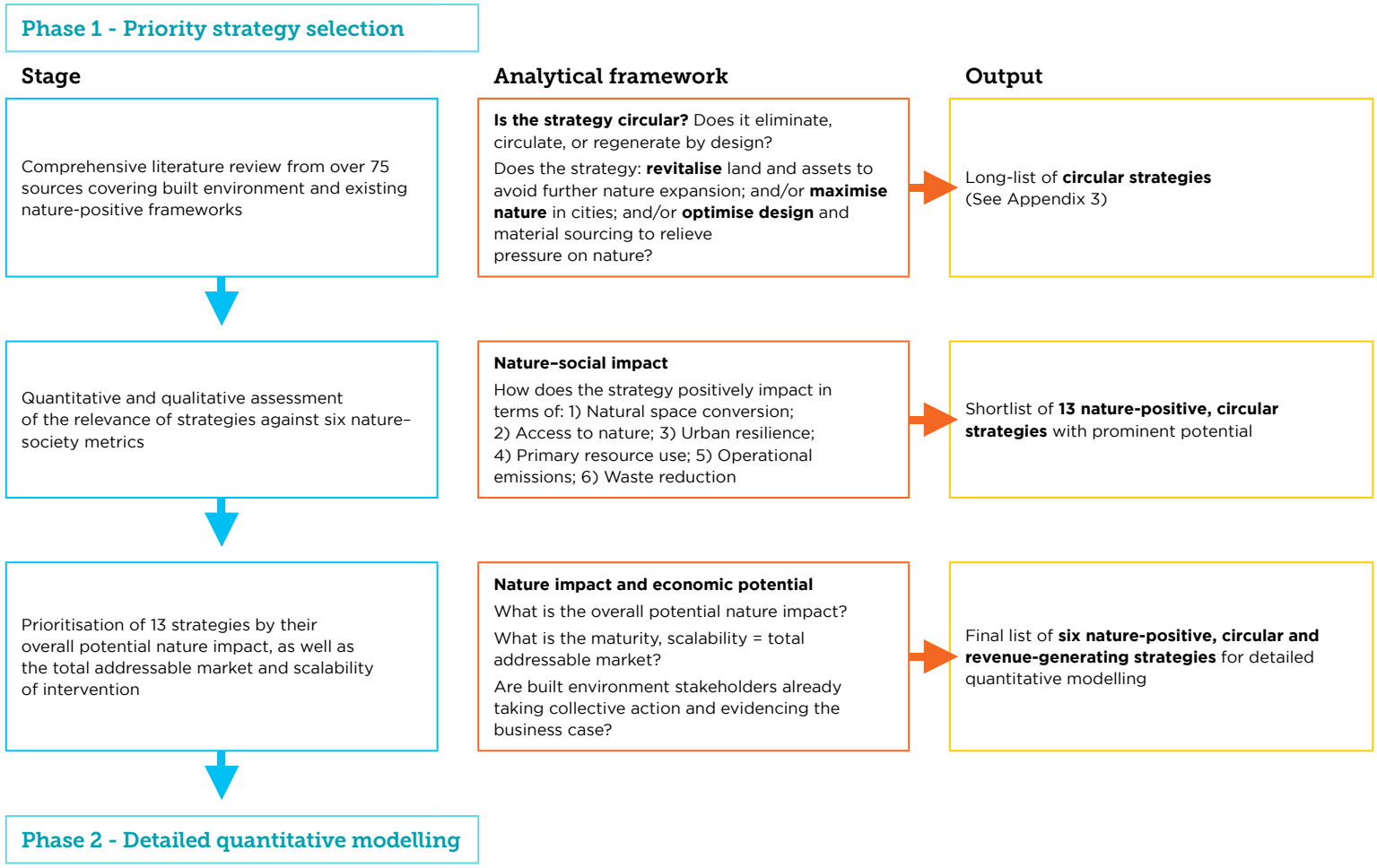
4 Key assumptions for the analysis

5 Supplementary information in support of analysis on wider benefits

1: Analytical approach and rationale for selecting the circular built environment strategies with nature-positive impact potential

A comprehensive literature review was conducted (over 75 sources reviewed and tracked) and over 70 practitioners and experts from 47 organisations were interviewed (see Acknowledgements) to inform and consolidate the analysis with insights and data. An analytical framework was created to map the 40+ identified circular built environment strategies with the potential to drive nature-positive impact. This framework was analysed in relation to scientific principles related to pre-determined impact categories, as well as the Foundation's circular economy principles (eliminate, circulate, regenerate) and concepts and frameworks from the wider circular built environment ecosystem. Assessing the relevance of 40+ strategies against six metrics of impact revealed 15 with outsized potential (see Appendix items 2 and 3). The top two strategies in each ambition dimension (i.e. Revitalise / Maximise / Optimise) were prioritised by their economic maturity and identified addressable market potential, as well as by their nature-positive potential impact when scaled across the EU. This prioritisation enabled a meaningful deepdive into the top two strategies for each of the three ambition dimensions, resulting in the six circular built environment strategies. As has already been mentioned within the report's main narrative, while each strategy could be implemented on its own, they will be most effective as part of an integrated system, within which each strategy reinforces each other's impact and benefits.

