POLICIES TO REDUCE WHOLE-LIFE CARBON IN THE BUILT ENVIRONMENT

Learnings from the EU and Sweden

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SUMMARY

Whole-life carbon (WLC) emissions from buildings, encompassing both operational and embodied emissions, contribute 40 % of global CO2 emissions. Policy efforts have largely focused on operational emissions, resulting in significant reductions in building energy use and emissions in the EU.

However, measures to tackle embodied emissions have lagged. As such, these emissions are becoming an ever-larger part of buildings' carbon footprint. In Sweden, where operational emissions have been significantly reduced over time, embodied emissions are already larger than operational ones.

Since Sweden is one of the leading countries in life cycle-based building regulations, this CEPS In-Depth Analysis compares EU and Swedish policies for reducing WLC in the built environment. By mapping the different policy frameworks to buildings' life cycle stages, we identified gaps and opportunities for strengthening existing measures.

While some experiences from the Swedish case could be applied to the EU context, further EU support to Member States could also significantly simplify the harmonisation and implementation of WLC frameworks. Ambitious limit values on WLC, better valuing of existing building stock, expanding buildings' lifespans and circularity, and fostering demand for low-carbon materials are all important levers to decarbonise the built environment. These measures could be implemented or strengthened in a range of existing policies.

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CONTENTS

1. INTRODUCTION

The built environment sector plays a key role in addressing the climate crisis. Emissions from construction, maintenance, and operations of buildings (whole-life carbon or WLC) account for about 40 % of global and EU CO_2 emissions (see Figure 1) (International Energy Agency, 2023b). WLC encompasses all greenhouse gas (GHG) emissions occurring in a building's life cycle. It is the sum of both operational and embodied emissions. The operational emissions, i.e. those produced when using a building, are composed of direct emissions from fuel use in buildings (Scope 1) and indirect emissions from use of electricity and district heating (Scope 2). 'Embodied emissions' (Scope 3) are those generated from the materials and construction processes throughout a building's entire life cycle.

So far, policy efforts have mainly focused on reducing operational CO2 emissions from heating, cooling, and lighting in buildings (Birgisdottir et al., 2017; International Energy Agency, 2023a; Röck et al., 2020), which have significantly reduced building energy use and emissions in the EU (European Commission, 2023; European Energy Agency, 2023). Efficiency improvements and renewable energy adoption led to a 34 % reduction in CO2 emissions from the use of buildings in the EU between 2005 and 2022 (European Energy Agency, 2024).

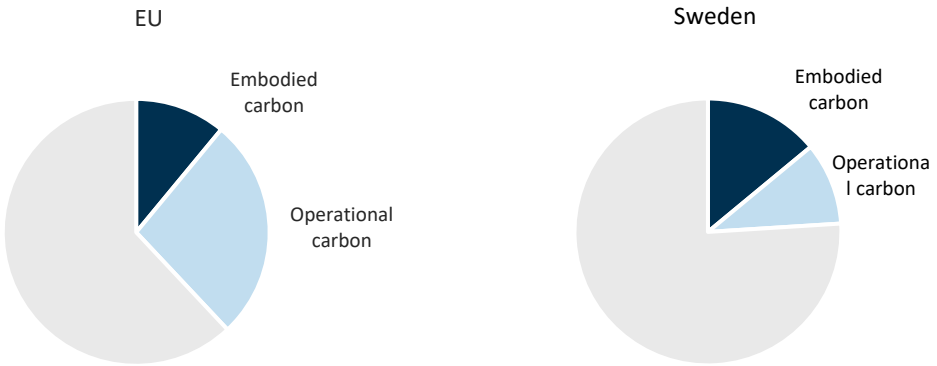
However, efforts to tackle embodied CO_2 emissions — those from manufacturing, transportation, construction, and end-of-life phases — have lagged (UNEP et al., 2023). Currently, embodied emissions contribute around 13 % of global and EU CO_2 emissions (International Energy Agency, 2023b). Embodied emissions are increasing with rising floor area per capita in the EU, which has also offset half of the operational emissions savings that could have arisen from energy efficiency gains (European Environmental Bureau, 2021).

Embodied emissions are becoming a larger part of a building's life cycle (Röck et al., 2020). Studies show they significantly contribute to the overall carbon footprint, particularly in new constructions, where they often dominate life cycle emissions (Karlsson et al., 2021; Röck et al., 2023; Zimmermann et al., 2023).

About two thirds of embodied emissions in new buildings occur upfront and are linked to the initial construction (life cycle stages A1–A5) (Görman et al., 2024; Röck et al., 2022). These emissions, locked in over the building's lifespan, highlight the importance of reducing upfront carbon emissions. In a static energy system, operational emissions may take 35 years to match upfront embodied emissions, a timeline that could extend beyond 50 years with the ongoing energy transition (Röck et al., 2020).

Moreover, as a part of its decarbonisation approach, the EU aims to double the retrofit rate of existing buildings (International Energy Agency, 2023c), which also entails substantial embodied emissions. If current trends continue, embodied emissions could surpass operational emissions in the EU in the coming decades (UNEP et al., 2023; World Green Building Council, 2019). This mirrors the situation in Sweden, where embodied carbon emissions are larger than operational emissions (as illustrated in Figure 1). Operational emissions in Sweden have dropped by two thirds since the 1990s due to efficiency mandates and shifts to greener heating systems, while embodied emissions have remained steady (Boverket, 2024c).

Figure 1. Comparison of embodied and operational building emissions as a share of total CO_2 emissions in the EU and Sweden. Data from 2021.



Sources: EU: (European Commission, 2023; European Energy Agency, 2023; International Energy Agency, 2022), and Sweden (Boverket, 2024c; Naturvårdsverket, 2023).

Most embodied emissions stem from materials like concrete, steel, and metals used in structural components (Balouktsi & Birgisdottir, 2023). Cement clinker production, along with steel and other heavy industries, are considered 'hard-to-abate' sectors requiring significant technological investments for decarbonisation (Davis et al., 2018; Habert et al., 2020; Karlsson et al., 2020; Malmqvist et al., 2023). Decarbonising construction demands strategies such as reducing the use of high-emission materials (UNEP et al., 2023).

In this report, we provide a policy description and analysis for both the EU and Sweden related to whole-life carbon. By focusing on both the EU and a national context, it is possible to highlight the overarching policy context and regulatory developments, and identify relevant gaps regarding the EU policy landscape as well as complementary regulatory approaches at a national level. We have chosen to focus on Sweden as a frontrunner in shifting its focus from operational to whole-life carbon emissions, both in mitigation action and in its regulatory development.

We aim to work out to what extent EU and Swedish policies for buildings cover whole-life carbon, looking at the individual life cycle stages of buildings. By comparing the two cases, we uncover gaps and potential future regulatory developments that may complement the current policy framework towards a more holistic WLC approach.

Avoiding the construction of new buildings through better distributing the existing residential and non-residential building stock and by prolonging building lifetimes through renovations could support the reduction of resource use in the sector and a faster reduction of sector emissions (Kuittinen, 2023). Indeed, retaining and rehabilitating existing buildings is less carbon intensive than new construction (Storck et al., 2023; Zimmermann et al., 2023). This may also reduce the emissions associated with changing land use that result from building in a greenfield location. We note that these emissions may be significant, but these types of emissions and associated regulation have not been the focus of this analysis.

