

European Circular Economy Stakeholder Platform



Leadership Group on Construction and Infrastructure

A two-year stakeholders' consultation on the
construction and infrastructure value chains.
Output Paper of the activities coordinated by ENEA in 2020-2021

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1 Introduction

A Sustainable Built Environment is a key target for the European Union. This goal is reflected in many European policies such as the *Renovation Wave*, aiming at the improvement of energy efficiency, doubling annual energy renovation rates until 2030, as well as in initiatives like the *New European Bauhaus*, intending a design movement based on sustainability, quality of experience, and inclusion. Moreover, instruments such as *Level(s)*, the European framework for sustainable buildings, are promoting the implementation of a life-cycle approach in the built environment design and transformation, by allowing the assessment and comparison of the sustainability performance of buildings along the full life cycle, based on LCA-related indicators. Circularity is seen as crucial to improve the level of resource efficiency in the construction sector in the *EU Green Deal* and in the *Circular Economy Action Plan*, where the European Commission committed to launch a comprehensive Strategy for a Sustainable Built Environment. In this framework, although the environmental impact of infrastructures is significant, little attention has been given to green infrastructure in EU circular policies although the European Commission had adopted an EU-wide strategy for a green infrastructure across Europe and a Trans-European Network for Green Infrastructure in Europe, a so-called TEN-G, in 2013. However, there is evidence of a radical change in this sense: the InvestEU Fund gives priority to investments in sustainable infrastructure, defined as one out of four EU policy windows and providing financing for projects concerning sustainable energy, digital connectivity, transport, the circular economy, water, waste, and other environment infrastructures over the period of 2021-2027.

Aim of the present document is to focus on the theme of circular economy in the construction sector, by illustrating the main market dynamics relative to materials for buildings and infrastructures, and active and/or potential value chain collaborations in a circular and industrial symbiosis perspective. With the contribution of essential European stakeholders, it offers an overview of the relevance of construction and infrastructure value chains within EU economy, of their potential for circularity, resource efficiency and decarbonisation and of main barriers and levers.

In fact, the present Output Paper reports the outcomes of the activities of stakeholders engagement and consultation on the abovementioned topics, developed by ENEA:

- with the collaboration of Environmental European Bureau, within the “European Circular Economy Stakeholder Platform” (ECESP) in the *Leadership Group Construction* (2020), led by ENEA, and
- with the collaboration of alchemia-nova and Innowo, within the ECESP in the *Leadership Group Construction & Infrastructure* (2021), led by Holland Circular Hotspot.

The Paper contains different contributions from the stakeholders involved in this two-year consultation, within a more theoretical framework defined by ENEA with the contribution of alchemia nova, Innowo and European Environmental Bureau, and the identification of the next steps to boost circularity in the construction sector.

2 Context

2.1 Relevance of construction and infrastructure value chains within EU economy

Construction is a sector of high strategic importance due to its key role in the socio-economic development of a country. It provides building and infrastructure on which all sectors of the economy depend. Construction can be categorized into four main types: residential buildings (e.g. apartments and houses), institutional and commercial building (e.g. schools, hospitals, shopping centers, retail stores, etc.), specialized industrial construction (e.g. chemical industry plants, power plants, etc), infrastructure and heavy construction (e.g. roads, tunnels, bridges, railways, sewage systems, pipelines, etc). 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.

The construction value chain is composed by different stages starting from eco-design to end of life passing through financing, logistics and other interrelated value chains (Figure 1).

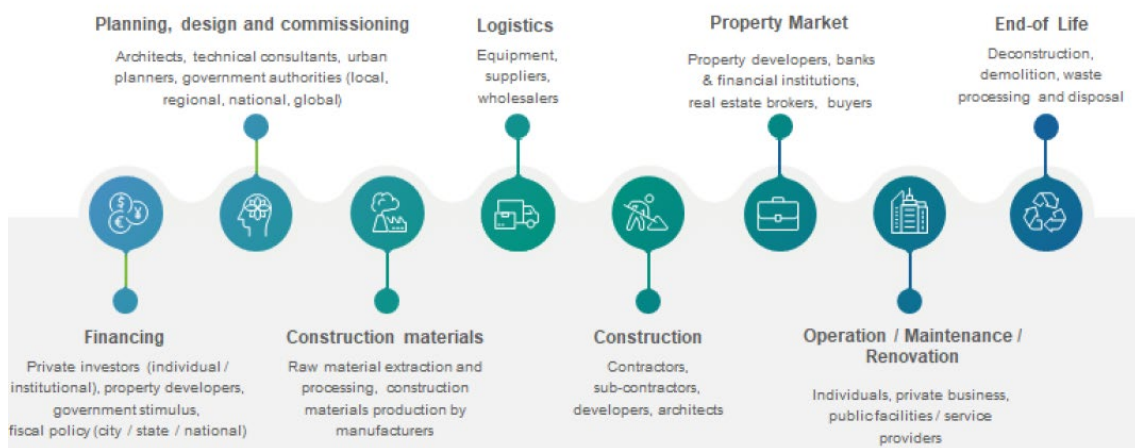


Figure 1. Stages of the construction value chain. Source: Task Group IRP-One Planet network (2021)

Despite there are limited information available on the use of materials and flows along the global construction value chain, some details should be presented.

In the EU, the construction sector represents approximately 10% of GDP - Gross Domestic Product - and it is the largest industrial employer with the 30% of industrial employment as a whole (JRC, 2021). It is composed by nearly 5.3 million small and medium enterprises and 24.9 million people employed (European Commission, 2021). To these numbers the mining and quarrying sector have to be added: it is made up of more than 17 thousand firms and 0.4 million employees (Eurostat, 2018).

The construction sector is also responsible for a huge environmental impact because it generates a large amount of waste consuming in the meanwhile natural resources, affects biodiversity and soil and it has high level of energy consumption. 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 (JRC, 2021). Moreover, construction and demolition waste (C&DW) comprises the largest waste stream in the EU: construction contributed 35.9% of the total in 2018 and was followed by mining and quarrying (26.6 %) (Eurostat, 2018). A lot

of the waste from these sectors is classified as major mineral waste: almost three quarter (74 % or 5.2 tons per inhabitant) of the total waste generated in the EU in 2018 was major mineral waste.

Moreover, circularity in the construction sector is urgently needed to provide a contribution to the goal of decarbonization. In fact, the combined implementation of circular economy and digital innovation could deliver as much as 296 Mtons of GHG emissions (Material Economics, 2019) from heavy industry alone (56%). This could also help creating markets for product and process innovation and investment opportunities towards climate neutral production, as well as reuse and recycling of materials. Waste valorisation and material resource efficiency are needed in most industries, while material recirculation could allow to save up to 178 Mtons of CO₂ (mostly in the plastic sector) (Material Economics, 2019). Another relevant share of CO₂ emissions (up to 56Mtons) could be saved through production improvements and process rationalisation (15% of building materials are wasted during construction). Finally, the extension of lifespan of products (i.e. via multipurpose design of buildings) and a better and more intense use of these can contribute up to an additional 64Mtons of CO₂ reduction.

2.1.1 The aggregates sector

Construction and infrastructure are counted to the most resource consuming sectors in Europe, the building sector being responsible for nearly half of all extracted materials.

Among the sectors involved in construction and infrastructure, natural aggregates is the largest amongst the non-energy extractive industries in number of sites, companies, employers and tonnages produced. The European (EU+EFTA, 2018) average demand for aggregates is almost 6 tons per capita per year.

Primary aggregates are produced from natural sources, extracted from quarries, sand & gravel extraction sites, and in some countries, sea dredged. Secondary aggregates include recycled and re-used aggregates which are reprocessed materials previously used in construction, and manufactured aggregates, sourced from industrial processes such as blast or electric furnace slags or china clay residues (UEPG, 2019-2020).

The recovery rate of non-hazardous construction and demolition mineral waste is relatively stable over time (Table 1) on average 88% in EU27. Recycling rates vary among Member States and the overall recycling potential is higher than the current rate. This aspect can suggest that construction sector is highly circular but actually, C&DW recovery is largely based on backfilling operations and low-grade recovery (European Environment Agency, 2020). Though the EU is self-sufficient for aggregate materials and no particular threats for what concerns social sustainability and security of supply exist¹, this situation decreases the potential of recycled material and hampers full implementation of circular economy objectives.

¹ Joint Research Centre (JRC)-Raw Materials Information System (RMIS).
<https://rmis.jrc.ec.europa.eu/?page=rm-profiles#/Aggregates>

Table 1. Sources: 1. UEPG (2019); 2. Background data from UEPG (2019); 3. Bio by Deloitte (2015); 4. Non-CRM factsheets (2017); 5 - 8. Background data from Eurostat Comext (2019)

EU-28 production (2017)¹	2,860 million tonnes of aggregates (2,439 million tonnes of natural aggregates)		
Major EU-28 mine producers (2017)¹	Germany (20 %); France (13 %); Poland (11 %)		
Compound annual growth rate of worldwide mine production over the last ten years (2008-2017)²	-2.9 %		
Major end uses in the EU (2012)³	Construction (100 %)		
End of life recycling input rate (2016)⁴	8 %		
EU-28 Trade balance (2017) (processing)	<u>Imports</u>	<u>Exports</u>	<u>Balance</u>
Aggregates (total)⁵	20.5 million tonnes EUR 433.9 million	9.5 million tonnes EUR 205.9 million	(-) EUR 227.5 million
Sand and Gravel⁶	6.6 million tonnes EUR 107.0 million	6.9 million tonnes EUR 126.3 million	(+) EUR 19.3 million
Crushed Rock⁷	8.6 million tonnes EUR 112.9 million	0.9 million tonnes EUR 18.1 million	(-) EUR 94.8 million
Granules, chippings and powder (of marble and other natural stones)⁸	5.3 million tonnes EUR 213.9 million	1.6 million tonnes EUR 61.5 million	(-) EUR 152.4 million

2.2 Main EU and National policies promoting circularity in the C&I value chains

The main legislation in the EU environmental policy is the **European Waste Framework Directive** (Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste) which provides the legal framework on how to treat waste within the community with the aim to protect the environment and human health. The introduced “waste hierarchy” states the order of preference for the generation of waste where landfilling is the least favourable. Its main objectives are to: decrease demolition waste and set the conditions for re-use, recycling and other material recovery of non-hazardous construction and demolition waste; promote selective demolition; reduce waste generation.

