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THE ELEPHANT IS ~~IN~~ THE ROOM

Why it makes sense giving priority to circular economy measures in the building industry in the 2020s

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We are Europe's largest network of environmental citizens' organisations. We bring together over 160 civil society organisations from more than 35 European countries. Together, we work for a better future where people and nature thrive together.

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The aim of this policy brief

The issue we would like to discuss is fairly simple to explain: with CO2 emissions in the energy sector expected to rapidly decrease in the coming years, material production will become the largest climate problem of our economy.

At the current pace, material production alone will be responsible for 900 bn tons CO2eq by 2100 worldwide, which is more than what IPCC has estimated as a total budget for this century (800 bn tons CO2eq). The largest share of responsibility lies with the building construction sector: the sector (including material manufacturing, transport, etc.) accounted for 36% of global final energy use and 39% of energy-related CO2 emissions in 2017[1]. According to our calculations, the sectors analysed in this document must decrease from 2250TWh consumption of 2015 to 1434TWh in 2050 to be compatible with the Paris Agreement[2].

The elephant is in the room or, better said, the elephant is the room.

It is highly unlikely that the EU will manage to achieve carbon neutrality by 2050, let alone 2040, the date put forward by the IPCC study, if we keep our consumption models unchanged: the number of products we use and consume is staggering. We need to sharply decrease waste along the whole value chain and extend the lifespan of products to reduce both demand and production. This should be the prime concern of industrial policy makers.

Energy-intensive industries are on a path to decarbonisation but so far, their efforts have not been sufficient. They all have some degree of commitment to tackling climate change, some more than others, but their plans are largely based on carbon removals and/or the prioritisation of the industry's supply side by focusing on the purchase of low carbon feedstock, green electricity, and hydrogen. These plans further fail to connect with the other environmental improvements needed in their sector such as biodiversity protection and zero pollution.

This brief summarises the commitments the European industry has made so far and compares them to some of the potential climate benefits of circular economy policies. It goes on to suggest circular economy measures that are financially competitive, reduce the amount of green energy and material needed to be effective and deliver relevant contributions not only to the decarbonisation but the other European Green Deal goals such as the biodiversity strategy and the zero-pollution objective.

[1] International Energy Agency and the United Nations Environment Programme. (2018). 2018 Global Status Report: towards a zero-emission, efficient and resilient buildings and construction sector

[2] www.pac-scenarios.eu/scenario-development.html#Chapter1:Sector-specificenergydemand

The economic argument is particularly relevant. On average CE measures cost less than 50 euro per ton CO2eq, thus making their results comparable to measures that are now prioritised on the supply-side for industry, such as the greening of energy and material supplies.

The amount of CO2 reduction needed in the heavy industry is appalling and requires the greatest attention from lawmakers: As the decade progresses, digitalisation is expected to deliver more savings in this sector, engendering a growing recycling rate, and a more efficient and reliable sharing economy for the use of goods and spaces. Already today up to 58% of the total amount of CO2 emissions the most relevant industry sectors (steel, cement, plastics) can be cut with a pathway focused on Circular Economy available measures and technologies.

This, we believe, is the way forward.

This work largely builds on the studies 'The decarbonisation benefits of sectorial circular economy actions' and 'The Circular Economy: a powerful force for climate mitigation'. These reports are used as sources of data, unless specified otherwise. It also assesses the commitments of the 'Masterplan for a competitive transformation of EU energy-intensive industries enabling a climate-neutral, circular economy by 2050'. For the full bibliography of this work click here.

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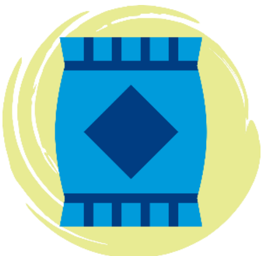

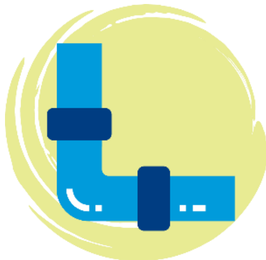

Cement

The Situation

In the building sector, the manufacturing, transport and use of cement/concrete is the most important contributor to CO_2 emissions. Cement production is responsible for 8% of the emissions globally and it is a significant source of emissions in the EU as well: 114 Mt CO_2 p.a.. In the 'business-as-usual' scenario, the growth in demand for cement will outbalance improvements to production processes, hence emissions in 2050 would be similar to today's, at 113 Mt CO_2 p.a..

