European
Circular Economy
Stakeholder Platform

EUROPEAN CIRCULAR ECONOMY STAKEHOLDER PLATFORM (ECESP)

CIRCULAR BUILDINGS AND INFRASTRUCTURE

STATE OF PLAY REPORT
ECESP LEADERSHIP GROUP ON
BUILDINGS AND INFRASTRUCTURE
2021

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FOREWORD

The built environment has a significant impact on a multitude of sectors, on local jobs and on the quality of life. The construction sector accounts for 50% of materials extracted in Europe and is responsible for more than 35% of Europe's waste. To put it bluntly: if we cannot make the built environment more circular and sustainable, we will not reach the climate goals. The new Sustainable Built Environment measures focus mostly on buildings, yet infrastructure is just as important for achieving a climate-neutral, circular European economy. Similar to buildings, infrastructure, such as roads, bridges, and waterworks has a high environmental impact due to material use and waste production, which leads to CO2 emissions. Circular best practices are already being implemented in every part of the value chain. They could work in every part of the world, but they need to scale. Together, these initiatives from circular design, the use of renewable materials, new circular business models as well as high-quality reuse and recycling, collectively have a huge potential in tackling climate change. There is momentum. Let's for a moment dive into the regulatory part. Europe is the continent with the farthest-reaching sustainable ambitions, which are presented in the EU Green Deal. As part of the Green Deal, Europe has launched the Renovation Wave. Currently, roughly 75% of buildings in the EU are not energy efficient, yet 85-95% of today's buildings will still be in use in 2050 . The renovation wave strategy aims to intensify renovation efforts throughout the EU, in order to make the necessary contribution to the buildings sector for the 2050 climate neutrality goals, as well as creating jobs and improving lives. The Renovation Wave should be a Circular Wave as well. Also, under the 2020 Circular Economy Action Plan, a lot of initiatives related to the built environment are being implemented, such as the strategy for a Sustainable Built Environment in 2021 or the Revision of the Construction Product Regulation. More recently, the Fit for 55 Package has been published, charting the way towards a more carbon-neutral Europe with infrastructure as an important supporting sector to achieve this. There is a financing momentum as well. In a post-pandemic world, significant funding is available for a sustainable recovery. An important aspect to mention is that the European Commission (EC) has developed a policy agenda on sustainable finance, including the Action Plan on Financing Sustainable Growth (and, more recently, the new Strategy for Financing, the Transition to a Sustainable Economy). At the core of the Action Plan is the EU Taxonomy Regulation, which could have a huge impact on circularity and this is currently being developed. All these developments can help to unlock the potential of circular construction. Frontrunners have the biggest market potential. By demonstrating and scaling working solutions and approaches in the domain of circular buildings and infrastructure, European entrepreneurs inspire the world and create global market opportunities: "European solutions to global challenges".

ECESP aims to have a role as a catalyst and transition broker in this discussion. When the European Commission and the European Economic and Social Committee (EESC) jointly launched the European Circular Economy Stakeholder Platform (ECESP) in March 2017, they created a space for stakeholders, for the Circular Economy community at large, to exchange ideas and good practices. Nearly 5 years later, we are delighted to see how far the Platform has come. Its thematic working groups, known as Leadership Groups, led by Coordination Group (CG) members, bring the subjects to the audience using the #EUCircularTalks concept. This series of events has brought together experts from various disciplines to discuss topics, such as the importance of infrastructure in tackling climate change, the challenges and opportunities of the renovation wave, and the value chains and market in the sector. This is the conversation and action that Europe needs, with actively engaged people striving to create a better and more circular economy.

Let the journey continue!

Freek van Eijk
Co-chair European Circular Economy Stakeholder Platform
Coordinator Leadership Group Construction, Buildings and Infrastructure
Director Holland Circular Hotspot

INTRODUCTION

Source: © Program Chaplin

Buildings and infrastructure represent our built environment and therefore play an undeniably crucial role in our health, wellbeing, and safety. They provide us with the basic structures we depend upon to enjoy productive and prosperous lifestyles; such as the homes we live in, the offices we work at, the roads and railways we travel through, and even delivering the clean water we drink. It is a fundamental factor in advancing civilizations and positively shaping the environment in which we exist.

On a European scale, many governments are keen on using the post-Covid-19 pandemic “momentum for recovery” (and the regeneration funds that come with it) as an opportunity to invest in creating a more resilient, sustainable, and futureproof construction sector.

Despite its unquestionable value-adding characteristics, this sector comes with a heavy toll on the environment due to the resources and materials it consumes, the emissions it releases, and the waste it produces. This brochure highlights the impact of the sector, as well as the role of Circular Economy in tackling the pressing challenges the sector faces, and refers to best practices and innovations currently being implemented across the EU region and the UK.

CHAPTER 1:

THE BUILDINGS & INFRASTRUCTURE SECTOR

Construction

Construction is a sector of high strategic importance due to its essential role in the socio-economic development of a country. Additionally, it connects many sectors such as mining, industrial, energy, waste, and mobility. When it comes to the topic of circularity in the built environment, building materials play a central role. The building materials market refers to the market in which products for structural construction works (cement, concrete, sand, bricks, wood or glass panels, etc.) and products for finishing works (insulation, glass-wool, mortars, clay tiles, ceilings, etc.) are traded. Although limited information is available today on the use of materials and flows along the global construction value chain, some figures are worth mentioning.

Economically, the sector has a gross value added close to 6% of EU GDP[2]. It is among the largest economic sectors, composed of nearly 3.3 million enterprises and 12.1 million employees[3]. To these numbers, the contribution from the mining and quarrying sector has to be added, with more than 17 thousand firms and 0.4 million employees[4].

The aggregate sector is the largest among the non-energy extractive industries in the number of sites, companies, employees, and tonnages produced. The European[5] average demand for aggregates is almost 6 tons per capita per year. According to Union Européenne des Producteurs de Granulats (UEPG) data, in 2018, the production of aggregates in the EU28 plus EFTA countries was 3.07 billion tonnes. The production of secondary aggregates, comprising recycled plus re-used aggregates, was an impressive 327 million tonnes, representing 10.6% of total EU plus EFTA production.

At the same time, the construction sector has a huge environmental impact because it generates a large amount of waste while consuming natural resources and energy, as well as emitting large quantities of CO2 emissions, and affecting biodiversity and soil. In fact, buildings are responsible for more than 30% of the European carbon footprint and more than 40% of the primary energy consumption in Europe[6]. Moreover, construction and demolition waste (C&DW) comprises the largest waste stream in the EU: 839 million tonnes in the EU in 2018, followed by 622 million tonnes produced by mining and quarrying[7]. However, there is clear room for improvement as 75% of European buildings are energy-inefficient[8] and 15% of building materials are wasted in the construction phase, while recycling rates of construction materials are high across the EU, most of its value is lost after the first cycle as 70% of this recycling can actually be defined as downcycling[9].

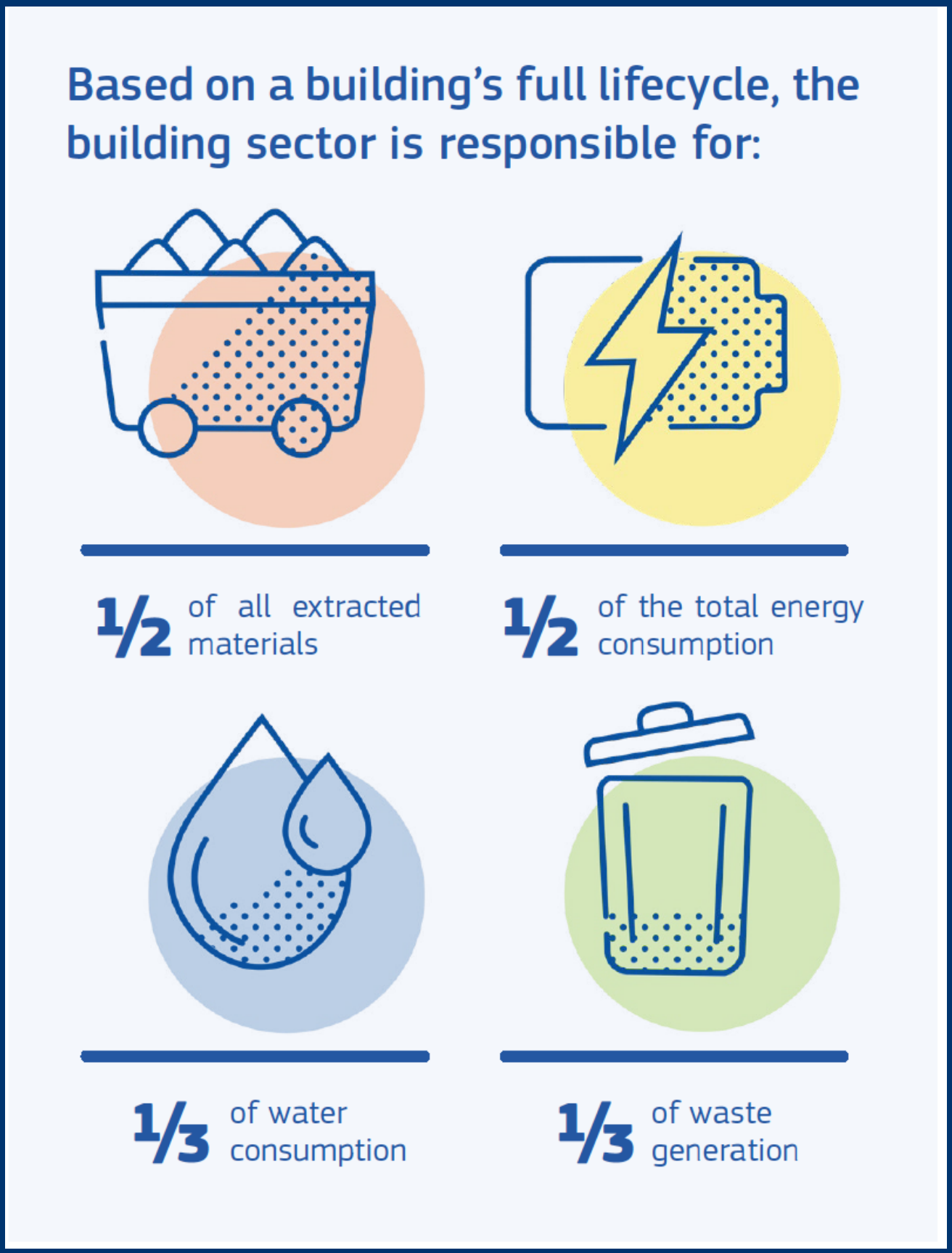


Figure 1: The impact of the construction sector

European Commission. (2021). Level(s), What's in it for construction companies and contractors, manufacturers, asset managers, facilities managers, and occupants? - Retrieved February 3, 2022, from source

Buildings

Buildings represent roughly half of the construction sector. This refers to residential, commercial, and institutional buildings. Unlike infrastructure, construction for buildings can be undertaken by individual landowners as well as corporations or public institutions. Housing is among the most significant drivers of the sector, with investments worth 5.4% of EU GDP in 2020 (figure 2). According to the recently published Circularity Gap Report, 38.8 Gt of resources are consumed by the housing sector.