2: Overview of analysis: Three Ambitions, Six Circular Strategies



Nature ambition	Selection of 16 strategies	Priority list of six strategies	
 Revitalise land and assets to alleviate further pressure on nature	**1** Revitalise vacant residential dwellings **2** Convert vacant commercial to multi-family homes **3** Upward extensions – add storeys to existing buildings **4** Design for compactness, mixed-use, and multi-unit **5** Brownfield site redevelopment **6** Expand walking, cycling, and public transport infrastructure[a]	Brownfield site redevelopment repurposing abandoned or underused land into mixed-use, nature–rich efficient urban communities	Convert vacant commercial buildings to multi-family homes focusing on older/lower class properties
 Maximise nature in cities to create resilient and vibrant urban landscapes	**1** Green roofs **2** Increase tree canopy cover **3** Expand blue and green urban spaces **4** Allotments and community gardens **5** Permeable surfaces	Increase tree canopy cover focus on underused streets, and regions more exposed to climate impacts	Expand green-blue urban spaces – focus interventions on nature-based solutions that enhance ecosystem services
 Optimise building design and material sourcing to capture economic value, reduce waste, and achieve climate targets	**1** Material-efficient design **2** Low-impact material substitution **3** Energy renovations[b] **4** Digital building passports **5** Modular and adaptable buildings	Material-efficient design – design optimisation and the adoption of prefabricated construction methods	Low-impact material substitution – increase use of green steel, green cement, and engineered timber

a) Active and public transport is a key strategy for walkable, 15-minute, resilient, healthy cities. However, it is not top ranked as we focus our interventions on the immediate built environment.

b) Energy renovations is a crucial lever, however it was not selected for this study as it is already a highly mature topic, featuring in several other comprehensive studies and with real estate developers already taking collective action, evidencing the business case, and actioning unlocks to improve operational emissions.

3: Long-list of identified circular built environment strategies

System level	**Buildings**		**Systems**				
Scope	Retrofit/ repurpose buildings	Design better buildings	Improve urban systems	REVITALISE	MAXIMISE	OPTIMISE	Prioritised
Modular retrofit of underused (single-family) homes for higher/adaptable occupation	●	○	○	●	○	○	○
Repurpose underutilised dwellings (e.g. create highly attractive+affordable mixed-generational homes/neighbourhoods – motivating occupants of under-used homes to liberate them for families)	●	●	○	●	○	○	○
Revitalise or repurpose empty dwellings and commercial buildings (residential/non-residential) – usually with deep retrofit (mixed-use)	●	●	●	●	○	○	●
Build rooftop extensions on existing buildings	●	●	○	●	○	○	●
Build compact (mixed-use) multi-unit buildings (ideally around public transport connections, where greenfield building unavoidable) – smart designs, e.g. modular	●	●	●	●	○	○	●
Build on brownfield land with integrated regeneration using efficient designs (where housing need)	●	○	●	●	○	○	●
Build on infill sites, multi-unit	○	○	●	●	○	○	○
Build/upgrade active and public transport infrastructure	●	○	●	●	○	○	●
Over-compensate for any anavoidable new building with out-sized regional renaturing	○	○	●	●	○	○	○
Factories as forests, regenerative facilities	●	○	○	○	●	○	○
Enable mini-habitats: bee-friendly balcony flowers, bee homes, etc	●	●	○	○	●	○	○
Install (accessible) green roofs	●	○	○	○	●	○	●
Install green walls	○	●	○	○	●	○	○
Biomimicry solutions for e.g. heating/cooling	○	●	○	○	●	○	○
Renature/upgrade biodiversity of existing green spaces, e.g. lawns, parks	○	○	●	○	●	○	○
Create mini parks with trees and permeable pavements on underused urban space (e.g. parking space) and tree-lined streets	○	○	●	○	●	○	○
Build strategic wildlife corridors	○	○	●	○	●	○	○
Public/active transport connections to 'real' nature outside of city	○	○	●	○	●	○	○
Blue and green nature-based solutions e.g. riparian restoration (like in London – tributaries of the Thames), urban parks, and forests	○	○	●	○	●	○	●
Allotment and community gardens	○	○	●	○	●	○	●
Permeate sealed surfaces (e.g. removing tiles, permeable asphalt)	○	○	○	○	●	○	●
Repair/renovate for longer lifetime of buildings/products	●	○	○	○	○	●	○
Energy renovations, incl. insulation, heat pumps	●	○	○	○	○	●	●
Material-efficient, modular buildings (pre-fabricated) – incl. design of smaller-grid layouts to optimise structural material need	●	●	○	○	○	●	●
Use more (sustainably sourced) timber and bio-based materials (structural with pre-fabricated modules)	●	●	○	○	○	●	○
Use lower carbon concrete and steel (green cement/steel)	●	●	○	○	○	●	○
Low-carbon heating and cooling	●	●	○	○	○	●	○
Refuse furnishing/finishes where possible	○	●	○	○	○	●	○
Adopt passive design principles and adaptive comfort models (also in re-design)	○	●	○	○	○	●	○
Adopt less invasive design principles (e.g. raised foundations, vernacular principles)	○	●	○	○	○	●	○
Deconstruct and re-use blocks and modules	○	●	○	○	○	●	●
Use recycled materials	○	○	●	○	○	●	○
Rainwater harvesting	○	○	●	○	○	●	○
On-site/neighbourhood waste water recycling (e.g. nutrient recycling)	○	○	●	○	○	●	○
Building/neighbourhood organic waste/compost facilities	○	○	●	○	○	●	○
On-site waste sorting optimisation facilities	○	○	●	○	○	●	○
Energy-positive wastewater treatment plants	○	○	●	○	○	●	○
Build reneweable energy infrastructure	○	○	●	○	○	●	○
Digital building passports to facilitate buildings as material banks	○	○	●	○	○	●	●
New digital solutions for smart cities	●	●	●	○	○	●	○

