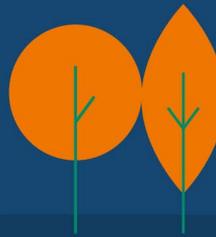
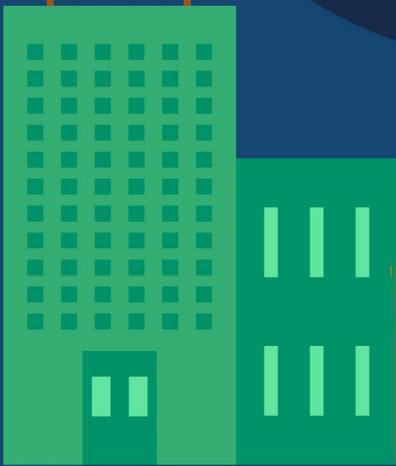




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EU POLICY
WHOLE LIFE
CARBON ROADMAP
#BUILDINGLIFE



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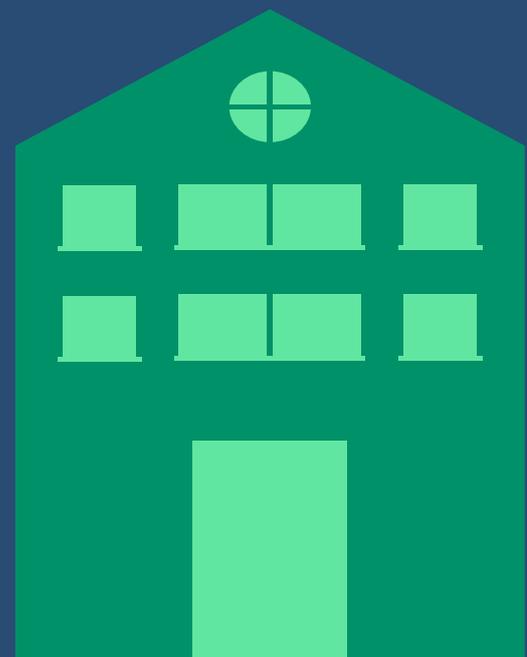
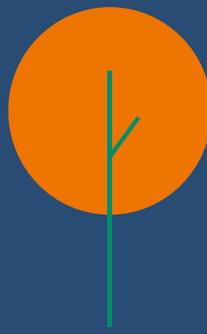
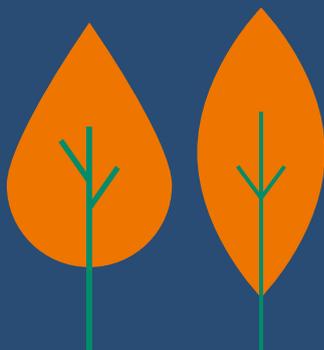
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GLOSSARY

These definitions are adapted from the [World Green Building Council's Bringing Embodied Carbon Upfront](#) report (2019). They refer to the current life cycle modules set out in European standard [EN 15978: Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method](#). As of 2022, this standard is under review; as such, the definitions may be updated in future.

Beyond the lifecycle

Carbon emissions or emissions savings incurred due to reuse or recycling of materials or emissions avoided due to using waste as a fuel source for another process (module D). Consideration of module D is key for maximising resource efficient uses of materials at the end of life. Under forthcoming updates to European standards, it will be mandatory for environmental product declarations to report module D alongside other lifecycle stages in most cases, and will also be required for building assessments.

Carbon emissions

Refers to all greenhouse gas emissions. The global warming potential (GWP) of emissions is quantified in units of carbon dioxide equivalence.¹ A kilogram of carbon dioxide therefore has a GWP of 1 kg CO₂e.

Embodied carbon

Carbon emissions associated with materials and construction processes throughout the whole life cycle of a building or infrastructure. Embodied carbon includes: material extraction and upstream production (module A1),² transport to manufacturer/factory (A2), manufacturing (A3), transport to site (A4), construction and installation processes (A5), use phase (B1), maintenance (B2), repair (B3), replacement of building components (B4), renovation (B5), deconstruction (C1), transport to end-of-life facilities (C2), processing for reuse, recovery or recycling (C3) and disposal of waste (C4). Benefits and loads from product reuse, material recycling and exported energy / energy recovery beyond the system boundary (D) should be reported separately according to EN 15978 and associated standards (see 'whole life carbon').

End of life carbon

The carbon emissions associated with deconstruction/demolition (C1), transport from site (C2), waste processing (C3) and disposal (C4) phases of a building or infrastructure's lifecycle which occur after its use.

Net zero embodied carbon

A net zero embodied carbon asset is a (new or renovated) building or infrastructure asset that is highly resource efficient with upfront carbon minimised to the greatest extent possible and all remaining embodied carbon reduced or, as a last resort, offset to achieve net zero across the life cycle.

Net zero operational carbon

A net zero operational carbon asset is a (new or renovated) building or infrastructure asset that is highly energy efficient and powered using on-site and/or off-site renewable sources.

Net zero whole life carbon

A net zero whole life carbon asset (new or renovated) is highly energy efficient, with upfront carbon reduced to the greatest extent possible and all remaining carbon reduced or, as a last resort, offset to achieve net zero across the whole life cycle.

Operational carbon

Emissions associated with energy used to operate the building or infrastructure (module B6).

Upfront carbon

Emissions from materials' production and construction phases (module A) of the life cycle before the building or infrastructure begins operation.

Use stage embodied carbon

Emissions associated with materials and processes needed to maintain the building or infrastructure during use, for example renovations. This does not include operational carbon emitted due to heating, cooling and power, etc.

Whole life carbon

Emissions throughout the life cycle of a built asset (modules A–C) as defined in European standards (particularly EN 15978 and EN 15804). This life cycle encompasses both embodied and operational carbon. The standards also describe a module D, which outlines benefits and impacts from product reuse, material recycling and exported energy / energy recovery that is not accounted for in modules A–C. Module D should always be reported separately to ensure consistent accounting; separate reporting avoids double accounting of loads and benefits – if, for example, a product is reused and assessed twice in connection with the first and second use. There may be scope to count benefits beyond the system boundary towards a net zero carbon balance.

Zero-carbon-ready building

The International Energy Agency defines a zero-carbon-ready building as one that is: 'highly energy efficient and either uses renewable energy directly, or uses an energy supply that will be fully decarbonised by 2050, such as electricity or district heat. This means that a zero-carbon-ready building will become a zero-carbon building by 2050, without any further changes to the building or its equipment.'³

1 Different greenhouse gases can remain in the atmosphere for different lengths of time, so their GWP will depend on the time period used. It is best practice to report the time period used alongside results. Divergence from the widely used GWP100 (ie 100 years) should be explained.
2 A forthcoming update of EN 15978 may include a new module, A0, encompassing pre-construction activities such as site preparation works.
3 IEA (2021), [Net Zero by 2050: A Roadmap for the Global Energy Sector](#).

SECTION 1: BACKGROUND AND POLICY CONTEXT

INTRODUCTION

This Roadmap outlines the key EU policy interventions, regulatory measures and tools needed to achieve a decarbonised, circular, resilient and well-designed built environment by 2050. It focuses on measures to address whole life carbon (WLC) at the building level.

Created as part of the #BuildingLife project, this Roadmap provides:

- A reference for European policymakers to guide decision-making in relation to key EU built-environment policy packages to ensure they align with global and European climate and energy goals
- A resource for policymakers at national and subnational levels to understand how to harmonise multi-level governance to accelerate action on WLC
- A guide for anyone wishing to understand what trajectory policy (particularly EU policy) must take to ensure the built-environment sector delivers on the EU Green Deal and Paris Agreement
- A resource giving organisations across the sector a common position, building impetus for greater policy ambition

As such, the Roadmap details a comprehensive set of recommendations that will give the building and construction sector the knowledge and capacity to deliver on these policy ambitions. These recommendations include strong policy, regulatory and financial support for both demand-side and supply-chain actors. The Roadmap also clarifies the building sector's role in achieving the EU Green Deal's wider climate-neutral ambitions.

The Roadmap stops short of making specific product, database or technology recommendations. Issues such as the emissions trading scheme, carbon border adjustment mechanism and appliances within buildings are also outside its scope.

About #BuildingLife

#BuildingLife is a regional project that aims to drive decarbonisation in the building sector through private sector action and public sector policy. It is run by the [World Green Building Council \(WorldGBC\)](#), the world's largest global network focused on delivering the ambitions of the Paris Agreement and UN Sustainable Development Goals in the building and construction industry.

Alongside WorldGBC, #BuildingLife brings together a coalition of ten [green building councils](#) across Europe in:

- [Croatia](#)
- [Italy](#)
- [Finland](#)
- [the Netherlands](#)
- [France](#)
- [Poland](#)
- [Germany](#)
- [Spain](#)
- [Ireland](#)
- [the UK](#)

The project, which is funded by the [Laudes Foundation](#) and the [IKEA Foundation](#), aims to support the EU Green Deal by outlining how EU and national building policy can broaden its view beyond buildings' operational emissions, integrating embodied (whole life) carbon.

European Leadership Forum: Our 2050 vision statement

At the heart of the #BuildingLife project is a desire to galvanise support from a broad and diverse coalition around a common vision for the built environment. The #BuildingLife community, including the European Leadership Forum, worked together to develop the following vision statement:

Every European citizen lives in a totally decarbonised, circular, resilient and well-designed built environment that facilitates a high quality⁴ of life.

Priorities for 2050



Decarbonisation: All buildings, including existing buildings, are net zero operational carbon, and new buildings, infrastructure and renovations are net zero embodied carbon. In other words, all buildings are net zero WLC



Resources and circularity: A highly resource-efficient built environment reduces our consumption of resources to a level the planet can maintain, while also helping restore resources and natural systems as part of a thriving and sustainable circular economy



Quality and resilience: The built environment is designed to deliver quality, healthy, equitable and resilient communities, while restoring biodiversity and eliminating air, soil, water and pollution

4 [The Davos Baukultur Quality System](#) defines high quality as: 'well-designed places that change in line with societal needs while preserving their historical characteristics. It focuses on social needs and sustainable use of resources and adds economic value.'

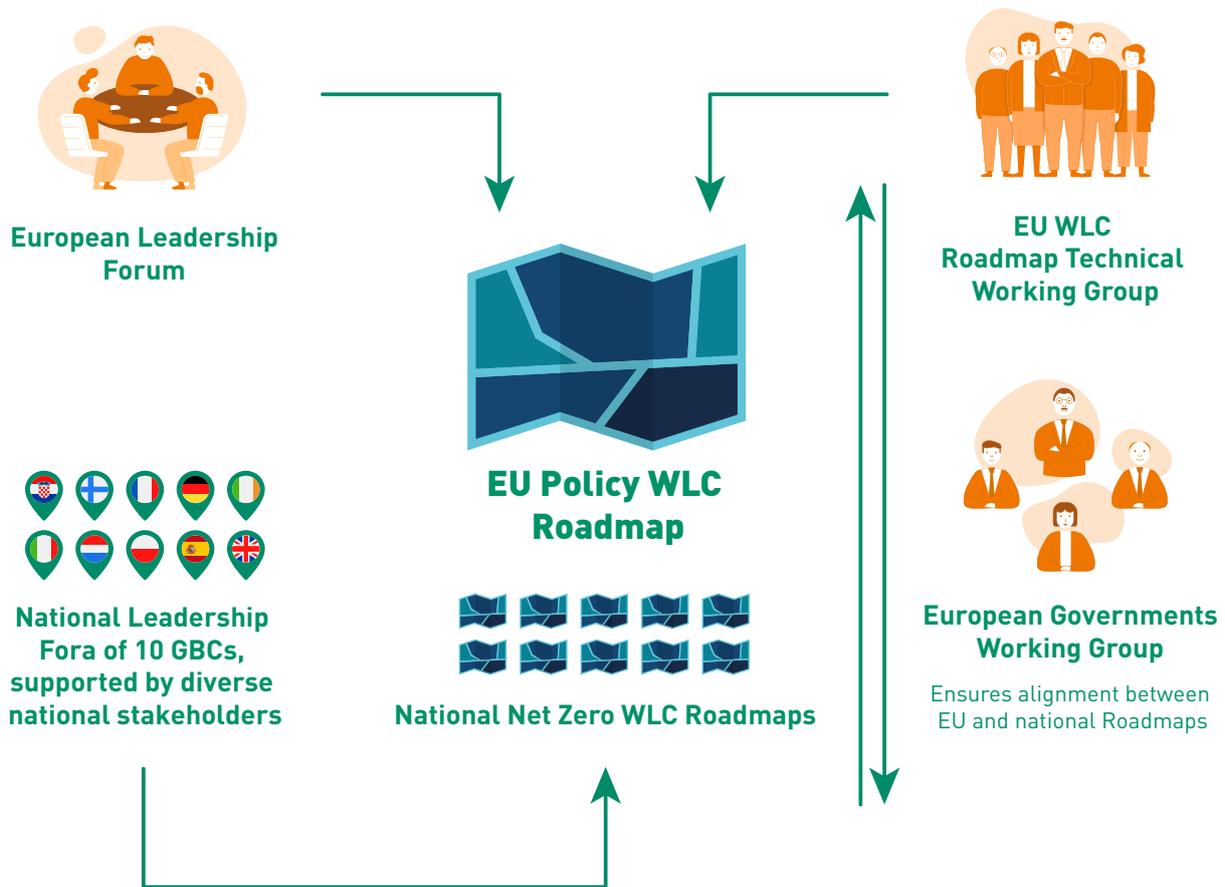
The project builds on the WorldGBC’s ground-breaking 2019 report, [Bringing Embodied Carbon Upfront](#), to put its findings and recommendations into a European context.