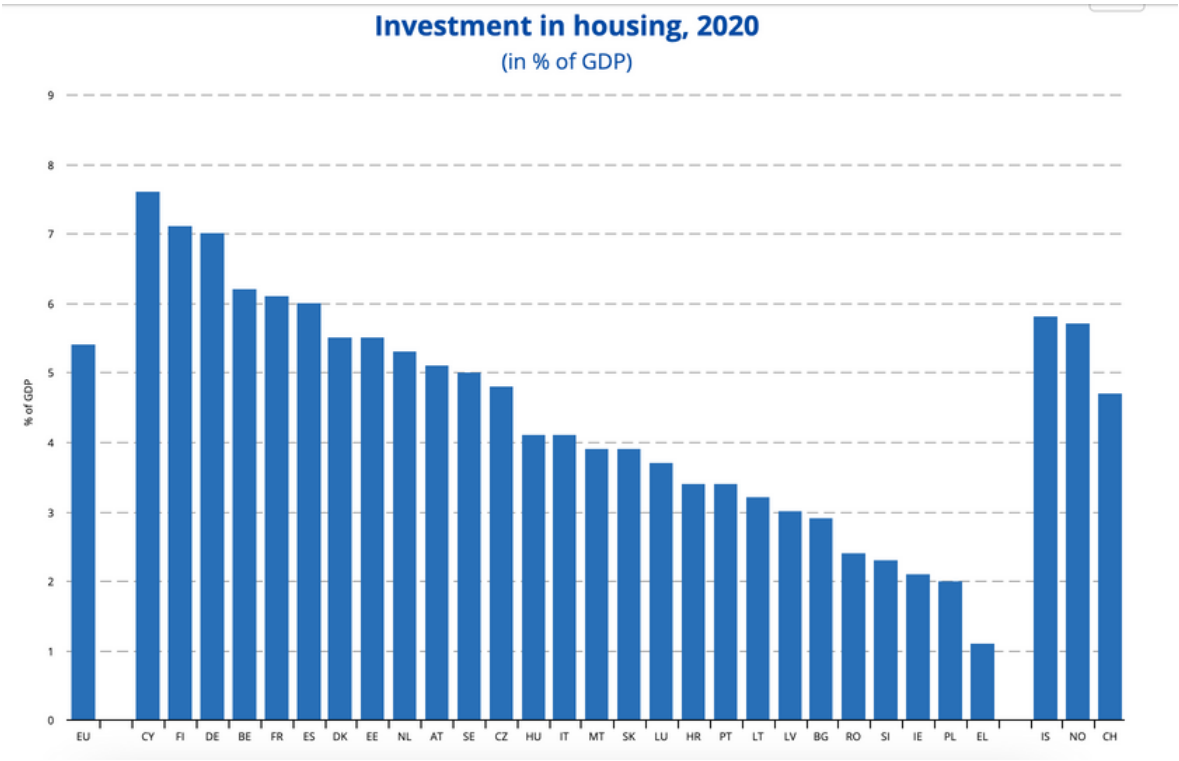


Figure 2: Investment in housing, 2020 (EU)
Eurostat. (n.d.). Construction sector. Retrieved February 8, 2022, from source

Infrastructure

Also often called “civil engineering works” or “public works”, infrastructure comprises the basic physical systems of a company, region, or country. Examples of infrastructure include transportation systems, waterways, communication networks, and electrical systems. These systems are typically capital and cost-intensive and require significant investments. They are vital to a country's economic development and prosperity. In Europe, infrastructure plays a crucial role in connecting and integrating markets, but also in ensuring the transition[10] to a low carbon economy.

Infrastructure has a number of specific features that require a dedicated approach to realize. Infrastructure works have a very long lifespan (80-100 years) and therefore need to be futureproofed from the design phase. The sector is highly government-dominated and consolidated, thus it deals with public tenders in the form of long-term investments and a small number of (homogenous) stakeholders.

Challenges facing buildings and infrastructure

With a global population set to grow by 20% to almost 10 billion by 2050,[11] **demand for buildings and infrastructure** is bound to increase as well. An estimated 60% equivalent of the current infrastructure is needed at the global level to cope with this increase. This is similar to building a new Paris every week for the next 30 years, which indicates **the strain and scarcity of materials** that could consequently be experienced following the current trajectory of consumption[12].

On several fronts and in many different European countries, much of the key infrastructure is **aging and becoming obsolete**. European countries have relied upon post-war infrastructure and facilities dating back to the 1950s and 1960s that need to be renovated or replaced.

Finally, as demonstrated throughout this chapter, **the environmental impact** of buildings and infrastructure resulting from material consumption, waste generation, and unfulfilled life spans must not be neglected if we are to succeed in keeping the **global warming** limit of 1.5 degrees within reach.

Source: © Re-sign

CHAPTER 2:

CIRCULAR ECONOMY AS A SOLUTION

The circular economy has a huge role to play in combating challenges such as climate change, resource scarcity, waste, the loss of biodiversity, and pollution. In order to reach the full potential of the circular economy, all sectors must adopt the principles of a circular economy, especially the construction sector which has a major impact on most of the other economic sectors. In the EU, the construction sector employs 18 million people and contributes close to 9% to the EU's GDP[13].

As seen in chapter 1, the construction sector is also one of the most environmentally detrimental industries in the world, impacting directly the use of raw materials, their determination of use involving the whole lifecycle, as well as all their surrounding environment. However, within the buildings and infrastructure sector, the transition from a linear to a circular economy is still at an early stage, and due to the long life span of buildings and infrastructure, it faces very unique challenges in implementing circular economy principles. The construction sector can be considered a key sector for the transition from a linear to a circular economy, allowing the accomplishment of the Sustainable Development Goals (SDGs) considered in the 2030 Agenda for Sustainable Development, in particular regarding the path towards "Sustainable cities and communities" (SDG11).

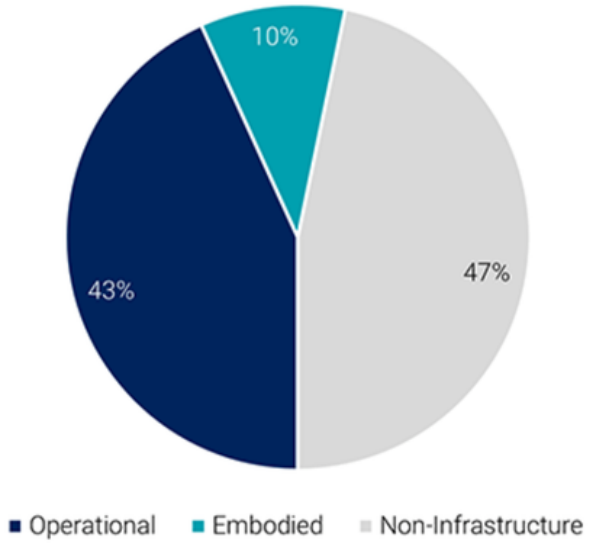
OPPORTUNITIES

The sector shows a high potential for contribution to **resource efficiency** improvement and to **climate mitigation**. Valorization of different types of **waste streams** and improved materials efficiency could be strategic in most industries. C&D waste is already re-utilized at a fairly high rate across Europe (74%)[14], yet mostly downcycled for backfilling operations, which is not the most environmentally sound waste treatment option. There are multiple barriers to unlocking the potential of re-utilizing construction materials already available in urban mines. This has to do with **logistics**, the **demand for reused materials**, **perceived performance**, and most importantly is the **lack of information** on what harvestable materials are present and what their value in reuse could be[15]. The production of cement - which is one of the main materials used in constructing buildings and infrastructure - is estimated to account for around 8% of CO2 emissions generated by human activities.

According to The Circularity Gap Report 2022, resource-efficient construction can lead to 3.45 Gt emissions saving and 4.05 material usage saving. The use of energy is another big aspect to consider since buildings (residential, commercial, and public) are responsible for consuming approximately 60% of global energy[16].

In total, the construction (infrastructure and buildings) sector consumes around 60% of the world's materials and is responsible for around 53% of the world's greenhouse gas emissions[17].

Figure 3: Estimate of infrastructure's contribution to global GHG emissions (as % of total GHG, 2018) (Global Infrastructure Hub)



Global Infrastructure Hub. (2021). Advancing the circular economy through infrastructure. Retrieved February 8, 2022, from source

What is circular economy?

The circular economy can be defined as an economic model aimed at the efficient use of resources, which occurs through the minimization of waste production, as well as the reduction in the use of primary resources in favor of reusable materials, with the aim to achieve closed cycles of materials, products and building components within the boundaries of environmental protection and socio-economic benefits[18].

When spoken about, the term 'circular economy' is often mistakenly used interchangeably with terms such as "recycling" or "waste management". Although end-of-life processes do indeed play a fundamental role in the transition to a circular economy, this misconception is far from accurate. Circular economy is about value retention along the whole supply chain and life cycle of a product, service, or structure. This begins at the design phase, minimizing materials utilized, sourcing from secondary, renewable, and biodegradable sources such as urban mines and existing building stock. Most importantly, the design has to focus on the whole use cycle and has to take the end of the use phase already into account. Moving through a use phase that protects the integrity of materials and components and retains their value through business models that validate repair and refurbishment, and favor value-added over ownership, such as product-as-a-service (PaaS). When a product eventually reaches its end-life, materials are easily recycled (technical sphere) or can be returned to nature (biological sphere).