2. EU POLICY OVERVIEW

While there exist targeted policies for the buildings and construction sector on an EU level, there is a larger policy framework in place that impacts WLC in the buildings and construction sector. The analysis below focuses on selected policies across different dimensions that were identified as particularly relevant. However, it does not claim to be exhaustive in its scope. Furthermore, voluntary measures, such as certification schemes, have also contributed to addressing operational emissions. Although this report does not focus on them specifically.

2.1. EMISSIONS POLICIES

The EU Emission Trading System (EU-ETS) is currently the main economic policy tool influencing embodied emissions in the EU. The steel, other metals, cement, lime, glass, mineral wool, plastic, gypsum board, and ceramic (tiles and bricks) industry are all covered by the ETS, thus, indirectly targeting the embodied carbon emissions of buildings. As the power sector is also included, the ETS also indirectly impacts building energy use, as well as material production, construction process or transports that use electricity.

The latest revision of the ETS included a phasing-out of free emission allowances, and an increased tightening of the emissions cap. The revision also introduced the so-called ETS2, which covers emissions from fuel combustion in buildings, road transport and some small additional sectors, including construction machinery. While reporting and monitoring of emissions starts in 2025, the ETS2 will become fully operational in 2027, as allowances will be needed for the ETS2-covered sectors by then.

Complementary to the ETS, the Carbon Border Adjustment Mechanism (CBAM) was introduced in 2023 to reduce the risk of carbon leakage and create a level playing field between EU and non-EU producers. The mechanism introduces a carbon tax on imported products, which reflects the ETS' carbon price. The CBAM will initially apply to several sectors that are at high risk of carbon leakage, including iron, steel, cement, aluminium and electricity generation.

Despite providing an overall trajectory towards decarbonisation of building material production, the effectiveness of the EU-ETS depends on a range of factors. For example, the gradual phasing out of free allowances, set to continue until 2035, poses challenges. These free allowances, intended to mitigate carbon leakage risks, have previously been identified as a major barrier to incentivising more efficient material use (Skelton & Allwood, 2017).

Many measures, particularly those related to resource efficiency and circularity, require broader engagement and policy measures across the value chain for effective implementation (Hernandez et al., 2018). This highlights the necessity of complementing carbon pricing with additional policies to address market failures and information gaps, as well as the negative externalities associated with construction (Söderholm, 2012). This includes the large output of waste and need for virgin materials from the construction sector.

While not directly targeting carbon emissions, the Industrial Emissions Directive (IED) is one of the overarching policies when it comes to regulating polluting emissions. The updated IED aims to promote innovation in new and emerging technologies, and foster material efficiency and decarbonisation by encouraging greener practices. Even though the IED does not set an overall target limit for emissions, it minimises pollution to protect the health of both people and the environment. The IED applies to more than 30,000 major industrial facilities that produce goods such as steel, cement, glass, lime, and ceramics. It also covers energy industries and waste management. By setting rules for all these basic materials, the IED contributes to lowering the embodied emissions of buildings.

2.2. ENERGY POLICIES

The Energy Efficiency Directive (EED) is the main overarching legislation aimed at improving energy efficiency across the EU. For construction, it promotes energy efficiency improvements in both new and existing buildings, ensuring that renovations meet minimum energy performance standards. The Directive also sets an annual energy savings target of 1.5 % for Member States, alongside the implementation of energy-efficient heating, cooling, and insulation solutions. By reducing energy consumption, the EED mainly targets the operational emissions of buildings. Furthermore, Member States have to renovate at least 3 % of the total floor area of publicly owned buildings.

While the overall binding target does not specifically mention efficiency of buildings, other articles address heating and cooling, and domestic hot water. Through requirements for public procurement, there is also potential for the development of energy-efficient construction products. All these EED measures, however, are either voluntary or simply entitlements. Therefore, their potential impact is limited.

The Renewable Energy Directive (RED) aims to promote the adoption and use of renewable energy sources in all sectors, including transport, industry, buildings, and the heating and cooling sector. The Directive sets binding and indicative targets for the required share of renewable energy in these sectors. An indicative target of 49 % for the share of renewable energy in buildings has been set for the year 2030. Additionally, there

is an annual increase target of 0.8 % for the use of renewables for heating and cooling of buildings. After 2026, this target will increase to 1.1 % per year, until 2030 (EUR-Lex, 2024).

The RED addresses multiple aspects of building emissions. The overall target can decrease the operational carbon emissions from buildings and construction through their energy use, as the carbon intensity of this energy will gradually go down. Renewables self-consumption development[1] in buildings is also supported, which allows the operational carbon emissions to reduce even further. Building renovation is also touched upon in the Directive, but not toward reducing embodied carbon emissions.

2.3. BUILDINGS AND CONSTRUCTION POLICIES

The recast Energy Performance of Buildings Directive (EPBD), adopted in 2024, aims for a zero-emissions building stock by 2050. It establishes a framework for calculating the energy performance of buildings and for minimum energy performance requirements for both new and existing buildings. While most provisions cover operational emissions, the EPBD also includes obligations to calculate and disclose the life cycle global warming potential (GWP) of buildings, without however establishing set targets to reduce WLC in buildings.

New buildings are at the centre of the EPBD's efforts to introduce WLC reductions. They will gradually have to include a life cycle GWP calculation in their energy performance certificates. Future delegated acts will establish the scope of building elements and life cycle modules to be included.

Currently, the EPBD establishes that the calculation[2] of total life cycle GWP refers to kilogram CO_2 equivalent per square metre ($kgCO_2e/m^2$) of useful floor area across 50 years. The EPBD also refers to Level(s), a voluntary standardised framework for assessing and reporting the sustainability performance of buildings.

Indicator 1.2 specifies the scope of building elements and technical equipment to be included in the calculation. It requires the inclusion of GWP data corresponding to at least 95 % of the mass of the building, but also has a simplified option containing a reduced scope and fewer requirements.

Beyond disclosure, Member States will need to publish roadmaps for introducing limit values on the life cycle GWP of new buildings from 2030 onwards. Although these

[1] *Renewables self-consumption is when a final customer operating within its premises generates renewable electricity for its own consumption, or stores or sells self-generated renewable electricity.*
[2] *The calculation needs to be in accordance with the EN 15978 standard (EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method).*

roadmaps, due by 2027, are a first step towards reducing WLC in new buildings, the lack of reduction requirements makes ambition levels in the short to medium terms uncertain.

Regarding existing buildings, WLC has received less attention. Member States will need to establish national building renovation plans for decarbonising the building stock by 2050. These plans must include an overview of the national building stock, including the policies that have been implemented or are planned for reducing whole life cycle GHG emissions for the construction, renovation, operation and end-of-life phases.

To make construction products more sustainable and circular, the revised Construction Products Regulation (CPR) was proposed in 2022[3]. Connected to the Ecodesign for Sustainable Products Regulation (ESPR), the CPR establishes information and product requirements for construction products, used construction products, and key construction parts and materials.

The CPR proposal itself does not establish targets, making it difficult to estimate the overall potential for reducing WLC. Rules for assessing the (environmental) performance of construction products will largely be established through harmonised standards, to be drafted by European standardisation organisations. The aim of these standards is to provide common assessment methods for construction products and a single European scheme for declaring product performance. This could improve uniformity in how embodied emissions are measured across the EU, making it easier to compare products and select those with lower environmental impacts.

Based on these standards, the Commission can then establish specific product requirements. The CPR proposal provides a list of environmental aspects that future legislation may require economic operators to address for specific products. This includes circularity (like durability, reusability, repairability or recyclability), resource efficiency (energy efficiency and increased modularity), and decarbonisation (minimising life cycle GHG emissions).