Six work streams

#BuildingLife follows WorldGBC’s systemic approach to driving impact, with activities in six work streams.

 **Collaborate**

To drive collaboration, a European Leadership Forum comprised of leaders from across the built-environment value chain gained consensus and steered the direction of this Roadmap. A Technical Working Group was also established to provide specialist input and analysis. Both groups have been instrumental in developing this Roadmap. Special thanks go to the Buildings Performance Institute Europe (BPIE), the Environmental Coalition on Standards and the European Environmental Bureau for their help in co-leading the development of the policy routes. A full list of contributing organisations is included in Annex A.



In addition, ten green building councils in WorldGBC’s European Regional Network established National Leadership Fora to work with diverse national stakeholders to develop and publish National Net Zero Whole Life Carbon Roadmaps throughout the project (available [here](#)).

To reflect the market’s readiness to act on WLC, WorldGBC updated its [Net Zero Carbon Buildings Commitment](#) to incorporate WLC targets and actions for signatories. This industry-led commitment clearly demonstrates to governments at all levels that now is the time for ambitious policy on WLC.

 **Advocate**

This Roadmap advocates for the full decarbonisation of the EU’s built environment and sets a clear route to delivering the EU Green Deal by harnessing the contribution of the building sector. It does so by setting out a trajectory of policy interventions from now to 2050 to catalyse decarbonisation in the following policy areas:

- Building regulations
- Sustainable procurement
- Waste and circularity
- Sustainable finance

Progress in these areas will be driven by greater data collection and reporting, effective multi-level governance, policy integration and support for subnational policymakers.

The national roadmaps produced by the ten green building councils involved in #BuildingLife will drive sustainable building advocacy on the regional scale. To ensure these roadmaps are aligned with the EU level, a European Governments Working Group has been convened and has regular meetings with European Commission and national government representatives from across Europe.

Finally, in June 2021, as part of the #BuildingLife project, [WorldGBC sent an open letter to European policymakers](#), signed by organisations representing over 4,500 companies across the building-sector value chain. It called on the Commission to ensure that key legislative files, such as the Energy Performance of Buildings Directive (EPBD), will support a WLC approach.



Communicate

To ensure the #BuildingLife project communicates its message as strongly and widely as possible, WorldGBC has been running a communications campaign since December 2020. A series of webinars, videos, op-eds and Europe-wide press releases has promoted the aims and message of the project.

One key goal was to bring diverse stakeholders on board as [campaign ambassadors](#). Over 150 individuals have joined the cause, including Members of the European Parliament, CEOs of prominent organisations and representatives from national and local government. All have endorsed the statement:

“ We call on the European Commission and national governments to support #BuildingLife by committing to ambitious policies to tackle the TOTAL carbon and resource impact of our sector.

STATE OF THE MARKET

Case for action

Buildings and the construction sector contribute significantly to carbon emissions and climate change. The sector presents great untapped potential to help decarbonise the global economy while also addressing other pressing societal issues, including energy security, resilience, health and well-being.

Worldwide, buildings are responsible for around 50% of all extracted materials, 33% of water consumption and 35% of waste generated,⁶ all with associated emissions. Other environmental impacts include resource depletion, air, water and land pollution and biodiversity loss.



Educate

To facilitate the transition to a WLC approach, the #BuildingLife project also seeks to educate professionals across the public and private sectors. It is rolling out an education programme for construction professionals and companies on life cycle assessment (LCA) and life cycle cost (LCC); for product manufacturers on environmental product declarations (EPDs); and for public authorities on how to incorporate LCA and LCC into their procurement processes.



Rate

We cannot act on WLC unless we have a clear and unified way to measure it. The rate element of #BuildingLife⁵ focuses on incorporating a streamlined Level(s) Reporting Framework into major green building certification schemes. This will enable the building sector to access comparable performance data across the whole life cycle of projects and set more accurate benchmarks. Similarly, #BuildingLife aims to improve the availability of product-level data by developing or supporting open-source product LCA databases in countries with insufficient or no data for construction products. This aim builds on evidence from leading markets, such as Finland, Germany and the UK, where freely available embodied carbon and LCA data have been an important catalyst for industry action.



Invest

Finally, investment must be channelled into sustainable building practices that align with our 2050 vision statement for the built environment. As part of this, members of the WorldGBC network will provide ongoing taxonomy support to the European Commission and key investor groups on how to embrace the whole life cycle perspective for the buildings sector.

In Europe, the operation (ie use) of buildings alone accounts for around 40% of all energy consumption and 36% of carbon dioxide emissions.⁷ Improving energy efficiency and decarbonising electricity and heat are thus key to reducing emissions in Europe.

Beyond operational emissions, embodied carbon in the built environment (carbon emitted during construction) contributes approximately 11% of all carbon emissions globally. Indeed, as operational carbon is set to reduce, experts estimate that over half of total carbon emissions from all construction between 2020 and 2050 will be upfront emissions from new buildings and, to a lesser extent, renovations, especially in Europe. This provides a compelling reason to address both embodied and operational carbon and to prioritise reducing upfront emissions urgently.

⁵ The rate element of this project is connected to the [LIFE Level\(s\) project](#). For more information, see 'Level(s)' on page XXX.

⁶ IEA (2017), [Global Status Report](#).

⁷ European Commission (2020), [Energy efficiency in buildings](#).

These issues are compounded by forecasted population growth. This will increase demand for floor space, making greater energy and resource efficiency an even more pressing concern. The total global floor area of buildings is estimated to double by 2060, with over 50% of that increase likely to occur within the next 20 years.⁸ Asia and Africa will see particularly rapid growth in new buildings, while Europe faces a different challenge: an ageing existing building stock. It is thought that up to 80% of buildings that will be in use in 2050 already exist. Indeed, about 35% of the EU's existing buildings are at least 50 years old, and 97% are not efficient enough to comply with future carbon reduction targets.

Energy security provides another compelling case for action, an issue highlighted by the energy crisis linked to Russia's invasion of Ukraine in February 2022. Russia supplies 40% of Europe's gas, so the resulting sanctions have caused supply issues in Europe and price hikes around the world. While some scramble to find alternative energy sources, buildings should not be overlooked. Increasing buildings' efficiency will reduce reliance on external resources, making this a cost-effective way to bolster energy security.

Recognising this potential, the EU has published a plan in response to the crisis (REPowerEU). It outlines how the EU can reduce dependence on Russian fossil fuels before the end of the decade and replace them with stable, affordable, reliable and clean energy supplies. One focus of REPowerEU is to renovate more buildings to reduce energy consumption by doubling planned deployment of heat pumps and installing more smart metres.

These challenges in the built environment also present opportunities, and both the public and private sectors have key roles to play in accelerating action and ambition. As more businesses act to tackle climate change, they encourage governments to advance their policies to give the private sector further clarity on the direction of travel. Public leadership (ie government) and private leadership can thereby elevate climate action through a phenomenon known as the 'ambition loop'.

Understanding operational carbon

Operational carbon refers to the carbon emitted during the operational or use phase of a building. It includes emissions from fuel and electricity use, refrigerants and certain maintenance activities. Accounting for 36% of EU emissions, this operational impact of Europe's building stock is a major contributor to climate change and provides an opportunity to tackle the built environment's WLC. To do so, both new and existing buildings must be considered.

Europe has many old, energy-inefficient buildings. Renovating these existing buildings to make them more energy efficient can vastly reduce their operational carbon footprint, and the technology to do so efficiently and deeply already exists.⁹ Possible measures include installing insulation, renewable heating systems and better windows. Decarbonising buildings' operations could also create jobs and tackle social issues like energy poverty.

New buildings, on the other hand, can be designed to minimise operational emissions from the start, ensuring they are [zero-emission buildings](#) (ZEBs) or Nearly zero-energy buildings (NZEBs) and that they will require no future renovation work to improve their performance.

When tackling operational carbon, however, the embodied emissions of the materials and processes used must not end up increasing the WLC impact of a building.

Understanding embodied carbon

Embodied carbon emissions, which amount to 3.67 million tonnes of carbon dioxide (2019) worldwide, are attributed to the construction, renovation, deconstruction or demolition and the wider supply chain of a building. In other words, before a building is even used, it has already contributed substantially to carbon emissions and depleted our 'carbon budget'. As this so-called upfront carbon cannot be reduced once a building starts operation, addressing these emissions is even more important if nations are to transition to zero emissions by 2050 at the latest, with substantial contributions this decade (approximately 50% reduction in global emissions by 2030).¹⁰

Embodied carbon is estimated to contribute between 10–20% of the EU's building carbon dioxide footprint, depending on factors such as building type and construction technique and materials. In countries with low-carbon energy, the embodied share can already be as high as 50%.¹¹ Indeed, as buildings become more efficient and the electricity grid is decarbonised – and as manufacturers decarbonise their supply chains and operations – the relative share of embodied emissions will increase.

Several factors affect the amount of carbon emitted at each stage of a building's life cycle. However, in general and for new buildings, a great portion of these emissions come from the product and use stages, as shown by The Institution of Structural Engineers in Figure 1.¹²

8 IEA (2017), [Global Status Report](#).

9 BPIE (2017), [97% of buildings in the EU need to be upgraded](#).

10 IEA (2021), [Net Zero by 2050: A Roadmap for the Global Energy Sector](#).

11 Material Economics (2019), [The Circular Economy - a Powerful Force for Climate Mitigation](#)

12 Institution of Structural Engineers (2020), [How to calculate embodied carbon](#).

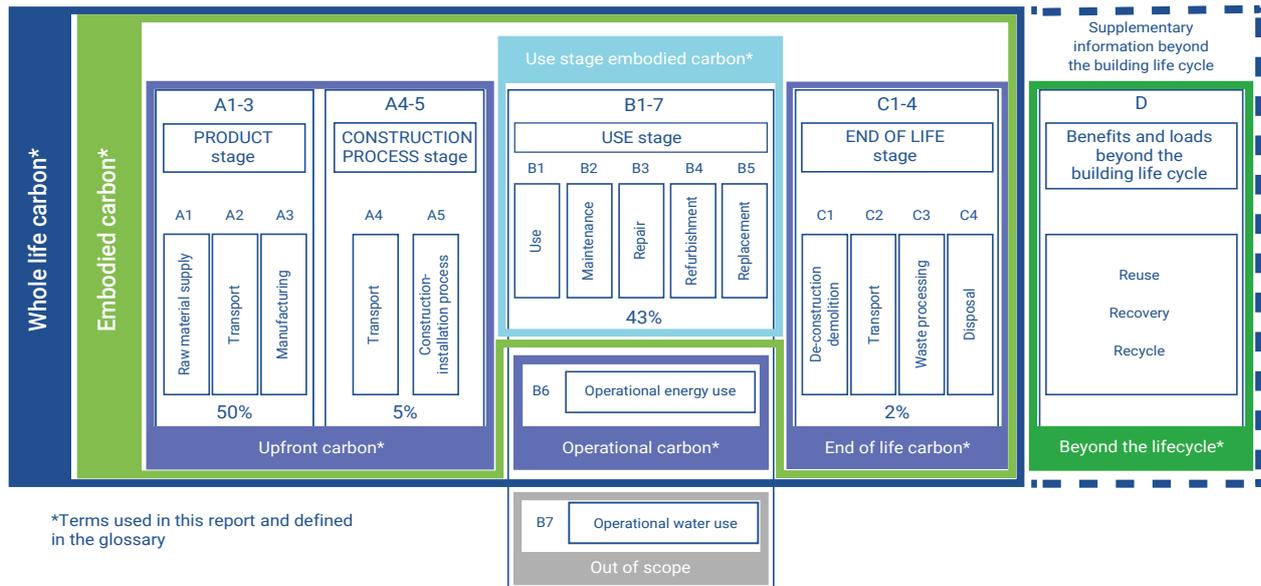


Figure 1: Life cycle stages and modules according to the Standard EN 15978 and the estimated distribution of emissions for a medium-scale residential building

From structural elements to finishes, building products often represent the biggest contribution. This is not just because these materials are used in such great volumes but because producing them is often highly carbon intensive. The most commonly used materials in structural elements, such as concrete, steel and aluminium, are responsible for approximately 20% of emissions.¹³ For example, during cement production, about 60% of the emissions come from chemical reactions during processing and 40% from burning fossil fuels in the manufacturing process.¹⁴ Other common construction materials, such as glass and plastics, are carbon intensive because it takes a lot of energy to produce them.