Taking a closer look at the production process, it is the clinker production that creates 60-65% of all process emissions in cement production.

Industry commitment

Circular economy provisions are to some extent already in place in the cement industry; 46% of its fuels is replaced by alternative fuels and feedstock sourced from a variety of waste streams. This however poses several problems in terms of emissions and social acceptance of such practices at local level is generally very low. The highest cement production carbon footprint relates to clinker production. The cement industry hence focuses on clinker substitutes such as 'supplementary cementitious materials' (e.g. blast furnace slag can offer very high clinker substitution rates, up to 95% in some cement types). At present about 25 Mt/y of blast furnace slag is generated in Europe, of which about 87% is granulated for use as a constituent for cement, concrete or road construction binders. Substitution usually occurs where installations exist in closer proximity to one another, such as in Belgium, where 63% of clink is replaced using locally abundant steel slag.

The CO_2 footprint of GG blast furnace slags is typically around 67 kg CO_2/t, enabling up to 30% CO_2 reductions for ordinary CEM I products.

The cement industry association has released a carbon neutrality roadmap which aims at achieving zero emissions along the value chain. Unfortunately, it largely relies on biomass, Carbon Capture and sequestration and Carbon Capture Use and the current 2030 seem not to be in line with EU's climate ambitions.

The massive use of waste and biomass for its energy input raise concerns over its sustainability. Cembureau targets to reach 60% alternative fuels (largely waste) containing 30% biomass in 2030 and 90% alternative fuels with 50% biomass by 2050.

The content of clinker in cement is slowly decreasing but the pace of the process seems to be too slow to achieve significative results: the target is to go from 77% to 74% in 2030 and to 64% in 2050.

The two other major technical solutions envisaged by the industry are CCS and CCU (using CO_2 emissions for i.e., algae production) and an increase of carbonation in processes, where cement and concrete would be acting as CO_2-absorbing materials.

What can be done

CE measures can cut emissions throughout the production, utilisation and all the way to the end-of-life of cement[3].

On the process side, improvements can come from the reusing of 30–40% of the clinker that often remains unused (or un-hydrated) and can in principle be reused to replace virgin material.

Quality innovation in the clinkers other than Portland cement can result in 20–30% CO2 savings in certain applications, as it reduces both the amount of limestone in the formulation, as well as energy consumption. A particularly interesting development is the one of LC3 cement, where calcinated clay largely replaces calcinated limestone in the cement, thereby cutting emission by roughly 40%, both from heat and process.

Taking stock of the increasingly high number of digitalised features, major achievements can be obtained in the use phase by reducing overspecification and by rethinking the design of the building: according to the Cembureau, cement in concrete can be reduced by 5% in 2030 and by 15% in 2050. Reducing overspecification can, in turn, decrease concrete use in buildings by 5% to 10% by 2030 and by 10% to 30% by 2050. This would be very relevant for the 2050 targets.

The end-of-use phase will also play a key role: if cement recycling becomes widespread, it would cut the average CO2-intensity of cement production by 23%, from 0.62 to 0.48 tons CO2 per ton cement.

Overall, the recovered cement can replace up to 80% of new cement in construction, saving almost half of the CO2 emissions at building level.

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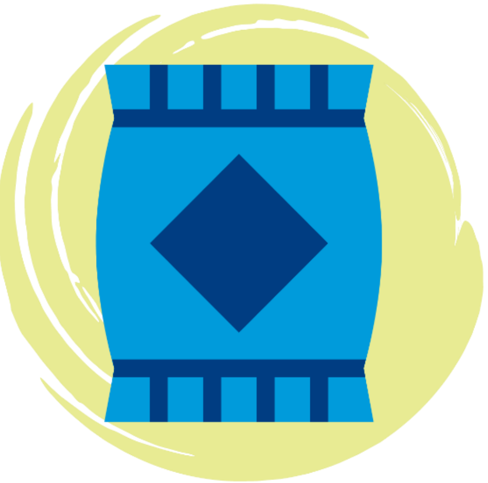
[3] The combined effects of the analysed actions in a high ambition scenario (100% diffusion of all CE actions) show an overall reduction potential of CO2 emissions by 130 Mt (-61%) compared to the base case (from 212.6 Mt to 82.5 Mt)

Policy suggestions

- Introduce overspecification requirements in green public procurement, building on a decreased weight/m² ratio
- Require a binding incremental share of recycled content in cement
- Require a binding incremental share of low-carbon alternative materials in clinker (such as volcanic ash, ground bottle glass)
- Promote the use of standardized prefabricated cement elements in the market, starting from public buildings and large buildings
- Integrate these circular economy provisions in the revision of the Industrial Strategy