Manufacturers will need to demonstrate that their products comply with the requirements set out in harmonised standards, and provide information on products' environmental performance over their life cycles via a digital product passport (DPP). This may increase transparency, facilitating the tracking and tracing of embodied carbon in buildings across value chains and the establishment of potential future embodied carbon thresholds for construction products.

[3] The information provided here refers to the European Parliament and the Council's agreed text that has not yet been published in the Official Journal at the time of writing.

The CPR also includes rules for Green Public Procurement (GPP). Defined as 'a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle' (European Commission, 2008, p. 4), GPP has so far been mainly voluntary in the EU. This has led to a fragmented approach across Member States, making it difficult to compare progress or track climate impacts (Nilsson Lewis et al., 2023). The Commission may start setting mandatory minimum environmental sustainability requirements for public procurement from 2027 onwards, depending on the outcomes of initial impact assessments. Such future GPP requirements could take the form of technical specifications, selection criteria, or contract award criteria, for example.

2.4. END-OF-LIFE

The Waste Framework Directive (WFD) is a crucial part of the EU legislation for a more circular economy and the decarbonisation of various sectors. The Directive establishes a legal framework and targets to manage waste within the EU. Establishing the waste hierarchy, it emphasises the need to prevent waste generation, promote reuse, and recycle materials efficiently. With regard to the construction sector, the WFD established a Union-wide target of reusing or recycling at least 70 % of construction and demolition waste (CDW) by 2020. A proposal for a WFD revision has been put forward by the European Commission, but does not include new measures on CDW.

By focusing on reusing and recycling materials and products, through the waste hierarchy, waste prevention programmes, and rules on end-of-waste status, the WFD aims to support the adoption of more sustainable and low-carbon construction products, while reducing the impact of the construction sector in the end-of-life stage. The Directive also introduces measures on extended producer responsibility, although these are voluntary for Member States and do not specifically mention CDW. If such measures are implemented, it could improve the design, reuse and information availability of construction products.

2.5. SUSTAINABILITY COMMUNICATION AND GREEN INVESTMENTS

The proposed Green Claims Directive aims to improve the reliability of environmental claims, reduce greenwashing, support informed purchasing, and ensure fair competition regarding product environmental performance. It sets criteria for companies to substantiate, communicate, and verify green claims, while introducing rules for environmental labelling schemes. The proposal applies to voluntary environmental claims made by businesses to consumers but does not cover mandatory claims or those regulated by existing EU rules. Therefore, and since it does not explicitly target the

construction sector, the proposal's overall impact on WLC in buildings may be rather limited.

The Corporate Sustainability Reporting Directive (CSRD) establishes detailed corporate reporting requirements on sustainability, including environmental, social, and governance factors. Its goal is to attract investment to support the green transition by improving the transparency of sustainability information. It requires companies to have sustainability reports certified by an independent auditor, and to comply with European Sustainability Reporting Standards (ESRS). Reporting will include emissions data, such as Scope 1, Scope 2, and (where relevant) Scope 3 emissions. This could impact WLC in the construction sector if companies use greener products and materials to enhance their environmental performance. Sector-specific ESRS will provide additional guidelines for disclosure per sector, including for construction and materials relevant to construction.

The CSRD is closely connected to the Corporate Sustainability Due Diligence Directive (CSDDD). This Directive requires large companies to perform due diligence to prevent and address negative environmental and human rights impacts within their operations and supply chains. The CSDDD also requires companies to align their business models with the Paris Agreement's 1.5 °C climate target, an obligation that the CSRD will enforce through mandatory reporting. Together, these Directives aim to foster corporate behavioural change and enhance sustainability efforts.

Companies in the scope of the CSRD need to disclose in their annual reports whether and how their activities are covered by the EU Taxonomy Regulation. The Taxonomy establishes a framework for classifying environmentally sustainable economic activities based on specific criteria. Its goal is to help companies and investors make informed sustainable investment decisions in alignment with the objectives of the Green Deal, without imposing mandatory environmental performance standards.

The Taxonomy defines environmentally sustainable activities as those that make a substantial contribution to at least one of the EU's climate and environmental goals. These goals include mitigating and adapting to climate change, promoting the sustainable use and protection of water and marine resources, transitioning to a circular economy, preventing and controlling pollution, and protecting and restoring biodiversity and ecosystems. A substantial contribution to each of these objectives, could, for example, consist of investing in more sustainable and/or circular construction products and materials. This would align with the Taxonomy by supporting climate change mitigation and circularity through reduced GHG emissions and increased use of secondary raw materials.

Additionally, the Taxonomy expands the definition of sustainable investments by including a Do No Significant Harm (to the above objectives) principle, and by introducing a requirement to comply with minimum safeguards and technical screening criteria set in delegated acts. Critical to embodied emissions in buildings, the Climate Delegated Act sets key performance indicators for the buildings and construction sector. These mostly refer to improving the energy performance of new and renovated buildings. When constructing new buildings that are larger than 5 000 m^2, it is necessary to calculate and disclose the life cycle GWP (as per Level(s) indicator 1.2) to investors and clients.

The Environmental Delegated Act includes circular economy criteria for calculating life cycle GWP for new buildings (regardless of their size) and renovation of existing buildings. As such, these criteria are more comprehensive regarding WLC than the criteria linked to climate change mitigation. The circular economy criteria also impose requirements on construction designs that promote circularity. This includes defining maximum levels of primary raw material for various construction products, as well as setting minimum levels for preparing CDW construction and demolition waste) for reuse or recycling, generated on the construction site.

Nevertheless, aligning with the EU Taxonomy only requires a substantial contribution to one of the EU's climate and environmental goals. Since the WLC requirements of the Climate Delegated Act are less strict than those of the Environmental Delegated Act, this may reduce the potential of the Taxonomy to reduce WLC.

3. THE SWEDISH CASE

Since 2015, Sweden has had a climate policy framework in place, which includes a Climate Act that aims to achieve net zero emissions by 2045. The country aims to be the first fossil-free welfare state (Regeringskansliet, 2017). In the built environment sector, the focus has shifted to reducing embodied carbon, as operational emissions have already declined significantly (Boverket, 2024c).

3.1. EMISSIONS POLICIES

Sweden was one of the first countries to introduce a Carbon Tax in 1991. The Swedish carbon tax is an excise tax on fossil fuels used by companies. The carbon tax was part of the reason for a large-scale transition from individual oil heaters to district heating and heat pumps (Sterner, 2020). Since the EU-ETS was launched, Swedish facilities included in the emissions trading scheme do not have to pay the carbon tax. Nowadays, smaller facilities typically group together to pay the Swedish carbon tax. The carbon tax is also levied on fossil transport fuels such as gasoline and diesel, thus impacting logistics and the construction process. For construction machinery and maritime transports however, the carbon tax is reduced by 30 %.

3.2. ENERGY POLICIES

In addition to the energy policies at the EU level, Sweden has energy taxes on electricity, heating fuels and on petrol and diesel in addition to the carbon tax. Related to transport fuels, Sweden also has a GHG Reduction Mandate for gasoline and diesel, where suppliers must reduce emissions through the blending of biofuels. This has led to reductions in emissions for transports and construction machinery linked to the building sector, until the quota was drastically reduced after a government shift in 2022.

3.3. PLANNING POLICIES

Planning regulations indirectly impact the WLC of buildings at the municipal level by creating conditions that affect WLC. Overarching principles include environmental and climate considerations, but the regulations do not explicitly target WLC. Although municipalities are interested in using planning to drive the climate transition, there is a lack of tools, data, and processes to track the climate impact of decisions (IVL Svenska Miljöinstitutet, 2022).