4: Key assumptions for the analysis

The key assumptions employed for the analysis reflect ambitious yet achievable goals which are based on existing practices in Europe, existing commitments, and peer-reviewed findings.

Revitalise

For our analysis, we have assumed 4% of Europe's brownfield sites and the 8% of office buildings currently unoccupied could be revitalised into nature-rich, mixed-use communities.

Redeveloping 4% of Europe's available brownfield results in c.80% of new builds on brownfield land

- In cities with higher competition and prices for vacant land, high brownfield redevelopment rates of c.90% (e.g. London) are already a reality, whereas nation-wide averages are significantly lower (e.g. UK c.50%). The UK is taken as an illustrative example case as data on brownfield development remains limited on the EU, country, or city-level
- Already, brownfield developers, such as Ginkgo, successfully revitalise urban areas with residential and commercial spaces on former derelict areas requiring severe remediation

Revenue pool calculations: pragmatic yet nuanced assumptions were employed by the project's analytical team:

- Revenues for construction companies, material suppliers, and other built environment supply chain players are not considered separately, as they are already covered by the strategies within the Optimise ambition
- Revenue for remediation suppliers calculated using both official government estimates and review of case studies
- Three million brownfield sites available in Europe

  - Converting 4% of these sites over ten years would meet 78% of EU residential and non-residential, including wholesale and retail (28%), offices (23%), educational (17%), hotels (11%), hospitals (7%), sport facilities (4%), and other (11%) building demand
- Scope: building for residential and commercial use, not utility buildings (e.g. logistics centres). Housing demand and the importance of mixed-use, walkable neighbourhoods led us to choose residential and commercial development
- Industrial development is an important lever (23.3% of land take, EEA) but driven by different drivers and space considerations including outside urban centres
- Brownfield remediation costs assumed to be EUR 600,000 per ha, within range of UK government estimates
- Conversion of brownfield area to number multi-family homes (MFH) units assumed to be in line with existing literature from the EU and USA, and case studies from industry
- Brownfield development allows for substituting demand that would otherwise be met with new single-family homes (SFH) on greenfield land, leading to further land sealing. For example, it was found that for every hectare of brownfield development, up to 4x of greenfield conversion could be avoided (Source: interview with industry expert)
- 50% of new development is MFH that has enough scale for management fees, which would not exist without brownfield

- Management fees assumed to be 20% of rental, which is 5% of property values per year
- Digital solutions: 3% of entire value chain revenue pool

Baseline assumptions - Brownfield redevelopment

- We presumed that ~50% of housing is still built on greenfield on outskirts of cities and in rural areas (similar to the share of EU residents living in single-family housing). Between 2000 and 2018, the EEA reported land take of 4000 km^2 from suburban housing expansion in Europe, in comparison urban housing only contributed to 50 km^2 of new land take
- There is significant potential to scale up brownfield development across Europe and reach levels of cities which are leading with high shares due to their limited and high-value urban land
- This would likely require (re)vitalisation efforts in smaller and medium-sized cities to shift some of the future housing demand currently predicted to concentrate on large cities. Most importantly, it would require a more metropolitan urban planning approach in smaller and medium-sized cities that are already growing and sprawling

Repurposing all 8% of Europe's vacant commercial buildings stock results in c.10% of avoided new builds

- Across the EU, and also in cities with high demand for space (e.g. Paris), office vacancy rates stand at c.8% with ongoing trends of remote work and online retail and increasing vacancy rates
- Cases from London, Paris, and Warsaw show that office conversion to residential space is already done successfully

Revenue pool calculations: pragmatic yet nuanced assumptions were employed by the project's analytical team:

- 8% of Europe's commercial buildings will face vacancy high enough to justify conversion (Source: Savills)
- This will satisfy 12% of EU residential and non-residential, incl. wholesale and retail (28%), offices (23%), educational (17%), hotels (11%), hospitals (7%), sport facilities (4%), and other (11%) building demand
- Conversion will be focused on older/lower class commercial buildings
- Conversion costs of ~EUR 1,485 per m^2 based on US study (Source: Moody's Analytics)
- There are 6 billion m^2 of commercial real estate in Europe, about half of which is for retail and offices
- Assumes an average office building to have 25,000 m^2 of floor space for conversion
- Assumes rental income of 5% of property value, with 20% management fees
- Digital solutions: 3% of entire value chain revenue pool

Baseline assumptions - Office revitalisation

- Office revitalisation is a reality in high-pressure cities, e.g. in London, 21,000 new homes were created by converting vacant offices in 2015/2016
- With increasing office vacancy rates across Europe (from 7.7% to 8.3% in one year), leveraging the full potential of office and commercial space vacancies could satisfy 12% of EU's new building demand for residential and commercial (offices, retail, education, etc.) in the next ten years

Maximise

For our analysis we have targeted a threshold of 45% green cover for all EU cities, recommending that 80% of this be achieved through strategic tree-planting and 20% through the expansion of urban blue-green parks.