With the introduction of the **Roadmap to a Resource Efficient Europe**, as a part of the Resource Efficiency Flagship of the Europe 2020 and supported by subsequent reports and action plans, the European Commission (EC) has expressed its fundamental interest to substantially improve the resource efficiency of the European economy and enable the transition towards the Circular Economy (CE). As part of the Resource Efficiency Roadmap, a dashboard of indicators has been developed to track the progress towards a more resource efficient Europe. Within the policy target of transforming the economy, the areas of sustainable production, consumption, taxation, innovation and research and ‘waste as a resource’ are tackled. Initiatives affecting directly the C&I value chains include assessing the whole life-time costs of buildings (including construction and demolition waste) and better infrastructure planning. The **European Green Deal** aims to promote growth by transitioning to a modern, resource-efficient, and competitive economy. One of the main building blocks of the European Green Deal, is the second **Circular Economy Action Plan ‘For a cleaner and more**

competitive Europe following the first Circular Economy Action Plan ‘Closing the loop’ of 2015. This new action plan announces initiatives along the entire life cycle of products. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented, and the resources used are kept in the EU economy for as long as possible. In this sense, even recycling where you break material in small pieces and destroy the major value, is already seen as last option. The new Circular Economy Action Plan also focus on the sectors that use the most resources and where the potential for circularity is high, among which construction and buildings. In the new circular economy action plan and in the new industrial strategy for Europe, the Commission committed itself to come forward with a **Strategy for Sustainable built environment** (European Parliament, 2022). The C&I sector, in fact plays an important role in the recent EU Green Deal. Indeed, it calls for a **Renovation wave** for the building sector in 2020 and for a revision of the construction products regulation promoting a design of new and renovated buildings oriented towards the circular use of resources. It is an integral part of the Green Deal in conjunction with the **Recovery Plan-Next generation EU**. The Commission launched, at the same time as the Renovation wave strategy, the initiative on the **New European Bauhaus**. The initiative is both a network and a contact point at the crossroads between culture, social inclusion and innovation. The New European Bauhaus is a movement and it is considered an ideal platform for the nature-based materials made by EPF members for construction, furniture, packaging and other end-uses. It unfolds in 3 phases: Co-design, Delivery and Dissemination.

The **European Climate Law** (Regulation (EU) 2021/1119) writes into law the goal set out in the European Green Deal for Europe’s economy and society to become climate-neutral by 2050.

The European Commission has also provided non-binding guidance, among which, guidance on the management of construction and demolition waste, guideline for the audits before demolition and renovation works of buildings, and Circular Economy principles for buildings design. The **Construction and Demolition waste protocol** (European Commission, 2018) includes good practices from across the EU that can be sources of inspiration for both policy makers and practitioners. It also includes an overview of definitions and a checklist for practitioners. The Protocol fits within the **Construction 2020 strategy**, as well as the **Communication on Resource Efficiency Opportunities in the Building Sector**. It's also part of the Circular Economy Package. Its overall aim is to increase confidence in the C&DW management process and the trust in the quality of C&D recycled materials. This will be achieved by: a) improved waste identification, source separation, and collection; b) improved waste logistics; c) improved waste processing; d) quality management; e) appropriate policy and framework conditions. The **guidelines for waste audits** (European Commission, 2018), provide guidance on best practices for the assessment of construction and demolition waste streams prior to demolition or renovation of buildings and infrastructures. The guidance aims to facilitate and maximise recovery of materials and components from demolition or renovation of buildings and infrastructures for beneficial reuse and recycling, without compromising the safety measures and practices outlined in the European Demolition Protocol. The **Circular Economy principles for buildings design** (European Commission, 2020) focuses on a set of principles important for sustainable building design, with the aim of preventing and reducing construction and demolition waste, facilitating re-use and recycling of building materials, products to help mitigate the environmental impact and life cycle costs of buildings. The document is aligned with **Level(s)**, a voluntary reporting framework to improve the sustainability of buildings. It is an assessment and reporting framework that provides a common language for the sustainability performance of buildings. Level(s) promotes lifecycle thinking for buildings and provides a robust approach to measuring and supporting improvement from design to end of life, for both residential buildings and offices. Level(s) uses

core sustainability indicators, tested with and by the building sector, to measure carbon, materials, water, health and comfort, climate change impacts. Level(s) is open source and freely available to all as for all those in the sector, the challenges of cost control and environmental gain are met both by the reduction in energy, materials, and water use; and by future-proofing buildings. For those commissioning, designing, or occupying buildings, Level(s) helps them ensure that their high-quality, fit-for-purpose buildings meet their cost and environmental objectives.

Another important European strategy is for example the **EU Ecodesign Directive** (Directive 2009/125/EC), that establishes a framework under which manufacturers of energy-using products are obliged to reduce the energy consumption and other negative environmental impacts occurring throughout the product life cycle. The **EU Ecolabel** is a label of environmental excellence that is awarded to products and services meeting high environmental standards throughout their life cycle promoting the circular economy by encouraging producers to generate less waste and CO₂ during the manufacturing process. The EU Taxonomy states to include sustainability criteria in all investment processes.

Another instrument to boost the circularity is the **Green Public Procurement (GPP)** that can help in stimulating the demand for more sustainable goods and services which otherwise would be difficult to get onto the market. The European Commission and a number of European countries have developed guidance in this area, in the form of national GPP criteria. Despite GPP Minimum Environmental Criteria represents a voluntary instrument, they are intended to be made mandatory. This is already the case in Italy, for instance in energy-related sectors including construction.

At the national level, several EU Member States have implemented policies to promote circularity in the C&I value chains as exemplified in Table 2 here for the countries Belgium, France, Germany, Italy and the Netherlands.

Table 2: Policies implemented in some MS to promote circularity in the C&I value chains

Member State (MS)	Policies
Belgium	<ul style="list-style-type: none"> • The Brussels Regional Programme for Circular Economy / Be Circular (PREC) (2016-2020)² • The Brussels Construction Industry Roadmap (2019)³ • Circular Flanders – Green Deal on Circular Construction (2017, 2019)⁴ • Circular Wallonia (2021)⁵

² BE Circular, 2016. Programme régional en économie circulaire. Available on:

https://document.enviroennement.brussels/opac_css/elecfile/PROG_160308_PREC_DEF_FR.

³ Be Circular, 2019. The Brussels Construction Industry. Available on:

https://www.circulareconomy.brussels/wp-content/uploads/2019/06/BE_beCircular_feuille-de-route-CD_def_FR1.pdf.

⁴ Circular Flanders, 2019. Green Deal on Circular Construction. Available on: <https://vlaanderen-circulair.be/en/circular-business/green-deal-on-circular-construction#>.

⁵ Circular Wallonia, 2021. Available on:

https://economiecirculaire.wallonie.be/sites/ec/files/user_uploads/Rapport%20Circular%20Wallonia_D EF_v6_0.pdf.

France	<ul style="list-style-type: none"> • The Circular Economy Roadmap (2018)⁶ • Anti-Waste Law (French: Loi anti-gaspillage) and law for a circular economy (2020)⁷ • Label bas-carbone (2018)⁸
Germany	<ul style="list-style-type: none"> • Resource Efficiency Program (ProRess) III (2020-2023)⁹
Italy	<ul style="list-style-type: none"> • ITACA Protocol (2004) and later Reference Practice PDR 13/2019¹⁰ • Italian National Action Plan on Green Public Procurement (2008 and update DM 10.04.2013) with relative Minimum Environmental Criteria¹¹ • Decree on construction DM 11.10.2017 updated DM 24.12.2015¹²: Minimum environmental criteria for the awarding of design and construction services for the new construction, renovation and maintenance of public buildings
Netherlands	<ul style="list-style-type: none"> • Dutch Building Decree (2012)¹³ • Green Deal 159: Circular Procurement (2013)¹⁴ • A Circular Economy in the Netherlands by 2050 (2016)¹⁵ • Roadmap for Circular Land Tendering, Amsterdam (2017)¹⁶ • Circular Construction Economy Transition Agenda (2018)¹⁷

3 Implementing circularity in the C&I sectors

The construction sector is the ideal industry for introducing a closed-loop economic model. It is characterized by high durability of products, the possibility of repairs and adjustments as well as resale on the market. Features of buildings such as durability, the possibility of modernization and reuse predispose them to apply circular concepts – closing economic loops,

⁶ République Française, 2018. The Circular Economy Roadmap. Available on:

<https://circulareconomy.europa.eu/platform/sites/default/files/feuille-de-route-economie-circulaire-50-mesures-pour-economie-100-circulaire.pdf>.

⁷ République Française, 2020. Anti-Waste Law. Available on:

https://www.legifrance.gouv.fr/download/pdf?id=tIvngK1-pPYKGFzbZJvgnB0La5rYk6ys5dm_FwTPZs=.

⁸ Ministère de la transition écologique, 2018. Label bas-carbone. Available on :

<https://www.ecologie.gouv.fr/sites/default/files/Label%20bas%20carbone.pdf>.

⁹ Resource Efficiency Programm (ProRess) III, 2020. Available on:

https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Ressourceneffizienz/progress_iii_programm_bf.pdf.

¹⁰ Protocollo ITACA, 2004. Available on: https://www.itaca.org/valutazione_sostenibilita.asp.

¹¹ Italian National Action Plan on Green Public Procurement, 2008. Available on: <https://gpp.mite.gov.it/>

¹² CAM Edilizia. Available on:

https://www.mite.gov.it/sites/default/files/archivio/allegati/GPP/allegato_tec_CAMEdilizia.pdf

¹³ [Government information for entrepreneurs , 2012. Dutch Building Decree](https://business.gov.nl/regulation/building-regulations/)

<https://business.gov.nl/regulation/building-regulations/>.

¹⁴ Green Deal 159: Circular Procurement (2013). Available on: <https://www.greendeals.nl/green-deals/circulair-inkopen-meer-waarde-voor-de-hele-keten>.

¹⁵ Government of Netherlands, 2016. A Circular Economy in the Netherlands by 2050. Available on: <https://www.government.nl/documents/policy-notes/2016/09/14/a-circular-economy-in-the-netherlands-by-2050>.

¹⁶ Metabolic, 2017. Roadmap for Circular Land Tendering, Amsterdam. Available on:

<https://www.metabolic.nl/publications/city-of-amsterdam-roadmap-circular-land-tendering/>.

¹⁷ Circular Construction Economy Transition Agenda, 2018. Available on:

<https://hollandcircularhotspot.nl/wp-content/uploads/2019/09/Circular-Construction-Economy.pdf>.

so that the goods circulate as long as possible with simultaneous value maximization. Repairs, real estate trade, sharing or renting rooms have been taking place for hundreds of years and are all examples of applying the circular concept in real life. However, the use of circular concepts occurs at most at earlier stages of the life cycle of buildings, as usually there is no key closure of the loop, or it is often a non-optimised process. To address this problem the reclaim of material from C&DW is of the essence. Additionally support of the reclaimed materials usage is indispensable to enable economies of scale and broad adoption of circular construction materials and practices.

The method of how material recycling is conducted is a related issue. In many cases recycling does not have to occur only within one company's products lifecycles or even within one branch of the economy. In other words, waste from one process can be used effectively as a resource for other processes.