Addressing whole-life carbon in the building stock requires enabling functional changes in existing buildings. In Sweden, the need for new detailed development plans often hinders this process (Bergström et al., 2022). In response, Boverket has proposed

regulatory changes to support a simplification to allow for changes in use, while digitalising current plans (Boverket, 2024e).

3.4. BUILDING AND CONSTRUCTION POLICIES

Related to buildings, there are several laws and regulations that govern energy efficiency and energy use in buildings. The Swedish Building Code includes requirements for energy efficiency, such as heating, ventilation, and insulation. These include the need for efficient heating systems, minimising heat loss through good insulation, and ensuring ventilation systems recover heat to reduce energy consumption.

All buildings that are sold or rented out in Sweden must also have an Energy Performance Certificate, according to the Energy Performance of Buildings Act. This is linked to an energy classification, where Energy Class C corresponds to the requirements that would apply to the building if it were built today according to the Swedish Building Code. These requirements are aligned with the definition of nearly zero-energy buildings (NZEB) within the EU.

Since 2022, Sweden has required a Climate Declaration for new buildings over 100 sqm to obtain final clearance. Developers must calculate upfront embodied emissions, covering materials, transport, and processes, in line with the European life cycle standard (modules A1–A5). This includes the building envelope, load-bearing structures, and interior walls, which account for about 75 % of these emissions. These emissions should be reported using the indicator Global Warming Potential-Greenhouse Gas (GWP-GHG), which excludes biogenic emissions or sinks.

To aid compliance, the Swedish National Board of Housing, Building, and Planning (Boverket) has created a national climate database with generic data for over 200 construction products and energy sources. The regulation mandates the use of conservative values (25 % above the market average) for construction products unless verified environmental product declarations (EPDs) are provided, leading to a significant increase in available EPDs. Boverket also maintains a digital handbook for guidance on the regulation (Boverket, 2024b).

The regulation aims to enhance knowledge about the climate impact of buildings, facilitating cost-effective measures to reduce this impact. A climate declaration register is provided, and the authority has made efforts to prepare the market and develop its supervision. Still, the quality of registered climate declarations has been low, indicating a lack of maturity among stakeholders (Boverket, 2024f). A key issue is inaccurate estimation of resources used in the construction. While initial supervision focused on guidance, oversight will be tightened, requiring reporting of the calculation basis and potentially including sanctions for non-compliance (Boverket, 2024d).

The climate declaration regulation lays the foundation for the subsequent development of the regulatory framework that will cover most of the life cycle of buildings from 2027, thus bringing it into alignment with the EPBD (Boverket, 2019). However, the Swedish proposal also includes groundworks and soil stabilisation as well as certain renovation projects requiring building permits (Boverket, 2023).

Proposed limit values have been set for upfront embodied emissions to establish the maximum climate impacts, and they are proposed to be implemented in 2025, out for consultation in spring 2024 (Boverket, 2024a). All building elements are included – from the foundation and its insulation and upwards, except for solar cells and fixed equipment. The baseline is a comprehensive reference value study including embodied carbon assessments for 68 buildings of various types with separate limit values for single-family houses, multi-dwelling blocks, office buildings, education excluding preschools, special housing and other buildings (Malmqvist et al., 2023).

The focus is on upfront embodied carbon emissions (life cycle stages A1-A5) in the proposed limit value regulation. This is because these emissions can be immediately verified, and account for a significant portion of building climate impact in Sweden, ranging between 60 % and 80 % in new constructions (Görman et al., 2024). According to Boverket, revisiting system boundaries may be useful if methods emerge that highlight durable, easy-to-repair design choices, while other policy tools are seen to be more effective for promoting energy efficiency and future reuse (Barjot & Malmqvist, 2024).

Consultation responses raise concerns over the proposed limit values, which are seen as unambitious, set above the 2020 median levels of reference buildings. Boverket justifies these thresholds based on the construction industry's cost sensitivity (Boverket 2023). For 2030, Boverket proposes a 25 % reduction in limit values and a 15 % reduction for single-family homes. However, many stakeholders argue that a 50 % reduction is both feasible and necessary to meet the Paris Agreement and Sweden’s climate targets, supported by research from Mistra Carbon Exit (Karlsson, 2024).

A reliable assessment procedure requires recognised standards and advanced digitalisation. With current low-quality climate declarations, accurate calculations and quality assurance are vital as new limit values emerge. Boverket proposes that developers include a calculation base covering 80 % of resources used, while ensuring that 75 % of a building’s climate impact is verifiable with EPDs, resulting in 50 % being verified under current proposals. A robust digital system could achieve 95 % coverage, aligning with Level(s) standards. Digitalisation and standardisation are thus essential for efficient, high-quality climate declarations.

Increasingly underutilised office space provides potential for conversion to housing, but sector stakeholders find that current building regulations make converting older office buildings into housing more costly than demolition. To address this, Boverket has been tasked with proposing relaxed requirements concerning design and technical performance requirements and alterations, during rebuilding, and conversions. This is aimed at lowering costs and improving the use of existing buildings. This is to be reported in June 2025 (Regeringskansliet, 2024).

3.5. END-OF-LIFE

Several regulations have been introduced in Sweden to align with EU waste legislation, focusing on sorting CDW, preventing waste, and implementing the waste hierarchy principle in control plans (Statens Offentliga Utredningar, 2024). This requires at least gypsum, glass, plastics, wood, metal and minerals (concrete, tiles, ceramics) to be sorted separately at construction sites. The goal is to achieve at least a 70 % rate of reuse or recycling by weight by 2025. Currently, the rate stands at 50 %, primarily involving downcycling for 'backfilling' in excavated areas or landscaping. To improve this situation, more effective supervision is needed to ensure compliance with sorting requirements and control plans.

3.6. VOLUNTARY INITIATIVES

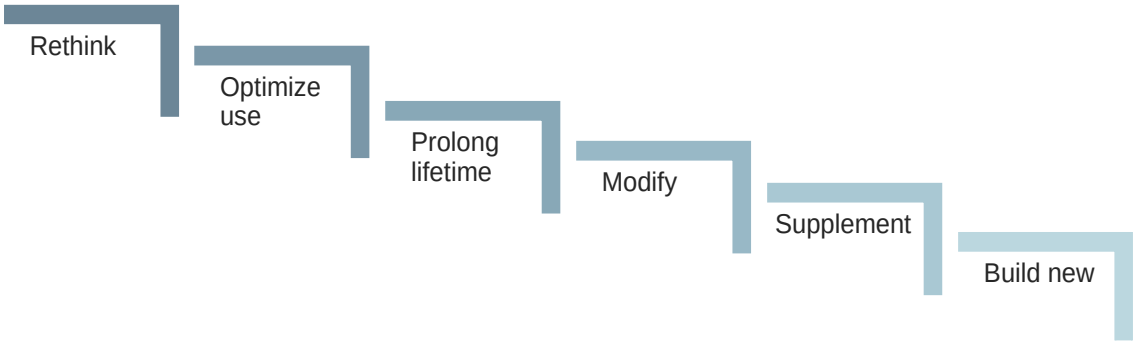
To support Sweden's climate goals, the government established Fossil Free Sweden in 2018 as a link between government and various stakeholders, including businesses and municipalities. As part of this initiative, 22 industries have created roadmaps to enhance their competitiveness by transitioning to fossil-free or climate-neutral operations, with many linking to the building construction sector.