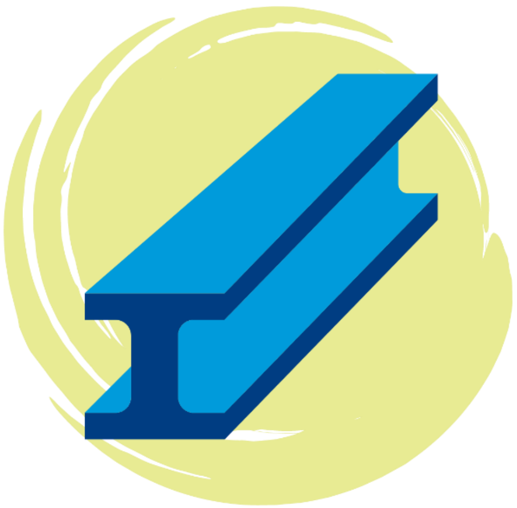


Steel

The situation

Excluding power plants, the largest individual sources of carbon pollution in Europe are all steelworks. Steelmakers emit almost two metric tons of CO_2 for every ton of steel produced.

Europe's demand before Covid-19 was roughly 150M tons p.a. Most of it would be electric-arc furnace steel, while primary steel, five times more CO_2 intensive, would be mostly dedicated to exports. Remarkably, roughly the same amount of steel is lost annually due to production losses and lack of scrap recovery.



Industrial commitment

In its climate-neutrality paper in 2018 industry committed to -80% emissions in the framework of circular economy by 2050. This result, according to Eurofer, will largely rely on reuse of CO_2 emissions through the so-called 'Smart Carbon', a pathway that focuses on biomass and waste plastics as the source of energy and on CCU to convert CO_2 emissions into hydrocarbon liquids (ethanol) or solids (plastics). This, according to industry findings, would help reduce the plastic waste.

If the European steel industry switched to using bioenergy, around 200-250 million tons of biomass and waste would be needed each year. Yet, this estimate fails to address the issues of competition with the other sectors, overlooks the fact that the amounts of plastic waste should be progressively reduced, and that sustainable biomass is relatively scarce and faces competing demands.

Arcelor Mittal, Europe's largest steelmaker, has pledged to reduce by 30% CO_2 emissions by 2030 and to achieve carbon neutrality by 2050 by implementing both technological innovations like the DRI (direct injection into the blast furnaces) and the Smart Carbon approaches, though this pathway largely relies on fossil fuels.

ThyssenKrupp, another major market player, committed to climate neutrality in 2050, both for indirect and direct emissions via the same technologies.

What can be done

The impact of CE measures on the steel market varies according to studies. Ramboll outlined that in 2050 50% to 60% of steel in construction could come from reused steel and that reducing overspecification at the design phase could reduce emissions by 36% to 46%, compared to the BAU scenario.

Material Economics has provided a scenario where up 85% of EU steel production in 2050 could come from secondary steel production. Achieving such a high share of recycling without offshoring emissions will require "that nearly all available scrap is utilized, high-quality steel production from scrap is feasible, and copper contamination is resolved." The Electric Arc Furnace (EAF) secondary scrap route achieves more than a fourfold CO2 footprint reduction (<0.2tCO2eq/ton of steel produced), in particular when powered through renewable electricity. It also has the additional benefit of significantly reducing air pollution mitigation (in particular SO2, NOx dust and heavy metals)[4].

Since 2016, several steelmakers have announced plans to abandon their blast furnaces and switch to hydrogen-based processes. These commitments currently add up to a production capacity of 30 Mt of green steel, which is more than enough for the 22Mt of primary steel needed if ambitious CE policies are to be fully implemented.

The University of Lund estimates that the number of operating blast furnaces[5] that need to be converted into clean primary production processes would decline from today's 65 down to as low as 15, if secondary production is maximised.

With a hopefully long-term impact, Tata Steel and Arcelor Mittal were among the partners of the REDUCE project, which successfully demonstrated that steel for building construction can be designed to be 100% reusable.