To reduce carbon emissions in these industries, therefore, their plants must be more energy efficient. This could be achieved through new technology and/or materials or transitioning to renewable energy, green hydrogen, waste incineration and biofuels – or a combination. Natural products, such as wood, have also benefited from low-carbon technologies and more efficient equipment in their manufacturing processes, such as carbon-free mills and energy-efficient kilns.¹⁵

The industry recognises that using mature wood from sustainably managed forests in long-life products such as building fabric can act as a valuable carbon store.

However, it lacks consensus on the methodology used to calculate these products' carbon storage and thus their potential for decarbonising the sector. Standards bodies and the European Commission must lead the way to clarity on this issue.

The need for better data

A scarcity of reliable and comparable data across Europe makes it difficult to reach a consensus about the extent to which emissions can be attributed to embodied carbon in Europe's building stock. However, we do know that a 'business-as usual' scenario risks the future of generations to come. This is why, until more information is gathered and a consensus on baselines is reached, WorldGBC calls for at least a 40% reduction in embodied emissions,¹⁶ based on the average performance of current case studies around the world.

Estimates of buildings' current emissions indicate that embodied carbon could account for 10–50% of the total life cycle,¹⁷ while a recent [report](#) from One Click LCA (formerly Bionova) shows that, depending on building type and location, this figure is approximately 450 kg CO₂e/m².¹⁸ This corresponds to results published by DGNB, the German Sustainable Building Council, which found the average for new buildings to be around 435 kg CO₂e/m² (assuming a 50-year lifespan).¹⁹

13 Architecture 2030: [Why the building sector?](#)

14 Carbon Brief (2018), [Q&A: Why cement emissions matter for climate change.](#)

15 Carbon Smart Materials Palette (n.d.), [Carbon Impacts of Wood Products](#)

16 WorldGBC (2019), [Bringing Embodied Carbon Upfront.](#)

17 I. Sartori, A.G. Hestnes (2007), Energy use in the life cycle of conventional and low energy buildings: a review article. *Energy and Buildings* 39 (3) 249–257. See also Institution of Structural Engineers (2020), [How to calculate embodied carbon.](#)

T. Ibn-Mohammed et al. (2013), Operational vs. embodied emissions in buildings: A review of current trends. *Energy and Buildings* 66 (2013) 232–245.

T. Ramesh, R. Prakash, K.K. Shukla (2010), Life cycle energy analysis of buildings: an overview. *Energy and Buildings* 42 (10) 1592–1600.

Huang L. et al. (2017), Carbon emission of global construction sector. *Renewable and Sustainable Energy Reviews.*

18 One Click LCA (2018), [The Embodied Carbon Review.](#)

19 DGNB (2021), [Benchmarks for Greenhouse Gas Emissions from Building Construction.](#)

A similar study by Ramboll estimated the average embodied carbon for new buildings to be around 600 kg CO₂e/m², where 70% of this embodied carbon is emitted upfront, and suggested that such emissions are continuing to increase.²⁰

As the One Click LCA report highlights, the number of certifications and regulations addressing embodied carbon has been growing and evolving rapidly.

Although this is very encouraging, a lack of alignment means the emerging benchmark data appears quite variable, and best practices cannot be easily shared or adopted. With at least five different methodologies identified, this lack of comparability can cause confusion and delay action.

Similarly, Ramboll warns that robust data from different life cycle stages, building types, building elements and materials is required to ensure effective measures to decarbonise the sector; large samples of data are missing, and existing datasets face challenges if they are to be useful for producing robust embodied carbon benchmarks.

Such inconsistencies must be addressed. What's more, all parts of the value chain must have a thorough understanding of the impact of both operational and embodied carbon data. To achieve this, European and national policymakers must mandate WLC reporting and clearly outline the methodology behind calculation, reporting, benchmarking and limits under the relevant modules of EN 15978.

Table 1: EU countries with regulations to reduce embodied emissions

Country	Regulation
DENMARK	Regulation from 2023 sets WLC limits for new buildings, encompassing both operational and embodied emissions, based on LCA. Carbon dioxide limits will also be progressively tightened, starting at 12 kg CO ₂ e/m ² per year. ²¹
FINLAND	Finland plans to announce carbon limits for different building types from 2025. It has developed an assessment method and will create a generic emission database. ²²
FRANCE	France's RE2020 came into force in January 2022. It requires a dynamic LCA, which weights current emissions more heavily than future emissions. France is the first country to introduce dynamic LCA. ²³
NETHERLANDS	Since 2018, new residential and office buildings have been subject to limits on whole life cycle emissions. The embodied impacts are assessed based on a national LCA method and are converted into monetary value. ²⁴
SWEDEN	Sweden plans to announce limits on embodied carbon from 2027 using a national LCA methodology. ²⁵

Barriers and opportunities

Tackling WLC – both operational and embodied carbon – involves numerous challenges, but it also presents opportunities. Green buildings represent a major global investment opportunity, with buildings making up the largest segment of the EUR 200 billion energy efficiency market.²⁶

By combining a better understanding of the current needs, the proven cost-effective practices and increased financial incentives for green investments, organisations and cities have taken the opportunity to create more sustainable places while boosting their economy. To realise these opportunities, we must overcome barriers in key areas, as outlined below.

20 Ramboll (2022), [Towards embodied carbon benchmarks for buildings in Europe](#).

21 BPIE (2021), [Whole-Life Carbon: Challenges and Solutions for Highly Efficient and Climate-Neutral Buildings](#).

22 M. Kuitinen, T. Häkkinen (2020), Reduced carbon footprints of buildings: new Finnish standards and assessments. *Buildings & Cities* 1 (1) 182–197.

23 Ibid.

24 Ibid.

25 Ibid.

26 European Bank for Reconstruction and Development (n.d.), [Green Building Investments](#)

Policy and regulation

Voluntary and mandatory guidelines shape the life cycle of a building: from conception to design and end of life. They therefore have a significant impact on emissions.

While certain initiatives have already promoted ambitious targets and increased energy efficiency, further supply-side policy measures are needed to encourage manufacturers to invest in new low- and zero-carbon technologies and processes. These measures could also include incentives for reusing and recycling materials.

To strengthen the supply side, national governments must: (1) send consistent policy signals to minimise investment risk for private sector stakeholders; (2) introduce upskilling/re-skilling programmes to train stakeholders in the construction-industry value chain; and (3) provide sufficient technical assistance and resources to subnational governments so that they can strengthen the supply side locally, fostering both local value chains and employment.

On the demand-side, policymakers must promote energy-efficient and resilient deep renovations with WLC assessments more widely. These measures will help accelerate action, especially in less advanced regions and sectors. To further strengthen demand, policymakers should: (1) promote neighbourhood- or district-level approaches to integrated renovation campaigns; (2) help subnational governments set up and run advisory hubs (one-stop shops) that help and raise awareness among (prospective) property owners; and (3) ramp up public procurement policies and public building programmes.

Key to the success of any policy and regulation is its collaborative conception and implementation. Policy alignment across multiple levels of governance (EU, national, regional and local) is critical to successfully delivering any new policies or regulations. Building policy and regulations directly impact homeowners and end users, so their needs, priorities and the protection of vulnerable groups must be considered when designing and implementing policies. Policies and measures must also be aligned with and embedded in local climate and energy action plans to maximise the potential of integrated action, ensure stakeholder buy-in and boost the impact of existing medium- to long-term strategies.

Awareness-raising and stimulating demand

A key challenge in decarbonising the sector is raising awareness and stimulating demand across the value chain. Although designers are familiar with tools for calculating and addressing low carbon, and energy-efficient measures are already widely used during the operational stage, tools for embodied carbon are less common.

For manufacturers, developing and publishing a product's environmental impact data (such as EPDs) is sometimes perceived as time consuming and expensive. As a result, the supply chain struggles to deliver certified products, while the demand-side opts for materials without considering the environmental impact. It is therefore essential to make it easier – and less expensive – to access reliable, comparable and verifiable embodied-carbon information.

The finance community must also be aware of the risks they face in terms of stranded assets if the buildings they invest in or own are not futureproofed now. As more innovative solutions come to the market, insurers will need to increase their awareness and update their policies to ensure they do not prevent future solutions from entering the market.

Stimulating demand will also require a major shift in awareness, as well as financial incentives and adequate, conveniently located facilities for processing materials for reuse and recycling. Major investment in skills and capacity-building across the value chain will also increase demand; without the necessary knowledge and tools, any carbon reduction strategy will struggle. To drive this, the whole sector must become more transparent, sharing solutions and best practices through networks such as green building councils.

Finance

For manufacturers, the cost of investing in low-carbon technologies and certification processes can be prohibitive. Estimates suggest that heavy industries such as steel and cement may need up to 60% more investment than current levels.²⁷ Those looking to innovate with circular business models may also face barriers in accessing finance because they may be deemed higher risk when assessed using traditional financing criteria.²⁸

To reach more sectors of the building industry, therefore, it is not enough just to promote initiatives such as the EU Green Deal and the EU taxonomy. The national, regional and local green loans, grants, subsidies and carbon pricing that can create necessary enabling conditions for such initiatives must be promoted too.

Furthermore, to meet decarbonisation goals, the finance sector must develop financial products and services targeted at low-carbon projects for the buildings and infrastructure sector.

Besides introducing publicly funded incentive schemes, national governments will play an important role by creating enabling conditions for the emergence of innovative private finance solutions. Subnational governments can also help de-risk private finance by functioning as a guarantor or support the establishment of bankable energy-efficiency projects. Further research into the social cost of embodied carbon could strengthen the business case and help inform practice and trade-offs between life cycle stages over time.

Provided they are well designed, carbon pricing and carbon markets can help carbon products and services compete with their conventional equivalents. To be most effective, these mechanisms must be inclusive and flexible enough to account for technological advancements. They must also be designed and monitored to avoid carbon leakage, for example, by preventing companies from circumventing them by transferring production to a third country.

27 Material Economics (2019), [Industrial Transformation 2050: Pathways to Net-Zero Emissions from EU Heavy Industry](#).

28 European Commission (2019), [Accelerating the transition to the circular economy: Improving access to finance for circular economy projects](#).

POLICY CONTEXT

Many policies, regulations and initiatives impact buildings and the built environment. The key relevant policies are listed below.

International context

The Paris Agreement

At COP21 in 2016, 196 countries adopted the Paris Agreement, a legally binding international treaty on climate change. It aims to limit global warming to well below 2°C – preferably to 1.5°C – compared to pre-industrial levels. Under the terms of the Paris Agreement, every five years, countries must submit nationally determined contributions (NDCs). NDCs are essentially action plans outlining how each country will reduce their emissions and adapt to climate change.

NDCs were most recently updated for COP26 in Glasgow in 2021. According to estimates from Carbon Brief,²⁹ the actions countries are currently taking will lead to around 2.6°C–2.7°C warming by 2100. If countries meet both conditional and unconditional NDCs for the 2030 target, the projected warming by 2100 would fall to 2.4°C. If countries meet their long-term net zero promises, global warming could be reduced to around 1.8°C (1.4°C–2.6°C) by 2100, but the lack of stronger commitments for emissions cuts by 2030 creates a ‘very big credibility gap’.

As the collective impact of the current NDCs is incompatible with the Paris Agreement, countries have been requested to update their NDCs earlier, before COP27 in Egypt. This provides an opportunity to realign with the 1.5°C goal and to elevate the profile of the buildings sector in mitigating and adapting to climate change.

Buildings and NDCs

In November 2021, the COP26 summit dedicated a day to cities, regions and the built environment. This iteration of COP saw [positive progress, particularly with the recognition of buildings’ role in addressing climate change](#). Since 2015 – when countries first submitted their NDCs – coverage of buildings in NDCs has increased from [90 to 136 countries](#). Today, 80 countries have developed building codes, from 62 in 2015. Yet, overall, actions are too few to drive the kind of systemic transformation needed in the built environment. The inadequate coverage of emissions from the built environment in NDCs must be addressed by governments, which must also adopt robust building policies that address both operational and embodied carbon to align with the 1.5°C target.

The experience of recent years has taught us that governments alone will not meet the goals of the Paris Agreement. Complementary to government action, several international frameworks and alliances have called publicly for harmonised and effective strategies to address buildings’ WLC.

In 2019, WorldGBC published its [Bringing Embodied Carbon Upfront](#) report, which outlines a hierarchy of actions to optimise resources.

- 1. Prevent:** The best way to reduce embodied carbon is to avoid unnecessary new construction and prioritise renovation
- 2. Reduce and optimise:** Databases and building simulation tools can optimise building designs and renovations to minimise the use of new material and foster circularity
- 3. Plan ahead:** New buildings and renovations must integrate circular economy principles, WLC assessments and natural systems restorations, among other strategies, to mitigate end-of-life emissions
- 4. Offset:** After maximising the available techniques, technologies and resources, residual carbon emissions must be appropriately and effectively offset

Also in 2019, the World Resources Institute published a working paper with a similar hierarchical approach: [Accelerating Building Decarbonization: Eight Attainable Policy Pathways to Net Zero Carbon Buildings for All](#). It explores proven, feasible pathways towards zero-carbon buildings in different countries.