A specific construction sector roadmap was launched in 2018 and updated in 2024, highlighting that many companies now recognise the climate transition as crucial for profitability and growth. Although voluntary, it has attracted nearly 200 stakeholders from across the construction value chain and established itself as a key reference point for climate transition in the sector. The original roadmap indicated that emissions could be halved using existing technology, which has now been demonstrated in various projects (Fossilfritt Sverige, 2024). The roadmap sets targets for a 50 % reduction on whole-life carbon emissions by 2030 and net zero by 2045, with participants adopting aligned or more ambitious goals.

The updated roadmap includes concrete commitments from all actors in the value chain, ensuring that goals are actionable, and progress is monitored. It also outlines necessary support from policymakers and promotes collaboration across the entire value chain, from material manufacturers to property developers.

A significant addition is a resource hierarchy agreed upon by all stakeholders, see Figure 2. This prioritises maximising the life cycle benefits of existing structures through maintenance, adaptations and optimisation. At each step in the hierarchy, flexibility and the potential for upgrades to meet future needs are considered. Demolition is avoided, and large parts of existing structures are reused where appropriate from a needs and life cycle perspective.

Figure 2. Resource hierarchy adopted in the Swedish Construction and civil engineering sector roadmap for fossil-free competitiveness (freely translated).



Sources: Adapted from (Fossilfritt Sverige, 2024).

Viable Cities is a Swedish strategic innovation programme, aiming for climate-neutral cities by 2030, involving close to 50 city municipalities. These cities collaborate on innovative approaches aimed at reducing emissions through planning and procurement. These cities integrate the entire urban planning process into the climate transition, initially focusing on new buildings but also addressing embodied carbon in renovations. In Sweden various local and regional low-carbon construction initiatives have also emerged, fostering collaboration between industry, municipalities, and academia.

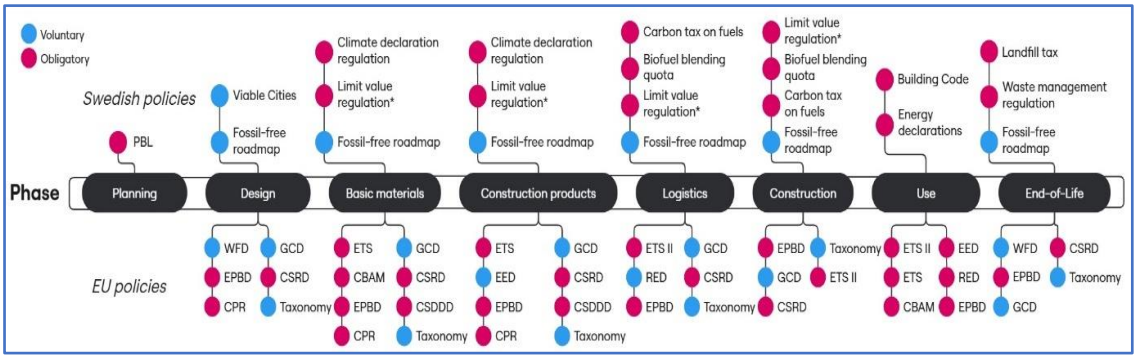
4. IMPLICATIONS FOR WLC

The analysis of the above policies has revealed both parallels and differences in the EU and Swedish approaches with regards to WLC. In the EU, the existing and emerging policy mix addresses different aspects of the construction value chain (see Figure 3). While many policies (carbon pricing, energy and end-of-life policies) play a role in providing a trajectory towards reducing emissions from the sector, others (EPBD and CPR) directly target life cycle aspects of buildings and construction.

Sustainability communication and finance policies may help create (lead) markets for products, materials and activities that contribute to reducing WLC emissions. For these policies, identifying individual life cycle stages is not as clear-cut, and as such they have been included horizontally in the analysis. Policies also differ in their level of 'strictness', with some of them including obligatory requirements and targets for Member States, while others are more voluntary in scope.

The policy framework in Sweden, like other Member States, is a combination of EU and national regulation and initiatives. While the building code and energy declaration requirements in Sweden have set strict sets energy efficiency standards for a long time, its building regulations increasingly emphasise WLC. Still, integration of explicit WLC considerations remains an emerging area in Swedish planning policy.

Figure 3 Swedish and EU policies and their coverage of the different phases of construction.



SourcesI: Based on own data 2025-2027

Planning

Planning regulations for the built environment are a competency of national governments rather than the EU because national and local governments are deemed to be better equipped to address specific needs and conditions based on their own contexts.

However, the EU can play a crucial supporting role in promoting low-carbon planning across its Member States.

In Sweden, the overarching principles of the planning regulations (PBL) include climate considerations. While the regulations create conditions that affect WLC, to date they do not explicitly target WLC.

Design

Several of the discussed policies have implications for the design stage, although this could be strengthened, particularly as regards the existing building stock. The EPBD requirements for all new buildings to have zero on-site emissions will inevitably require changes in design but may lead to increased embodied emissions unless tackled simultaneously. However, the EPBD's requirement to calculate and disclose the life cycle GWP of new buildings starting from 2028 may encourage designers to incorporate low-carbon, energy-efficient features early in the design stage – even in the absence of a reduction target.

The CPR will require environmental sustainability performance information for construction products, which will impact design by encouraging architects and engineers to select products with verified low-carbon or circular performance. With the future harmonised standards, designers can better compare products on durability, resource efficiency, and climate impacts, supporting more sustainable design decisions. The proposal also includes a list of environmental aspects for the design of construction products that future legislation may put forward, including for circularity, resource efficiency and decarbonisation. The design phase of buildings is also addressed, albeit marginally, by the WFD through the waste hierarchy and the extended producer responsibility rules.

In Sweden, regulators expect that introducing limit values will affect the design stage, even though the verification is only taking place after construction is completed for final clearance to be granted. However, for the this to occur, it is necessary that the limit values are strict enough to necessitate changes to the design.

Basic materials

The basic materials, such as steel, cement, glass, and ceramics, are primarily covered by the ETS, which imposes a cap on emissions from these industries, as well as the power sector. In addition, the CBAM ensures that imported products covered by the ETS are also subject to a carbon price. Although CBAM does not yet apply to all ETS-covered products, it is expected to expand in the future.

While its concrete implications depend on future harmonised standards and secondary legislation, the CPR is one of the policies to explicitly cover basic construction materials. As such, construction materials will need to adhere to certain (environmental) performance and information requirements, most of which are to be defined in the future. How the EPBD could potentially affect basic materials (as well as other supply chain stages) depends on whether future limit values on WLC (currently operationalised by the EU as GWP) will be introduced. Right now, obligations focus on calculating and disclosing GWP – which could of course be introduced by using low-carbon materials, for instance.

In addition, policies focused on improving sustainability disclosure and reporting could, combined with the EU Taxonomy, encourage investments into low-carbon materials.

Producers of basic material (and construction products) in Sweden are predominantly impacted by EU policies in relation to embodied carbon.

Construction products

Construction products are subject to similar policies as basic materials, but with some differences. The ETS indirectly covers construction products like tiles and bricks, as well as those that require steel, cement, or glass in their production. Meanwhile, the EED partially addresses the renovation of buildings, which can extend the lifespan of construction products and spread their embodied emissions over a longer lifespan. However, the EED does not impose obligatory requirements in this regard.

Here, too, the CPR has the potential to play a crucial role by directly regulating threshold levels and performance classes for the environmental characteristics of construction products. Manufacturers will also need to provide information on the life cycle environmental performance of construction products, which is relevant for increasing GPP. At the same time, markets for green construction products could be created through combating greenwashing and improving sustainability reporting. Additionally, green investments could be fostered through the EU Taxonomy.