Target green cover of 45%

- Literature review identified 45% as a tipping point for a functioning, resilient, and liveable urban nature ecosystem, while also lying between the EU average of all cities (42%) and the top 20 cities (50%) which includes a geographical spread representative of Europe; this comes with assumption that the green-blue interventions are optimally chosen and distributed for local conditions
- 66% of cities are below the target green cover: additional green area was derived by accumulating the current delta
- Cities like Ljubljana (SLO) demonstrate that significant increase of green cover is achievable

Key Assumptions:

- All cities can and should increase green cover to the recommended minimum of 45% of city area
  - Source: Land Use Policy and Systemiq analysis/interviews
  - The paper found "45% is the minimum proportion of green-blue space to sealed space required for good environmental performance in the neighbourhood". A 45% threshold was chosen because above this, surveyed neighbourhoods: 1) Solve the problem of stormwater retention (Flood resilience); Avoided water deficiency from evapotranspiration intensity (Drought resilience); Crossed the threshold to move from poor to adequate human thermal conditions (Heat island/liveability)
- A well distributed 45% proportion of green-blue cover would be the tipping point to ensure all cities provide a functioning, resilient, and liveable urban nature ecosystem, while making significant contribution to the EU's carbon reduction targets (assuming the optimum nature-based solutions are selected for each local environment)
- These conclusions can be considered a realistic yet ambitious target for Europe given:
  - Average green cover of top 20 European cities (inc. Southern cities): 51.5%
  - Average green cover of other European cities: 42%
  - Currently, 66% of all EU cities are below the minimum

- Deducted assumption that at least 11.4% of sealed urban surface area is underutilised and can be greened (6.5% of total urban area):
  - Aligns and slightly exceeds the 5% target in EU restoration law (by 2050, but we want to promote faster uptake)
  - EU cities show stark differences, and the additional green cover should be distributed so that vulnerable cities achieve levels of green cover suitable to mitigate impacts of climate change, such as urban heat islands, heat waves, and flooding, and to increase accessibility and liveability for urban residents

Revenue pool calculations: pragmatic yet nuanced assumptions were employed by the project's analytical team:

- Based on total EU city area and the assumption to bring all cities up to the minimum 45% of recommended green cover → 8,474 km^2 available for naturing over the next ten years (2025-2035)
  - 80% for urban trees: 678 km^2 available for unsealing and 6.8 million trees per year
  - 20% for urban green-blue parks: 169 km^2 unsealing, 0.8 million trees and 11 km^2 blue infrastructure per year
  - Total potential will be linearly developed until 2035, i.e. over ten years
  - Means that on avg. an additional 6.5% of total city area will be greened, which is on avg. 11.4% of the sealed city area
- Digital solutions: 2% of entire value chain revenue pool
- Remediation of sealed area: Unsealing and potentially decontaminating urban area costs GBP 200,000 per ha and is required for the entire area for parks and street tree root systems
  - There is a 20% overlap with the remediation of brownfields for green space, which is only accounted for in the Revitalise strategies' revenue pool calculations
- 2023 prices were taken for revenue pool analyses

Baseline assumptions - Tree-lined roads and urban parks

- Many cities are committing to urban tree planting and increasing green infrastructure — they are already delivering first results:
  - Paris: Target: 170,000 trees and 30 ha of new parks, gardens, and squares from 2020-2026
    63,000 trees in three years achieved
  - Lisbon: Target: 240,000 trees and shrubs
    98,000 trees since in four years achieved
  - Nice: Target: One tree per resident in 2019-2026 (200,000) and 70 ha of new green areas 2019-2026
    70,000 trees in two years and 33 hectares in 15 years achieved
- With the Nature Restoration Law, the EU is committing to an additional 5% of urban green space by 2050 and three billion new trees by 2030 (includes non-urban space)

Optimise

The target assumptions for lower-impact materials are a reinforced concrete-to-engineered-timber-replacement leading to a 7.7% reduction in concrete use, and a linear year-by-year increase in low-impact green cement and green steel as the maturity of the technology progresses, leading to a further 15 percentage point reduction in demand for carbon intensive construction materials.