3.1 Value chains collaboration in a circular/industrial symbiosis perspective

Although most of the above consideration focus on the reclaim of construction materials recycling does not have to occur only within one branch of the economy. There are a lot of possible collaboration in a circular/industrial symbiosis perspective (Luciano et al., 2018). A great example of the so-called industrial symbiosis is the use of by-products of combustion in the building materials industry. This applies mainly, but not only to autoclaved aerated concrete, where ash accounts for approx. 70% of its content. In most cases the concrete plants are usually directly connected to the power plants with pneumatic transport lines. By-products of combustion are not only ashes (Taherlou et al., 2021 and Ghosh et al., 2018), but also slags (Piemonti et al., 2021) and post-reaction products from fuel desulfurization installations (also their mixtures), which can be used as a raw material for the production of hydraulic binder, mineral fillers, aggregates, etc.

This is just an example of how industrial symbiosis could be put to a use to reclaim material for the construction sector. That being said, it has to be emphasised that the construction sector necessitates the use of vast amounts of materials (40% of all materials in the EU), incomparable to other industries. Thus, the option for industrial symbiosis is limited to other companies in the sector or to industries that offer comparatively huge amounts of materials, that could be used in construction processes, as the example of the energy sector above. Nevertheless, for some construction materials, such as cement or concrete, the substitution rate is limited by the need to ensure specific levels of performance and, therefore, the demand for secondary materials can more easily be satisfied by different industries.

Typically, such collaborations require a project-based pricing. Usually, a flat fee arrangement to be agreed to at the outset of an industrial symbiosis project. All the involved actors may make an estimate of the quantity of secondary raw materials they will need to address their production requirements throughout the project lifecycle and set a fixed price accordingly. However, it is highly recommended to allow for adjustments, accounting for the price volatility of recyclable and secondary raw materials. This will offer companies the necessary flexibility to adjust prices, maintaining the competitive advantage of exchanging by-products at a lower than the market-based rate.

3.2 From design, to construction, to end-of-life: Life Cycle perspective as a driver to increase resource efficiency

As it was already said the resource efficiency of a building can be increased on every stage of its lifecycle. In fact, this is the exact goal of circular economy – to retain as much economic value of a good as possible. Closing economic loops in the construction industry has rich history. This is true to such extent that we no longer address activities such as repairs, real estate trade, sharing or renting as circular practices. Nevertheless, there is much room for improvement.

The selection of appropriate technologies is a fundamental issue in the implementation of circular construction in its initial phase. The durability of the building, the possibility of managing its parts, or finally its total, long-term economic value is dependable on the design (i.e. treating the waste as a resource). During this process, basic principles should be kept in line with the concepts of the circular economy. For example, treating a building as the sum of its layers, where each layer has its own function and lifetime. In addition to extending the durability of the building, it also allows for more economically efficient building management, repairs and modifications as well as a high level of adaptability. In addition, it can radically contribute to the simplicity of disassembly and optimal recovery of its economic value. It is also possible to significantly reduce the amount of waste. For example, detailed information obtained during the design of the building may allow for the purchase of strictly calculated quantities of materials. Another example is the possibility of limiting the quantity of materials used during the production of building parts, thanks to computer modelling and 3D printing. Once the construction industry has an incentive to maintain buildings and the inherent quality, the incentive for a circular economy, in which products and materials cycle as long as possible, grows inherently.

Circular construction is characterized by a low level of waste generation and low demand for raw materials not only at the design stage or at the end of the life-cycle, but above all during use. This is the stage of the building's life, which generates the largest costs for the natural environment, e.g., through greenhouse gas emissions or sewage production. The most attention is paid to the consumption of energy and its renewability. Examples of such technology are efficient, perovskite photovoltaic cells, windows producing electricity, heat pumps, but also entire cogeneration and trigeneration installations. These installations allow to produce not only electricity but also heat, or air-conditioning. Although energy efficiency is often the first thing that comes to mind when thinking about building's sustainability, one of the most popular resources – water requires as much attention. Recycling of grey water from sinks and showers and rainwater recovery is recently gaining popularity. In both cases, we obtain colourless, odourless and hygienically safe water, which can be reused for flushing toilets, watering the greenery around the building or washing buildings and machines.

At the end of life of a building the reuse of buildings and their parts is crucial in the endeavour of implementing circular construction. An example of such technology is the automated process of cleaning mortar bricks for reuse. In combination with the modularity and standardization of buildings, as well as IT technologies, this gives a radical increase in the ability to adapt buildings to new needs, as well as to reuse its parts.

In order to close the economic cycle in the construction sector, a recycling process is necessary. In the past, due to the relatively simple materials and building parts, such as stone, bricks, almost no recycling occurred. Instead, a process of reusing these raw materials, preferred in the waste management hierarchy, took place. Currently, together with the growing number of relatively complex building materials (e.g., reinforced concrete, plastics,

cables made of various materials), a recycling process has become necessary to implement the circular model. Fortunately, in recent years, we have seen a significant increase in the number of these types of technologies. An example of recycling process with great potential could be the use of concrete and brick debris from demolition waste, not only as a secondary raw material for road foundation and soil reinforcement, but as a material for the production of a full-fledged component for new concrete. Recycling of boards from various types of polystyrene (PS, EPS, XPS), which as a nonmaterial is suitable for recycling, is also becoming more and more common.

3.3 The relevance of assessment and certification processes to increase materials circularity

The best way to deal with these problems is by the standardisation and certification of the secondary material. Standardisation plays an important role in the assessment of the performance of secondary materials in products replacing virgin materials, as well as in the design of construction products. It is often the basis for certification used in trade and business.

When the construction material is certified, both suppliers and consumers certainty about the quality of the material and the liability aspects during the service time of the material are clarified. Certification is a means of ensuring the products comply with legal standards, therefore it has to be considered as an important step towards successful market introduction of secondary materials.

3.3.1 Recycling in Building Certification

Sustainable certificates for buildings have become firmly established in the property market in recent years. Currently the most used certification systems worldwide are BNB, DGNB, BREEAM and LEED.

- The sustainably Building Ratings System (BNB) explicitly promotes construction using closed materials cycles with circular economy bonuses since the launch of the 2018 system version. Ten criteria include recycling aspects in the broad sense and the labels range from bronze (only for previously existing buildings), silver and gold up to platinum.
- The Building Research Establishment Environmental Assessment Methods (BREEAM) certification system includes recycling aspects involving building materials in the eleven criteria groups in the categories of “Materials” and “Waste”.
- Leadership in Energy and Environmental Design (LEED) rates positively the disclosure of environmental impacts by using building products with environmental product declarations in the “Material and raw materials” category.
- Level(s), the European framework for sustainable buildings, is based on a Life Cycle Assessment and might favour the use of secondary materials thanks to some specific indicators such as resource use and environmental performance of buildings.

Many of the verification stages needed to reach the certifications in buildings certification are also make it possible to satisfy the verifications that serve to demonstrate the adoption of the Minimum Environmental Criteria for building defined in the framework of Green Public Procurement.

3.3.2 Recycling in Product Certification

While rating systems comprehensively scrutinise a building's quality at the structural level, product ratings concentrate on ecological and social criteria in the manufacturing processes, usage, and end-of-life phases of individual building products.

In conclusion, for market introduction of secondary materials many problems need to be overcome. A successful market introduction depends heavily on certification and dealing with the interests of all involved parties. Best results can be expected when authorities, suppliers and users of the new material collaborate in a transparent manner. When certification procedures are set up in dialogue with all parties of interest, they will satisfy demands of both government and customer and be clear for the supplier(s).

Currently the most used certification systems for construction materials product are the EU Ecolabel¹⁸, and the Environmental Product Declaration - EPD, to which other ecological labels, recognized and applied in various European countries, are added.

These certifications can/may be used in Green Public Procurement (GPP) providing a number of conditions are met. Ecolabel can be used in public tenders for the drafting of the technical specifications of the goods or services to be purchased and can help, as one means of proof, to check compliance with these requirements. EPDs also may contain a valid means of proof, if they report additional environmental information.

4 Barriers and drivers

4.1 Barriers to the implementation of circularity in the C&I value chains

According to recent environmental policies and the improvement of waste treatment techniques, the construction industry is confronted with low availability of secondary recycled materials, that can be used as an alternative for traditional raw materials. Nowadays, new digital markets and platforms for secondary materials are common, as well as the use and increase of circular materials databases and new models of collaboration between the different actors of the supply chain, like BIM and material passport. These tools allow for better decision-making for the entire lifecycle of a structure, following the core idea that materials must be recovered, recycled, or re-used in an openly traded materials market. However, even when the secondary material satisfies all necessary product demands and leaching conditions, this is still not always sufficient for a successful market introduction. All aspects that could influence a successful introduction on the market can be categorized into three items: material properties (physical and environmental); commerce (financial and image related); policy (governmental and industrial). Benefits deriving from the use of recovered/recycled construction materials are well known: savings on large amounts of energy, elimination of waste going to landfills, and consequently decreasing the consumption of natural resources to produce new materials.

The use and application of secondary materials in the construction sector implies several obstacles. The main barriers are economic, especially concerning the quality control, the potential discontinuity of supply and the delay in comprehending measurable results from the implementation of circular economy concepts at different lifecycle stages. The market acceptance of products produced using secondary resources as input material will only be assured when production costs are lower than for virgin materials. Furthermore, another

¹⁸ Ecolabel. Available on: https://ec.europa.eu/environment/ecolabel/index_en.htm

obstacle for material reuse is the lack of standards, experience and guidance. Additionally, challenges in data transfer along the value chain lower trust in the quality of secondary materials and products. For some materials, technological innovations and new business models are also required. The Extended Producer Responsibility (EPR) is not yet applicable for construction products with long lifespan, implying that the roles and responsibilities of different actors are not completely clear.

4.1.1 Legal and regulatory barriers

- *Lack of coherence between policies*

In some national cases the regulator aims to support circular economy, while at the same time, he is incoherent with other legislation (e.g. support reclaimed materials market while implementing waste regulation that limit the use of materials considered waste).

- *De iure vs. de facto regulations*

Despite the existence of regulations supporting the implementation of circular concepts in construction, in many cases they are not exercised or their use is limited.

- *Precipitant regulations*

Only partial or fictional support of circular concepts due to rash, hasty legislation that answer short-term problems, while neglecting the long perspective. Typically, such regulations are developed without genuine consultations with all stakeholders. Furthermore, such regulations undercut the principle of investment certainty.

4.1.2 Economic barriers

- *Lack of economies of scale*

The relatively small size of circular production does not allow economies of scale to be achieved. This creates a vicious circle that restricts the greater use of circular products and materials by limiting the price-competitiveness against standard, non-circular products and materials.

- *Unfavourable financing model (developer is not the user)*

The current financing model separates the investor and the user. The investor does not build for himself but considers how to sell the building even before the construction is completed, he is not interested in long-term costs. Simultaneously, due to asymmetry of information, the user is unaware of these long-term costs, and in effect, the price of the property becomes the decisive factor. Consequently, the economic advantage of circular buildings is overshadowed.