Logistics

The logistics involved in the construction sector of buildings, particularly the transport of materials to building sites, are addressed by the ETS 2, which caps emissions from fuel combustion related to road transport. When using maritime transports, the emissions are covered by the original ETS. Logistics may also be impacted by the EPBD, if calculation and limit values on GWP that cover material transport are introduced.

In Sweden, the emissions from fossil transport fuels are covered by a domestic carbon tax. Land-based transports pay the full tax, while it is reduced for commercial maritime transports.

Construction

The emissions that occur in the construction phase are partially covered by the ETS II, as it covers non-road mobile machinery (i.e. construction machinery). Moreover, the CPR (Annex I.1) puts forward basic requirements for construction works, which include environmental aspects. For example, it specifies that construction works have to use natural resources sustainably throughout their life cycles, maximising resource efficiency, reuse and recyclability, while minimising the amount of raw materials used, waste generated and embodied energy consumed. Construction waste arising in new construction and renovations are also covered by the WFD.

Finally, the EPBD's obligations to calculate and disclose GWP of buildings also includes construction-site activities. However, it is not yet clear whether limit values in EPBD roadmaps will cover construction-site activities.

In Sweden, the emissions from fossil transport fuels used in construction machinery are covered by a domestic carbon tax at reduced levels. Other energy use on site, such as electricity and heating fuels, is covered by energy taxes. Waste management regulations require construction-site wastage of many construction materials to be sorted separately, with limited effect due to restricted compliance controls.

Use

Operational emissions in the use phase are covered by both the ETS and ETS 2. The ETS covers the emissions from the power sector, addressing any emissions that come from electricity use in the operational phase, while the ETS 2 covers fuel consumption within buildings. Additionally, CBAM applies to any imported electricity generation from outside the EU, which could be used in buildings. The EED extensively covers use-phase emissions, setting efficiency requirements for heating and cooling of buildings, as well as insulation solutions and hot water usage.

The RED aims to reduce the emission-intensity of Member States' electricity grids, hereby addressing emissions from the use phase of buildings. Furthermore, the RED includes a target to increase the number of buildings with renewable heating and cooling and promotes the development of more self-sufficient buildings, which also impacts the use phase.

The use phase of buildings is also covered by the EPBD and its minimum energy performance requirements for new and existing buildings. Given that most of the policy's

requirements actually target operational emissions, the use stage is at the core of the EPBD, aiming to ensure that all new buildings will have zero on-site emissions from fossil fuels in the future. In addition, the national building renovation plans also aim to address the use-stage emissions of the existing building stock by 2050.

Embodied emissions during the use phase, i.e. from maintenance, repair, replacement and refurbishment (life cycle stages B2-B5) may be covered by the WLC requirements of new buildings in the EPBD depending on life cycle stages specified in future delegated acts. However, embodied emissions during the use phase of the existing building stock are not yet directly addressed in the EU.

In Sweden, certain renovations requiring building permits will need to produce an embodied carbon calculation from 2027. In terms of energy use, it is important to note that the Swedish building regulations have strict requirements for both energy efficiency and energy performance certificates.

End-of-life

The WFD is the main policy for tackling emissions associated with the end-of-life stage of buildings. It does this through the waste hierarchy and a target for CDW, which aim to reduce the amount of waste. In addition, it sets down rules to harmonise end-of-waste criteria, although the WFD proposal is still under consideration. Other policies, like the CPR, also influence the EoL (end of life) stage, by providing rules for circularity. However, concrete product requirements for circularity are still to be determined.

Waste management regulations on CDW in Sweden are aligned with the EU WFD, but there is a need for more effective supervision related to control plans and sorting requirements.

4.1. COMPARISONS AND LEARNINGS

The EU has a strong opportunity to overcome challenges to ensure that embodied carbon as part of WLC is reduced in line with the EU Climate Law. These goals require aligning and enhancing efforts in policy and industry to reduce WLC emissions of buildings. Additionally, EU-level legislation provides the opportunity to reduce the complexity for practitioners in building design and construction through a certain degree of harmonisation across EU Member States.

Sweden and the Nordic region have led the way in life cycle-based building regulations. By early 2025, all Nordic countries plan to introduce a legal framework for disclosing life cycle GHG emissions giving them experience before the revised EPBD requires WLC assessments starting in 2028. By 2027, EU Member States must publish a roadmap for carbon limit values for new buildings, aiming for climate neutrality by 2050, with binding

limits by 2030. Many experiences from the Swedish and Nordic approaches can be used in the EU context.

Assessing life cycle emissions of buildings involves extensive data, assumptions, and calculations. The results can only be compared if the data and calculation methods adhere to the same methodology and scenario settings (Balouktsi et al., 2024; UNEP et al., 2023). Harmonising these methods is crucial for consistent reporting, especially in countries with less-developed LCA frameworks, and for ensuring fair competition and encouraging low-carbon solutions. The experiences of Sweden and other countries underscore the importance of establishing uniformity or at least a minimum level of comparability in assessment methods. This can facilitate better decision-making and promote sustainable practices across the construction sector.

The EU can support Member States by providing a clear framework and support in developing and implementing a WLC framework. This will simplify implementation and avoid cross-border complexity in building design and material supply.

There should be potential to enhance the coverage and ambition related to, e.g. life cycle stages, building elements, quality assurance and limit value thresholds as Member States and stakeholders mature and learn. Sharing experiences across Member States, preferably with EU support, could accelerate this process. This includes insights from the implementation of climate declaration and limit value regulations, where early adopters have faced different challenges. Emerging analyses comparing various approaches will be crucial for refining strategies and improving outcomes (Balouktsi et al., 2024; Erlandsson et al., 2024; Steinmann et al., 2023).

Related to the Swedish case, quality assurance, compliance control regime and implementation support have been highlighted as critical. Compliance control in Sweden has predominantly served a guiding role, which could be pertinent and important for capacity building. However, only 10 % of cases have been checked, which signifies the importance of ensuring that sufficient resources are allocated for compliance governance (Balouktsi et al., 2024).

Nevertheless, Sweden has supportive structures in place, such as an updated generic climate database for products and fuels, which facilitates high-quality calculations. The Swedish housing authority also provides a complete and continuously updated digital handbook including step-by-step guidance on application of the regulation as well as web learning modules, answers to frequently asked questions etc.

Applying these insights to the EU, the regulatory framework on WLC should be accompanied by instruments, tools and resources to support capacity development in Member States. Special attention should be given to value chain segments with the

largest lack of awareness and skills. This would ensure rapid implementation – and reduction – in all countries.

In its implementation of carbon limit values, Sweden has chosen to restrict the scope to upfront carbon. There are many reasons for giving special attention to upfront emissions. This part of the life cycle can be confirmed with real values at the building delivery, and focuses on the reduction of current emissions, rather than those that may occur further in the future. Finally, the ongoing transition of energy systems and industry towards low emissions means that future emissions are likely to be comparatively low (Balouktsi et al., 2024).

There is however reason to expand the scope in jurisdictions where regulations targeting operational energy efficiency or carbon emissions remain limited. One reason could be to avoid sub-optimisations between different stages of the product's life cycle. However, keeping the limit values for upfront carbon emissions separate is recommended as this approach ensures that emissions are reduced as quickly as possible.