In 2020, the Global Alliance for Buildings and Construction published the [GlobalABC Roadmap for Buildings and Construction 2020–2050](#), which shows that cost-effective energy efficiency and decarbonisation measures in buildings could represent a third of the total reductions required to achieve the Paris Agreement goals.

European context: EU level

At the EU level, several initiatives seek to accelerate the transition towards a totally decarbonised built environment based on the principles of sustainability, complete LCA, circularity and transparency. The main initiatives are included here; additional legislation is included in the annex to this report.

EU Green Deal

Published in December 2019, the EU Green Deal sets out an [action plan](#) for moving to a clean, circular economy while restoring biodiversity, cutting pollution and reaching climate neutrality by 2050. It outlines a series of policy initiatives, including:

- [EU Climate Law](#)
- [EU Biodiversity Strategy for 2030](#)
- [Climate Change Strategy for 2030](#)
- [Fit for 55 Package](#)
- [EU Strategy on Adaptation to](#)
- [Renovation Wave](#)
- [Circular Economy Action Plan](#)

Under the Green Deal, the EU will also provide financial support and technical assistance to those most affected by the move towards the green economy. This is called the [Just Transition Mechanism](#).

29 Carbon Brief (2021), [Analysis: Do COP26 promises keep global warming below 2C?](#)

EU Climate Law

The European Commission presented its [proposal for the first European Climate Law](#) in March 2020; its adoption in June 2021 legislated the EU Green Deal's goal for Europe's economy and society to be [climate neutral by 2050](#).

To achieve this ambitious target, the Commission has committed to:

- Reduce EU greenhouse gas (GHG) emissions by at least 55% (compared to 1990 levels) by 2030
- Adopt a 2030–2050 EU-wide trajectory for GHG emission reductions
- By September 2023, and every five years thereafter, assess consistency of EU and national measures with the climate-neutrality objective and 2030–2050 trajectory

Fit for 55 package

The [Fit for 55 package](#) is a set of proposals seeking to make the EU's climate, energy, land use, transport and taxation policies 'fit for' reducing net GHG emissions by at least 55% (compared to 1990 levels) by 2030 in line with the Green Deal's climate-neutrality goal.

Energy Performance of Buildings Directive

As part of Fit for 55's recalibration efforts, the [EPBD](#) is being updated. It currently covers a range of policies to help national governments boost buildings' energy performance and improve the existing building stock.

The proposed [revisions](#), published in December 2021, include introducing mandated WLC for all new buildings from 2030 and a ZEBs concept, as well as the staged introduction of minimum energy performance standards (MEPS). It also set out plans for energy performance certificates (EPCs) to be harmonised across Member States by 2025 and the introduction of building renovation passports (BRPs) by the end of 2024.

Circular Economy Action Plan

The [Circular Economy Action Plan](#) (CEAP) aims to prevent waste and keep resources used in the EU economy for as long as possible. Construction and buildings is a crucial topic of the plan, which considers initiatives along the life cycle of products.

In March 2022, the Commission presented measures that had previously been promised under the CEAP, including a proposal for an [Ecodesign for Sustainable Products Regulation](#) and the [revised Construction Products Regulation](#) (see Annex).

Waste Framework Directive

In 2023, the European Commission will update the [Waste Framework Directive](#) (WFD). This update is expected to foster circularity by [setting waste reduction and minimum material recovery targets](#), although the level of ambition remains to be seen.

EU taxonomy

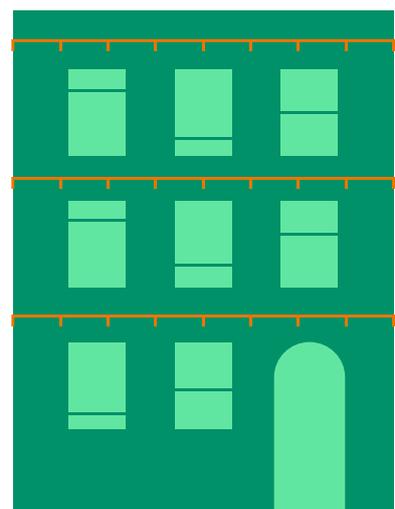
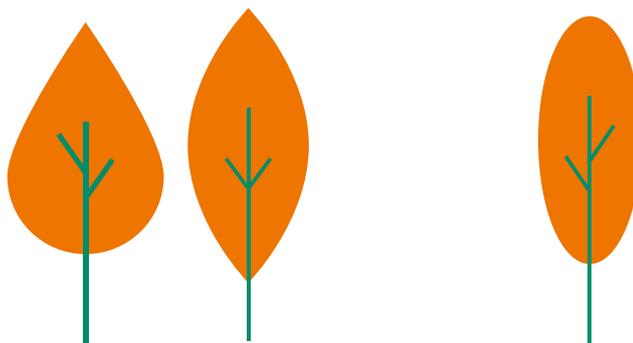
To drive progress on the financial side, legislation on the uniform [classification of sustainable investments \(taxonomy\)](#) came into law in June 2020. The taxonomy sets various criteria across different categories for determining which financial products and investments can be declared 'sustainable'. On 9 December 2021, the Commission published the first delegated act on sustainable activities for climate change mitigation and adaptation.

Within the buildings sector, it aims to apply clearly defined taxonomy criteria to new buildings, renovation measures and acquiring/owning buildings. By applying performance thresholds, investors can identify which activities are environmentally friendly and where performance needs improving. Ultimately, it will help grow low-carbon sectors and decarbonise high-carbon ones.

In future, finance and investments marketed as 'green' will need to be explained using the taxonomy criteria. This will help the market determine whether an underlying economic activity is contributing to climate objectives.

Level(s)

The [voluntary reporting framework, Level\(s\)](#), developed by the Commission, is key to delivering the EU's overall ambition of climate neutrality. It provides a set of common indicators and metrics for measuring the environmental performance of office and residential buildings, taking into account their full life cycle. It focuses on six areas: GHG emissions; resource efficiency; water use; health and comfort; resilience and adaptation; and cost and value. Each indicator is designed to link a building's impact with its sustainability priorities at a European level. As such, Level(s) users can focus on a manageable number of essential concepts and indicators for their building while contributing to EU and Member State environmental policy goals.



European context: National level

At the national level, European countries have developed a range of strategies to help their building sectors transition away from carbon (see Table 2).

Table 2 reveals stark differences in countries' levels of ambition; many do not yet go far enough.

Table 2: Targets and initiatives for reducing carbon emissions in Europe, by country

Country	Targets*	Policy initiatives
BELGIUM	Carbon neutrality by 2050. ³⁰	<ul style="list-style-type: none"> • Mandatory national LCA for state government buildings • Net zero 2050 initiative • Supporting policies include regulatory instruments for building envelope, heating fuel switch, appliance efficiency, renewable electricity and materials
CROATIA	Reduce carbon dioxide emissions by 80% in the building construction sector by 2050. ³¹	<ul style="list-style-type: none"> • Integrated energy and climate plan for 2021–2030, promoting NZEB standard in construction and refurbishment and introducing measurable indicators to make existing building stock climate neutral
DENMARK	Reduce emissions by 70% by 2030 and achieve carbon neutrality by 2050. ³²	<ul style="list-style-type: none"> • National strategy for sustainable construction, including carbon dioxide limit values for new buildings from 2023 • Mandatory national life cycle carbon limits on new buildings to be introduced in 2023
FINLAND	Carbon neutrality by 2035. ³³	<ul style="list-style-type: none"> • LCA method and generic emission database for products and materials, energy sources, modes of transport and other processes such as site operations • Mandatory national life cycle carbon limits on new buildings (from 2025)
FRANCE	Carbon neutrality by 2050. ³⁴	<ul style="list-style-type: none"> • 2050 National Low-Carbon Strategy (carbon-neutral law) • Fully decarbonise energy production by 2050; halve energy consumption through energy efficiency; increase and safeguard carbon sinks; promote carbon capture and storage, technologies and products from the bio-economy • Mandatory national life cycle carbon limits on new buildings from 2022

30 Government of Belgium (n.d.), [Belgium's long-term strategy](#).

31 Ministry of Construction and Physical Planning (2014), [Proposal of the Long-Term Strategy for Mobilising Investment in the Renovation of the National Building Stock of the Republic of Croatia](#).

32 Ministry of Foreign Affairs (n.d.), [Global Climate Action Strategy](#).

33 Ministry of the Environment (2021), [Climate-neutral Finland by 2035](#).

34 Minister for the Ecological and Inclusive Transition (2017), [Government's Climate Plan](#).

Country	Targets*	Policy initiatives
GERMANY	Reduce emissions by 65% by 2030 and achieve carbon neutrality by 2045. ³⁵	<ul style="list-style-type: none"> • Federal Climate Change Act • Climate Action Plan 2050, outlining the roadmap for almost climate-neutral building stock, including regulations to improve energy efficiency and funding heating systems based on renewable energy sources • Ökobaudat (LCA platform for buildings) • Voluntary national LCA requirement for federal government buildings • Public funding for sustainability measures; mandatory life cycle GHG emissions and primary energy limit values (since July 2021)
HUNGARY	Carbon neutrality by 2050. ³⁶	<ul style="list-style-type: none"> • National Energy and Climate Plan • National Clean Development Strategy • 2021–2027 Partnership Agreement, Operational Programmes and Hungary Recovery and Resilience Plan (proposes to increase budget of energy efficiency programmes and distribute funds more effectively; partially adopted)
IRELAND	Reduce GHG emissions by 7% each year between 2021 and 2030 and achieve carbon neutrality by 2050. ³⁷	<ul style="list-style-type: none"> • National Energy and Climate Plan 2021–2030 • Proposals include: stricter requirements for new buildings and substantial refurbishments; public buildings to have a B Building Energy Rating (BER) by 2030; a third of commercial (and mixed-use) buildings to have a B BER (or carbon equivalent gains) by 2030; 600,000 heat pumps installed between 2021 and 2030
NETHERLANDS	Reduce emissions by 49% by 2030 and 95% by 2050. ³⁸	<ul style="list-style-type: none"> • Mandatory national life cycle impact limits on new buildings • Amsterdam to be fully circular (new buildings and products by 2023; renovations by 2025) • New houses' environmental performance more stringent from 2021 • Uniform assessment method for circular measures (upcoming) • Performance requirements progressively more stringent, ultimately halved by 2030
NORWAY	Carbon neutrality and circular economy by 2030. ³⁹	<ul style="list-style-type: none"> • Roadmap for property sector to be carbon neutral by 2050 • New climate strategy to reduce emissions by 95% by 2030 • Tighter energy consumption limits: 100 kWh/m² for single houses, 95 kWh/m² for apartments and 115 kWh/m² for offices • Banning fossil fuel heating systems; phased in since 2016 and in full force since 2020

35 Climate Home News (2021), [Net zero by 2045 after landmark court ruling](#).

36 Climate Home News (2020), [2050 climate neutrality goal set in law](#).

37 Climate Home News (2021), [Climate bill to set 2050 net zero goal in law](#).

38 Government of the Netherlands (2019), [The Climate Act and the National Climate Agreement](#).

39 Climate Action (2016), [Norway brings forward carbon neutral target to 2030](#).

Country	Targets*	Policy initiatives
SPAIN	Reduce emissions by 23% by 2030 and achieve carbon neutrality and circular economy by 2050. ⁴⁰	<ul style="list-style-type: none"> • Climate law under review • Plans for electricity system to be 100% renewable by 2050 and to ban all new coal, oil and gas extraction projects • Regulation to reduce energy consumption by over 35% through renovation (upcoming) • Regulation for carbon-neutral new buildings (under review)
SWEDEN	Carbon neutrality by 2045. ⁴¹	<ul style="list-style-type: none"> • Climate reporting for buildings including all life cycle stages • Increased EPD requirements • Embodied carbon regulation (preliminary limit values of 12 kg CO₂e/m² from 2023 recommended by the Swedish National Board of Housing, Building and Planning) • Energy and carbon taxes, including homes and commercial buildings • National carbon reporting for new buildings (limits expected by 2027)
UNITED KINGDOM	Reduce emissions by 78% by 2035. ⁴²	<ul style="list-style-type: none"> • Net zero WLC Roadmap from the UKGBC • Mandatory Greater London Authority requirement for new projects • Industrial decarbonisation strategy • Strategies to reduce demand for energy include improving resource and energy efficiency and 'greener' societal choices

* Targets have 1990 baseline unless stated otherwise.

Subnational leadership

Subnational governments must lead the way when it comes to tackling the WLC impact of their buildings, not least because urban areas are responsible for 71–76% of global energy-related carbon dioxide emissions.⁴³ Municipal governments can do so in various ways, such as public procurement, as well as overarching net zero targets that include the built environment through ambitious renovation and green building targets. Below are some examples of cities that have started to act.

In 2018, Paris implemented the embodied carbon requirements of the French national buildings standard before the rest of the country.⁴⁴ Since then, new buildings have had to be assessed across the whole life cycle of the building: from material choices to end of life.