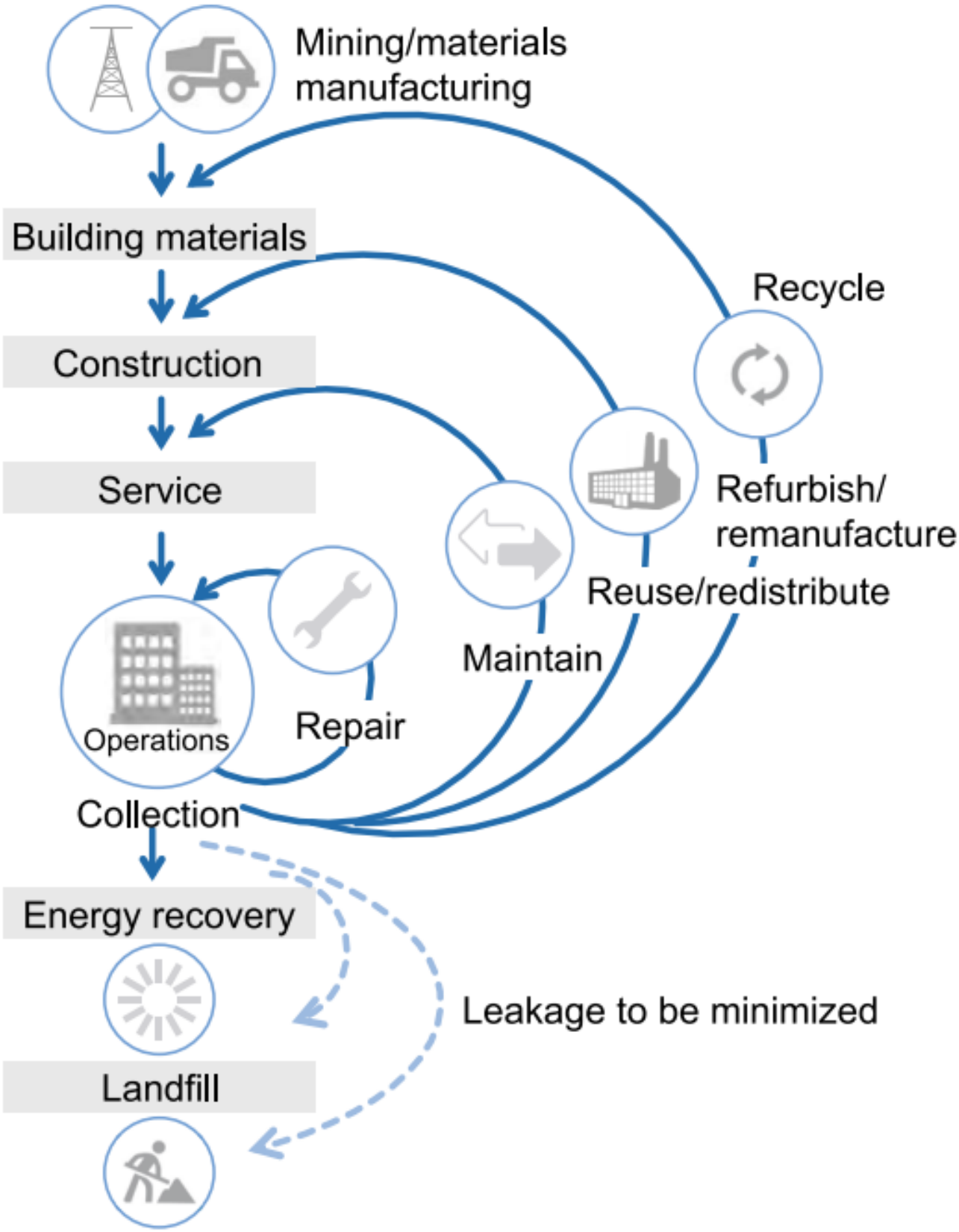


Figure 4: Circular Economy Principles in the Construction Value Chain

Breene, K. (2016). Can the circular economy transform the world's number one consumer of raw materials?. Retrieved February 8, 2022, from source

Circular economy in buildings and infrastructure

Circular construction can be defined as developing, using and reusing buildings, construction components or products and materials, areas, and infrastructure without unnecessarily depleting natural resources, polluting the living environment and affecting ecosystems. Carrying out construction such that it is economically justifiable and contributes to the welfare of people and animals, here and there, now and later. When it comes to buildings, a circular building optimizes the use of resources while minimizing waste throughout its whole life cycle. The building or infrastructure's design, operation, and deconstruction maximize value over time by using:

- Durable products and services made of secondary, non-toxic, sustainably sourced, or renewable, reusable or recyclable material;
- Space efficiency over time, through shared occupancy, flexibility and adaptability;
- Longevity, resilience, durability, easy maintenance and reparability;
- Reduction of mixing materials, layering and focussing on mono-material solutions
- Disassembly, reuse or recycling of embedded material, components and systems;
- Life-cycle assessment (LCA), life-cycle costing (LCC) and readily available digital information (such as building material passports).

Table 1 highlights various circular aspects along the life cycle of a building on an infrastructure element.

Source: © Big Buyers

Table 1: Circular economy aspects across a building's life cycle stage

Life cycle stage	Circular economy aspect
Design	DfD Design for adaptability and flexibility Design for standardisation Design out waste Design in modularity Specify reclaimed materials Specify recycled materials
Manufacture and supply	Eco-design principles Use less materials/optimise material use Use less hazardous materials Increase the lifespan Design for product disassembly Design for product standardisation Use secondary materials Take-back schemes Reverse logistics
Construction	Minimise waste Procure reused materials Procure recycled materials Off-site construction
In use and refurbishment	Minimise waste Minimal maintenance Easy repair and upgrade Adaptability Flexibility
End of life	Deconstruction Selective demolition Reuse of products and components Closed-loop recycling Open-loop recycling
All stages: management of information including metrics and datasets	

Adams, K., Osmani, M., Thorpe A., & Thornback, J. (2017). Circular economy in construction: current awareness, challenges and enablers. Retrieved February 8, 2022, from source

A POWERFUL STRATEGY FOR CLIMATE MITIGATION

Buildings

The European Union commits to be climate-neutral by 2050, achieving an economy with net-zero greenhouse gas emissions. As Europe's buildings are responsible for ½ of total energy consumption, and 36% of CO2 emissions, a lot of efforts have been made to improve the energy efficiency of buildings during operation. However, beyond the operational phase, CO2 emissions generated in other phases of the value chain of the building have also to be considered in order to reduce emissions in a short time.

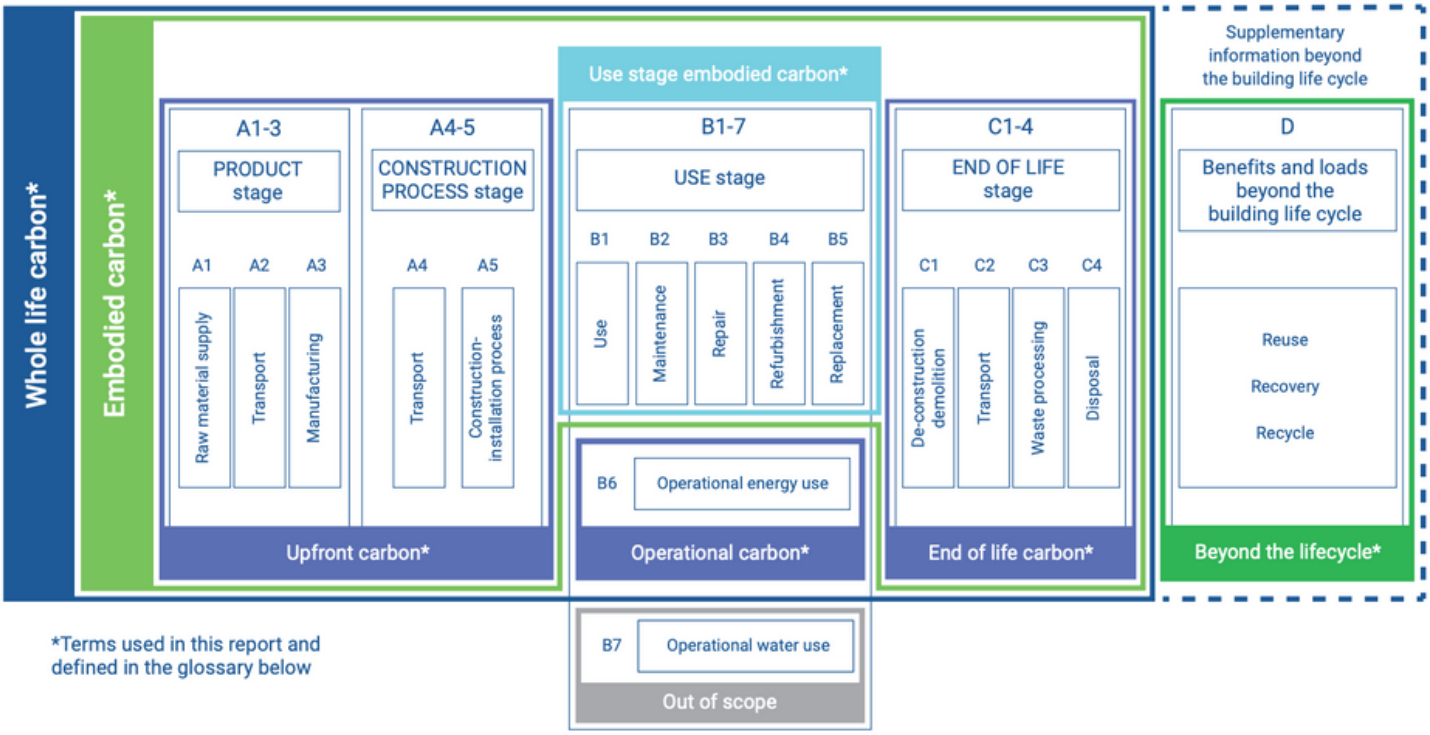


Figure 5: Lifecycle stages or modules defined in the widely-adopted European standard EN 15978

World Green Building Council. (2019). Bringing embodied carbon upfront. Retrieved February 8, 2022, from source

As defined in the report Bringing embodied carbon upfront Coordinated action for the building and construction sector to tackle embodied carbon, World Green Building Council, 2019, **Embodied carbon** is carbon emissions associated with materials and construction processes throughout the whole lifecycle of a building. Embodied carbon therefore includes: material extraction (module A1), transport to manufacturer (A2), manufacturing (A3), transport to site (A4), construction (A5), use phase (B1, eg concrete carbonation but excluding operational carbon), maintenance (B2), repair (B3), replacement (B4), refurbishment (B5), deconstruction (C1), transport to end of life facilities (C2), processing (C3), disposal (C4).

The embodied emission is a challenge to be faced by the EU to decarbonise the built environment even if they are counted in the industrial and waste sector and not in the current definition of the building sector. It is estimated that it represents between 10-20% of the construction-related CO2 emissions within the EU and might be higher, such as in some European countries where it could be around 50%. In order to make effective the decarbonization of the built environment, the Circular Economy shows a pathway to ensure the efficient and sufficient use of resources and to reduce the embodied emissions generated by buildings across their lifecycle stages.