- *Market is not willing to invest upfront*

This barrier is directly connected with the financing model. As the investor is interested in short-term profit, investing in more costly circular solutions makes no sense for him. Though it would be beneficial for the user.

- *Long pay back times*

The benefits of using circular products and materials are visible in the long-term. Along with the unfavourable construction financing models this makes their application economically unviable.

4.1.3 Technical barriers

- *Separating waste streams locally requires intensive human labour*

Due to the characteristics of construction products, which in most cases are very durable, an often-encountered problem is the recycling of materials from different periods, subject to different standards.

- *Demolition is mostly downcycling*

Material reclaimed from demolition is often used for backfilling, losing its economic value in the process.

- *Asymmetry of information*

The investor has increased knowledge over the user/buyer on aspects such as energy efficiency of the building, durability of materials used, etc. In many cases he uses this asymmetry for own financial benefit.

- *Not keeping proper track of construction waste*

This problem is particularly important as the lack of regulations regarding the tracking of construction waste is not replaced by naturally developed market mechanisms. As long as the cost of transferring mixed up construction waste to landfills will be the cheapest option for getting rid of it, it will be virtually impossible to convince waste owners (both construction and demolition waste) to properly manage it without top-down regulation.

4.1.4 Cultural (social) barriers

- *Limited awareness among clients and consumers*

Low awareness of the economic viability and environmental benefits of designing, implementing and operating buildings in the spirit of a circular economy.

- *Perception of reuse of materials and building parts*

The basic social barrier to the introduction of circular construction is the negative perception of the reuse of building materials and parts. The fundamental problem is the uncertainty as to the durability and quality of the product, which means that this type of goods are not taken into account by architects, constructors and customers in the construction of a building.

- *Declarations vs. practice gap*

Despite the fact that declarations on ecological consumer choices in the European Union seem positive closing the loop for building products and materials requires increasing consumer awareness and, what is more important, putting it into practice. Often, the consumer is not aware of the long-term benefits and consequences of the specific materials and technologies used, which despite the declarations of positive preferences does not translate into consumer choices of circular goods.

- *Investor's lack of knowledge and competences*

The low level of knowledge and preparation to use circular solutions, both in the public and private sectors is a significant problem. The identified problem is directly related to currently accepted standards of investors' activities.

4.2 Drivers for the implementation of circularity in the C&I value chains

Recovering secondary construction materials entails many benefits, especially from an environmental point of view: first, it allows the reduction of the amount of waste sent to landfills and incinerators. It allows the conservation of natural resources such as timber, water

and minerals, preventing pollution by reducing the need to harvest/mine primary raw materials. Alongside, it reduces the necessary energy and all associated greenhouse gas emissions. There are also economic benefits: reusing and recycling construction materials reduces the cost of disposal and transportation, and production. Finally, construction companies that reuse/recycle materials have a competitive advantage, due to the increasing importance of green buildings. The use of secondary materials can help building owners earn points for sustainability certifications and rating systems. Finally, from a social perspective, it helps to sustain the environment for future generations and to create new well-paying jobs in the associated regional value generation.

4.2.1 Legal and regulatory levers

- *Regulators have been putting emphasis on sustainability issues*

There is a growing number of regulations and policies supporting circular economy, specifically, but not limited to, the European level.

4.2.2 Policies and fiscal policies

- *Policies and fiscal policies*

Define a structural framework of fiscal levers and taxes that can encourage both the production and the use of secondary materials. High disposal fees for recyclable materials or higher taxation of virgin materials can be a positive lever for the market, despite a temporary fiscal bonus.

4.2.3 Technological drivers

- *Construction sector is predisposed to CE implementation*

Features of buildings and structures, such as durability, the possibility of modernization and reuse predispose them to apply circular concepts – closing economic loops, so that the goods circulate as long as possible with simultaneous value maximization.

- *Digitization enables the rationalization of possible economic effects of CE implementation*

Technologies that increase the amount and flow of information in the construction sector are the basis for the transition to the circular model. This applies above all to the permanent and more detailed knowledge of the elements and materials used in construction, from design to the end of its life-cycle.

4.2.4 Cultural drivers

- *Social pressure for sustainability is on the rise*

The society is aware of the need to fight negative environmental phenomena, especially global warming. As the construction sector is the biggest polluter, this necessitates the use of circular model in the sector.

5 Stakeholders' consultation in 2020 and 2021

The stakeholder consultation activities coordinated by ENEA in 2020 took the form of a Workshop entitled "Promoting circularity in the construction value chain"¹⁹, carried out as part of the ECESP 2020 Annual Conference, on November 4th 2020, in which ENEA as leader of the Leadership Group "Construction" outlined the 2020 LG Orientation Paper on circular construction²⁰.

In 2021, then, ENEA, with alchemia nova and Innowo, as members of the new Leadership Group "Construction & Infrastructure" lead by Holland Circular Hotspot, followed the new format of the #EU Circular Talk, launched by the Commission through ECESP, with two twin events organized online on 28th and 30th September²¹.

The activities and key messages that emerged from the stakeholders involved are summarized below.

5.1 Workshop 2020

The Building & Construction Workshop 2020 combined invited discussions and group discussions in order to present the main issues and challenges to improve circularity in the B&C sector. In the workshop the stakeholders' contribution was asked through a guided discussion and a Slido Poll with a few questions. Participants were asked to identify the top priority among six key areas of intervention aimed at promoting circularity in the construction value chain. After that, participants were asked to identify the top action in the chosen area. It should be noted that all the actions are presented briefly in the 2020 Orientation Paper.

After the workshop, a public consultation was opened in order to classify all the actions previously identified in each of the six areas of intervention, with an evaluation scale from 1-neglectable to 5-mandatory.

The following section summarises the key message of the invited discussion and the stakeholders' contribution.

¹⁹ <https://circulareconomy.europa.eu/platform/en/news-and-events/all-events/ecesp-annual-conference-workshop-construction-and-buildings>

²⁰ <https://circulareconomy.europa.eu/platform/sites/default/files/leadership-group-construction.pdf>

²¹ <https://circulareconomy.europa.eu/platform/en/news-and-events/all-events/construction-and-infrastructure-value-chains-and-market>



Davide Sabbadin

European Environmental Bureau (EEB)

Davide Sabbadin is Senior Policy Officer for Climate and Circular Economy. Davide tries to bridge the gap between CE policies and Climate policies to decarbonize industry and the heating sector. He is also working on climate sequestration in buildings and on the development of the batteries sector. In the past he has been working for a long time at Legambiente, in the fields of energy efficiency, refrigerant gases and circular economy. He holds a master's degree in political sciences from the University of Padua, Italy, and he likes to bike his way through Europe on holidays. He's also interested in trekking, rhymes and trains.

Promoting circularity in the construction value chain

The speech gave an overview of the Construction and Building (C&B) sector and its connection with material production and waste creation focusing also on possible actions in order to increase resource efficiency and reduce CO₂ emissions in the sector. Some examples are: reduction in the use of concrete at design stage, the reuse of structural concrete, design in view of disassembling the building.

Key messages:

- Reducing the demand for buildings and building material is a priority in order to reduce emissions dramatically, but industries do not seem to take this into consideration. It is important to extend the life of buildings and materials;
- Usage should be preferred to ownership of a building, but this means for industry to change its business model for the future;
- It is important to think circular since the beginning;
- Research is useful and needed to improve the quality of secondary cement (clinker reduction) and steel (to avoid downgrading).

Via CiscoWebex



CE IN CEMENT

The climate potential of CE

Cement production is a significant source of emissions in the EU: 114 Mt CO₂ per year today

It is the clinker production that creates 60-65% of the process emissions in cement production (excluding combustion emissions)

CEMBUREAU has committed to climate neutrality in 2050 but has a pathway largely relying on CCS



+73



Laura Cutaia

ENEA --ICESP (Italian Circular Economy Stakeholder Platform)

Laura Cutaia, researcher at ENEA, is an Environmental Engineer (1996) with a PhD in raw materials engineering (2002). Her main research topics are: industrial ecology and symbiosis, technology for raw and secondary materials treatment, resources management, Life Cycle Assessment, Environmental certification, End of life management.

She is working on the circular economy and resource efficiency, industrial ecology and symbiosis, LCA, environmental certification schemes, the REACH regulation and sustainable industrial areas.

She is also president of SUN - Symbiosis Users Network (Italian network for industrial symbiosis) and president of UNI CT 057 on the circular economy that works with ISO TC 323 on the circular economy. UNI is the Italian competent body for standardization.


The Orientation Paper on the circularity of the construction sector

The speech presents the Orientation Paper on the circularity of the construction sector made by ENEA, with the participation of INEC, ACR+, EEB and Ecopreneur. An overview of the main C&D strengths and weaknesses was presented as well. Some strengths are: Material recirculation for decarbonisation; Production/process improvements for material footprint reduction; Extension of lifespan of products for CO2 emissions reduction; Reused/recycled C&DW as a substantial alternative to virgin material; Design for deconstruction to improve quality/quantity of secondary materials. Some weaknesses are: Price competition between recycled and virgin materials; Lack of confidence in quality and structural properties of secondary materials; Presence of hazardous substances in recovered materials; Lack of sufficient/reliable data on existing buildings' materials; Time delay between implementing circular actions and their benefits.

In the orientation paper six areas of intervention with relative actions to be implemented to improve circularity in the B&C sector were identified: 1) Integrated policies and governance between construction & extractive sectors, 2) Integrated metrics for construction, 3) Integrated tools to foster interconnections among construction/extractive and other sectors, 4) Territorial initiatives to close the loop in the value chain, 5) Educational initiatives to form experts at any level, 6) Citizens awareness raising initiatives (*Made to last, Disown ownership, Get local, Get clean*).

Key messages:

- No carbon neutrality target will ever be achieved if circular economy provisions are not put at the heart of B&C sectorial policies.
- It is urgent to activate synergies between the construction industry and the various supply chains connected to it, with regard to both the policies and regulations of the different industrial sectors and the material flows, in an industrial symbiosis perspective.






CIRCULAR ECONOMY STAKEHOLDER CONFERENCE
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ENEA
Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

Orientation paper

**AREAS OF INTERVENTION TO IMPROVE CIRCULARITY
IN THE CONSTRUCTION SECTOR**

Area #1	Area #2	Area #3	Area #4	Area #5	Area #6
Integrated policies and governance between construction & extractive sectors to integrate secondary supply and urban planning	Development of integrated metrics for construction	Integrated tools to foster interconnections among construction/ extractive and other sectors	Territorial initiatives to close the loop in the value chain	Educational initiatives to form experts at any needed level with an integrated approach and awareness-raising initiatives	Citizens awareness raising initiatives
					


5.1.1 Results of the Workshop live poll

Among the participants a strong participation of firms and trade associations was registered (64%). Concerning the results of the live poll, the key challenge for the Building & Construction sector has been identified in the “Integrated policies and governance between construction & extractive sectors to integrate secondary supply and urban planning”, voted by 47% of the participants and followed by the “Development of integrated metrics for construction”. As shown in Figure 2, within the crucial area of integrated policies and governance, the most relevant action identified by the stakeholders is the adoption of a life cycle thinking approach for sustainable assessment (voted by 42% of the participants). Implementing circularity considering the life cycle thinking approach as a comprehensive assessment tool is in fact key in order to consider impacts along the entire supply chain, including embedded emissions, and to consider multiple environmental impacts, highlighting possible trade-offs.