Since 2020, Helsinki has included circular economy requirements in its demolition contracts. The Finnish capital requires that a minimum of 70% of waste generated on site is recycled or reused, and that materials including metal, glass, wood, concrete and brick must be source-separated and recycled. The city also aims to integrate LCA into construction procurement for building and infrastructure projects by 2025.⁴⁵

As a signatory of the C40 Clean Construction Declaration in 2020, Budapest aims to reduce embodied carbon emissions by at least 50% for all new buildings, infrastructure projects and major renovations by 2030 and is striving for at least 30% by 2025. It also aims for all construction sites across the city to be zero emission by 2030.⁴⁶

40 European Parliament briefing (2021), [Climate action in Spain](#).

41 Ministry of the Environment and Energy (2017), [Swedish climate policy framework](#).

42 Department for Business, Energy & Industrial Strategy (2021), [UK enshrines new target in law](#).

43 IPCC (2017, p. 25), [Summary for Policymakers](#).

44 See [The Paris Climate Agency](#).

45 Urban Environment Publications (n.d.), [Helsinki's Roadmap for Circular and Sharing Economy](#).

46 C40 (n.d.), [Clean Construction Declaration](#).

SECTION 2: DEFINING A POLICY ROUTE FOR WHOLE LIFE CARBON

INTRODUCTION

Achieving the vision outlined in Section 1 requires major adjustments to buildings' design, construction, operation and end-of-life phase. No single policy can implement this shift: systemic change is needed, involving all actors in the building sector. Our recommendations are outlined in this section.

Overview of the potential policy routes

Various mechanisms can be applied to achieve a decarbonised built environment. The recommendations in this report have been broken down into four cross-cutting and complementary policy routes.

1. Building regulations

Updating building regulations to tackle the full environmental impact of the built environment is a crucial way to mandate low-carbon construction for new builds and renovation. These regulations dictate the standards to which buildings must be constructed and renovated across Member States as well as what data must be reported. They should respect the 'energy efficiency first' principle to address the built environment's operational impact and support a move towards addressing WLC. A regulated move to a WLC approach would transform how all building value-chain actors plan and deliver projects.

2. Waste and circularity

As the building sector accounts for an estimated third of Europe's total waste footprint, EU policy must also go further to tackle the WLC impact of buildings during construction and end-of-life phases. Using regulation to mandate a shift towards a construction ecosystem that embraces circularity will help decarbonise the entire building life cycle through increased resource efficiency.

3. Sustainable procurement

This policy route recognises that sustainability decisions regarding many building projects rest with public procurers. EU policy should enable these entities to be the sector vanguard, leading the way in adopting the tools and methods needed to decarbonise the built environment. The [updated Energy Efficiency Directive \(EED\)](#) highlights the opportunity public procurers have to use Level(s) metrics to assess WLC. This is the first step in driving market demand for these new solutions, but more work is needed. Designers, construction companies and manufacturers that have already embraced a WLC approach would stand to benefit.

4. Sustainable finance

As financial assets, buildings are at serious risk from climate change, both physically and from the potential economic impact of changing regulations. Introducing financial mechanisms that support sustainability would provide a powerful tool for improving the environmental and economic sustainability of Europe's building stock.

Importance of an integrated approach

As the EU policy framework evolves to consider circularity and WLC, it must recognise the synergies and interdependencies between the policy routes as outlined in this Roadmap. Only by looking at the built environment in a truly systemic way can we address its full impact.

Integrated policymaking and implementation will require the engagement of a broad range of stakeholders, including subnational governments, businesses, NGOs, research institutions and representatives from community groups.

Furthermore, current policies that impact buildings are often targeted at different points in the building life cycle and overlook interdependencies, as shown in Table 3.

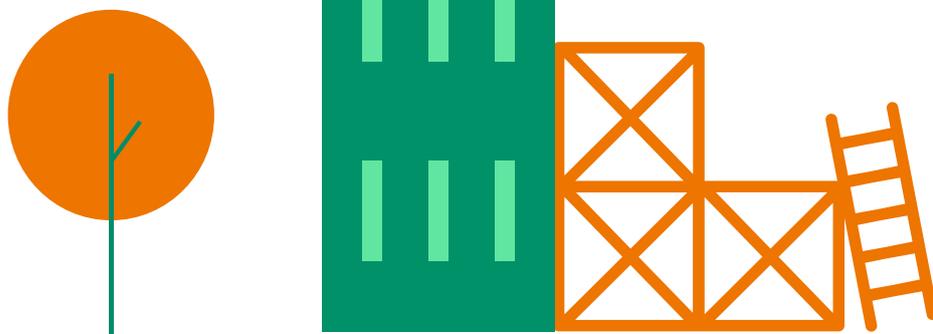


Table 3: Scope of various EU regulatory and non-regulatory measures against the building life cycle

Lifecycle stages	Modules	EU policy instruments								
		EPBD	EED	CPR	Ecodesign	WFD	GPP	ETS	Level(s)	Taxonomy
PRODUCTION	A1 Raw material supply	(*)	(*)	(*)	•	-	•	•	••	(*)
	A2 Transport	(*)	(*)	(*)	•	-	•	(*)	••	(*)
	A3 Manufacturing	(*)	(*)	(*)	•	-	•	•	••	(*)
CONSTRUCTION	A4 Transport	(*)	(*)	-	-	-	•	(*)	••	(*)
	A5 Construction installation process	(*)	(*)	-	-	-	•	-	••	(*)
USE	B2 Maintenance	(*)	(*)	(*)	-	-	•	-	••	(*)
	B3 Repair	(*)	(*)	(*)	-	-	•	-	••	(*)
	B4 Replacement	(*)	(*)	(*)	-	-	•	-	••	(*)
	B5 Refurbishment	(*)	(*)	(*)	-	-	•	-	••	(*)
	B6 Operational energy use	••	••	-	•	-	•	(*)	••	••
END-OF-LIFE	C1 Deconstruction	(*)	(*)	-	-	•	•	-	••	(*)
	C2 Transport	(*)	(*)	-	-	-	•	(*)	••	(*)
	C3 Waste processing	(*)	(*)	(*)	-	••	•	-	••	(*)
	C4 Disposal	(*)	(*)	(*)	•	••	•	-	••	(*)
BEYOND LIFE	D Reuse/recycle	(*)	(*)	(*)	•	•	•	-	••	(*)

“•” – partially covered, “••” – fully covered, (*) – under revision

Source: BPIE – [Whole-life Carbon: Challenges and solutions for highly efficient and climate-neutral buildings](#)

No single solution can achieve a decarbonised built environment; the future EU policy framework must consider policies (and enabling tools) to address buildings' impacts more systematically.

Local and subnational governments' key roles in securing a climate-neutral and resilient transition for Europe's built environment must not be overlooked. Effective multi-level governance is key to accessing their full potential, and overcoming their obstacles,

by integrating subnational contributions into overarching goals and strategies while optimising vertical and horizontal institutional arrangements (see Section 3).

Effective co-designed and co-implemented regulations, policies and initiatives are needed for Europe to become the world's first carbon-neutral continent by 2050. Recommendations and tools that can help deliver this systemic change are outlined below under the four policy routes.

BUILDING REGULATIONS

Building regulations are an effective policy route to mandating a low-carbon trajectory for new construction and renovation. At the EU level, the EPBD is the single most important legislative tool available for tackling the built environment's climate impact. The EED is also an important legislative tool as it requires renovation of buildings in the public sector, which can show the way to a low-carbon building stock. These directives should evolve rapidly to include additional requirements on minimising the WLC footprint of buildings.

Policy efforts to decarbonise Europe's building stock have primarily focused on energy efficiency and measures to decarbonise heating and cooling. Furthermore, the EU regulatory framework focuses on new buildings' energy performance. For existing stock, Member States are required to develop long-term strategies to renovate existing buildings, but mandatory performance requirements only apply to major renovations, resulting in very low average performance improvement rates of just 9% and 16% in energy efficiency for residential and commercial renovations, respectively.⁴⁷

To achieve a climate-neutral Europe, regulation must also tackle sources of building carbon emissions from other parts of the life cycle. This involves quantifying the embodied carbon of the manufacturing, transportation, construction, renovation and end-of-life phases of built assets and setting targets to reduce these GHG emissions. For new builds with the highest energy efficiency standards, and therefore low operational energy needs, embodied carbon becomes the most significant area of carbon emissions over the building's lifetime.

EU policymakers must implement WLC metrics and thresholds to bring building policies in line with long-term carbon neutrality goals. As not all carbon emissions are related to energy, simply making a building energy efficient will not necessarily mean it is a zero carbon emissions building. Accounting for embodied carbon emissions at a building level would create greater demand for low-carbon materials.

Furthermore, the current EU renovation rates of 1.2% to 1.4% are insufficient to achieve the Paris Agreement goals. The rates should increase to 3% to 5% per year.⁴⁸

A renovation rate of 3% is considered economically attainable without shortening the normal renovation cycle and unnecessarily increasing costs for households, businesses or governments. It is key that building regulations promote higher renovation rates at a sustainable pace.⁴⁹

Defining zero-emission buildings

The ZEB concept proposed in the recast EPBD currently only refers to buildings' operational performance. However, to reach carbon neutrality goals, all buildings must evolve to be net zero WLC. The Commission must therefore outline how ZEB definitions, based on the 'energy efficiency first' principle, will go beyond the NZEB and current proposed ZEB ambitions to ensure that energy and carbon metrics (based on the Level(s) framework) are complementary and support the 2050 goal of net zero WLC new building infrastructure and renovations.

The net zero WLC buildings definition should clarify the boundaries and scope of emissions under EN 15978. This definition must be supported by guidance and principles to harmonise Member States' approaches and to enable comparisons across the EU.

Introducing whole life carbon targets

The EU will simply not meet carbon neutrality goals unless WLC targets are introduced for all buildings. We recommend that the Commission establish WLC targets in line with its decarbonisation trajectory; however, we have not indicated limit values for these targets due to lack of available data.

Therefore, our Roadmap recommends urgently collecting the WLC data so that benchmarks for different building types can be established and WLC limit values can be integrated into EU and national policy frameworks.

Buildings Performance Institute Europe's recent [How to Embed Whole Life Carbon in the EPBD report](#) provides a guide for aligning with the decarbonisation trajectory. As stated in the report, there is an urgent need to fill those data gaps and develop an EU-wide WLC trajectory aligned with science-based pathways. An illustrative example of how these targets could look is shown in Figure 2.

47 European Union (2019), [Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU](#).

48 See [NDC Partnership](#).

49 See [Eurima](#).

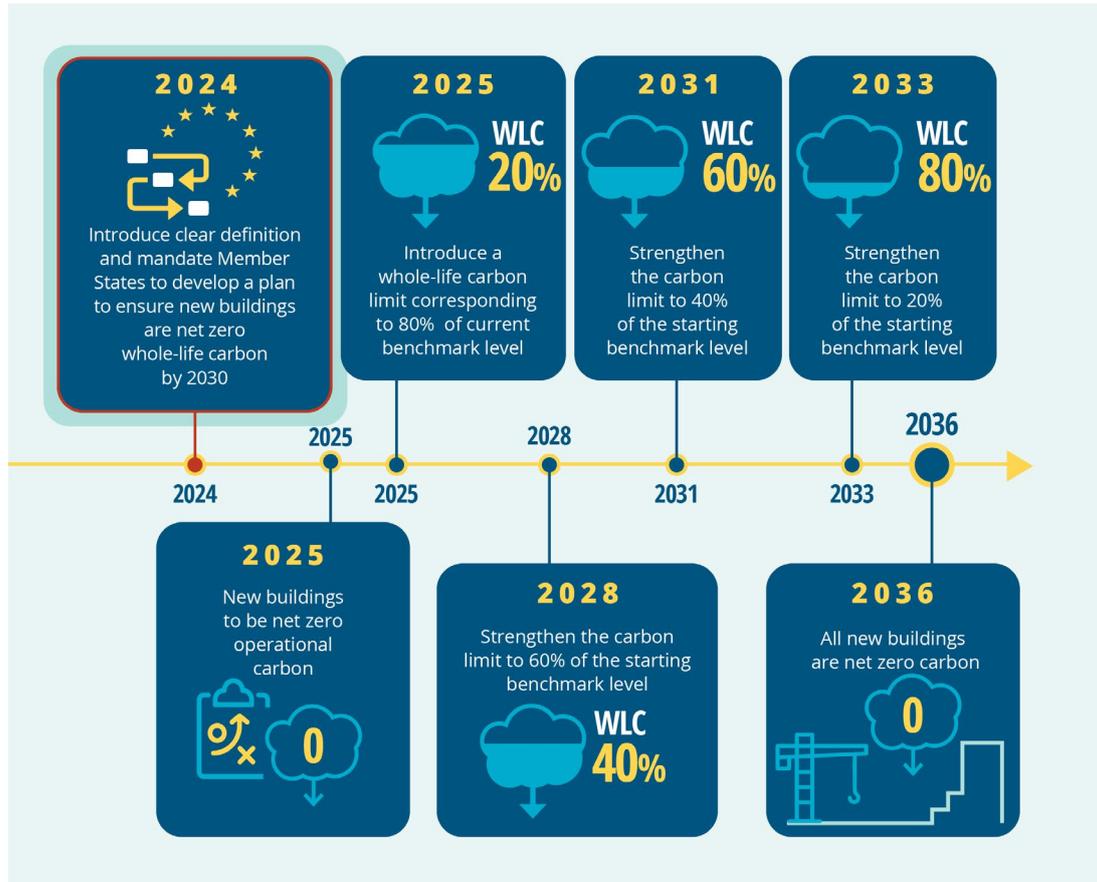


Figure 2: Indicative timeline of introducing net zero whole-life carbon requirements

Source: Roadmap to climate-proof buildings and construction – How to embed WLC in the EPBD

Minimum energy performance standards

MEPS are essential to reaching EU climate goals. By implementing minimum standards that can be increased over time, MEPS provide a key tool for guiding stakeholders through the deep renovation journey and enabling the delivery of net zero WLC. If the implementation of MEPS leads to deep-staged renovation, as opposed to deep renovation carried out in one go, they must be introduced alongside BRPs.