Infrastructure

According to the Global Infrastructure Hub's (GIH) roadmap to build knowledge of infrastructure's potential to enable the circular economy, construction consumes about 60% of the world's materials and contributes around 53% of global greenhouse gas emissions. It is estimated that roughly half of this impact is caused by infrastructure.

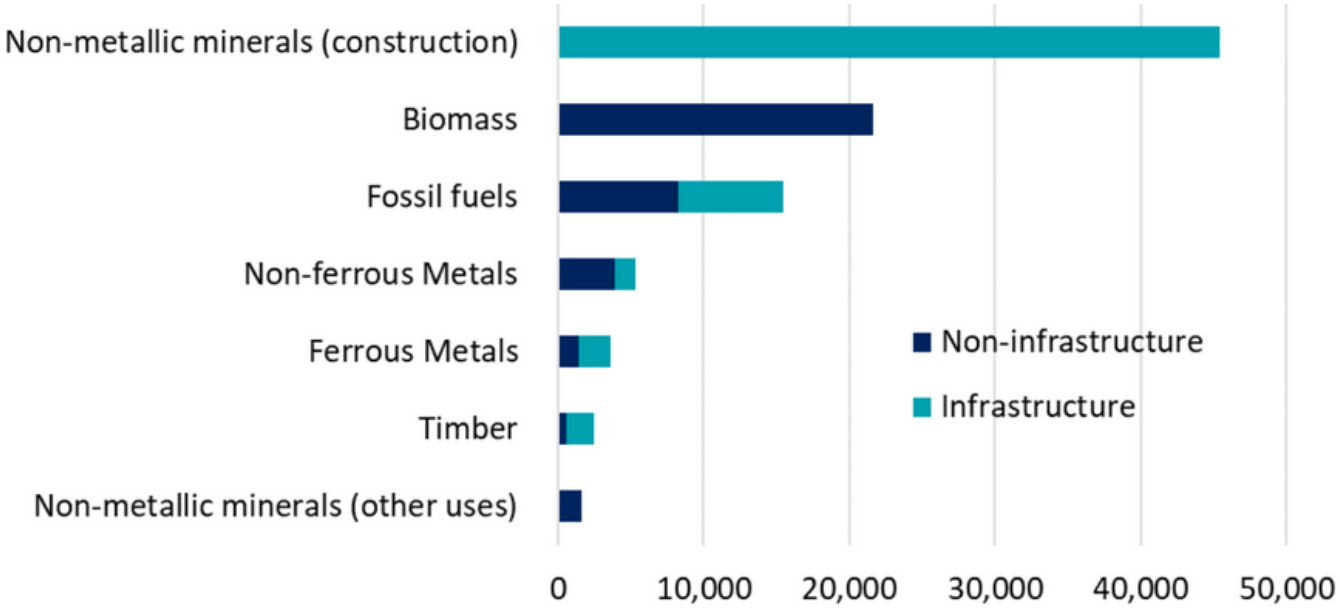


Figure 6: Breakdown of material demand globally (in million tonnes per year, 2018)

Global Infrastructure Hub. (2021). Advancing the circular economy through infrastructure. Retrieved February 8, 2022, , from source

The two largest contributors to the associated emissions are the production of steel and cement. Circular infrastructure encourages repurposed infrastructure that reduces or forgoes the demand for materials, and infrastructure that replaces finite materials with renewable or natural materials, as well as materials sourced from existing construction stock. According to TNO, the CO2 emissions from infrastructure can be reduced by as much as 40% through more efficient use of energy and materials, extending the lifespan, re-using more, and by using innovative materials, products, and processes.

CHAPTER 3:

CIRCULAR ECONOMY APPLICATIONS IN BUILDINGS & INFRASTRUCTURE ACROSS EUROPE

> "Realising a circular economy is not about copyright, rather, it's about the right to copy." - Freek van Eijk

Innovations in circular buildings and infrastructure are emerging from all over the world. In this chapter, we dive deeper into circular buildings and infrastructure by illustrating best practices representing on-ground implementations from different European countries.

Since the circular economy is a holistic approach that calls for a system change, naturally, circular innovations cannot be limited to only technical applications that only deal with materials and construction methods. Rather, circular innovations should exist along the entire value chain and life phases of buildings and infrastructure. The best practices showcased in this chapter are grouped in the following categories in order to capture and reflect innovations from various value chain actors across the sector:

- Building passports
- Circular buildings
- Platforms
- Public procurement
- Secondary raw materials
- Standards

Building passport

Buildings and infrastructure are complex structures that consist of a wide range of materials and systems. The availability of quality data is an important initial step in the transition to a circular economy. Building passports can track the journeys of products, components, and materials in the urban environment. They promote high-value reuse at the material, product, element, and building levels.

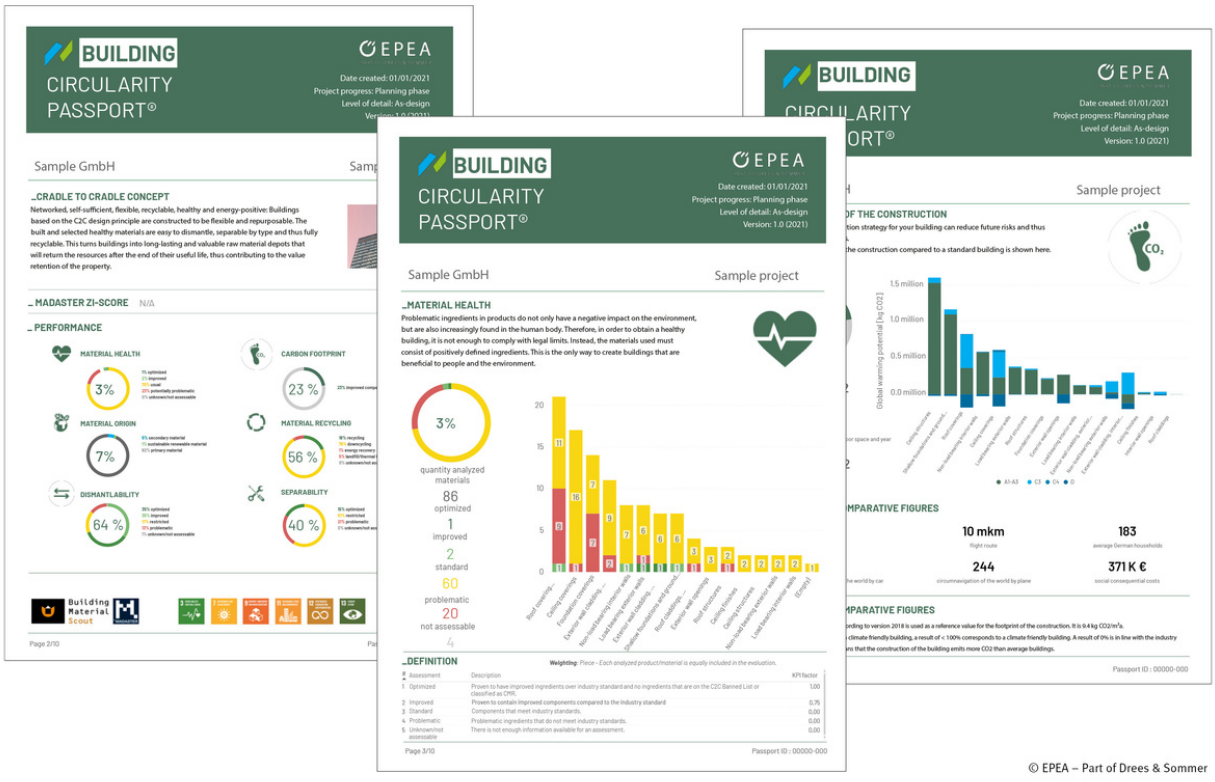
(DE/NL) Building Circularity Passport®, EPEA / Drees & Sommer

In construction projects based on the Cradle to Cradle® design principle, the Building Circularity Passport® serves both as a planning tool and as documentation after construction completion. The goal is to work together with architects, all planning disciplines and the contractors to enable the building to be recyclable and to demonstrate this quantitatively in retrospect. This is becoming increasingly important, not least against the backdrop of tightening ESG regulations and EU taxonomy. For completed construction projects, the Building Circularity Passport® also provides detailed information on which materials can be easily separated and the chemical composition of the products used. It also makes it easy to determine the monetary values of the structures used in the buildings.

This information about the property provides you with a great deal of added value for financing from a risk perspective, determining the value, and the upcoming operation of the buildings.

Furthermore, by combining the Building Circularity Passport® with the Building Material Scout® project platform, it becomes an end-to-end documentation tool, which additionally contains actually installed products together with information, data sheets and verifications.

The design of the Archipel building, New Vinci HQ, in Paris is an outstanding example of the application of Cradle to Cradle® principles and building passports in the building sector.



© EPEA – Part of Drees & Sommer

https://epea.com/en/services/buildings

Archipel building, New Vinci HQ, in Paris

(DK, ES, FI, NL, NO, PT) City Loops H2020 project

The CityLoops project brings together seven small to mid-sized European cities – Apeldoorn, Bodø, Mikkeli, Porto, Seville, Høje-Taastrup and Roskilde - to pilot a series of demonstration actions to close the loop of two major waste streams in Europe: Construction & Demolition Waste, and Bio-waste. Their aim is to become circular cities in which no resource goes to waste. The developed solutions include a selective demolition procedure, digital material marketplace, urban metabolism assessment and procurement guidelines. The cities use digital material passports to ensure recovered materials are traceable from demolition sites to their new uses. The passports store data such as a material's history, quantity, quality, estimated value, location, necessary maintenance, reuse or recycling potential, and instructions for disassembly and storage.

This information can be collected in a variety of methods, including drone imaging, laser scans, BIM and inspection by an experienced auditor.

https://cityloops.eu/

(NL) Cadastre of Material, Madaster

Madaster, the "Cadastre of Material" is the first platform that facilitates the central standardized, web-based generation and registration of materials and products applied in real estate and infrastructure. It is operational in 5 European countries and has projects registered across the globe. The Madaster platform generates and registers material, product, building and area passports, providing a detailed inventory with information about quantities, qualities, dimensions, and locations of all materials, components and products used in a specific construction object. In addition, the platform calculates a financial valuation (current and future expected residual value of materials) and provides an overview of the environmental impact (a circularity index, embodied carbon calculation and detachability). The Madaster material passport can be adapted and enriched over time providing a dynamic repository of building and infrastructure data. The data set can be 'archived', resulting in an authenticated, timestamped set of data that cannot be changed anymore.

https://madaster.com/

(DE) Concular, SIGNA/Karstadt Hermannplatz

The iconic 40.000 sqm department store in the center of Berlin will be retrofitted from 2022 until 2026. In collaboration with SIGNA, David Chipperfield Architects, Concular created a digital material passport for the complete building.