This could provide insights for EU-level legislation. While the EPBD does address multiple stages of a building's life cycle – from material extraction and construction (A stages) to operation (B stages) and eventual demolition and disposal (C stages) – its focus is more on calculation and disclosure requirements than on binding emissions limits. To more effectively address upfront carbon emissions more effectively, it would be necessary to establish separate and explicit limit values, particularly for the A stages. Sweden's example illustrates this need.

Another important aspect relates to the different perspectives on biogenic carbon consideration in LCA in the various countries with WLC regulations, which can strongly influence the climate impact outcome of building assessments and the decisions and actions of stakeholders (Erlandsson et al., 2024).

Finally, the decisions made around different aspects may also affect which parts of the value chain are impacted. For example, setting requirements for WLC calculations to be produced at an early project stage and with separate limits on upfront carbon emissions would place more emphasis on the design stage. Furthermore, a decision to include or exclude transports or the construction process in the limit value requirements would impact logistics and on-site activities differently.

4.2. CHALLENGES AND GAPS

There are positive developments regarding developing and implementing the calculation of, and setting limit values, on construction of new buildings in the EU. Sweden and the other Nordic countries are leading by example in the EU in terms of their proactive and

coordinated development of climate regulation for buildings. Still, policies that more directly target the planning and design stages are needed. For the design stage, this could include requirements for WLC calculations to be produced at an early stage with separate limits on upfront carbon emissions.

If climate targets are to be reached, the building stock decarbonisation pathways need to show a higher level of ambition than what is currently implemented or planned in those Member States that have such plans (Tozan et al., 2022). Limit values for the climate impact of buildings need to combine a high ambition level with a smooth adoption by the industry. In addition, limit values need to be tightened rapidly to mitigate climate impacts in the building sector.

Differentiated minimum requirements for Member States around limit values could ensure that ambition levels remain in line with overall climate targets. Developing ambitious, but cost-effective differentiated requirements could be performed in alignment with the process of nationally distributed targets included in the EU Effort Sharing Regulation (ESR). To ensure a faster adoption, the EU Taxonomy could include limit values on new construction and/or renovation prior to the requirements in the EPBD. This could facilitate demand creation for low-carbon construction products and processes.

A frontrunner in this regard is Denmark. On the back of industry advocacy for stricter limits (EFFEKT et al., 2023), Denmark will tighten its limit values by 40 % from July 2025 with further tightening in 2027 and 2029 (Nordic Sustainable Construction, 2024). This includes varied limits for different building types and specific limit values for emissions from transport and the construction site. Around 85 % of new buildings covered by the requirement must perform better in terms of climate impact compared to 2021. Furthermore, the newly tightened limit values will come with a comprehensive review of the current Danish building regulations to eliminate barriers and facilitate a cost-effective compliance with the limit values.

While the instruments planned and implemented to date focus predominantly on new buildings (see, for example, the EPBD), an expansion to the renovation of existing buildings is necessary. This will ensure that absolute WLC levels are reduced as much as possible across the building stock. Additional research and policy design is needed to prepare this extension of scope.

The deep renovation wave connected with the implementation of the recast EPBD will trigger an immense potential for decarbonisation in operational energy, but will also imply large amounts of additional materials with associated embodied carbon (BPIE et al., 2022). To keep embodied carbon at bay, there is a clear and critical need to

complement the EPBD with support and, at least eventually, requirements towards low-carbon renovation methods and materials. A progressive requirement for climate declarations within the national renovation plans in the EPDB combined with performance requirements for relevant product categories within the CPR are relevant priorities in this regard.

In Sweden, Boverket proposes that certain renovation projects will be included in the climate declaration from 2027 (Boverket, 2019). Various initiatives are also developing climate calculation frameworks, along with reference and threshold values specifically for renovation projects (Borgström et al., 2024; Offentliga fastigheter, 2022).

Finally, there is scope for improving the circularity of new buildings through stronger EU requirements. Within the Ecodesign and Construction Products Regulations, the EU could facilitate prolonged building life cycles and circularity through product design rules aimed at improved durability, repairability and shifting recovery and recycling obligations for construction products toward producers. This could also include measures to allow for adaptability and multi-functionality of buildings, e.g. multiple use, co-living, co-working etc.

At refurbishments and at the end of a building's life, minimising CDW is essential. Designing for disassembly facilitates recycling and reuse of materials, reducing the environmental impact (Moschen-Schimek et al., 2023). The EU's target to recover 70 % of CDW by 2020 also highlights the need for better sorting and recycling practices. In addition, future targets should emphasise increasing material lifespan to reduce the need for new resources (Zhang et al., 2021).

Prioritising reuse and repair over recycling or disposal is crucial for increasing the materials' lifespan. Emphasising the value of retaining the structural integrity of products and materials in circulation further supports this objective. The Waste Hierarchy already makes this distinction, but the waste targets do not seem to reflect this distinction. Specifically, for CDW, this could include incentives to retain the structural elements of buildings in the renovation or demolition phase, in order to keep these emission-intensive products (i.e. steel and cement) within the value chain.

However, there is currently no mandatory producer responsibility for construction products in the CPR or the WFD. This means that producers of construction products are not responsible for waste management and are also not influenced by price signals from actors in the reuse and waste sectors when a building is either fully or partially demolished. Therefore, producers have no incentive to design products that are easier to recycle or reuse. Measures that place responsibility and costs on those who market products can therefore be considered. As a best-practice example, France introduced

producer responsibility for construction products and building materials in 2023 (BPIE, 2024). This obliges all marketers of products to take measures to prevent waste, and to finance product waste management. The costs for waste management should be included in the product price and stated on all invoices.

4.3. VALUING THE EXISTING BUILDING STOCK

A third of Europeans live in under-occupied dwellings (Eurostat, 2023); 40 % of office space is vacant or unused during office hours (Savills, 2024), while it is estimated that 5-15 % of dwellings (excluding holiday homes) and office buildings are completely vacant (OECD, 2024; Statista, 2024). This highlights the potential of better using the existing building stock to meet housing needs while reducing environmental impacts associated with extracting and processing virgin raw materials.

Avoiding the construction of new buildings through better distributing the existing residential and non-residential building stock and by prolonging building lifetimes through renovations are important levers for reducing absolute WLC emissions (Alaux et al., 2024; Graaf et al., 2024; Kuittinen, 2023). Renovating or converting existing buildings can significantly lower emissions compared to new construction, with potential savings averaging 60-70 % (Storck et al., 2023). Kuittinen (2023) therefore suggests the implementation of a 'building hierarchy' in developed countries, prioritising the utilisation of vacant and shareable spaces over renovating and extending (e.g. adding additional floors to) existing buildings, and finally constructing new buildings if the other options are not viable.

Despite discussions being initiated in a few countries, including the Nordics and France, the question of how to better value the existing building stock remains unanswered – even in the most progressive Member States.

The EU could provide significant leverage by including provisions in the EPBD roadmaps and renovation plans. As part of the recast development process of the EPBD, the European Parliament provided amendments in March 2023 (European Parliament, 2023). These introduced the concept of 'sufficiency', defined as 'the minimisation of demand for energy, materials, land, water, and other natural resources over the life cycle of buildings and goods'. In the recitals, sufficiency was described, together with efficiency and circularity, as a way to minimise the whole-life cycle GHG emissions of buildings. The amendments suggest for Member States to minimise the number of unoccupied buildings and encourage deep renovation and exploitation, through special administrative and financial measures.

According to the proposed amendments, Member States must include an indicator for national targets on sufficiency (without further definition of such a target) for every five-

year period in their building renovation plans and put in place economic instruments that incentivise sufficiency. In the opinion of the Committee of the Regions, one of the policy recommendations stated that the concept of sufficiency should be central in the EPBD proposal, as well as in the renovation passports. However, the concept was ultimately not included in the adopted version of the EPBD.