Policy suggestions

- Reduce the losses of steel along the value chain and particularly at the design phase
- Enable the use of secondary steel across a wider range of product groups globally (e.g. tackling copper contamination)
- Require process shift through the adaptation of Union standards (EU BREF) and state aid schemes (e.g. conversion aids are limited to the direct reduction of steel-making using hydrogen produced through electrolysis, where the share of renewables is set at progressively higher rates starting from 50%)
- Steel that cannot be produced via EAF route should not be allowed to be produced through the Blast Furnace route, unless it serves uses that are essential to achieving an environmental / climate benefit (e.g., steel grades needed for renewable energy production infrastructure)

[4] The Net-Zero Steel Pathway Methodology Project, Stakeholder Reference, Group update, 27th November 2020

[5] Assuming an average blast furnace capacity of 1.5 Mt.

Plastics

The situation

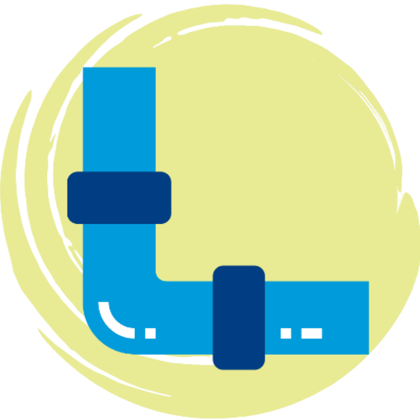
Emissions from plastics are a worldwide concern: if plastic production grows as currently planned, its emissions could reach 1.34 Gt p.a. by 2030 — equivalent to the emissions released by more than 295 new 500-megawatt coal-fired power plants[6]. By 2050, the total of greenhouse gas emissions from plastic could reach over 56 Gt, 10% to 13% of the entire remaining carbon budget. In addition, there are major concerns regarding plastic waste on land and in waterways, seas and oceans, as well as regarding impacts on the environment, economy and health.

Plastic manufacturing is both energy- and emissions-intensive. The cracking of alkanes into olefins, the production of chlorine (mainly for PVC), the polymerisation and plasticisation of olefins into plastic resins, and other chemical refining processes all produce significant emissions: On average, for every ton of plastic produced, 2.5 tons of CO2 are emitted.

Buildings account for almost 20% of the market for plastics. The different types of plastics produced for this market (e.g. PVC, PS, Expanded PS, PP) are shaped in pipes, cables, coverings, panels, films, windows and doors and their presence is growing in the market as they are a key component of insulation and smart service solutions. PVC is a particularly problematic problem for both its climate footprint, highly polluting manufacturing process and the toxic chemicals it contains (phthalates in coating and cables, lead and other heavy metals in rigid products like window frames) as these hinder recycling.

In 2018 only 29Mt ton plastics were collected separately after use. Of these, only 32.5% was recycled. Given losses in the recycling sector, the overall recycled content today is estimated to roughly match 10% of the demand.

According to the PVC industry, some 300,000 tons of window profiles and related building products were recycled in 2017. But the situation varies from country to country – of this total, 70% of windows, shutters and profiles were recycled in Germany and UK, and 30% in the rest of the EU-28. To our knowledge, only one facility in the EU is authorised to recycle PVC coating.



As for polyolefins (PP and PE) currently 2 Mt/y of secondary polyolefins materials are placed in the European market through new products.

[6] Plastic and climate, CIEL, 2019

Industry commitment

Plastic Europe has published some generic commitments for the industry that include improved plastic circularity and production efficiency. This was accompanied by a target in increased use of recycled materials, but no mention to lifespan extension and reduction of the demand was made. A major emphasis is given to the use of very controversial technologies such as chemical recycling[7].

Since 2000, VinylPlus, a voluntary consortium of the European PVC industry, has been implementing some Circular Economy measures. More specifically, it committed to recycling at least 900,000 tons/y of PVC into new products by 2025, within the framework of the overall 10 million tons objective set by the Commission for the plastic industry. The objective for 2030, though, is to only increase that amount to 1Mt, which would be roughly 40% of the available waste. It is worth noticing that PVC recycling is largely done by introducing a layer of recycled content in more virgin material, effectively introducing even more PVC into the market.

As for polyolefins, PCEP, the industry association pledged to increase the use of recycled post-consumer polyolefin waste such as PP and PE in new products to 3 Mt/y 2025, with an increase of 1 Mt/y.

Regarding PS and EPS (expanded Polystyrene), industry organisation SCS pledged to dramatically increase and accelerate the commercial use of game-changing technologies such as depolymerization and dissolution in order to make PS-based products fully, and repeatedly, recyclable, thus creating closed loops.