Figure 2: Results of the Workshop live poll

Slido Consultation results

TOP PRIORITY AREA OF INTERVENTION AND RELATIVE ACTION

	Area #1
	Integrated policies and governance between construction & extractive sectors to integrate secondary supply and urban planning
	#1.1 Assessment, planning and valorization of primary geological deposits and secondary supply
	#1.2 Creation of cross connections between construction and extractive sectors and others
	#1.3 Application of the waste hierarchy to existing buildings and C&D materials
	#1.4 Adoption of a life cycle thinking approach for sustainable assessment
	#1.5 Support to the circular use of bio-based products in the C&D sector
	#1.6 Promote development and implementation of GPP and certification systems

5.1.2 Results of the guided discussion

Some key questions guided the discussion:

- i. What are the market approaches that could nudge towards circular consumption patterns in the B&C sector?
- ii. What type of information should be made available and/or required along the value chain down to the final user to streamline sustainable circular consumption patterns in the B&C sector?
- iii. What policies and specific actions can influence the choice of final users on the merits of more sustainable buildings towards circularity trends (such as “made to last”, “disown ownership”, “get local”, “get clean”)?
- iv. What specific policies could help promoting a reduced use of virgin materials and a more productive use of materials in the B&C sector (e.g. metals, plastics, cement)?

From the audience the main contribution and highlights can be summarized as follows:

- **Constructions Product Regulation (CPR) in order to foster CE-marking of construction products.** Revised eco-design regulation should provide a really transversal framework, setting (minimum) requirements applicable to all products. For products having specific requirements, sectorial policies should be set up (i.e. construction product regulation). [ISO TC 323](#) and [EU DG Connect](#) are discussing on the topic.
- **Competitiveness of secondary raw materials.** Landfill prices can be increased for C&D products to promote material recycling, but this measure is not enough. Regulations concerning administration of recyclable products should also be facilitated and be more efficient. In some countries (i.e. Italy) landfilling costs are still too low and extractive costs do not take externalities and environmental impact into account. In Italy Green Public Procurement is mandatory and requires pre-demolition audits and a certain percentage of recovered waste. This is a way to move the market towards the use of secondary materials. Moreover, a common EU framework for construction products, concerning a content declaration to provide building managers, during renovation works, with information on products to check which recyclables can be integrated in the building passports/logbooks can be considered a driver to foster the use of secondary raw materials. A big issue of recycled products is their integration into the regulatory framework set by the CPR through the Declaration of Performance (DOP). The uncertainty for the sector is not so much the extraction costs, but the need to ensure that recycled products can demonstrate their products performance compliance with the Basic Work requirements (ex. resistance, etc.) of the CPR.
- **Standards & Environmental Product Declaration (EPD) as tools to assess products performance.** Regarding environmental performance indicators, the EN 15804 is being used in the construction sector to integrate the EPD. EPD remains a privileged instrument to assess LCA of products and provide the data needed. Industrial standards are important, but private, and they are mostly discussed between industries, while regulations come from governments. Standards do not always consider all the aspects, while regulations do. [CEN](#) follows a consensus approach where many stakeholders, including non-profit organisations, are part to the process (ex. [ECOS](#), [ANEC](#), technical committees such as SBS, as mandated by [regulation \(EU n.1025/2012\)](#)). Moreover, the initiative [Circularity Dataset Standardization](#) launched by the Ministry of Economy of Luxembourg aims to create an open standard to solve the lack of efficiency in circulating information on security properties of materials through

the whole supply chain, hence the difficulty to measure security, but also to decide on recycling.

- **Holistic approach.** The new challenge is to address the sustainability of the whole value chain, in a life cycle and holistic perspective, from materials extraction or recycling until the end of life of buildings, without limiting the focus on single building components.
- **Intra-die and extra-die relations and possible synergies.** There is the urgency of activating synergies between the construction industry and the various industrial sectors connected to it was raised. These links need to regard both the policies and regulations of the different industrial sectors and the material flows, in an industrial symbiosis perspective.

5.1.3 Results of the on-line survey

It is interesting to note that, in Area n. 1, the action “adoption of a life cycle thinking approach for sustainable assessment” received a 75% of level 5 answers plus a 25% of level 4: this result therefore substantially coincides with that of the live poll. Today life cycle thinking implementation, therefore, is still seen by the stakeholders as a priority action for the Building & Construction sector, even though it is a consolidated approach in other industrial sectors. The second most important action was chosen again in Area no. 1 and received a very high share of level 4 plus 5 answers (82%): it was the “Application of the waste hierarchy to existing buildings and C&D materials”, showing again a strong need for a spread of the basic principles of circularity in the B&C sector.

5.2 EU Circular Talks 2021

The #EU Circular Talks organized by ENEA with alchemia nova, Innowo and the ECESP Secretariat on the 28th and 30th September 2021 aimed at illustrating the value chains and market perspectives of circularity in the construction and infrastructure sector, with the contribution of main European stakeholders, offering an overview of the relevance of construction and infrastructure value chains within EU economy, of their potential for circularity, resource efficiency and decarbonisation and of main obstacles and drivers.

The #EU Circular Talks were organized in two sessions focused on: “Value chains collaboration in a circular/industrial symbiosis perspective” (Session 1, looking at the active and potential connections along the Construction and Infrastructure value chain and with other value chains); “Market of primary and secondary construction and infrastructure materials” (Session 2, highlighting the main market dynamics relative to materials for buildings and infrastructures and demonstrating strengths and weaknesses of the use of secondary materials (in substitution of primary ones) in the market).

The engagement of stakeholders was ensured through the participation of a large number of speakers and supported by a live poll during each event, followed-up by a stakeholders’ survey, aimed at raising awareness and connectivity of stakeholders for the circular economy potential of this sector.

Detailed agendas, presentations and videos of the sessions are available online²².

²² <https://circulareconomy.europa.eu/platform/en/news-and-events/all-events/construction-and-infrastructure-value-chains-and-market>

#EUCircularTalks

Construction and Infrastructure
value chain and market

28 & 30 SEPT 2021 - 10:00-12:30 CEST



Hosted by



5.2.1 Stakeholders' contribution

Below all #EU Circular Talks speakers' interventions are presented through a short bio of the stakeholder and an abstract with speech's highlights.



Baiba Miltoviča

Section for Transport, Energy, Infrastructure, and the Information Society (EESC)

Baiba Miltoviča has been appointed in 2020 President of the "Transport, Energy, Infrastructure and Information Society" Section (TEN) of the European Economic and Social Committee (EESC). In her previous mandate at the EESC, Ms. Miltoviča held a position as Vice-President of the Diversity Europe Group of the European Economic and Social Committee.

Ms Miltoviča is a member of the Consumer Policy Advisory Group established by the European Commission Directorate-General Justice and Consumers.

At the national level Baiba Miltoviča serves as the International and EU Affairs Adviser of the Latvian National Association for Consumer Protection (LPIAA, member of the European Consumer Organization, BEUC) and is Member of the Advisory Board of the Latvian Public Utilities Commission.

Opening remarks

The transition to a circular economy is essential for a more sustainable and more robust European economy. Recognising the need to bring stakeholders from the field in a one place, the European Commission and the EESC launched a joint initiative known as the European Circular Economic Stakeholder Platform, today's event co-host.

The Platform is a European one-stop-shop for the circular economy community. It is a place for dialogue and a bridge between existing circular economy initiatives. As the exchange concept of the European Circular Economy Stakeholder Platform, the EU Circular Talks are the ideal forum for stakeholders to come together and exchange their ideas and practices in specific fields, such as Industrial Symbiosis.

Apart from its active role in ECESP, the European Economic and Social Committee (EESC) acts as a driver for Industrial Symbiosis, while identifying the barriers through its Opinions. In its role as consultative body to the EU institutions, the EESC organises thematic exchanges with a wide range of civil society actors and prepares opinions on issues related to industrial symbiosis, drawing on input from experts in the Employer, Workers and Various Interests Groups. One example is the EESC Opinion on Circular Public Procurement.

The EESC has already recommended policy interventions to mainstream industrial symbiosis in order to promote the circular economy (cf. INT/883). And it has already called for a use-value oriented industrial policy for Europe, adjusted according to local characteristics and promoting clusters and cooperation, preserving scale benefits following the principles of industrial symbiosis and circular economy'



Aurelio Braconi

*European Steel Association
(Eurofer)*

Ph.D. graduated in structural engineering and earthquakes in 2004, he joined the steel industry in 2007 as R&D manager and then EUROFER in 2011. He is now senior manager on Circular Economy & Raw Materials and his activity deal with waste legislation, products legislation, and by-products valorisation.

Reuse and recycling of steel by-products in construction: State of art and future perspectives

The steel industry along the decades has established exchange channels with other industrial sectors for the industrial residues: synergies. This presentation wants to focus on the ferrous slag, material fatally co-generated with steel and fundamental for giving steel grades their final properties. Different types of slags arise from the steel production and its processes; in particular, each type of slag has its own properties and preferential applications. Notwithstanding past good practices and applications of the ferrous slag in the past, recent developments of the EU policies although promoting circularity still have elements of concerns for the use of industrial residues. The presentation wants to address the legal aspects related to the ferrous slag and its use in the construction sector. Topics such as legal status, legislative approaches hampering circular practices and market instruments for supporting the use of the ferrous slag will be discussed.