Based on the material passport inventory, the architecture office is planning the retrofitting by recirculating as many materials as possible. In addition, the retrofit based on the available materials is the subject of Germany's largest student competition, the Urban Mining Student Award.

https://concular.de/de/projekte/
http://www.urbanminingstudentaward.de/

Circular buildings

From reconstructable buildings to building from secondary/renewable materials, a building can be looked upon as a reservoir for materials, keeping them correctly in use and within reach for future utilization. Construction methods such as modular construction can save time, materials, and energy, as well as enable the design of demountable and reusable structural elements.

(NL) Triodos Bank: circular office wooden office building, RAU

The headquarters of Triodos Bank, Europe's leading ethical bank, was designed with the ambition to create a dynamic balance between nature, culture and economy, reflecting the values of the bank. The leading aspect in the design and construction of this new building was future reuse by creating a construction that could be dismantled and reassembled, and thus, preserving value. The building is the world's first fully circular, demountable office building with a structure made entirely from wood, including its core. 132 standardized wooden elements, wooden floors, wooden shafts and wooden columns are held together with 165,312 screws to form three towers of up to five storeys. The building and landscape are designed to enhance the biodiversity of the area. A green roof captures rainwater for flushing toilets, cools the building in the summer and provides space for insects and birds. The building is energy positive. Due to the choice of wood, the building captured more CO2 than it had emitted during its fabrication and construction, making it one of the first carbon-negative office buildings in the world of this size.

https://www.rau.eu/portfolio/triodos-bank-nederland/
https://www.breeam.com/case-studies/offices/triodos-bank-de-reehorst-netherlands/

(AT) gugler* media company circular flagship building, gugler*

The Austrian print house gugler* is certified according to Cradle to Cradle® Gold Product Standard. The company's new building, open in 2017, was constructed based on circular economy principles with a focus on reusability. 95 % of the materials in the building can be reused in case of future demolition. 43% of all used materials are already recycled, sourced either from the company's products or other sources of materials. For example:

- used printing plates from the company's production were used for the facade
- the insulation consists of cellulose from the company's own wastepaper
- the floor is made of recycled concrete

The building is TQB certified (Österreichische Gesellschaft für Nachhaltiges Bauen). The company's ecological efforts in green buildings are also reflected in its first building (operating since 2000) which was built using natural materials.

https://www.gugler.at/gugler-macht-sinn/sinnreich/campus
https://www.gugler.at/

(AT/GR) Treating wastewater using green walls, alchemia-nova

Alchemia-nova, a Viennese R&D company (Cradle to Cradle® partner), has collaborated on various projects to develop green walls which treat wastewater to service water standards and create plant biomass and fertilizer. The "GRETA" green façade panels enable water treatment with gray water to be reused as service water and irrigation. The panels can be seen at MUGLI (Vienna) since 2020. "vertECO®" is a vertical ecosystem for indoor wastewater treatment. It won the 2019 "Energy Globe Award Austria" in the "Water" category and it has been part of the 2018 "EOOS.Liquid Gold" and the 2020 "IBA" exhibitions in Vienna. "LooPi" is a nature-based public unisex toilet, based on an integrated vertical constructed wetland that treats the urine and sends it back in the loop again for flushing, while the plants absorb the nutrients contained in it. The LooPi prototype was rolled out in Vienna in spring 2021.

https://www.alchemia-nova.net/projects/

Platforms

Platforms are where actors from different disciplines and backgrounds can engage, collaborate, exchange ideas and services, and create synergies. Circular platforms can offer multiple services including awareness and knowledge sharing, promoting tools and best practices, matchmaking, marketplaces for material exchange, and databases for public procurement.

(BE,DE,NL,PL,SE,UK) Do you see a Building... or a Bank of recyclable Materials? - BAMB 2020 - H2020 funded project

https://www.bamb2020.eu/

The BAMB (Buildings As Material Banks) project started in September 2015 and for a duration of 3,5 years as an innovation action within the EU funded Horizon 2020 program. It involved 15 partners from 6 EU countries and Bosnia-Herzegovina. The project has developed and integrated tools that will enable a systemic shift where dynamically and flexibly designed buildings can be incorporated into a circular economy: Materials Passports and Reversible Building Design – supported by new business models, policy propositions and management and decision-making models. During the course of the project these new approaches have been demonstrated and refined with input from 6 pilots. BAMB led to significant insights for future circular constructions beyond the H2020 project.

BAMB
BUILDINGS AS MATERIAL BANKS

(IT) Platform Re-sign, Re-sign società benefit srl

The Italian company RE-sign has developed an app matching up supply and demand for reclaimed construction materials. The project brings together things, people and ideas to make circularity happen, all on one platform. The platform collects listings for the trade in reclaimed construction materials and components, and each listing comes with geolocalisation, the option of downloading BIM component models and the owner's contact details. The platform is a hub where professionals specialized in reusing materials can network and promote their business, as well as a place to exchange ideas about how to reuse construction materials.

RE sign

https://re-sign.it/

(ES) The 2021 Catalogue of circular initiatives in Navarra, Asociación de la Industria Navarra

The Navarre region promotes European collaboration opportunities for R&D and circular business models from Navarre. The Circular Navarre Catalogue 2021 is an update of the first showcasing booklet published in 2020. This new edition includes 30 organisations - based on circular business models - in the Navarre region, looking for cross border and international cooperation. Its aim is to share information about these organisations, related to:

* their position in a circular value chain
* their interest in taking part in the EU programmes
* their features in terms of positive environmental, social and economic impact
* the SDGs they are pursuing

http://www.forosnavarra-europa.eu/es/redes-e-iniciativas/catalogo-de-organizaciones-en-la-economia-circular-en-navarra-1

Gobierno de Navarra Nafarroako Gobernua

(AT,CH,DE) Marketplace for the reuse of construction material, restado

restado.de is a marketplace matching construction materials coming from demolition or oversupply with the demand in new construction projects. Restado's mission is to extend the product life cycles of building materials, which are reused as often as possible. On the platform, it is possible to find building materials from dismantling and over-ordering.

The target group of restado is mainly craftsmen, smaller construction companies, and private DIY.

https://restado.de/

restado

(AT,CH,DE) Digital platform enabling circular construction, Concular

Concular is a digital platform enabling the recirculation of construction materials. The platform is catered to professional actors of the construction industry such as portfolio holders, project developers, building owners, manufacturers, and architecture offices.

The software allows to digitize materials in new and existing buildings using AI-technology, measure the embodied carbon, and reduce it by recirculating the materials of a building. Architecture offices can also source reclaimed low-carbon materials using Concular.

https://concular.de/

Concular

(IT) DECORUM: DEmolition and COnstruction Recycling Unified Management, ENEA

The DECORUM Project produced a platform to support the interaction of the several actors involved in all phases of the life cycle of public works: clients/contracting authorities; designers, construction managers, testers, analysis laboratories, construction and demolition companies, producers of recycled materials for construction and operators of treatment plants and production of recycled aggregates. The platform allows the integrated management of the different steps, guaranteeing compliance with regulatory and environmental requirements, and is divided into different sections and functional modules for different users[20].

DECORUM
DEmolition & COnstruction Recycling Unified Management

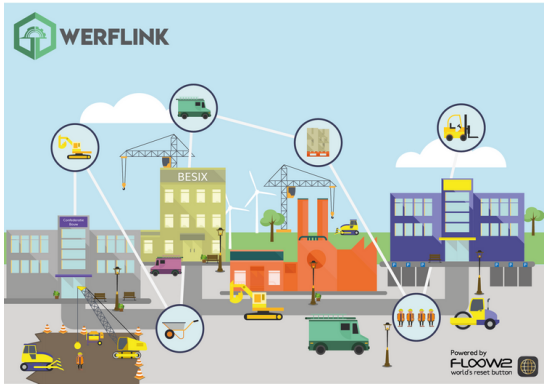
https://www.icesp.it/buone-pratiche/decorum-demolition-and-construction-recycling-unified-management

(NL) Sharing construction equipment and materials, Werflink

Werflink enables construction (and related) companies within The Netherlands and Belgium to swap, sell and share construction equipment, building materials, storage, and freight space with each other. These activities result in reduced waste, greater reuse of materials, collaboration between companies, cost savings and additional turnover. The basic idea of this project is to match supply and demand between construction companies and sites from the same region to avoid unnecessary transport. The sharing platform has 675 companies using it in Belgium and The Netherlands. Over 200 items have been shared through Werflink but this amount is probably higher as not all transactions flow through the platform itself. Werflink is powered by FLOOW2, the Dutch expert in digital B2B marketplace solutions.

Click here for more information.
https://www.parksharing.nl/werflink.html

FLOOW2
world's reset button



(NL) PLATFORM CB'23

Platform CB'23, a collaboration for Circular Construction in 2023, aims at making unambiguous agreements to anchor circular thinking and actions in the daily construction practice. Platform CB'23 is committed to drafting these agreements for the entire Dutch construction sector, which includes both residential and non-residential construction as well as civil engineering. Teams of professionals from the entire sector have laid a solid basis with a Lexicon Circular Construction and guidelines for Measuring circularity in the construction sector and Passports for the construction sector. Two guides about Circular design and Circular tendering are drawn up in Dutch and guidelines for Future re-use are in production.

PLATFORM CB'23

https://platformcb23.nl/

(IT) Symbiosis® - ENEA's Platform for Industrial Symbiosis and Resources Audit

In order to support the creation of cross-sectorial symbiosis pathways between companies, ENEA has developed an online platform called Symbiosis®. The aim of this platform is to match the supply of resources of any kind, such as materials, energy, competencies and services, and facilitate the sharing and/or transfer between different companies.

Companies interested in using the platform are asked to register and to report and characterize their production of waste, by-products or other kinds of resources they would like to share or receive from other companies. The collection of information supports the identification of possible synergies between companies.

The approach to industrial symbiosis promoted through Symbiosis® can be usefully integrated by the Diagnosis of Resources methodology, proposed by ENEA, aimed at carrying out an audit of the resources used by an organization to improve efficiency and reduce the resources consumption with internal optimization and external matching.