[7] www.no-burn.org/chemicalrecycling/

What can be done

CE measures in this sector apply throughout the whole value chain, with major results from the design (designing for longer lifespan and reuse) to the end-of-life phase. Recycling can and must be enhanced in closed loops to prevent downcycling. Most plastics are recyclable, and recycling saves 90% of the CO2 emissions arising from new production. In a detailed assessment of plastics types, flows, and uses, we find that a combination of reuse and recycling could meet 60% of all plastics demand by 2050, cutting CO2 emissions by half.

Policy recommendations

- Promote the use of nature-based solution for cladding, insulation and structure (e.g., straw, hemp, clay, timber) in the Construction Products Regulation and energy-performance related legislation
- Phase out PVC from construction, due to its higher carbon footprint, combined with highly polluting life cycle, difficult recyclability and toxicity of recycled materials[8].
- Ensure a longer lifespan of plastic products and closed loop recycling via product policy legislation
- Remove hazardous chemicals that prevent full recycling

[8] https://link.springer.com/article/10.1007/BF02978888

Glass

The situation

The sources of CO_2 emissions in glass manufacturing are primarily high-temperature heat (between 1300 and 1500°C) from fuel combustion for melting (representing between 75% and 85% of the total CO_2 emissions) and process emissions linked to the decomposition of carbonates in the batch (between 15% and 25% of the total CO_2 emissions). The switch to electric melting using renewable electricity is not yet an option for large furnaces (from 200 to 100t/d), like those producing container glass and flat glass, making up 85% of the European production and emissions. The use of other technologies such as CCS/CCU is also limited by the fact that the industry is characterised by small, dispersed units, mostly located in brownfields, making transport an issue.

Industry commitment

Saint-Gobain, one of the main actors in this market, has announced its strategy towards zero-carbon in 2050. They also committed to reduce by 2030 33% of their direct and indirect emissions and 16% the value chain emissions, vis à vis 2017 levels. Remarkably, they envisage an increase in recycling (-80% of unrecovered waste) through logistical improvements in the short term. Design-phase innovations such as the greater integration of recycled content and design for recycling, are foreseen only in the mid-term. Unfortunately, the design of lighter products is the only material efficiency measure in the list and no specific reuse research/application stream is mentioned. An overall target of -30% raw materials by 2030 has been set.

A larger coalition of glass-related industries has announced a European action plan called ‘Close the Glass Loop’ to try and achieve 90% of separate collection and recycling of glass containers by 2030.

What can be done

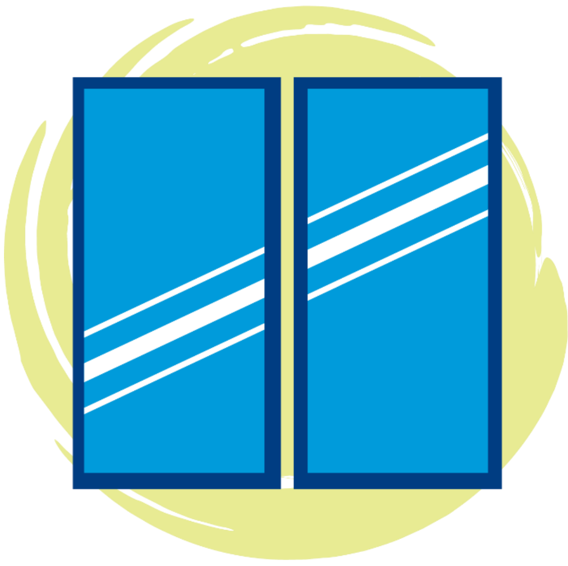
Considering process innovation and that carbon capture and storage (CCS) may not playing a major role in this sector, improvement in climate emissions must be obtained via CE measures such as extending the lifetime of products by reusing container glass and windows glass. Design for reusability of windows and increased harmonization of products specification could boost reuse and extend the lifespan of products.

Roughly 3Mt CO2eq can be obtained by recycling the 26% of container glass, which ranks first in the glass sector in tonnage, that today still ends up in waste[9].

Unfortunately, as in the photovoltaic sector, the glass industry claims emissions savings from the building value chains because of the insulation properties of its products: we believe this is an unacceptable double counting the savings in the building sector.

Policy suggestions

- Maximise reuse and closed loop recycling of container glass
- Improve standards for product recycling
- Promote harmonisation of size and performances to boost reuse of flat glass



[9] Estimation from the Glass Alliance position paper, 2019

Horizontal policy recommendations for the new Industrial Strategy and beyond

To fully achieve the European Green Deal goals of climate neutrality and zero-pollution, and to fully recover from the economic crisis, industrial transformation must go beyond technical feasibility measures focused on industrial processes.