To ensure the building stock is fully decarbonised by 2050, MEPS must be aligned with the Commission's decarbonisation trajectory and incorporate progressive performance standards. The Commission should also commit to assessing the feasibility of adding WLC metrics to MEPS once widespread reporting exists.

A vision for energy performance certificates

The current EPC framework is not fit for purpose. It must be improved and harmonised so that homeowners and other stakeholders have accurate and accessible information about their buildings' projected and actual performance.

To be equally useful for all stakeholders, EPCs' building data should be more comprehensive. For policymakers, designers and other stakeholders, EPCs provide a useful calculated asset rating figure, but this should be complemented with real data about buildings' measured energy consumption.

Providing real-time information on home performance would empower building owners and occupiers to model and project the impact of building improvement on the EPC rating, thus enhancing their decision-making. New EPC updates should also be required at key points in a building's life, such as when renovation work takes place and when a property is sold or rented.

The ongoing EPBD revision must outline how to make the current EPC framework more robust, reliable and trustworthy. The use of EPCs within the EU taxonomy criteria makes it even more important that they are harmonised across the EU. This will also increase their reliability and accuracy as design tools.

In addition to the indicators proposed in the revised EPBD, EPCs must also require disclosure of WLC data for new builds.

A Fit for 55 approach to data

To deliver the recommendations outlined in this Roadmap, outdated aspects of the current policy framework must be updated. Clarity is needed on how to consolidate and future-proof initiatives and policies.

National Climate Action Roadmaps

At a Member State level, National Building Climate Action Roadmaps should replace long-term renovation strategies so all buildings – both current and future – are covered by national Roadmaps compatible with the EU's goal of climate neutrality by 2050.

These roadmaps must:

- State the impact of the national building stock on national carbon emissions
- Outline a trajectory to net zero WLC for all buildings by 2050
- Verify that WLC limits for all buildings are aligned with a net zero trajectory

These plans must be continuously monitored and verified. For EU-wide comparability, the framework of indicators developed via the [BUILD UPON² project](#) should be the blueprint for the common template of specific data and indicators.

Individual Climate Action Roadmaps

At a building level, Individual Climate Action Roadmaps, incorporating BRPs, should be required for all buildings to ensure that both current and future buildings have a plan to achieve net zero WLC.

These roadmaps must outline:

- How progressively tightened MEPS can help operationalise the pathway to climate neutrality
- Measures for reducing WLC emissions
- Expected energy savings, GHG emission reductions, health and comfort benefits

The Commission must clarify how digital building logbooks can support these roadmaps and act as a common repository for all relevant building data based on EPCs, Level(s), material passports, etc.

Harmonisation and standardisation

The performance and comparability of WLC calculations currently vary between Member States. A consistent and harmonised approach to quantifying, reporting and setting thresholds is needed to enable a solid basis for enforcing and setting accurate WLC targets.

The Commission must develop guidance on how the Level(s) framework will be used to develop relevant measures, including how to harmonise WLC calculation, reporting, benchmarking and limits under the relevant modules of EN 15978.

Indeed, some governments have little incentive to regulate WLC as it is based on consumption (ie emissions from manufacturing and transport of imported products), whereas overall EU climate targets and most national targets are based on production (ie emissions in the country). This anomaly must be tackled to give Member States a clear picture of emissions' contributions, on both a production and consumption basis, and to incentivise them to act on this.

Databases

As data is key to implementing the recommendations in this Roadmap, the development of open-source databases at EU and Member State level must be a priority. Data collection will help improve data-source consistency, address disparities between Member States, align approaches to calculating carbon, provide benchmarks for different building types and enable the setting of WLC limit values.

Data in Individual Climate Action Roadmaps can populate WLC databases at the national level and inform WLC benchmarks. Linking these databases to a central database for all buildings in the EU will facilitate a harmonised and open data system enabling comparability of WLC figures across Europe.

Building level

Individual Climate Action Roadmaps act as a central repository for all relevant building data.

National level

The EPBD mandates that Member States establish open-source databases with the information in Individual Climate Action Roadmaps being used to populate national WLC databases.

EU level

EU-level database with information from national databases enables the setting of EU-wide benchmarks and WLC targets.



POLICY RECOMMENDATIONS FOR THE EUROPEAN COMMISSION: TIMELINE

2022 - 2024

A clear vision

- Establish a clear vision of how building stock will help meet EU climate goals, set out its contribution to carbon emissions and reduction targets for 2030 and 2040, and align with trajectory for net zero WLC by 2050
- Outline a long-term vision for how the EPBD will boost and sustain building renovation, mandate staged disclosure of buildings' embodied carbon and operational emissions (WLC), and integrate circularity
- Provide guidance on how WLC limit values for buildings align with the decarbonisation trajectory up to 2050 and establish provisions for revising policies if necessary
- Clarify how measures will complement the transition to a net zero WLC building stock to ensure it is resilient to climate change impacts and can meet future needs

Guidance

- Specify how Level(s) framework will provide common principles from which to develop relevant measures and harmonise calculation, reporting, benchmarking and limits to WLC under EN 15978

- Clarify the methodology for calculating carbon storage and facilitate discussions to gain consensus on its role in decarbonisation
- Provide a timeline to clarify how ZEBs, as defined in the recast EPBD, will evolve to cover net zero WLC (see box on ZEBs)

MEPS

- Outline mandatory MEPS and a timeline for their achievement in line with net zero emissions by 2050
- Ask Member States to develop National Climate Action Roadmaps by 2024 in line with EU climate objectives, going beyond long-term renovation strategies and covering all buildings

EPCs

- Indicate a clear process for updating EPCs to help harmonise and validate performance to increase reliability and improve asset rating calculation with measured building performance. Mandate that: (1) final energy demand, primary energy demand and WLC in EPCs are reported and (2) that EPC databases must report calculated and measured energy performance

2022 - 2024



2022 - 2024 CONTINUED

Climate Action Roadmaps

- National Climate Action Roadmaps must include milestones to ensure all buildings are net zero WLC by 2050
- Require Individual Climate Action Roadmaps for all buildings; these must articulate how MEPS can contribute to climate neutrality (see box on Climate Action Roadmaps)
- Embodied carbon metrics can be based on bills of materials and measured or estimated energy consumption for relevant stages of the life cycle (eg construction, transportation and demolition)
- Emission factors for operational and embodied carbon assessments should be robust and high quality, ideally based on a recognised national database

Databases

- Signal that Member States must develop open-source databases on calculated and measured energy performance and GHG emissions of building stock to contribute to an EU-wide database
- EPBD requires Member States to assess and disclose information on WLC metrics for all new constructions and major renovation⁵⁰
- EPBD mandates pre-demolition audits

WLC

- Update EPBD to facilitate a pan-European approach – based on Level(s) – for reporting operational and embodied carbon metrics: operational carbon metrics should be based on high-quality asset ratings and in-use verified energy consumption data, if available, or on realistic estimates



50 Major renovation, as defined by the EPBD.

BEFORE 2025

EPCs

- Must report on WLC for new, public and larger non-residential buildings
- Must report on operational emissions

Databases

- Develop an open-source database that can be linked to Member State databases and provide guidance on how to align them

Climate Action Roadmaps

- Roadmaps must be established to: help implement MEPS; phase out worst-performing buildings; facilitate low-carbon refurbishment and avoid lock-ins
- Member States' roadmaps must be compatible with the EU's 2050 climate-neutrality goal, as well as the 2030 and 2040 milestones
- Member States' roadmaps must align with their targets for new buildings and long-term climate objectives and be monitored by transparent, national-level mechanisms

BEFORE 2026

Databases

- Member States must have launched open-source databases linked to the EU-wide database

WLC

- All new buildings must be zero operational emission buildings; they must also assess and disclose information on WLC
- Member States must have set national targets and WLC limit values (per square metre) for new public and all large buildings and major renovations

BEFORE 2028

Guidance

- Evaluate progress against decarbonisation trajectory defined by the Commission's WLC Roadmap and highlight any necessary policy and regulation adjustments

MEPS

- Revise MEPS threshold to ensure alignment with decarbonisation trajectory

National Climate Roadmaps

- Member States must update their roadmaps and extend their scope to cover WLC for existing buildings and provide evidence that their trajectory is compatible with the 2030 and 2050 objectives

2025 - 2050



BY 2030

Guidance

- Propose a framework for sustainable buildings which guides policies that address buildings' WLC and broader sustainability issues
- All new ZEBs are already net zero operational carbon and their evolution to net zero WLC by 2050 is clearly outlined

MEPS

- Revise MEPS threshold to ensure alignment with decarbonisation trajectory

Climate Action Roadmaps

- Member States must update their roadmaps and prove their trajectory is compatible with the 2030 and 2050 EU climate objectives; if they are not, key indicators and milestones should be reviewed and adapted

Databases

- Member States are using data in Individual Climate Action Roadmaps to increase reliability of building-level databases (linked to EU database)

WLC

- Member States must set national targets and WLC limit values (per square metre) for all buildings and major renovations
- EPBD revision in 2028 evaluates progress towards decarbonisation, highlighting adjustments for policies and regulations for further alignment

BY 2040

MEPS

- Revise MEPS threshold so that it aligns with decarbonisation trajectory

Climate Action Roadmaps

- Member States must update their roadmaps and prove their trajectory is compatible with 2050 EU climate objectives; if they are not, WLC limit values must be reviewed and lowered

WLC

- Embodied and operational carbon limits must be continually reviewed and lowered in line with 2050 WLC Roadmap and national goals

BY 2050

- Entire building stock will be net zero WLC



WASTE AND CIRCULARITY

The buildings sector is responsible for a third of Europe's waste and half of its extracted materials.⁵¹ The waste generated includes leftover construction materials, remnants of demolished buildings, packaging and other debris.

EU policy must do more to tackle this environmental impact. Central to this will be developing policies that enforce and encourage greater circularity and increased resource efficiency.

The end goal of such policies will be to design waste out of the construction value chain and end the sector's reliance on finite resources. The first step is for these policies to enable and catalyse a major increase in the reuse of construction products and materials, with high-quality recycling of construction and demolition waste. Optimised building material standards and legislation for how to deal with materials on site and at end of life will also be required.

These policies must be supported by measures that stimulate market demand so that reusable and secondary materials are accepted. Conveniently located and adequate reuse and recycling facilities (including required technologies) will be essential.

Box 1: Circularity in the Level(s) framework

The Level(s) framework provides guidance for putting circularity into practice under objective 2 (efficient and circular material life cycles), under which four indicator areas assess the most important opportunities for improving resource efficiency and circularity:

- 2.1 Bill of quantities, materials and lifespans
- 2.2 Construction and demolition waste and materials
- 2.3 Design for adaptability and renovation
- 2.4 Design for deconstruction, reuse and recycling

The above indicators use existing practices and standards/metrics. They should be considered a useful and substantive basis for promoting practices and setting targets under these policy routes. Overarching circularity indicators are also now being standardised by ISO, with construction sector indicators.

See Level(s) section on page 15.

Regulatory tools to address circularity

Circularity is a cross-cutting issue in the building value chain. It can be integrated into the following EU policy instruments:

The EPBD and the [Construction Products Regulation](#) (CPR) (see Section 1 and the annex, respectively) can set requirements on circularity performance (information on proper dismantling, reusability, recyclability, recycled content and in-use requirements) at both the building and product level. The Waste Framework Directive (WFD) deals with prioritising and applying waste prevention and treatment measures to increase the efficiency of resource use (including setting end-of-waste criteria for materials).

The EU Public Procurement Directive and relevant Green Public Procurement (GPP) criteria can also require circularity requirements to be included to specify higher reuse of materials, minimum recycled content and the design approaches to be followed. However, this is highly reliant on the integration of product and building design standards (see Section X, Procurement).

The EU's updated New Industrial Strategy prioritises digitalisation under the Construction Sector Transition Pathway to allow the storage of essential data about products and buildings, thus making their reuse and circularity more feasible.

Circularity in the Energy Performance of Buildings Directive

Integrating circularity requirements into the EPBD will help address building WLC, drive circularity and deliver on the goals of the CEAP. The EPBD should be used to help Member States and regional authorities set and implement circularity requirements. Introducing such requirements will help increase the share of circular products in construction projects and the reuse of in-situ building elements.