As one example, a comparison between the current destinations of some types of sludge from the processing of lava-stone and the potential uses in the context of industrial symbiosis is presented in the table below.

http://www.industrialsymbiosis.it/piattaforma

The data relating to a study carried out on a 90 firms production district in the region of Sicily, in Italy, where some important synergies have been identified, able to reach relevant economic and environmental advantages for the involved firms.

"Business As Usual" Scenario					Symbiosis Scenario		
Firm codes	Resources	Quantity	mu	Current use	Distance (km)	Synergy	Firm codes
C23033	Mixed sludge	20	t	landfill	77	Bituminous mixtures	G46.002
C23032	Sludge of basalt	1185	m³	re-use	79		G46.002
C25035	Mixed sludge	200	t	landfill	64		G46.002

SYMBIOSIS® Piattaforma di simbiosi industriale

Public Procurement

In construction - and especially for infrastructure - works are often procured by the public sector or by large-scale developers. Up until 2014, the EU spent around 1% GDP on transport infrastructure alone[21]. The huge procurement volumes offer unique opportunities to lead the way towards an interesting market for stakeholders to develop climate-neutral and circular solutions.

(AT, BE, FR, NL, NO, PL) Big Buyers for climate and environment

This group of big public buyers focuses on procurement strategies for more resource-efficient and low-carbon construction of public space, roads, and infrastructure.

The involved entities collaborate to move forward the market for innovative solutions in the whole construction lifecycle, from dismantling and transformation of existing built components to design, renovation and new construction with secondary materials.

Together, they exchange market intelligence and procurement criteria, explore innovative solutions, and share on their pilot projects, particularly around asphalt and concrete. Finally, they want to communicate barriers and priorities to policymakers at a higher scale (national and EU).

The collaboration is financed by the European Commission, DG GROW.

Website: https://bigbuyers.eu/
More information: https://www.youtube.com/watch?v=Ko2hISxDs08
contact email: info@bigbuyers.eu

big buyers for climate & environment

(IT) GPP compliant school building in Pesaro, Leed Platinum

The “Antonio Brancati” secondary School in Pesaro (IT) is the first LEED Platinum certified school building in Europe, inaugurated in 2021. The building is also compliant to the Italian mandatory Green Public Procurement Minimum Environmental Criteria. The Brancati School project has been developed by the municipality of Pesaro, which has decided to invest in quality construction, also following the vision of architect Margherita Finamore, project manager and internal designer. The School project is based on high energy performances (nZEB levels) and indoor well-being and health for students, teachers and all visitors to the building, with a special focus on natural ventilation (one of the first schools conceived, in times of Covid-19, right from the design stage for correct ventilation of the indoor spaces), passive heating and daylight control. The entire project is also focused on circularity, in the choice of "circular materials" (with the use of 98% of recycled materials, 536,378 kg on a total of 556,630 kg of materials used), in the closed-loop use of water (with a tank for collecting rainwater) and in the use of renewable and passive energy.

https://www.ilsole24ore.com/art/a-pesaro-scuola-certificata-leed-platinum-ADA3lKNB?refresh_ce=1

Comune di Pesaro

Secondary Raw Materials

Materials are the main focus of the circular economy. It is assumed that building and infrastructure consume around 60% of the world's materials and are responsible for around 53% of the world's greenhouse gas emissions [22]. It is thus essential to narrow, extend, and close material loops in the sector.

(IT) Greenrail sleepers, Greenrail Group Srl

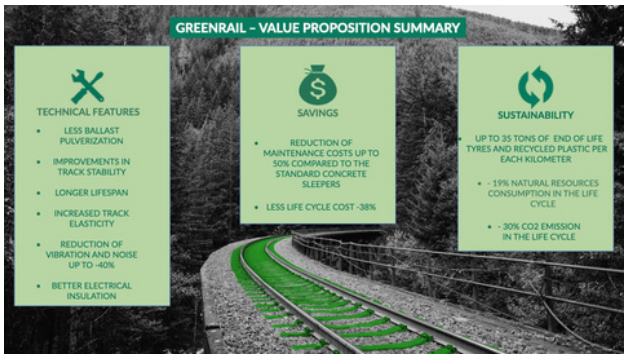
The railway infrastructure sector has not undergone any innovation in the past decades. The standard solution, nowadays, consists of concrete railway sleepers, introduced at the beginning of the 20th century. Since this technology is already quite out-of-date, it entails numerous problems, such as:

- ballast pulverization,
- high noise and vibration levels, and,
- last, but not least - elevated maintenance costs.

Greenrail sleepers are sustainable, as they are made of recycled plastic and rubber collected from End-of-Life Tyres (ELTs). They consist of an outer cover made of a blend of ELTs and recycled plastic, and an inner core of pre-stressed, reinforced concrete. They guarantee all the mechanical characteristics of the railway sleepers for various types of rail lines - including high-speed ones, thus offering countless advantages.

http://www.greenrailgroup.com/en/home/

GREENRAIL™



(UK) M-LS by O.C.O Technology: a carbon-negative limestone aggregate created with residues from waste to energy residue, O.C.O Technology Limited

Using its pioneering Accelerated Carbonation Technology (ACT), O.C.O recycles a wide range of wastes including air pollution control residues (APCr) from the Energy from the waste sector, turning it into manufactured limestone (M-LS) – the World's first carbon-negative aggregate for construction.

By blending APCr and other wastes to form a reactive mixture and then applying liquid CO2 and water, O.C.O permanently captures the CO2 as well as stabilises the reactive mixture. The stabilised mixture is then mixed with binders and fillers and pelletised to form the M-LS which is then cured, allowing it to absorb CO2 directly captured from the air.

https://oco.co.uk/

O·C·O TECHNOLOGY

(SK) SK-Tex

SK-Tex takes old clothing and textile and turns it into products that can be used in cars, furniture, and buildings. It started with products made from secondary raw materials now targeted at textile panels and mats EKOSEN ACOUSTIC used for noise reduction, interior and exterior heat insulation EKOSEN AT and water retention mats sold as SENIZOL GREEN, RETAIN and GROW used for green and/or blue roofs constructions and water retention parking places. EKOSEN textile-insulation products have significant advantages in terms of heat retention and score the highest marks for noise reduction, acts effectively to control moisture, making it a beneficial insulation material for people suffering from allergies or asthma. SENIZOL and EKOSEN products react to climate changes and propose the optimal solutions for CO2 reduction in building processes.

Contact person: Ing. Miroslav Futrikanič
Tel. +421-948-426489
e-mail: futrikanic.m@sk-tex.com
www.sk-tex.com

SK-Tex
člen skupiny ENVIROTEX

(FR/IT) The Saint-Gobain Gypsum Activity at the head of Circular Economy, Saint-Gobain Gyproc

Taking advantage of the eternal recyclability of gypsum, Saint-Gobain's gypsum subsidiary Gyproc launched a voluntary and ambitious policy in 2000 to encourage the recycling of pre and post-consumer gypsum waste. Enhancing the access to natural resources by developing outstanding construction & demolition waste management aims at diverting such waste from landfills by applying the waste hierarchy methodology. External gypsum pre and/or post-consumer waste for the plasterboard process is now available in 15 countries through the Saint-Gobain network and the gypsum recycling service is to be launched in 5 additional countries by 2021. Various waste collecting, sorting and reprocessing organizations exist and collaborate additionally with Saint-Gobain depending on the local situation.

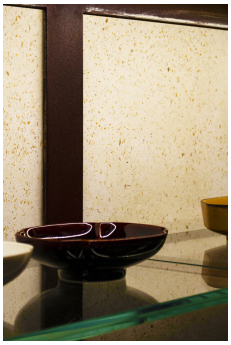
In Italy, for instance, three recovery centers dedicated exclusively to treating gypsum-based construction & demolition waste and a network of collecting sites have been opened through the Gy.eco Project (2012). Saint-Gobain, through the Project, has also developed an innovative recovery system using a “mobile” technology, thus covering the entire national territory. The gypsum waste recovery system provides, in addition to recovery, the certification of the secondary material.

https://www.placo.fr/Services/Le-service-recyclage-Placo-R/Filiere-de-recyclage-Placo-R-Recycling
https://www.gyproc.it/gyeco

(IT) Rice for architecture, Ricehouse Srl SB

Primary agricultural production generates a considerable amount of secondary material. The majority of this is simply thrown away, even if in some cases the material has an intrinsic market value that is potentially higher than the costs associated with managing and processing it as waste. Raw materials must be taken from the environment, transformed, used, disposed of and returned to the environment from which they were taken. Ricehouse is a benefit corporation that enhances by-products of rice cultivation. It is innovative, developing and placing new construction materials on the market. These include rice straw, rice husks, thermo-plastering base coat, lightweight screeds and clay- and lime-based finishes.

https://www.ricehouse.it/en-home



(AT) Cambium HOUSEFUL installations, Alchemia-nova

The community of residents Cambium was founded in 2014 with the aim to build up an economic, social and ecological sustainable village. In 2017 the Cambium Community Project rented the former military barrack Hadik in Fehring (close to Graz, Austria) and began to transform it into a suitable living and working area with residential units, co-working spaces, studios and a seminar facility. In May 2019, Cambium bought the property with an “asset pool”, a direct credit campaign, with over 250 investors. The goal is to build an eco-village with minimal environmental impact and therefore to implement sustainable agriculture techniques and circular building technologies. Wastewater from bathrooms, toilets and the communal kitchen will be separated and transformed into usable resources together with other organic waste. Organic solid waste will be converted into biogas, to be used within the building. The liquid organic-waste component will be processed by a vertical plant-treatment unit, producing valuable fertilizer for agricultural use. The H2020 project HOUSEFUL will provide an advance in this building circularity by offering solutions for its calculation, as well as new methodologies for stakeholder engagement and co-creation materials, water, waste, and energy resources.

https://houseful.eu/demos/cambium-community-center/

(NL) lignin bio-asphalt, Program Chaplin

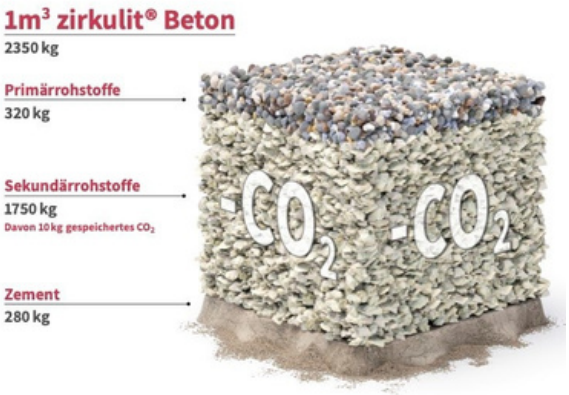
CHAPLIN aims to contribute to the sustainability of road construction. The program is a result of a unique collaboration of partners along the entire value chain. The companies (road builders, asphalt producers and lignin suppliers) are supported by research and technology parties. Rijkswaterstaat, provinces and municipalities are heavily involved as road authorities and they are committed to the development of biobased asphalt into a fully commercially available and specified product. Lignin plays an important role and is a substance that is a natural binder and gives strength, as it does in plants and trees. When plants and trees are growing, carbon dioxide is absorbed from the atmosphere and once processed into asphalt, it is fixed in the road for a long period of time. The development is at TRL 6 with 20 test strips on public roads. With 50% replacement, we can reach up to 75% CO2 reduction. If you are interested to join the CHAPLIN collaboration please contact us!