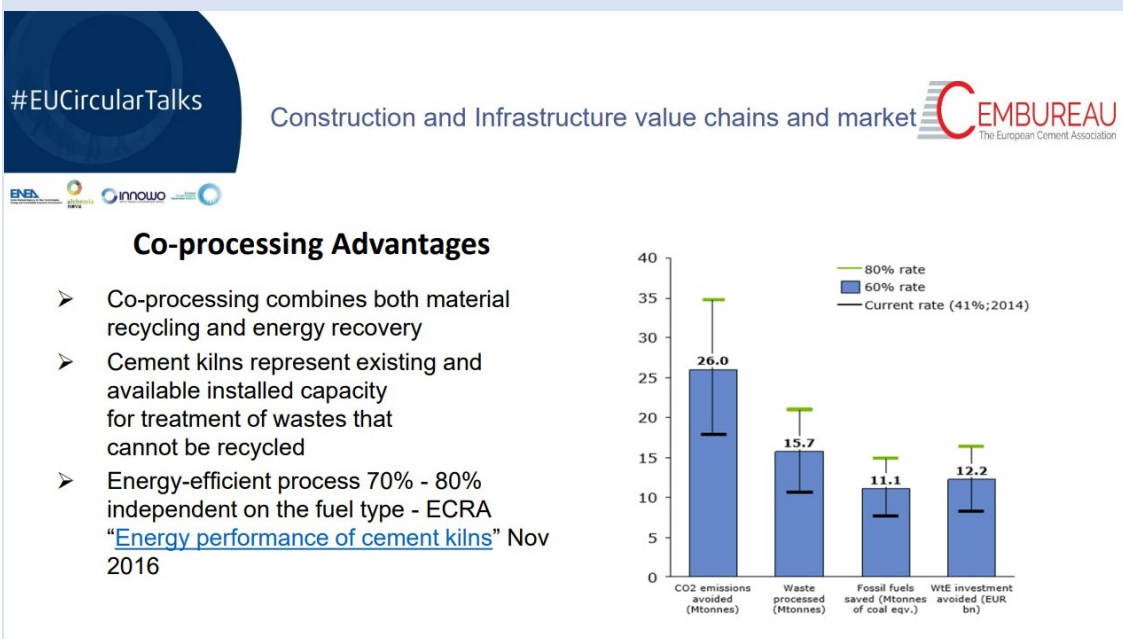
Nikos NIKOLAKAKOS
Cembureau

Joined the CEMBUREAU team in October 2017, as Environment & Resources Manager dealing with the topics of waste use, emissions to air, resource efficiency and biodiversity.

Before that, used to work for 14 years in Halyps Cement plant (belonging to HeidelbergCement Group) in Athens, being in charge of the quality assurance and environmental management departments.

Raw material substitution rate in concrete/cement production and waste derived fuels utilization rate

CEMBUREAU's Carbon Neutrality Roadmap to 2050 has been published in May 2020. The intervention has highlighted the contribution of the European cement sector to the EU Circular Economy, including the main data and stats of the EU cement industry related to the fuels substitution rate. The benefits and advantages of using waste in the cement sector as a sound environmental solution. Finally, the most important policy requests for the future increase of the substitution rate in the concrete/cement sector were presented.



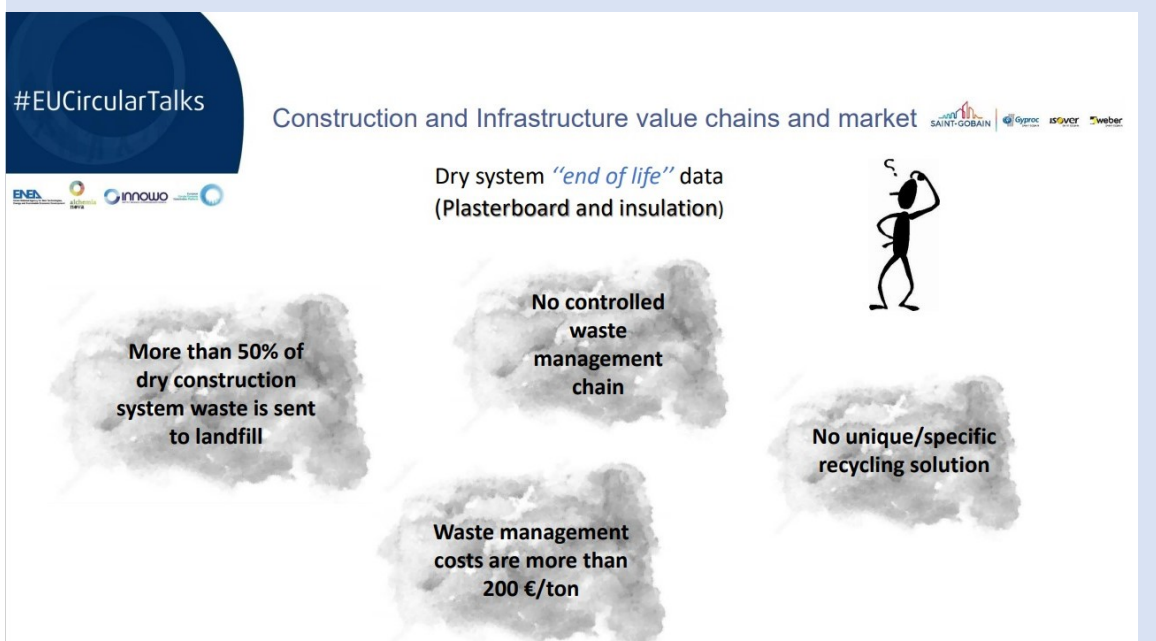


Alessia Olga Iscaro
GYPROC - Saint Gobain

Alessia O. Iscaro is the Environmental, Sustainability and Public Affairs Manager of Saint Gobain Italia, where she coordinates the activities focused on the development of business solutions to improve sustainability and circular economy for the construction industry. She earned her PhD in Material Engineering and her BS in Environmental Engineering from the University of Rome “La Sapienza”. Alessia O. Iscaro joined Saint Gobain Group in 2007 where she initially served as Project Manager for programs dedicated to innovative recycling system of construction and demolition waste. Alessia O. Iscaro is also the inventor of the innovative technology developed for Gy.eco to recycle gypsum scraps and protected with patent since 2014.

Dry construction system for the refurbishment of built environment: barriers and opportunities in the disposal of materials and components of plasterboard systems

The management of construction and demolition waste is a critical issue that requires an immediate intervention. For several years now, Europe has been trying to strongly reduce the landfilling of waste by pushing as much as possible towards selective recovery systems. This endeavor has been supported by management tools based on techniques of waste production prevention. However, there are still confusions and regulatory deficiencies regarding the definition of detailed, shared criteria for waste recycling. These criteria should identify the specific methods of transformation to guarantee a total reuse of materials in replacement of the equivalent raw materials. Dry construction systems represent this situation very well, as the circular management of two main components, namely plasterboards and insulation panels, is yet to be defined. In the first part of the intervention, the life cycle of dry construction systems will be described, from supplying of raw materials to the end of life in buildings and used products. In the second part of intervention, the barriers to the not circularity of dry construction solutions will be discussed.





Ivan Poroli





NADECO

Coordinator of the Technical Commission of the Italian National Association for Demolition and Circular Economy for Construction (NADECO), part of EDA

Improvement scenarios in recycling of demolition waste through selective demolition

European demolition companies are already adapting new standards, demolition companies have already shown their capacity for innovation and transformation, as has happened for the improvement of safety in demolitions. We are already observing significant changes in the demolition process with new lay outs of the demolition site, significant increases in manpower, machines with different technical characteristics, new attachments, all with the ultimate goal of producing materials with homogeneous characteristics ready to be recycled. But all of this is not enough. Today the balance between costs and benefits still hangs dramatically towards costs. In order to start the virtuous process of circular economy, an effective incentive system must be combined with selective demolition.

#EUCircularTalks

ENEA    

Construction and Infrastructure value chains and mark

NADECO
Associazione Nazionale Demolizione
ed Economia Circolare per le Costruzioni

COSTS

- RISK OF PENALTIES
- MORE SPACE NEEDED
- MORE EXECUTIVE TIMES
- HIGHER COSTS FOR SAFETY
- HIGHER COSTS FOR MANPOWER

BENEFITS

- LOWER DISPOSAL COSTS
- ECONOMIC VALUE OF MATERIALS
- INCENTIVE SYSTEMS

In order to start the virtuous process of circular economy, an effective incentive system must be combined with selective demolition



Margherita Galli

FEDERBETON

After getting graduated with a bachelor's degree in environmental engineering and a master's degree in environmental engineering and economics, she worked as a researcher at Ispra, the Italian Environmental Protection Agency. Subsequently, she joined Atecap, the Italian Association of Ready-Mix Concrete Producers, where she worked for 14 years as an Environmental Health and Safety Manager. Currently she is an Environmental Manager at Federbeton, the Italian Federation of Cement and Concrete Associations, part of Confindustria.

C.E. in the C&I sectors in Italy. The ICESP experience

Cement and concrete can provide an important contribution to the circularity of the construction sector, by using recycled materials, by-products, and End of Waste in their production process. Unfortunately, though, the Italian market does not have enough recycled aggregates, usable from a regulatory standpoint, to produce structural concrete (as per Ministerial Decree of 17 January 2018 "Technical Standards for Construction", UNI EN 12620). The data provided by the Italian Environmental Protection Agency shows that the recycling target set by the Waste Framework Directive, specifically for the construction and demolition wastes, is being achieved by the Italian country since some years, but frequently this happens for waste downcycling processes (for instance for backfilling). As per the activities done in the ICESP working groups, this intervention is meant to focus on the specific topic concerning the usage of the recycled aggregates for green concrete production, diving either into the national situation and into the main critical issues, which keep the utilization rates still too low. Finally, the proposed solutions were examined, including, for example, the development of selective demolition and financial support for recycling plants, facilitating the production of high-quality recycled aggregates.

#EUCircularTalks

Construction and Infrastructure value chains and market



Italian Circular Economy Stakeholder Platform

- ENEA chairs and coordinates ICESP, a National convergence point on initiatives, experiences, critical issues and perspectives that Italy wants to represent in Europe
- **Over 100 signatories**, including institutions, companies and public authorities.
- **169 Good Practices of Circular Economy**, developed by the stakeholders of the national territory (companies, associations, institutions), **collected in the platform** in order to promote **knowledge, dissemination and replicability** of "the Italian way for circular economy".



ICESP and ECESP interactions. Source: ENEA



Andrea Kessler

Materialnomaden

Since her interdisciplinary study of digital art and architecture at the University of Applied Arts Vienna, Andrea Kessler has been working on interventions and temporary usage of urban and built structures. As a designer and building artist, she works with inhabitants to develop usage concepts and designs for sustainable spatial solutions, usage scenarios. The built city itself, especially vacancies, demolition buildings and fallow urban areas are valued resources and serve as a source of inspiration. In terms of circular design and sustainable architecture, materiality and identity are preserved and supplemented or combined to a transformed novelty. In 2017, together with Peter Kneidinger and other architects, she founded a cooperative for the procurement of re:use components (HarvestMAP eG Vienna) from which materialnomaden gmbh emerged.

A good practice of recovery, reuse and enhancement of deconstruction waste

The presentation gave a brief summary of concepts due to the aspect of circular design, followed by the strategies for a circular design process including re:use materials, and how to embed available urban resources into a valued design products or building process. Best practice projects gave an image about future developments evolving to a high end design challenge.