A first step could be to propose that Member States set ambitious, specific and separate measurable national targets for reuse and recycling by 2030. Corresponding guidance for Member States should include recommendations for national targets based on commitments to double the circular material use rate by 2030 under the CEAP. Guidance should recommend that national targets include separate targets for secondary and recycled materials, with the targets integrated into national building renovation plans to reflect the EU's long-term vision on circularity.

51 Royal Institution of Chartered Surveyors (2021), [Is Europe ready for the circular economy?](#)

Sustainable and circular products

This Roadmap focuses on the building level rather than the product level, but driving circularity at the building level requires accurate product performance information. To foster the use of sustainable products and ensure value chains are more circular, this Roadmap supports the introduction of appropriate information requirements on product composition.

Standards bodies and the European Commission must lead the way towards consensus and clarity on the methodology used to calculate carbon storage and the potential of renewable materials.

To facilitate market entry of secondary materials, a standardised solution to exchanging product and material data between relevant actors in the value chain is needed. Such data will help foster circular building design and the use of buildings as material banks. So-called product passports – which would contain information on product lifespans, potential new-use scenarios, localisation and availability – could be used to meet this need.

Digitalisation

Digitalisation plays a key role in addressing WLC and enabling circularity. **Individual Climate Action Roadmaps** will be important in consolidating various instruments that provide information about a building, including digital building logbooks and BRPs.

Consolidating this data in one place will maintain essential building, system, product and material information covering all life cycle stages. Building-level information can then be linked to local, national and EU databases.

Standards in the construction industry

Construction industry standards provide greater reliability and consistency in terms of product or material quality, compatibility and compliance through defined common specifications, methods procedures and data exchange protocols. The construction industry has product- and building-level standards to drive circularity. These standards will be crucial in the transition to a decarbonised and circular built environment.

Building level

At the building level, the most common standard is EN 15978, which specifies the calculation method, based on an LCA and other quantified environmental information, to assess a building's environmental performance. The Level(s) framework refers to this standard, which applies to new and existing buildings and refurbishment projects.

Product level

At the product level, EN 15804 provides guidance on core product category rules relating to EPDs for construction products and services. It also enables data and outcomes to be integrated into building-level assessments supported by EN 15978. To ensure closer alignment with the Commission's Product Environmental Footprint (PEF), EN 15804 has been updated to EN 15804 + A2.

Further consistency improvements and a common European LCA database would minimise technical differences and harmonise aspects such as format, modelling and data quality. Further information on such issues can be found in BPIE's EPD factsheet.⁵²

Standards to drive circularity

The transition to a circular economy must be supported by harmonising and optimising these standards to help market actors implement circular economy practices throughout building life cycles and optimise sufficiency, reuse and high-quality closed-loop recycling processes of buildings' constituent elements.

Standards for measuring circularity must include minimum reusability and recyclability performance requirements, alongside standards for measuring and validating products' and materials' reusability. They must also establish quality assessments to facilitate secondary materials' re-entry to the market.

As more reused products enter the market, the industry must be assured of their safety and efficacy. To achieve this, reused products must be accompanied by a certification mechanism. This will not only ensure their quality but also help link them with reuse targets.

The European Standardisation Organisations and the International Organization for Standardization are currently standardising circularity indicators, including indicators specific to the construction sector. Standardised indicators and practices will be a useful and substantive basis for promoting practices and setting targets under the relevant policy routes.

Basing EU procurement and legislative requirements on these standards would also help unblock national-level bottlenecks preventing circular low-carbon products from being adopted at the EU and national levels. Alongside driving circularity, considering virgin and secondary materials within building standards can help prevent land-use change and biodiversity impacts in the supply chain.

52 BPIE (2021), [Addressing the hidden emissions in buildings](#)

POLICY RECOMMENDATIONS FOR THE EUROPEAN COMMISSION: TIMELINE

2022 - 2024

EPBD

- Provide guidance to Member States and regional authorities for setting and implementing circularity requirements in building regulations that must increase over time to drive maximum resource efficiency by 2050. Establish a timeline for introducing these requirements into EPBD, aligned with timeline for introducing WLC targets
- Requirements must increase over time to drive maximum resource efficiency by 2050

CPR

- Mandate provision of functional and environmental product information and establish how to inform sector about reusing products and materials
- Help relieve national-level bottlenecks that prevent adoption of circular and low-carbon products

WFD

- Establish how to reach EU targets for reducing construction and demolition waste (C&DW) by:
 - Investigating targets for the separate collection of key material streams

- Investigating targets for the reuse of construction products of appropriate quality for the intended application
- Investigating setting targets for closed-loop recycling of construction materials
- Introducing a landfill ban for non-hazardous waste and set out a timeline for introduction of an incineration ban on C&DW including a calendar for phasing out energy recovery of C&DW; safe handling or recycling solutions should be explored for hazardous fraction, with incineration as last resort
- Amending existing recovery targets to prevent Member States from reporting sub-optimal recovery activities (including waste-to-energy and backfilling operations) as part of their 70% target

Essential tools for circularity

- Provide guidance on the creation of localised circular supply chains
- Develop key standards and protocols for circularity, including certification mechanisms to validate safety and efficacy of reused materials
- Encourage use of Level(s) resource and circularity indicators in procurement

2022 - 2050



BEFORE 2026

EPBD

- Evaluate progress on integration of circularity requirements in the EPBD and Renovation Wave and potential of mandatory minimum requirement at building level to drive progress and help to reduce WLC

WFD

- Require Member States to implement EU C&DW protocol
- Introduce more EU-wide end-of-waste criteria to support uptake of secondary input materials and safe reusable products
- Mandate disclosure of waste product and material information on reusability, recyclability and traceability
- Mandate construction product and material take-back schemes for components that can either be collected and repacked or recovered for recycling
- Establish national and regional extended producer responsibility schemes

Essential tools for circularity

- Mandate harmonisation of EU standards and develop certifications based on Level(s) framework
- Harmonise calculation methods, including verification and monitoring obligations, for accounting of recycled and reused materials
- Promote circularity in insurance market by establishing and promoting certificates for responsibly sourced, reused and recycled materials

BEFORE 2030

EPBD

- Tighten circularity requirements in EPBD to increase share of circular products in construction projects and of reuse of in-situ building elements

CPR

- Integrate minimum thresholds on reusability, recyclability and other circularity performance indicators linked to mechanisms to ensure appropriate quality for the intended use

WFD

- Mandate full implementation of EU C&DW protocol

BEFORE 2035

WFD

- C&DW requirements are strengthened
- List of waste streams covered by EU end-of-waste and by-product criteria is expanded
- EU-wide model established for sorting, separate collection and labelling of C&DW
- Regional and national extended producer responsibility systems in place

Essential tools for circularity

- Further harmonisation of EU standards
- Finalisation and adoption of full suite of legal and voluntary standards for circular economy; in the insurance market, establish certification for responsibly sourced, reused and recycled materials, ensuring quality and suitability for reuse

BY 2040

WFD

- Strengthened to increase circularity of value chains and facilitate use of secondary materials from C&DW

Voluntary sectoral standards

- Integrate several sectoral standards covering circularity, resource efficiency and waste in key EU policies

BY 2050

EPBD

- Tighten circularity requirements to increase share of circular products in construction projects and of reuse of in-situ building elements

WFD

- National-level regulations eliminate C&DW; demand for building materials met by circularity and efficient use of existing resources
- Sectoral standards support harmonised, environmentally robust practices, helping meet key EU targets

SUSTAINABLE PROCUREMENT

Procurement provides an excellent route for a top-down shift in the way and terms on which public authorities engage the buildings sector in construction projects. European procurement must move towards a model with sustainability and circularity at its core, enforced disclosure of WLC emissions and progressively stricter emissions targets. The vision set out in Section 1 requires that all publicly procured projects be net zero WLC well before 2050.

In this vision, public authorities will be first-adopter role models embracing tools such as the Level(s) Framework and third-party verified environmental data for products to facilitate the multi-actor collaboration and large-scale thinking necessary to deliver a net zero carbon built environment. Public procurement is an important driver for broader market transformation, and the recommendations in this section aim to harness its clear leadership role to model sustainable best practice. Multi-level action is required, with a focus on revising the EU Procurement Directive and drawing inspiration from some of the best practices developed by leading countries and cities across Europe.

POLICY RECOMMENDATIONS FOR THE EUROPEAN COMMISSION: TIMELINE

2022

Guidance

- Expand GPP criteria to cover all public buildings. It should:
 - Integrate Level(s) framework, particularly WLC and circularity indicators (see box 1, page 28)
 - Offer GPP training to build procurers' capacity to implement WLC and circularity principles
 - Outline how carbon limit values for public buildings will be integrated into EU procurement rules
 - Explain how public procurers should help establish localised secondary material market supply chains for the construction sector

Tender criteria

Update the Commission's tender criteria to include:

- Mandatory reuse assessment and pre-demolition audits to encourage reuse/refurbishment
- Reporting of Level(s) indicators on WLC and circularity (see box 1, page 28)
- Third-party verified environmental data on key materials to start building databases and enable benchmark setting
- MEPS based on EPCs and the final energy demand of buildings, with an obligation to achieve progressively more ambitious levels
- Requirement to reuse and recycle construction products

2022 - 2050



BY 2025

EU Procurement Directive

- Requires all new public buildings to be positive energy (in operation), with service-/performance-based energy contracting and district integration where possible
- Mandates WLC limit values for all public buildings for new construction and major renovations
- Incentivises take-back schemes for building systems, lighting, furniture and promotes technology systems-as-a-service and energy-performance-based contracting
- Stipulates that all tenders include sustainability/circularity criteria based on Level(s)
- Requires all buildings to undergo reuse assessment to discourage demolition
- Requires all buildings to undergo pre-demolition/deconstruction audits and share data across value chain
- Introduces minimum requirements in new construction and renovations so a percentage of products/materials from demolition can be reused/recycled
- Minimum requirements for products/materials in public projects to be reused/reusable and recycled/recyclable
- Applies minimum requirements for new building design and large renovations
- Mandates reporting and checking of environmental performance criteria in design, delivery, commissioning and verification to close the performance gap
- Outlines criteria to award contracts based on LCC or total cost of ownership instead of capital costs
- Outlines criteria that encourage use of regionally and sustainably sourced secondary materials and/or minimal heavy transport
- Outlines criteria for awarding contracts based on lower embodied carbon through transition towards zero emissions construction machinery and materials transport



BY 2030

EU Procurement Directive

- Ensures that award criteria based on Level(s) circularity indicators are more heavily weighted
- Mandates that new and existing public buildings be net zero WLC by 2035
- Tightens WLC limit value for all public buildings in line with net zero goals
- Makes WLC and material circularity focal points in heavily weighted environmental criteria
- Reduces absolute demand for new construction by allocating appropriate financing and risk/responsibility between stakeholders and supporting the sharing and flexible programming of built space

Guidance

- EU and national procurement strategies use Level(s) framework to account for trade-offs and weigh environmental performance and quality in an integrated way

BY 2040

National and regional policies

- Procurement policies stipulate that building systems are integrated into urban districts and the wider built environment, with shared responsibility and widespread use of product-as-a-service and performance-based contracting models, effective maintenance and information management

2050

Implementation of EU Procurement Directive and procurement strategies at national and subnational levels ensures:

- Diversified ownership and occupancy models
- Buildings are treated and maintained as material stocks, not delivered products
- Public procurement supports functioning circular markets for building components and materials



SUSTAINABLE FINANCE

Sustainable finance is a powerful tool for improving the standard of Europe's building stock. However, there is a very significant investment gap that both public and private finance must fill. In most countries, the leverage factor required from private finance is likely to be between three and four times the available public funds. The EU taxonomy is being developed to recognise the financial sector's important role and the urgent need for investment in more sustainable activities. The taxonomy classifies economic activities and sectors that make a substantial contribution to climate change mitigation and adaptation, the circular economy, biodiversity, water and pollution.

A key pillar of the EU Sustainable Finance Strategy, the taxonomy directly impacts other important aspects of policy in this area, including the European Green Bond Standard, the Sustainable Finance Disclosure Regulation (SFDR) and the Corporate Sustainability Reporting Directive (CSRD).⁵³ Given its significance, the taxonomy is the focal point of the recommendations below.

The taxonomy is intended to be both science-based and dynamic, meaning criteria will be reviewed and updated as needed – following scientific evidence – at least every three years.

The taxonomy's first years of development and implementation will be key in shaping the criteria and measures with the greatest impact on reducing emissions and restoring ecological systems. These indicators are expected to become embedded gradually in all new projects, with the taxonomy upgraded accordingly.

Synergies with other policy routes

The sustainable finance recommendations have strong links with all the policy routes, particularly building regulations and waste and circularity. For example, WLC metrics reported under the taxonomy are aligned with the WLC metrics recommended under procurement and building regulations. Where the proposals include elements related to a future 'substantial harm' taxonomy category, this must be aligned with regulation, since the taxonomy must not penalise buildings that would be legally compliant.

Implementing the EPC recommendations under building regulations requires taxonomy criteria to be updated to consider real, in-use energy and carbon performance. It also requires enabling tools, particularly EPCs and BRPs. The databases discussed under building regulations are crucial to delivering and monitoring taxonomy-aligned construction activities.