(CH) Zirkulit concrete - Eberhard

zirkulit® concrete is a concrete produced in accordance with SN EN 206 and SIA data sheet 2030 and is characterized by equivalent static properties in all respects compared to primary concrete. zirkulit® concrete is used in the usual compressive strength classes up to and including C30/37 for all components. The material is made from secondary raw materials and buildings made from recycled concrete have been built for 20 years. In an average building, the proportion of concrete makes up more than 50% of the building fabric and is therefore an influential factor. zirkulit® concrete gives the opportunity to make this influential factor more sustainable by reducing the primary resource share and CO2 emissions. The recipe allows to reduce the cement fraction to a minimum and innovative technology turns the secondary material fraction into a storage of CO2.

https://zirkulit.ch/



(NL) Concrete recovery, SmartCrusher bv

SmartCrusher bv has developed a technique for recovering sand, gravel and cement from concrete. The concrete industry on a global scale is 3 times more polluting than the aviation industry. This is mainly due to the production of cement from CaCO3, whereby for every kilogram of cement, one kilogram of CO2 is released. The SmartCrusher can decompose concrete rubble into its constituent parts and the cement fraction can also be removed. The recovered sand and gravel can be reused immediately and give even better results. The recovered cement can serve as a CO2-free raw material to make new cement and can also be used as a concrete improver.

For more information, contact Koos Schenk (koos@slimbreker.nl)
https://www.slimbreker.nl/smartcrusher.html

SmartCrusher bv
We close the circle

Standards

Standards, protocols, and regulations, all play a big role in limiting the negative effects resulting from the sector. For example, ISO TC 323 "Circular Economy" aims at developing (by 2023) a set of standards regarding circular economy principles, guidelines for implementation, circularity measurement (methods and indicators), and case studies.

(IT) Sustainability protocols for construction and requalification of buildings, RINA S.p.A.

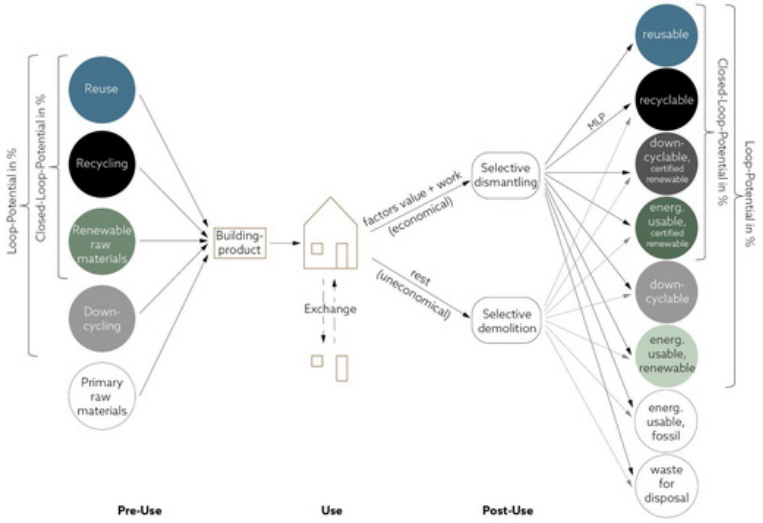
Sustainability protocols represent a series of good design practices aimed at reducing environmental impact and improving comfort inside buildings. The improvement takes place both in the construction phase and in the operation phase. The sustainability protocols use a scoring system, assigning a score to each proposed good practice and, in relation to the performance achieved by the building, assign a sustainability rating to the building at the end of its construction. The most widespread protocols in Italy today are the Itaca, LEED, BREEAM protocol.

https://www.rina.org/it

(DE)Urban Mining Index - Doctoral thesis at the University of Wuppertal, Dr. Anja Rosen

With increasing resource scarcity and pollution, it becomes necessary to manage building materials in the most closed and environmentally sustainable (consistent) cycles possible. Urban mining design takes this approach by designing and managing the anthropogenic reservoir of raw materials as an "urban mine." To do this, the circularity of buildings must be understood as a design parameter. In order to take into account the design principles of urban-mining-friendly building, planners need new, quantitative evaluation standards. The Urban Mining Index is the first system that makes the circularity of building designs quantitatively measurable, incorporating both the quality of circular material use and the deconstruction effort and economics of selective deconstruction into the evaluation.

https://urban-mining-index.de/en/



Urban Mining Index

(DE) DGNB System for the Deconstruction of buildings, Deutsche Gesellschaft für Nachhaltiges Bauen (German Sustainable Building Council)

Today, a large number of new buildings or renovation measures are preceded by deconstruction. In planning practice, however, this is often not yet taken into account. In order to consistently close material flows, promote a higher value of the building stock and establish solutions in line with the circular economy on all levels involved, a systematic look at the planning of deconstruction measures is required. It is a matter of protecting and preserving the building stock as well as valuing the materials. This is precisely where the DGNB System for the Deconstruction of buildings comes into play. As an instrument for quality assurance, it systematically sets incentives to increase the sustainability of deconstruction processes in a holistic way.

https://www.dgnb-system.de/en/buildings/deconstruction/

(DE) DGNB certification provides bonuses for applying circular economy principles in sustainable construction, Deutsche Gesellschaft für Nachhaltiges Bauen (German Sustainable Building Council)

The German Sustainable Building Council (DGNB) with more than 1,500 members is the German and international knowledge platform for sustainable building and provides the world's most advanced sustainable building certification system. Its aim is the planning and assessment of sustainable interiors, buildings and districts. The responsible use of resources has been a central concern of the DGNB from the outset. For this reason, the DGNB has anchored in its certification system and thus in the market a large number of aspects that contribute to a circular economy in the construction and real estate sector. These are for instance the life cycle assessment, the conscious choice of construction products with regard to their composition and origin, as well as the ease of recovery and recycling. Furthermore, circular economy bonuses allow for the first time to make concrete, progressive solutions for promoting circular economy at the building level assessable and measurable within the framework of certification. By awarding bonus points, which have a positive effect on the certification result, incentives are created to develop new circular solutions and promote innovation. The circular economy bonuses are included in all applications of the DGNB System, including new construction, buildings in use, renovation and deconstruction projects as well as interiors and districts.

https://www.dgnb-system.de/en/system/version-2020-international/
https://www.dgnb.de/en/topics/circular-economy/

CHAPTER 4:

REFLECTIONS ON CIRCULAR BUILDINGS AND INFRASTRUCTURE

Composed of a broad spectrum of organizations with a pan-European reach, the European Circular Economy Stakeholder Platform Coordination Group (CG) enables and implements change through its workplan activities, showing concretely how synergies can accelerate the circular transition.

Their role is to:

- Act as the Ambassadors of the Platform and the Circular Economy transformation
- Actively promote interaction in the Platform between stakeholders
- Promote and facilitate the exchange and mapping of Good Practices
- Foster European debate among all relevant circular economy-related stakeholders

The CG members also form Leadership Groups (LG) and bring the subject to the audience using the #EUCircularTalks concept. This chapter brings the reflections of the LG on Construction, Buildings, and Infrastructure. The LG has been coordinated by Holland Circular Hotspot following up on last year's coordination by ENEA. The LG members organized a series of events, which brought together experts from various disciplines, and also invited policymakers and MEPs to discuss the following sub-themes

- Circular Infrastructure, the road towards a sustainable future (led by RWS)
- Relevance of deconstruction design to enable the renovation wave (led by DGNB)
- Construction and Infrastructure value chains and market (led by ENEA)

This brochure is the report of the LG on Construction, Buildings and Infrastructure. This brochure gives an overview of the sector and the transition to a circular economy. As the topic is crucial and its messages should reach a large number of stakeholders, we shaped it in an easy and approachable way with facts&figures, circular transition options and illustrated with a vast amount of existing EU best practices. In this chapter, the outcome of the LG subgroups is summarized.

#EUCircular Talk 11 May 2021

Circular Infrastructure, the road towards a sustainable future

Policy and market context

The momentum to act is now. The EU has agreed on infrastructure plans similar to China's new Silk road, the USA is investing heavily in infrastructure, and the G7 launched the Build Back Better World (b3w) initiative. Buildings and infrastructure is included in many European and global initiatives and agreements, including the European Green Deal, EU's Strategy for the Sustainable Built Environment, Fit for 55 package, and more.

Present barriers

Despite the vast potential for circular construction, quite some barriers still exist. Public works in infrastructure are governed by relatively short contracts compared to the lifespan of the asset, which hinders the development of circular solutions. It is thus important to re-think such contracts and introduce new business models to the sector, such as infrastructure as a service (IaaS). Other barriers have to do with logistics, the demand for reused materials, perceived performance, and the lack of information on what harvestable materials are present and what their value in reuse could be.

Drivers and CE opportunities

Buildings and infrastructure offer enormous opportunities to tackle climate change through high-quality reuse and recycling, circular design, and the use of renewable materials. According to TNO, the CO2 emissions can be significantly reduced through more efficient use of energy and materials, extending the lifespan, more re-use, and innovative materials, products, and processes.

Recommendations. Next steps

In order to unlock the potential of the circular economy in the buildings and infrastructure sector, a holistic approach is required. This means: **We need to go circular together - the right frameworks must be set - develop and align circular international public procurement - utilize public funds and financing to support the transition.**
The findings are available in a downloadable brochure by RWS, TNO, and HCH that was launched officially during the Circular Europe Days at the Dubai World Expo on January 17, 2022.

#EUCircular Talk 19 July 2021

Relevance of deconstruction design to enable the renovation wave

Policy and market context

Circularity is a cross-cutting issue in the life cycle of buildings. A coordinated policy approach is necessary to ensure the circular economy potential of deconstructions. However, most circular measures are not mandatory in the European directives or regulations related to buildings, which hinder the promotion of circular markets and the need for a proper deconstruction process.