2035 green cement ratios of 35% and green steel ratios of 56% — with a gradual ramp up assumed until 2035 based on the need to build capacity and enabling conditions/tech

- Our analysis identified that after applying material-efficient design strategies the total annual demand for concrete could reduce concrete use in residential and commercial buildings from 630 Mt in 2022 to 435 Mt by 2035. The overall annual demand for steel could be reduced from 43 Mt in 2022 to 30 Mt in 2035
  - The underlying assumptions for the material reduction are:
    - A ~50% increase of bio-based materials compared to its current share in construction, leading to 7.7% less concrete use
    - Construction design efficiencies leading to an estimated 15% in volume reductions for concrete, steel, and other materials
    - A paradigm shift in newly built housing stock from Single Family Housing to more Multi-Family Housing, from 75%/25% today, towards 45%/55% by 2035, decreasing material use 8-12%
  - The resulting share of green cement in total cement is 35%, the share of green steel in total steel is 56%
- Share of green cement is based on already existing commitments for CCS (carbon capture and storage) capacity in the EU for 2030, with ambition to deliver double this by 2035 (Source: SIQ analysis of planned CCS projects, Leadit Green Cement Tech tracker)
- Share of green steel is aligned with the current commitment and projects announced by the EU steel industry for replacement of blast furnaces with direct reduced iron plants, with ambition that all announced projects run on green hydrogen by 2035 (construction steel); for electric arc furnaces, the low carbon percentage is assumed to be the same as the share of green electricity forecast for 2035 (rebar for reinforced concrete) (Source: Systemiq analysis of committed projects, Mission Possible Partnership Energy Institute)
- For further insight into the approaches being explored to meet the demand for green cement and steel, please refer to the work of The Mission Possible Partnership

2035 timber substituting 7.7% of reinforced concrete in new buildings — with a gradual ramp up assumed until 2035

- Conservative assessment of the sustainable availability of hardwood in Europe based on ‘moderate’ Metabolic 2023 scenarios, given ongoing and sensitive debate over sustainability of timber (e.g. see WRI, 2023) in which pro- and contra-timber advocates engage in an unresolved debate based on differing assumptions

- The share of timber building in some countries is exceptionally high compared to the EU average, e.g. Sweden with 90% for single-family homes and 15% for multi-story buildings, whereas EU average is 5%
- Although the sustainable share of timber construction is limited by supply and should therefore be adapted to local circumstance, it can be increased to 13% without compromising the regenerative ability of forests in Europe
- It should be noted that sustainable timber availability is an ongoing debate and the quantity scenarios of sustainably produced timber in Europe needs to be refined

Modular construction rate of 75% — with a gradual ramp up assumed until 2035 based on the need to build capacity and enabling conditions/tech.

For our analysis we have targeted 75% of new and residential buildings for improved material efficient design leading to a 15% material demand reduction, assuming the available supply at a sustainable level.

- Frontrunners in prefabricated and modular construction show higher shares in new building construction are feasible already, e.g. Sweden with 84%
- Growing number of players delivering prefabricated homes and investing in increased capacity — e.g. TopHat currently building the largest modular housing factory in Europe, to open in 2024, employing 1000 people and with plans to deliver homes for some of the largest players including BoKlok (Skansa and Ikea)

Revenue pool calculations: pragmatic yet nuanced assumptions were employed by the project's analytical team:

- Hybrid building solution:
  a) material efficient (pre-fabricated, modular) design (for reuse)
  b) substitute reinforced concrete with green cement and steel, and timber
- Scale:
  - Applied to new builds of residential buildings and commercial buildings
  - Share of SFH (single family home) decrease to 45% from 75% (incl. demi-detached and terraced)
  - Annual new buildings:
  705,600 SFH and 143,733 MFH (multi-family homes) (6 units): based on 3.5 new dwellings per 1,000 EU residents and SFH/MFH shares
  35,532 commercial: based on 25% floor space share in building stock
  161 million sq.m residential and 53.5 million sq.m commercial

- Application shares
  - 75% modular efficient (savings of 15% material use compared to average today) designs across residential and commercial
  - 35% share of green cement, 56% share of green steel, and 7.7% of concrete substituted by timber
- Modular and efficient building assumptions
  - 15% material savings through modular construction
  - Average 10% (up to 20%) cost savings from modular construction
  - Share of modules in total costs is 40% (incl. off-site labour, material costs)
  - Share of on-site labour in total costs is 20%
  - Design fees range from 5-12% depending on complexity and size of project
  - Excluded costs because same revenue pools as non-modular construction: site preliminaries (~10%), substructure (5%)
- Digital solutions: European share (~25%) of software market applied to McKinsey estimate of global construction software market revenue pool
- 2023 prices were taken for revenue pool analyses

Baseline assumptions - prefabricated/modular construction

- On average, prefabricated construction still represents only a smaller fraction of new buildings, for example just 20% in Germany, opening up a large potential for market growth

Baseline assumptions - sustainable materials

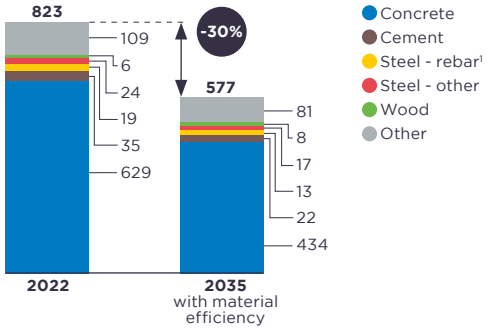
- Use of green cement and of green steel are currently near zero. As ambitions increase to decarbonise hard-to-abate industries, the capacity of green cement and steel production in Europe is expected to increase significantly in the coming years, allowing shares of 36% for green cement and 38% for green steel

Sustainable material ratios are applied after reducing material demand through material efficient design, with additional reduction of cement/steel from timber substitution/efficiencies. These assumptions have been tested with external/Systemiq experts in cement and steel decarbonisation pathways, nature-based solutions, and built environment interventions.