The requirements on circularity cannot be fulfilled unless stakeholders have access to circularity information in BRPs (under building regulations), as stipulated in the waste and circularity route recommendations.

53 The CSRD replaces the Non-Financial Reporting Directive (NFRD).

POLICY RECOMMENDATIONS FOR THE EUROPEAN COMMISSION: TIMELINE

2022

Taxonomy

- Provide tailored guidance to help actors understand how to work with the EU taxonomy criteria for buildings and civil engineering
- All eligible new buildings and renovations provide life cycle GHG emissions calculations and measures to reduce carbon dioxide emissions; to contribute to a circular economy, minimum thresholds for secondary materials must be met
- GHG supplements primary energy in climate-mitigation criteria
- Align EU taxonomy with sustainability disclosure regulations such as the CSRD and SFDR
- Review how the EU taxonomy can support Renovation Wave aims
- Update the taxonomy with substantial contribution criteria for renovations so that revenues from assets renovated to achieve significant energy efficiency improvements can be claimed as taxonomy aligned
- Update criteria for qualifying renovation investment to match EPBD ambition to achieve a ZEB stock by 2050
- Taxonomy-eligible renovations should be deep or staged deep, provided they are supported by a BRP

Renovation finance

- Channel EU recovery funds and the Social Climate Fund into renovation programmes to help tackle energy poverty by encouraging deep renovation and addressing worst-performing buildings in line with climate-neutrality goals, as per EU climate law

- Encourage Member States to develop financial mechanisms beyond recovery funds to promote renovation programmes in the next decade
- Review and map the market barriers for the financial mechanisms needed to help the Renovation Wave facilitate a just transition and maintain social cohesion
- De-risk and leverage private finance, tailor grants and subsidy schemes to tackle worst-performing buildings, support vulnerable groups and innovative financing solutions
- Ensure local governments have direct access to funds to establish and maintain renovation programmes and campaigns
- Implement financial incentives and economic instruments at European, national and local levels to promote a sustainable and decarbonised built environment, circularity, low-carbon materials, energy efficiency, sufficiency and renewables
- Develop standards for private financing products (eg mortgage portfolio standards) that are aligned with taxonomy definitions of minimum energy savings, ensuring safeguards for homeowners and to protect against short-term divestment

Other

- Evaluate feasibility of a green supporting factor in EU capital requirements for lenders, linked to taxonomy criteria
- Promote integrated approach to circular value chains, eg through financial support for companies with circular solutions
- Promote finance programmes adopting a fair-trade approach to accredit standards in responsible investment
- Promote private sustainable improvement loans/sustainability-linked loans for improving real estate assets in line with Paris Agreement targets

2022



BY 2025

Taxonomy

- Merge criteria for climate mitigation and circular economy so that both must be met for a new building to be considered as making a substantial contribution
- Require all eligible buildings to provide a climate pathway aligned with the Paris Agreement, targeting net zero carbon balance in operation by 2045
- All eligible new buildings and renovations must provide evidence of at least 50% lower embodied carbon footprint than reference values for the country
- If the taxonomy is expanded so that it includes criteria for significantly harmful activities, consider including criteria for worst-performing public and non-residential buildings
- Based on collection of WLC data on new public and large data required under EPBD, EU taxonomy must set out WLC thresholds
- Communicate that, from 2030, new construction that is not net zero in operation and does not meet specified maximum embodied carbon thresholds will be classified substantially harmful

Renovation finance

- Sustainable investment loans / sustainability-linked loans are taxonomy eligible if strict Paris Agreement-aligned targets are followed with stringent and transparent control mechanisms in place
- Update EU taxonomy renovation minimum energy savings requirements to reflect the need to go deeper and deliver optimal, real energy savings to qualify as 'green'

Other

- Assess feasibility of introducing or encouraging carbon offset funds that apply a carbon price to buildings that breach national or local thresholds for WLC, building on best practice examples⁵⁴
- Green insurance mechanisms are developed to promote low-carbon buildings through resilience risk assessment

BY 2030

Taxonomy

- EU taxonomy will have an integrated LCA at the core of built-environment criteria, leading financial market participants and corporates to make adjusted investments
- Criteria have been updated to consider real, in-use energy and carbon performance

Other

- Most financial mechanisms and policy instruments promote net zero embodied carbon buildings
- Update mortgage portfolio standards and other private financing standards to address renovations' WLC

BY 2040

Taxonomy

- Merge taxonomy criteria for climate mitigation, adaptation and circular economy so that all three must be met for any building to be considered to make a substantial contribution
- To make a substantial contribution to climate mitigation, all new buildings should be energy and climate positive across the whole life cycle
- Acquiring and owning buildings that are not net zero in operation is classified as significantly harmful, except where clearly defined and limited exclusions apply
- All new construction and major renovations that are not net zero WLC will be classified substantially harmful

2025 - 2040

54 See, for example, the [carbon offset fund set up under the London Plan](#).

SECTION 3: IMPLEMENTATION

INTRODUCTION

The policy recommendations in Section 2 outline how the EU policy landscape could shift towards a WLC approach. Section 3 examines what sector and government actors must do to achieve that vision, including adopting an approach that breaks down multi-level governance barriers and unites construction value chain elements behind this common purpose.

A MULTI-LEVEL GOVERNANCE APPROACH

If every European citizen is to live in a totally decarbonised, circular, resilient and well-designed built environment, all levels of government must engage in the process: from EU-level policy development to national-level transposition and the subnational (local) level, which is often responsible for on-the-ground implementation and enforcement. National, subnational/local governments and the EU will play various roles in this process, as illustrated in the following visual and explained in more detail below.

	Policymaker	Planner, architect and engineer	Procurer and standard bearer	Implementer	Awareness raiser	Observer, regulator and enforcer
EU level						
National level						
Subnational/local level						

Key:



Policymaker:

develops integrated strategy; plans cross-sectoral strategic action; embeds sectoral targets and measures within climate action, recovery and resilience objectives and plans; ensures policy alignment across all levels.



Planner, architect and engineer

zoning and land use; integrated energy systems design.



Procurer and standard-bearer:

influences the market via sustainable practices, adopting and enforcing standards.



Implementer:

provides financial backing; designs and implements renovation programmes; re-/upskills construction sector; integrates local renewable energy sources and nature-based solutions.



Awareness raiser:

responsible for group-specific community outreach and engagement.



Observer, regulator and enforcer:

monitors reporting frameworks; compiles GHG inventory; responsible for quality control.

EU roles

As the entity that develops overarching directives, the European Commission can support national- and subnational-level implementation by taking the following actions:

- Delivering the EU Sustainable Built Environment Strategy, which outlines the role of national and local government in delivering EU policy
- Specifying standards for interactions between levels of governance and requiring citizen engagement/consultation to implement key EU directives
- Ensuring funding for reforms is channelled effectively to strengthen multi-level governance processes and integrate strategies and policies vertically
- Supporting dedicated funding for demonstration projects to increase market readiness –of solutions, strengthen business models and promote integration of technologies
- Ensuring subnational governments have access to dedicated technical assistance and financing mechanisms so they can develop and replicate projects
- Ensuring subnational governments have direct access to funds (eg Social Climate Fund) that can be used for locally tailored solutions to enable the built environment to be transformed in a sustainable way, beyond carbon emissions

National government roles

National governments can transpose EU directives quickly, consistent with the spirit of the directive, and link EU-level requirements with local action via the following actions:

- Committing to implement national WLC Roadmaps which facilitate a holistic and integrated approach by considering how to bring national building codes in line with EU environmental objectives
- Embedding Level(s) in national procurement policy and using Level(s) indicators as the basis for developing or strengthening national building databases and preparing for WLC-reporting requirements under the EPBD
- Aligning long-term national renovation strategies with national and EU targets for new buildings and using the BUILD UPON Framework indicators to monitor progress
- Creating frameworks to support implementation of the WFD at national level
- Working with subnational authorities to ensure public procurement policy supports functioning markets for recirculation of building components and materials
- Encouraging use of building information modelling and building logbooks to improve materials' traceability

- Align funding (eg recovery funds, Social Climate Fund) with local and regional priorities to ensure impact, support vulnerable communities and drive skills development

Subnational government roles

Subnational governments have a crucial role as delivery partners due to their understanding of and direct influence on the local context. As procurers, policymakers and EU-financing channels, local governments can ensure the appropriate enabling frameworks are in place to deliver on local, national and European policy ambitions. Their proximity to citizens gives local governments a key role in ensuring new policies have community buy-in.

To deliver the recommendations set out in this Roadmap, subnational governments must commit to the following:

Building regulations

- Develop comprehensive local WLC Roadmaps, aligned with national and EU policies, outlining subnational government and regulatory authority roles
- Embed requirements and strategies to reduce embodied carbon emissions in new or existing policies
- Engage with relevant local stakeholders to define a clear strategy and policy path to creating equity for broad implementation, accessibility and affordability of low-carbon solutions; the strategy must be linked to and integrated in any existing climate and energy action plans, and firmly contribute to local political commitments and targets

Data collection

- Support the use of Level(s) in procurement and local regulations while linking activities to robust monitoring frameworks that contribute to local GHG inventories/databases
- Work with national government to understand how to align local inventories with national databases required under EPBD
- Facilitate circular buildings and infrastructure approaches through new designs allowing for greater reuse of materials from existing assets reaching end of life
- Disclose life cycle carbon calculations for all public buildings and infrastructure to contribute to high-quality data collection for benchmarking and target-setting purposes
- Use the BUILD UPON Framework to monitor renovation initiatives and maximise environmental, social and economic benefits for the local community
- Fully utilise technical and financial support, to be made available by national governments and/or EU entities, to establish robust monitoring and reporting frameworks as well as local data-driven policymaking

Planning and procurement

- Pilot and then standardise circular construction approaches in public renovation and new construction to lead by example and prove viability
- Support built-environment decarbonisation and greater resilience by integrating WLC into cross-sectoral action planning and embedding sectoral targets and measures within local climate action plans
- Use own procurement to stimulate and support a market for local secondary materials and demonstrate net zero WLC buildings' excellence and viability
- Maximise use of existing buildings (eg by sharing and optimised reallocation)

Financing

- Support setting up of local exchange sites for materials
- Explore direct access to funding (eg recovery funds, Social Climate Fund) and use relevant opportunities at regional and national levels (eg grants and loans); explore public-private partnerships; explore lighter forms of financial involvement by acting as a guarantor for private investments of strategic importance

- Implement financial policies covering taxation, fees, incentives and commercial (dis)advantages to reduce embodied carbon and limit unnecessary construction

Training and engagement

- Support construction sector re-/upskilling and creation of new local employment; align renovation strategy and targets with existing policies and measures to tackle energy poverty
- Connect to citizens and local private actors to mainstream tools and terminology and promote compliance with increasingly stringent and comprehensive requirements
- Collaborate to create joint commitments, transfer knowledge and share experiences with other cities, governmental levels and stakeholders
- Increase awareness and demand for highly energy-efficient and low-carbon buildings
- Develop and roll out target-group-specific community outreach and engagement campaigns

ENGAGING THE VALUE CHAIN

Realising the recommendations outlined in this Roadmap will represent a systemic change for the construction sector requiring action across the entire value chain. It will also include civil society, which is essential to uniting an often-fragmented sector around the common goal of decarbonisation, and educators to address the skills shift needed for a WLC approach.

Policymakers alone will not deliver the change. All parts of the value chain must commit to:



Collaborate:

Accelerate deep cross-sectoral collaboration across the value chain to prepare the market for future regulations



Advocate:

Act on calls from industry and civil society for greater ambition, leadership and clarity and to encourage other levels of government to do the same



Communicate:

State their support for a decarbonised built environment by becoming an ambassador for the [#BuildingLife](#) campaign



Educate:

Commit to educating their supply chain and public authorities about the importance of WLC and work with professionals to develop EPDs/PEFs



Rate:

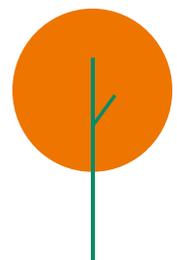
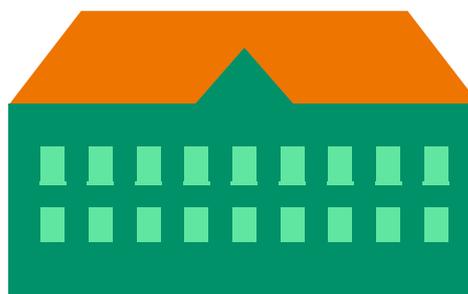
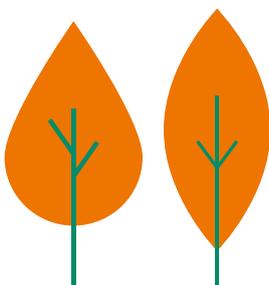
Commit to using rating tools employing a WLC approach and support database development at the national and EU level



Invest:

Support the EU taxonomy and sustainable finance principles

The vision articulated in this Roadmap can only be achieved if European policymakers and the entire value chain commit to tackling the entire carbon and resource impact of our sector.





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