#EUCircularTalks

Construction and Infrastructure value chains and materials

materialnomaden
circular design & architecture

- raising awareness is so important as the processes are not common yet
- making the samples visible also happens through the re:store



President of the Employment, Social Affairs, and Citizenship section at the European Economic and Social Committee (EESC)

Aurel Laurențiu Plosceanu

EESC

Opening remarks

The construction sector is referred to in the 2020 Circular Economy Action Plan and has significant impacts on many sectors of the economy, local jobs and quality of life while requiring vast amounts of resources and creating significant waste and emissions. The later need to be talked by higher material efficiency. Circular Economy is necessary for Europe to become a more sustainable and more robust economy. To bring stakeholders together, ECESP was founded and represents a one-stop-shop for European stakeholder to exchange on circular economy.



Philippe Moseley

*Policy Officer,
Sustainable Industrial
Policy and Construction,
DG GROW, European
Commission*

Philippe Moseley works in Brussels at the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. He is responsible for policies relating to the competitiveness of the construction industry, focusing on energy and resource efficiency aspects.

EU policies for a circular construction ecosystem

An overview of current EU policies and European Commission initiatives that aim to foster a circular economy in construction. These include the Industrial Strategy, the Circular Economy Action Plan, the Renovation Wave, funding programmes and other action.



Construction and Infrastructure value chains and market



Circularity in construction: ongoing action

Circular Economy Action Plan

- **Waste reduction targets** for specific streams and other measures on waste prevention
- Scoping the development of further EU-wide **end-of-waste and by-product criteria**

Renovation Wave

- 2050 roadmap to reduce **whole life carbon** in buildings
- Reviewing **material recovery targets** and supporting the internal market for secondary raw materials
- **Green public procurement** criteria



Geert Cuperus

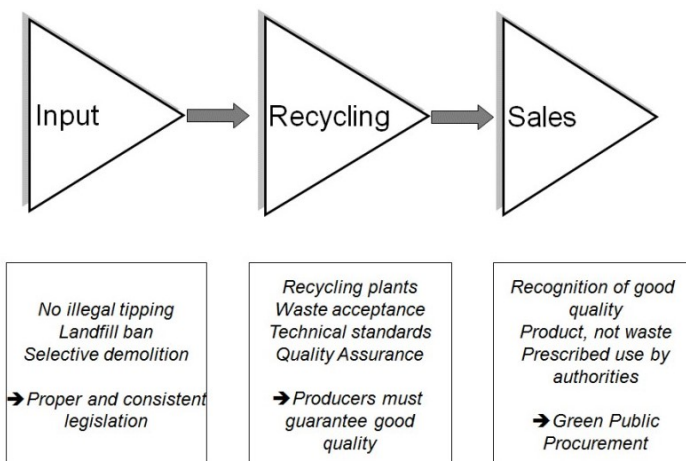
*Fédération Internationale du
Recyclage (FIR)*

Geert Cuperus studied chemical engineering and has worked for several years in the chemical industry. After that he became employed by a consultancy firm working on several environmental issues. In that job he mainly worked on soil decontamination and waste management. Many of his activities included assistance to the Dutch ministry on the development of policy and regulation. Work also included many practice related projects carried out for waste management operators. Since 20 years Geert has now been Secretary General of FIR. FIR represents the interest of European recyclers of C&DW and Incinerator Bottom Ash. Main parts of Geert's work relate to dissemination of knowledge and expertise in the area of recycling.

Acceptance of recycled materials

The intervention focused on how recycling of C&DW and markets for recycled aggregates can be developed and an overview of the situation in the EU and discuss existing opportunities and barriers.

Requirements for recycling





Eugenio Quintieri

*European Builders
Confederation (EBC)*

Eugenio Quintieri is the Secretary General of the European Builders Confederation (EBC), the organisation exclusively representing construction SMEs and craftsmen in Europe. In addition to managing EBC secretariat, Eugenio represents EBC in the European Social dialogue committee, supervises several legislative fields, including the digitalization of the construction sector, and acts as EBC main spokesperson. Representing EBC in SMEunited, Eugenio is also a board member of Small Business Standards, the organisation representing SMEs in the European and international standardisation processes. With a Master degree in European Interdisciplinary studies from the College of Europe, Eugenio speaks Italian, English, French and Spanish.

Competitiveness of secondary materials: design phase and end of life as parts of the same problem/solution

By simplifying the life-cycle of buildings to the design, execution and end-of-life phase and examining the circularity of buildings, it becomes clear that most existing buildings have not been built considering circular economy principles. The circular renovation is challenged by a market that is discouraging the use of secondary materials, uncertainty about recycled materials or reused products as well as several challenges for the recovery or recycling of materials remain. Therefore, data on existing buildings and financial incentives for the use of recycled materials and sustainable products need to be improved, a framework for issues related to the residual performance of materials/products is required and that construction enterprises benefit from an appropriate number of waste facilities located close to their sites



Construction and Infrastructure value chains and market



End-of-life (solutions)

- Ensure that construction enterprises are able to benefit from an appropriate number of waste facilities located close to construction sites or their businesses (maximum 20 km or 30 minutes transport time). The facilities may be waste collection centres or grouping/storage platforms.
- Remove the waste status from all materials and equipment that can be reused
- Financially support enterprises that reduce the general amount of packaging on their materials and equipment and are active on circular sorting.

must be ensured.



Kaitlyn Dietz

ICLEI

Kaitlyn Dietz works as a Sustainable Construction & Circular Economy officer with ICLEI's Sustainable Economy & Procurement team to support European cities and regions in enabling and promoting closed-loop systems and societies. She facilitates knowledge transfer and capacity building through the Circular Cities Declaration and other EU-funded cooperation projects, including several circular building demonstrations. As an architectural engineer with dual masters in international cooperation and urban development, she advises local governments in transitioning to a low carbon and resource-wise built environment by leveraging public procurement, enabling the innovation ecosystem, promoting energy and material efficiency, and utilising urban planning approaches to cover the entire construction value chain.


Circular procurement as an enabling tool for secondary material markets


The session introduced strategic procurement as a tool to accelerate the circular transition in the construction sector, highlighting how procurers can structurally support consolidation of secondary construction material markets through their own projects. Best practice examples showcased experiences of the Big Buyers Initiative working group on circular construction.

#EUCircularTalks

Identified challenges

to procurement of circular construction





Do these resonate with you?
Can you think of any additional barriers?

- Secondary materials:** Heterogeneous, limited in quantity, lack of reliable data on availability and certification of quality
- Closing the loop: Demo → new Construction value chain** Need for storage, new market actors to address logistics of matching and facilitating exchange of materials and management of risks
- Digital tools:** Extra cost and time of material inventory/ passports hard to justify without proven business case for reuse - need more (and more accessible) data, and supporting governance

- Awareness of architects & engineers:** Need larger demand for inclusion of secondary materials from construction clients, and design education for whole lifecycle

#EUCircularTalks - 30 September 2021
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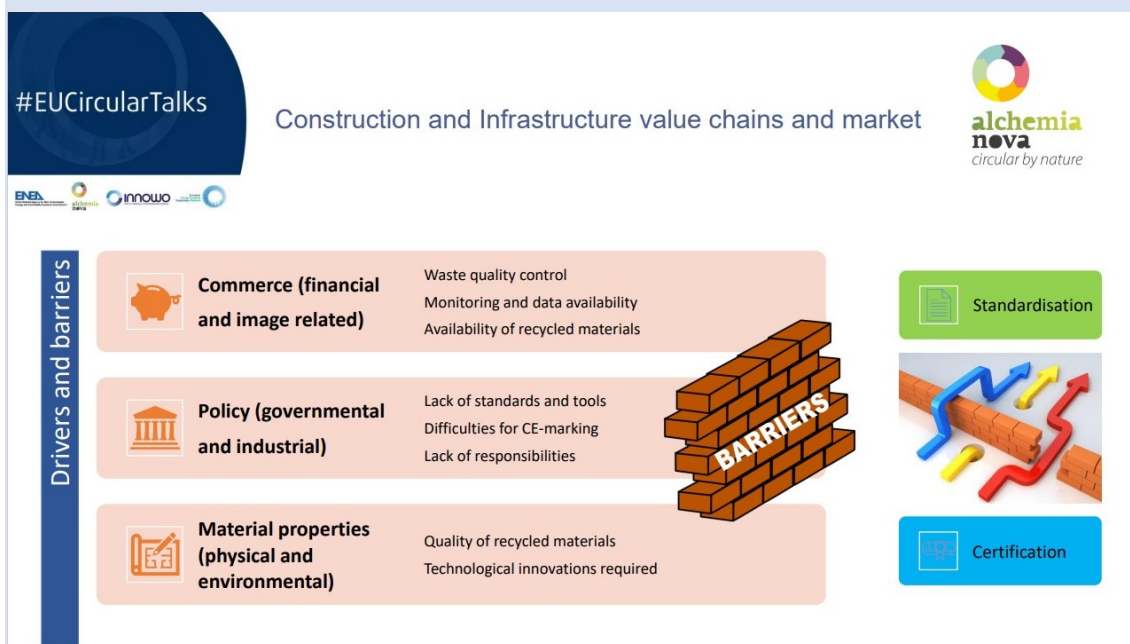


Gaetano Bertino
alchemy-nova

Master's degree in Construction Engineering-Architecture, with dissertation on waterfront's conservative refurbishment and sustainable redevelopment. 2nd level master's degree in Forensic Engineering, with dissertation on the evaluation of noise pollution in areas of landscape interest. Currently working as project manager at alchemia-nova GmbH. Currently PhD student at Universität für Bodenkultur Wien (BOKU), with project topic on circular solutions for a sustainable architecture.

Certification systems and standards for the use of secondary materials in the construction industry

According to the recent environmental policies and the improvement of waste treatment techniques, the construction industry is confronted with the availability of secondary recycled materials, to be used as an alternative for raw materials, following the core idea that materials must be recovered, recycled or re-used in an openly traded materials market. However, even when the secondary material satisfied all necessary product demands and conditions, this has not always been sufficient for a successful market introduction. All aspects that could influence a successful introduction on the market can be categorized into three barriers: material properties; economy and policy. The best way to deal with these problems is by the standardization and certification of the secondary material. This session highlights the current building and product certification systems regarding the use of recycled materials in the construction sector, analysing the different certification for buildings and products, evidencing



the current problems that need to be overcome.



**Michael Moradiellos
del Molino**

Drees & Sommer

Graduated Architect from ISAVH in Brussels, Michael Moradiellos also holds a PHD in sustainable urban planning and has co-founded several companies. He is an expert in Circular Economy and Cradle to Cradle, with a focus on innovative co-creation with stakeholders. His aim is to develop good practices that have a positive impact for humans and the planet, while demonstrating their economic viability.

Good practices

The WTC/ZIN C2C building in Brussels is a circular project under construction by Drees & Sommer, encompassing the renovation of two towers of the World Trade Centre as well a new tower and applying the cradle-to-cradle approach. Instead of demolishing everything, an approach including the design phase and a raw material inventory was chosen. Therefore, the weight of all materials was calculated. This allowed to have an overview of all materials on site and to choose different strategies such as material reuse, recycle and up-cycle. The project occurs in collaboration with different actors from the industry, asking them for materials to be certified. Recycled materials applied to the project include for example concrete and glass.