Despite this, the Directive's requirements for comprehensive building renovation plans – which include an overview of the current building stock and *can* also encompass GWP data – may pave the way for better utilisation of the existing building stock. This would be particularly helpful if the assessment of the existing building stock were to include information on unused or under-occupied residential and non-residential buildings. Improving data on vacant building area could help assessments of whether or not there is in fact a need for new buildings. In theory, the renovation roadmaps could promote a hierarchy that prioritises utilising existing buildings and conducting needs assessments before approving new construction projects. This approach could help the EU manage resources more sustainably, thus meeting demand without unnecessary use of resources.

As a first step, filling or repurposing vacant buildings is a low-hanging fruit which requires monitoring of vacant buildings. In France, the National Government, in collaboration with local authorities, has enacted a National Plan to Combat Vacancy. Municipalities are provided with vacancy data as well as tools for contacting owners of vacant properties.

There is potential for the EU Taxonomy to support such initiatives valuing current assets better in terms of the embodied carbon already invested in them. The Taxonomy criteria could encourage companies to make investments into decarbonising the existing building stocks, prioritising building extension or renovation over building new. The Taxonomy could also include indicators to incentivise the conversion of buildings – for example, turning unused offices into housing space, to make better use of the built environment.

Another issue experienced in Sweden is the regulation for rent-setting and capital gains tax creating lock-in effects, particularly for older individuals in larger homes. A review is underway to reform rent-setting, encouraging private rentals and better use of existing housing (Statens Offentliga Utredningar, 2024). Financial incentives like flat swaps or minimum occupancy rates could encourage downsizing (Bagheri et al., 2024; Lehner et al., 2024). Norway offers a best-practice example, where market-based rent-setting since 2010 has enabled private homeowners to rent out vacant space, by splitting or renting out vacant rooms, helping older individuals to retain their single-family homes (Kommunal- og distriktsdepartementet, 2024)

The measures taken at an EU level need to be accompanied by simplified planning and building regulations at a national level. Making repurposing easier than new construction

is a crucial step that should be combined with limitations on demolition permits and mandatory audits and plans for demolition or deconstruction. This would help to unleash the reuse potential of components and materials. To optimise the use of existing buildings and spaces over new build, it is important to promote or update existing tax regimes, zoning rules, building codes and other policies. These would then reduce demolition and favour the recording and repurposing of vacant buildings, as well as the multiple use of buildings and sharing spaces. This may create a better economic balance between new construction and repurposing.

In Sweden, government assignments in this direction and financial stimulus for municipalities that adopt detailed development plans supporting the conversion of premises into housing, are positive developments. The Danish government is adopting a holistic circular approach, thoroughly revising building regulations to ease remodelling, renovation, and repurposing of existing structures (Nordic Sustainable Construction, 2024). Separate rules will apply to existing buildings, potentially adjusting energy requirements to align with major renovations. The review also considers allowing municipalities to deny demolition permits or impose fees reflecting the environmental and climate impact of demolition. The results of these commissions and reviews could become examples of regulatory developments for other countries to be inspired by and learn from.

The EU could become an agent for change in promoting low-carbon planning by sharing good practices and provide capacity building support to its Member States. For example, the EU could provide dedicated funds through established mechanisms to finance low-carbon planning initiatives, particularly in regions with limited resources. Furthermore, the EU could strengthen monitoring by developing standardised metrics to track the carbon impact of planning policies and regularly assessing progress with recommendations. By focusing on these areas, the EU can empower its Member States to integrate low-carbon principles into their planning systems, helping to achieve shared climate goals while respecting national sovereignty.

5. POLICY MESSAGES

There are many levers towards reducing both relative and absolute WLC emissions in the built environment. Progress has been made towards targeting WLC within the policy landscape, but there are still gaps in relation to reaching the EU climate goals. Four different levers could, if life cycle considerations were included, lower the ecological impacts of buildings and the construction sector.

First, **nationally differentiated pathways for progressive limit values in roadmaps for new buildings within the EPBD** would be a good starting point, potentially developed in in alignment with the distributed target process within the EU ESR. Member States with existing or planned limit values highlight the need for greater ambition to meet climate targets. For instance, in Sweden, proposed thresholds remain modest despite calls for alignment with national climate goals, while Denmark is unique in having considered stakeholder input and strengthened its values from 2025. Roadmaps could be improved by gradually incorporating the obligation to perform embodied carbon assessments into national renovation plans. Sweden, for instance, plans to mandate these calculations for certain renovations starting in 2027, providing a useful model to follow.

Second, **better valuing the existing building stock** is another solution to lessen the cost of the climate transition in the built environment. A starting point could be to include an evaluation of building needs within the EPBD requirements around renovation plans and WLC roadmaps. The measures taken at an EU level need to be complemented by measures at a national level by promoting or updating existing tax regimes, zoning rules and building codes etc. The EU could become an agent for Member States to integrate low-carbon principles into their planning systems by developing standardised metrics, providing capacity building support and sharing good practices. As examples of good practices, both Sweden and Denmark are reviewing their planning and building regulations to better enable rebuilding and repurposing, while Denmark is also mulling limitations to demolition.

Third, if new buildings are unavoidable, **increasing their lifespan and flexibility to changing building needs, as well as the circularity of materials** could reduce WLC impacts. In this regard, ecodesign for construction materials and products is a crucial lever. Circular and sustainable ecodesign principles could significantly influence emissions across the construction sector by encouraging low-impact material choices, optimised design for durability and disassembly, and increased reuse of materials. However, ecodesign rules are currently missing from the CPR. Its sector-agnostic counterpart, the ESPR, will first target steel, while only introducing requirements for cement between 2028 and 2030.In addition, introducing extended producer responsibility for CDW through the WFD or the CPR could help boost the circularity of construction materials.

Fourth, **ensuring the demand for construction materials, products, and processes with a low-WLC impact** could be another lever. Several EU policies (the proposed Green Claims Directive, the CSDDD, and the CSRD) could strengthen their rules around life cycle disclosure. This could increase transparency and accountability around WLC. The CSRD's sector-specific guidelines will determine much of the policy's concrete impacts. Theoretically, they could shape reporting requirements around WLC impacts in buildings, allowing stakeholders to compare sustainability data more reliably. This comparability could help decision-makers to award building contracts to companies with lower demonstrated carbon impacts and higher environmental responsibility. It could also support green investments for construction products.

The EU Taxonomy offers additional potential to create a market for low-WLC products, materials and processes. Under the Environmental Delegated Act, circular economy criteria for calculating life cycle GWP have been included for both new and renovated buildings. However, their impact may be limited by less stringent criteria in the Climate Delegated Act. Moreover, the Taxonomy could better support the implementation of the EPBD and the CPR by ensuring market readiness through introducing WLC limits. The EU Taxonomy could also prioritise renovation over new construction, and promote adaptive reuse, such as converting offices into housing, to better value the embodied carbon already invested in the built environment.

Beyond the private sector, public procurement could play a role for market creation. Establishing clear GPP criteria aligned with WLC targets could drive long-term and stable demand for sustainable products, incentivising manufacturers to adopt sustainable practices broadly while also supporting the EU's climate goals.

By leveraging these policy pathways and fostering coordination between EU and national strategies, significant strides could be made towards reducing WLC in the buildings and construction sector and aligning the built environment with the EU's climate goals.

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