Supplementary analysis for the Optimise building design and material sourcing strategies

Substitution with bio-based materials, efficient designs, and multi-family housing can save an estimated 30% of building material for residential and commercial buildings by 2035.

Figure 1: Material Demand for residential and commercial buildings in EU27
Volume of building material, Mt/year

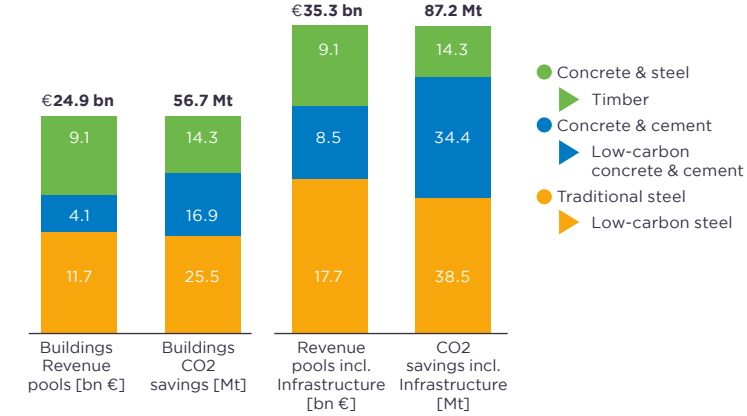


Source: Systemiq analysis for Building Prosperity

Three circular economy strategies are applied to reduce the material demand of housing to meet the Optimise ambition:

1. A ~50% increase of bio-based materials compared to its current share in construction, leading to 7.7% less concrete use[2]
2. Construction design efficiencies leading to an estimated 15% in volume reductions for concrete, steel, and other materials[3]
3. A paradigm shift in newly built housing stock from Single Family Housing to more Multi-Family Housing, from 75%/25% today, towards 45%/55% by 2035, decreasing material use 8-12%[4]

Figure 2: Three substitution levers lead to revenue pools of EUR 35 billion and saves 87 MT CO_2e when considering residential and commercial buildings and infrastructure.



Source: Systemiq analysis for Building Prosperity

Two strategies are applied to reduce the impact of material used in infrastructure:
35% of the cement can be substituted with green, near-zero cement
56% of the steel can be substituted with green, near-zero steel

No additional effect of material efficiency on infrastructure was calculated under the assumption that infrastructure developments are already optimised for material efficiency.

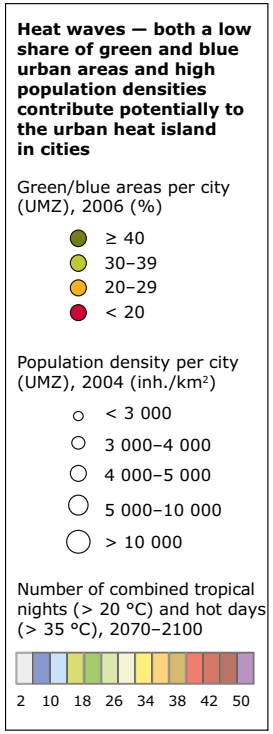
For residential and commercial buildings, the timber revenue pool is larger than concrete/cement despite small volumes due to the substantially higher price per tonne.