Transformative actions must be extended through the value chain and engage skilled workforces, new business models based on quality, rethinking products as services, improving ecodesign and transparency.

The following high-end circular economy policies should be put in place to enable a stable pathway to carbon neutrality, starting from the **European Industrial Strategy:**

- Improve resource efficiency in industrial production by systematically setting Best Available Techniques associated Environmental Performance Levels for resource consumption and waste prevention, set per production outputs. Amend the EU Policy framework[10] so that those BAT standards become clearly mandatory
- Increase the circular material use rate in the next decade by at least 100%, going beyond the objectives of the European Commission's new Circular Economy Action Plan, based on transparent sector benchmarking performance
- Introduce a minimal share of recycled and sustainably sourced renewable feedstock consistent with the EU climate goals in key products of the building market, such as cement and plastics
- Improve closed loop production systems by improving separate collection of the waste streams and setting quality targets for secondary raw materials
- Make sure the waste hierarchy (prevent, reuse, recycle, recover) is rigorously respected and support the creation of a sustainable market for the reuse of products and materials, especially for high-impact sectors and resources
- Ensure transparent information provisions on chemical components of all products to facilitate reuse, remanufacture, repair and recycling, making use of digital technologies

[10] E.g., EU ETS Directive Art 26 and Art 9 of the IED

The carbon neutrality objective must go hand in hand with the zero-pollution objective, as investments in industry have typically a long lifespan: the chance must be seized to use the Recovery funds and the post-COVID stimulus to give way to an unprecedent upgrade or EU industrial facilities that aims at achieving both goals

- Support low-carbon products with demand-side measures such as green public procurement and international green tendering procedures
- Set carbon footprint information and sustainability requirements for materials placed on the EU market, including recycled content, require demonstration of 'better' than Union Standards performance
- Promote a mandatory harmonisation of environmental and safety performance standards in the EU
- Redefine the approach on defining Best Available Techniques so it is based on achieving the best ratio of environmental impact against a public good or service provided, within a value chain approach and based on technical feasible performance levels rather than economically acceptable operation levels for industry
- Make sure proper benchmarking tools (e.g., revised EU PRTR / product register) are put in place to enable further use of data in a transparent and user-friendly manner, thus enabling comparability and opportunity for progress[11]

The key objective of reducing material consumption and embedded emissions can be enabled by a set of no-regret options focused on design and market requirements. Decreasing material consumption would greatly release the pressure our economy puts on the environment, particularly on pristine habitats such as the seabed.

- Make resource (energy and material) efficiency first principle a precondition for all innovation and refurbishment projects in industry
- Bring raw material consumption within planetary limits by setting a reduction target to halve material footprint by 2030 for metals, minerals, and plastics.
- Set waste prevention targets on commercial and industrial waste, requiring reduction of residual fractions (similar to halving residual municipal waste reduction target by 2030 as stated in the new CEAP)

[11] see more information here (EU PRTR) https://eeb.org/library/eeb-input-to-e-prtr-impact-assessment/

- Support setting stringent Paris-compliant high environmental performances for all energy-intensive materials, irrespective of intended use in the Raw Materials Alliance and Strategy
- Extend lifetime of building materials by imposing eco-design requirements. This should result in building materials becoming long-lasting and reusable, and, once they are discarded or reach their end-of-life, being collected through closed loops systems decontaminating and recycling them with equivalent functionalities as virgin materials
- Include embedded and transport emissions of materials in the energy and climate-related legislation such as the Energy Performance of Buildings Directive
- Within the framework of the Renovation Wave, ensure that new buildings are net-zero when constructed, as well as over subsequent stages of the life cycle
- Promote the adoption of provisions for a resource-efficient design of new constructions that will help minimise the material-use to functionality ratio in building codes
- Introduce a minimum requirement for recycled content in new buildings, enhancing the access to reused and recycled materials in the market – such content should by detoxified 2025 at the latest
- Give priority to circular economy in R&D, particularly to innovation in processes that substitute greenhouse gas emitting materials, those aiming at transforming buildings into ‘buildings as a materials bank’ and those enabling longer lifespan of products and higher usage through digitalisation
- Set up an enabling framework (assessment, regulation, finance) for strengthening the role of digitalisation in the decarbonisation of industrial production, both in terms of energy consumption and resource efficiency.

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