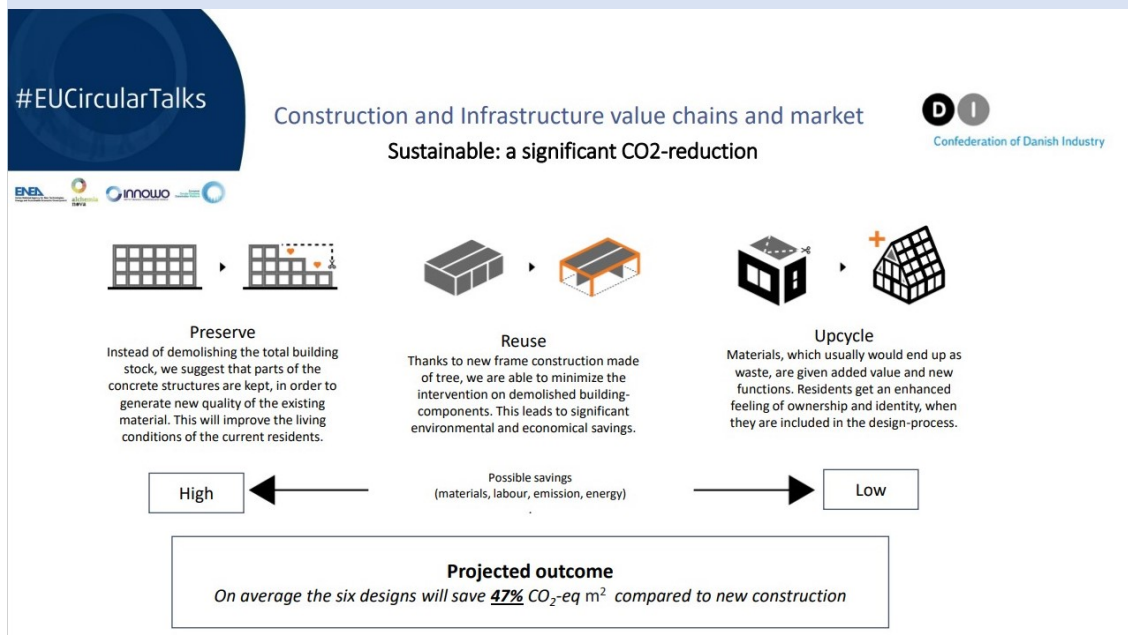
Leading Senior Adviser at The Confederation of Danish Industry

Henriette Thuen

*Confederation of Danish
Industries*

Good practices

The New European Bauhaus was initiated by the European Union alongside the Renovation Wave as a bottom-up movement to explore how we live better together, connect people, and develop lead markets in sustainability. In January 2021, the Danish Project for a Lighthouse Demonstrator as part of the New European Bauhaus began and launched several events on society, nature, and resources. The case of Ressource Blokken is an example of Upcycling Social housing from the 1960s and 70s where 15 social housing blocks in Denmark are being



renovated, upcycling concrete structures among other things.



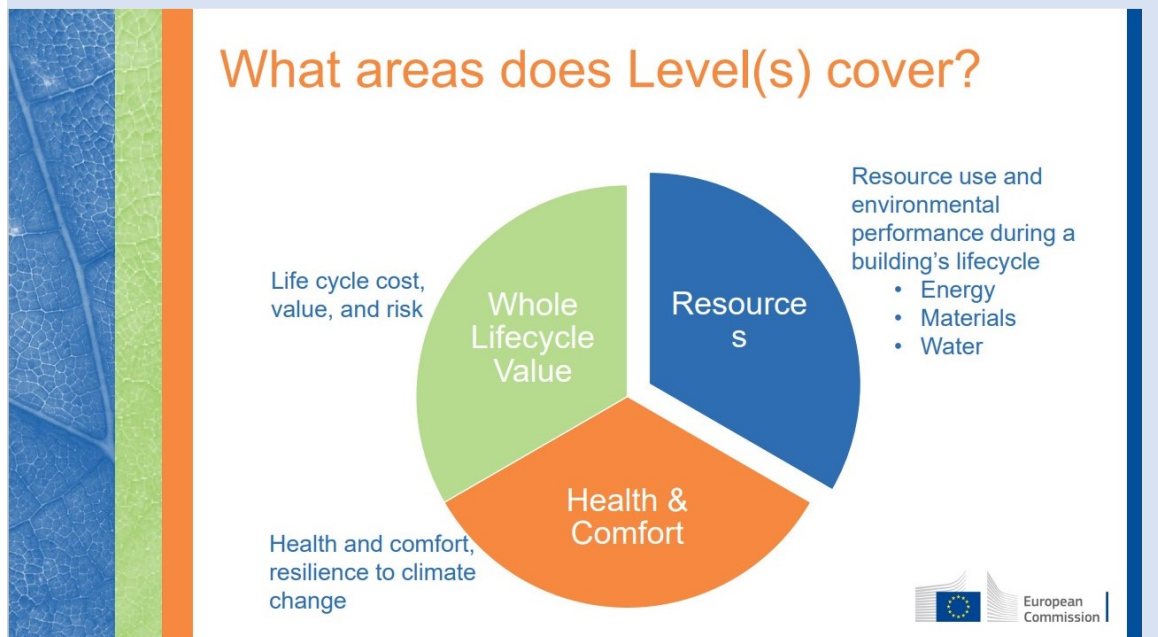
Josefina Lindblom

Policy officer, Sustainable Buildings, DG ENVI, European Commission

Josefina Lindblom is working at the European Commission for DG Environment, in the unit of Sustainable Production, Products and Consumption. She has been responsible for the work on "sustainable buildings" since 2011 and has among other things managed the recent collaborative developments of Level(s), a common framework for the assessment and reporting of the environmental performance of buildings. This work is at the heart of the efforts that the European Commission is doing to bring the building sector into the circular economy. Josefina works to make life cycle thinking a key part of existing European building policy. Moreover, ongoing efforts relate i.a. to the development of a roadmap for the reduction of whole life carbon and the inclusion of life cycle thinking of buildings into Horizon Europe. She has a Ph.D. in Chemical Engineering Design from Chalmers Technical University of Gothenburg, Sweden, partly conducted at the Institute for Paper Science and Technology in Atlanta, the US.

Level(s)

The European framework for sustainable buildings Level(s) is a common language to assess sustainability of new buildings and renovations, of residential buildings and offices. It covers resource use, health and comfort as well as life cycle cost and value. Furthermore, Level(s) has already started to influence policy on the EU level, e.g., the revision of the Energy Performance of Buildings Directive and the Roadmap for reduction of whole life carbon until 2050. The framework can be understood as the bridge between the ambition of the Green Deal and the realities of professional building operations.



5.2.2 Main findings from the discussion

During the #EU Circular Talks, a live poll was launched in form of a word cloud (Figure 3). The participants were asked to add words in response to this question: “Which issues can influence the market in order to boost value chain collaboration/connections along the construction value chain and other sectors?”. Among the most voted words the following should be highlighted: *standardisation*, needed to facilitate reuse and recycling of construction materials; *policies and planning*, essential for the creation of a stable market for secondary materials; *legal issues*, hindering the spread of circular processes; *digital platforms*, enabling the sharing of secondary resources; *design for deconstruction*, allowing circularity in the long term.

Figure 3. Word cloud collected during the #EU Circular Talks.



During the discussion some key points emerged.

The industry looks prepared for the collaborative, circular approach especially in the steel, cement, concrete, gypsum and demolition value chains, where the collaboration in a circular/industrial symbiosis perspective is strongly perceived and required. However, some legal issues, especially in some Member States such as Italy in the case of End of Waste criteria (still under development), represent a barrier for a widespread use of secondary materials. Moreover, despite the common EU framework, there are significant differences in its implementation between the Member States, in particular for waste management in the C&I value chains.

Indeed, on the side of reuse of buildings materials and components, high costs connected with selective demolition, standardization and materials qualification issues still cause a big market gap, though the potentialities are huge.

Some factors were highlighted as crucial to enhance circularity in the construction and infrastructure value chains:

- *Indicators and monitoring framework:* Monitoring of environmental and circularity performances is really important and needs investments, in relation with SDGs and the EU Taxonomy for Sustainable Activities; LEVEL(s) as a common framework can help to compare the results and promote better performances.
- *Collaboration among different actors.* Collaborations in particular between higher education, research, trade associations, designers and professionals' associations, are essential to facilitate innovation and its transfer to the market.
- *Coordination and integration between the different policies addressing the construction sector.* The EU Renovation Wave and other national policies/fiscal policies (such as the 110% bonus for refurbishment in Italy), while promoting energy efficiency, might cause negative/unpredicted effects in terms of waste production and materials consumption, while the coordination of circularity and energy efficiency policies can provide a relevant contribution to climate neutrality and sustainability goals.

Finally, it was highlighted how the construction sector should make a greater effort to promote circularity by increasing the ability to recover materials (through deconstruction and selective demolition) and also by generating higher quality products, for higher added value applications (in substitution of primary raw materials).

6 Final remarks

The construction and infrastructure sectors embed a high potential for innovation and ample room for improvement. The ongoing evolution is substantial, but the large-scale daily activity of the sector often fails to implement what is being developed at the research level. The processes and strategies activated so far both in the regulatory, economic and administrative field should measure with the actual ability to provide circular and sustainable solutions for buildings and infrastructures at wide scale in the day-by-day construction practices.

A critical comparison between renovation wave policy, green deal, energy efficiency policies and production of C&D waste and their management policies would be useful to compose an integrated framework in which the practice of construction is called to act. Circularity and energy efficiency may only have a dialectical relationship, therefore isolate the terms and identify sectarian policies makes the contradictions emerge.

In this sense, the case of insulating materials is representative of a strategic product to comply the energy efficiency requirements although not less assessed in terms of availability, use of secondary materials, rate of substitution, energy embodied related to the energy efficiency capacity during their lifetime application.

More broadly, the issue regarding construction materials from secondary materials and also from other supply chains still remain to experiment.

A European integrated and consistent 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. In particular following actions would be needed:

- 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 supply needs and offer 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.
- A 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.

Furthermore, innovation and research can play an important role in "rejuvenating" a sector that has an important inertia by its nature. With a view to circularity, there is a whole series of areas to be investigated by research, including: collaborations between supply chains; the use of bio-based materials; the possibility of using any kind of secondary materials for applications with high added value too.

Research implementation provides scalable solutions and produces significant impacts: knowledge and technology transfer, as well as communication of the feedbacks, of application and implementation evidence, are crucial for considering C&I value chains in a holistic and non-compartmental way. Then, a strong link between research, market and policies must be fostered, because policies should rely on research to make appropriate strategic choices. On the other hand, however, policies must allow research results to be transferred to the value chain at all levels

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