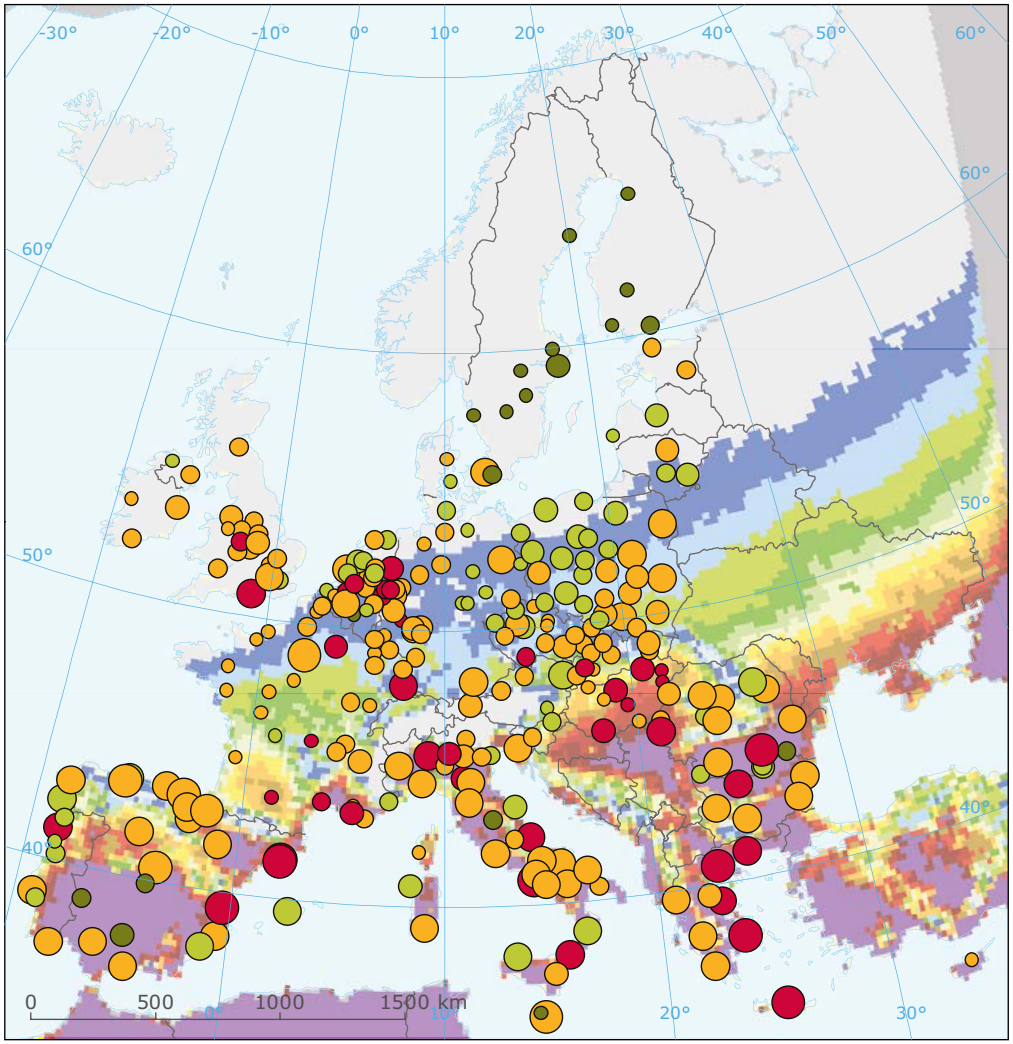
1 Assuming 44% of steel in construction is rebar, according to UIT Cambridge Ltd. (2012);
2 Moderate scenario from Metabolic (2023); not higher due to supply constraints in forestry;
3 Lawson & Ogden, 2010;
4 Based material-efficient lever Sources: Circular Buildings Coalition (2023), Towards a Circular Economy in the Built Environment; overcoming market, finance and ownership challenges; Metabolic (2023), Impact scan for timber construction in Europe; Mission Possible Partnership (2022), Making Net-Zero Steel Possible; Material Economics (2020), industrial transformation 2050

5: Supplementary information in support of the analysis on wider benefits

Background information on urban heat island effects within Europe, public green spaces across European cities, and predicted impact of climate change on land values

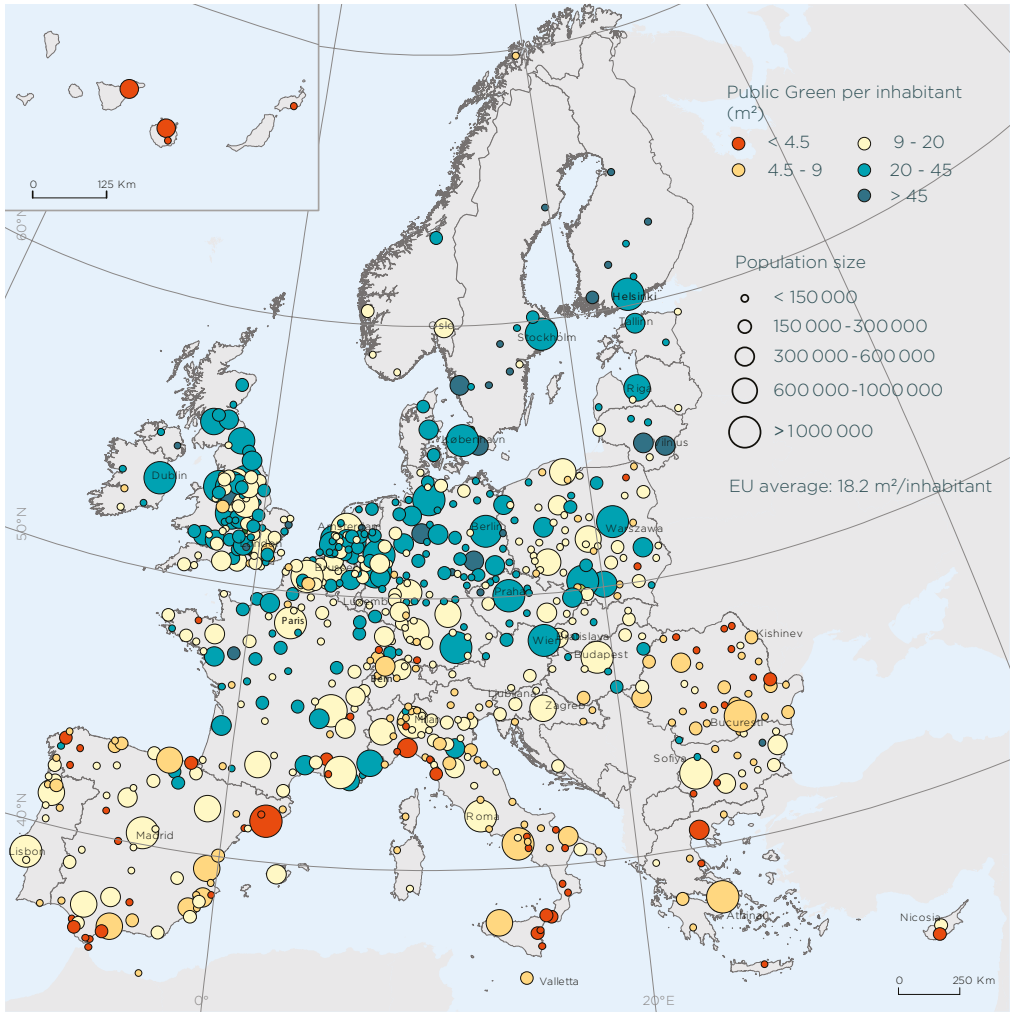
Map 1: Heat waves — both a low share of green and blue urban areas and high population densities can contribute to the urban heat island effect in cities