Present challenges. Drivers and CE opportunities

When circular design or circular buildings and infrastructure is discussed today it addresses most of the time the new construction case. When it comes to the big challenges and opportunities of the renovation wave it is crucial to understand today's deconstruction practices, address existing challenges and establish practical processes in order to appreciate the already existing materials and to raise awareness for the necessity of designing the deconstruction process.
Participants of a broadly diversified panel including the European Commission and leading figures of circular construction and real estate sector, focused on examples and possible solutions to define next steps, help facilitate action and demonstrate the systematic approach to a resource-efficient and impact-focused practice. Renovating our buildings to make them future-proof is a societal challenge that we must get right at the European level. Materials from deconstruction or partial deconstruction ahead of a deep renovation could be captured in a local circular economy. Using materials in a circular way is key – material banks could be an option going forward.

Inspirational examples. Approaches and tools

Italy is the first EU country to have made Green Public Procurement (GPP) 100 % mandatory, promoting circularity. This includes design for deconstruction applied to at least 50% (in weight) of building components used in the intervention, a minimum of recycled content of 15% on total weight of materials used as well as selective demolition.
In Germany, the DGNB has developed a certification system for the deconstruction of buildings. It is an instrument for quality assurance, which systematically sets incentives to increase the sustainability of deconstruction processes taking place today in a holistic way. Furthermore, DGNB provides a report and an online toolbox for "Circular Economy" with examples and practical tools for the implementation of a conversion and deconstruction-friendly design.

Recommendations

Throughout the world, we need architects integrating reused and recycled materials and applying digital solutions to make material choices easy and transparent, as well as policy makers to encourage and make circularity in construction compulsory. Stakeholders have to work closely together along the whole value chain in order to achieve a broad implementation. When it comes to the policy approach, the three main European building policies should support this process. Firstly, the Construction Product Regulation should establish minimum requirements for circularity based on performance indicators including durability, repairability, reusability, and recyclability for construction materials and information such as instructions for disassembly to support circular use of products. Secondly, the Energy Performance of Buildings Directive must promote circular handling of salvaged materials from renovations through pre-demolition audits. Moreover, boosting a secondary material market should be included in the national renovation plans. Finally, the Waste Framework Directive should establish harmonised standards on circularity and mandatory pre-demolition audits and increase to a minimum of 90 % by weight the preparation for re-use, recycling and another material recovery of non-hazardous construction and demolition waste, avoiding landfilling.

#EUCircular Talks 28 and 30 September 2021

Construction and Infrastructure value chains and market

Policy and market context

The Building and Infrastructure (B&I) sectors show high potential for circularity in the recovery and reuse of secondary materials, along the value chain and coming from other value chains, but this potential needs to be unlocked. The recognition of secondary materials by the very large market of the B&I sectors represents a necessary condition for this, making the implementation of deconstruction, selective demolition and materials recovery sustainable. Policies and fiscal policies, and in particular mandatory ones, can contribute to this, as it's happening in some member states.

Present challenges/barriers:

- Policies related to B&I sectors (e.g., circular economy, energy efficiency, waste regulations, at both EU and national levels) are not coordinated
- There is a gap between existing regulations and construction practice, as well as between consumer behavior and general aims and intentions
- Systemic application of CE in the B&I sectors needs the capacity of implementing scale economies by construction companies and materials producers
- Some of the main issues affecting the CE potential of B&I (e.g., selective demolition, long-term investments, new materials applications, etc.) are cost-related and, in the present scenario, investors are not encouraged to move in these directions

- All potential applications of secondary materials in the B&I sectors should be explored, considering high added value uses and not only large scale and low-quality ones
- On the side of reuse of buildings materials and components, there is a big market gap because high costs and issues in reclaimed materials' qualification still hinder its spread
- Low costs of waste disposal combined with low costs of primary materials don't favor the market of secondary materials
- The traceability of waste streams and by-products is limited
- There is limited awareness among clients and consumers of the economic viability and environmental benefits of designing, implementing and operating circular B&I
- There is a social barrier for the reuse of materials and building parts due to perceived uncertainty of their durability and quality
- The low level of knowledge and skills to use circular solutions, both in public and private sectors, stop investors from moving from accepted standards, therefore demolition is mostly downcycling.

Drivers and good practices:

- On the side of recycling, the industry is aware and is taking on the circular approach (EUROFER; SAINT-GOBAIN; CEMBUREAU; FEDERBETON)
- Standards and certifications on recycled materials can increase stakeholders' confidence and quality of the products while enhancing product development
- LEVEL(s) as a common framework can help to compare the results in terms of sustainability and circularity and promote better performances
- Balance whole costs between landfill and virgin materials (taxation, royalties) with those of the secondary production (from recycling, selective demolition, industrial symbiosis) (EDA; NADECO)
- Mandatory GPP can promote the secondary & sustainable materials market, product environmental certifications and B&I sustainability standards (GPP Minimum Environmental Criteria in Italy)
- Digitalization of processes and information can support CE implementation (traceability, sharing of materials, monitoring, etc.) (Materialnomaden)
- Material passports can disclose the potential for reuse of components and materials, increase the knowledge of construction materials throughout the life cycle and enhance their value (EPEA/Drees and Sommer).
- In monitoring environmental and circularity performances, it is important to invest in relation to SDGs and the EU Taxonomy for Sustainable Activities.

Recommendations / Next steps:

A European integrated legislative framework is needed to strengthen the interconnections between the construction and extractive sectors and other sectors potentially providing secondary raw materials, and to incentivize the safe use of high-quality secondary raw materials:

- Within the energy policies for the building sector, especially in those on renovation, circularity and sustainability, requirements should be integrated to promote a holistic, life cycle approach
- Plan the demand of materials in B&I considering and favoring the replacement of raw materials with secondary ones over time, for example through mandatory recycled/reused content
- Promote design for reuse of buildings, infrastructures, components and materials, and high-quality recycling
- Stronger collaboration among different actors is needed, in particular between education, research, trade associations, designers and professionals, to facilitate and transfer innovation
- Support the development of the secondary materials market, based on mechanisms such as mandatory recycled content and EPR for specific waste streams
- Enforce Green and Circular Procurement (in particular GPP) in the B&I sectors in order to promote circularity criteria in the design, procurement, construction, use and end of life phases
- Promote the construction of a system for monitoring, data collection and assessment of the current level of resource efficiency and circularity in the B&I sectors, so as to better calibrate policies, regulations and technical standards.

Source: © CB23 platform

Innovation and research

To support circularity in the C&I value chains, a strong link between innovation & research, market and policies should be fostered: policies should rely on research to make appropriate strategic choices; research results need to be transferred to the market. Some key actions should be implemented.

1. The **development of integrated metrics** for the built environment, key to measure circularity at the current state and its improvements and to orientate or integrate policies, based on reliable data, requiring:
   - **Development and implementation of monitoring tools,** including indicators, to assess circular economy performances of the B&I value chains (inputs/outputs, product as service, sharing, lifetime extension) in relation to their overall environmental impacts.
   - **Definition and implementation of reliable datasets for the B&I value chains' processes and products:** data systems (formats, data requirements) and standardized procedures for the collection and verification of datasets, for tools such as LCA, are needed for measuring, monitoring and supporting the use of environmental labels/certifications.
   - **Quantification of secondary materials'** (from different supply chains) **reuse potential** for the production of building materials, in total/partial replacement of primary materials, estimating the potential availability over time, in urban mining scenarios.
2. The definition of innovative circular and low carbon materials and products, calling for:
   - Identification and development of high-quality/high added value applications for construction and demolition waste and other secondary materials.
   - Support the circular use of bio-based products in the B&I sector, which can contribute to decarbonization, by promoting research on sustainable supply chains, in order to minimize bio-based materials' potential environmental impacts (land use, biodiversity loss).

For more information see:

- "2020 Orientation paper" by the ECESP Leadership Group on Construction [https://circulareconomy.europa.eu/platform/sites/default/files/leadership-group-construction.pdf]
- The outputs of the 2020 ECESP annual conference [https://circulareconomy.europa.eu/platform/en/annual-circular-economy-stakeholder-conference-3-4-november-2020]
- A two-year stakeholders' consultation on the construction and infrastructure value chains: Output Paper of the activities coordinated by ENEA in 2020-2021 [ct_ci_value_chains_and_market_output_paper_final.pdf (europa.eu)]

CLOSING REMARKS

The built environment has a significant impact on a multitude of sectors, on local jobs and on quality of life. The construction sector accounts approximately for 50% of materials extracted in Europe, and is responsible for more than 35% of Europe's waste. To say it bluntly: if we can't make the built environment more circular and sustainable, we will not reach our climate goals.
The momentum to act is now as demonstrated by COP26, the EU green Deal, the CE Action Plan (CEAP) and its ongoing Strategy for the Built Environment, the Action plan on Financing Sustainable Growth, the related EU Taxonomy Regulation, and the Fit for 55 package, to mention a few. The Renovation Wave is the perfect initiative to implement circular measures in the renovations of buildings.
We have touched upon a number of topics during 2021, yet, a lot more should be discussed. During the year, the Leadership Group made some realizations and we believe that, in order to achieve circularity, the following are needed:

- go circular together, both on the international and the regional and/or bilateral level, set up dedicated value-chain projects and material agreements, set up common knowledge & innovation development projects and connect stakeholders;
- set the right frameworks for climate neutral and circular buildings and infrastructure in an integrated approach, tackling construction, waste, climate policies, protocols, norms and standards. For example, harmonizing how to measure circularity and sustainability. Policies should be assessed not only from interdependent materials flow perspective but also from object and city/region perspective. The work of a.o. the Construction Products Regulation (CPR) and Eco-design Directive are relevant;
- develop, promote and align circular international public procurement and use Total Cost of Ownership approaches (clear link with the ECESP LG on Circular Procurement);
- use public funds and financing to support and accelerate circularity in infrastructure (both in EU Innovation & Research Funds, the work on taxonomy and access to Recovery Funding and Climate Financing.

To work on these actions, we can start now by drawing on existing knowledge, EU best practices and lessons learned about how to make buildings and infrastructure circular and climate neutral.
We love to team-up with partners with the same vision and ambition and who want to work together to unlock the potential of circular buildings and infrastructure. We look forward to engaging with the world to make that happen! The LG on Construction, Buildings and Infrastructure hopes that this brochure will help stakeholders join our coalition of the willing and together become a coalition of the doing.
Want to work together with us on this? Be sure to send your ideas, thoughts and proposals to the ECESP secretariat.

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