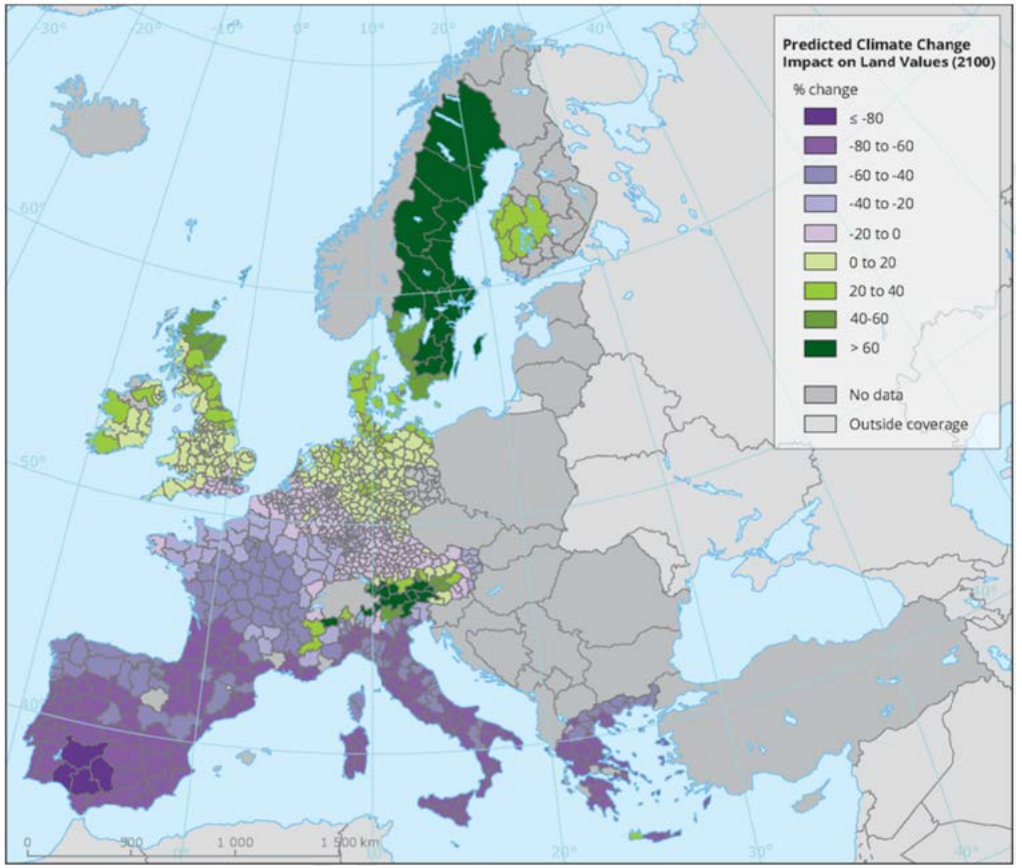
(Source: EEA)

Map 2: Public green space per inhabitant in European cities

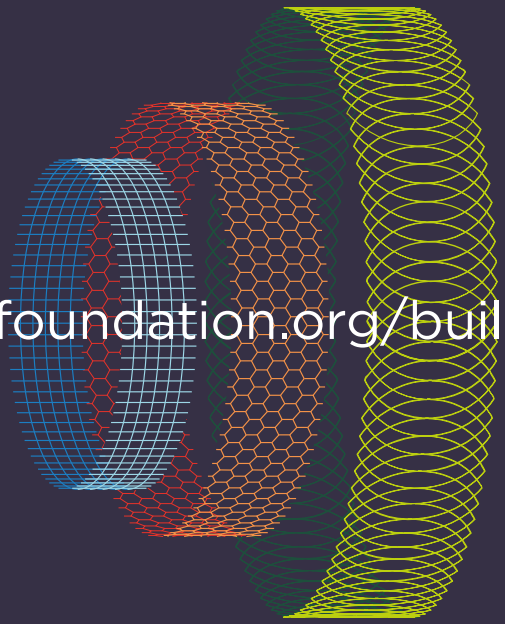


(source: JRC)

Map 3: Predicted Climate Change Impact on Land Values (2100)



(Source EEA)



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