

Cement co-processing is a sustainable solution for recycling end-of-life composite materials.

Executive summary

This paper summarises the position developed by [WindEurope](#), [EuCIA](#), [CEMBUREAU](#), [EBI](#), [Cefic UP/VE](#), [Cefic Epoxy Europe](#), and [Glass Fibre Europe](#) on the benefits of cement co-processing for end-of-life composite materials used in construction, wind, marine, infrastructure and industrial markets and how the EU regulatory framework can help to scale it up. Co-processing offers a sustainable and circular solution for recycling the end-of-life glass fibre reinforced composite materials. As partners, these organisations want to promote sustainable recycling approaches and encourage composite use sectors beyond the wind and boating industry to sustainably recycle their end-of-life composite materials.

Cement co-processing: A sustainable and circular solution for end-of-life composites

The associations representing the composites value chain including constituent material manufacturers, composites fabricators, composites users (wind and boating) as well as the cement manufacturers agree that cement co-processing offers a sustainable recycling solution, using 100% of end-of-life composite materials that can



immediately be deployed at large scale, which is different from other promising composite recycling technologies that have not reached yet technical and/or economical readiness. The cement co-processing of end-of-life composite materials allows material recycling by reducing the use of natural raw materials in cement manufacturing, while mitigating climate change contributions through replacement of fossil energy sources. As the cement in concrete can be fully recycled and used to make new concrete, cement co-processing is also a circular solution for the end-of-life composite materials.

This is a win-win solution that:

- 1) Allows for a sustainable recycling solution for end-of-life composite materials from decommissioned assets, vessels, and composites manufacturing processes.
- 2) Supports the sustainable development and decarbonisation of the European construction market.
- 3) Increases the overall circularity of end-of-life composite materials.

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EuCIA estimates that 40-70% of the end-of-life composite materials today still end up in landfills or is incinerated without energy recovery. Although the amount of end-of-life composite materials is relatively small in comparison with other waste streams, volumes are rapidly increasing and the need for waste management solutions in line with the circular economy model is becoming more and more urgent¹.

Call for an EU regulatory framework to scale-up cement co-processing.

Our industries stand united in promoting the co-processing of end-of-life composite materials in cement clinker production, but we need a strong supporting regulatory framework to overcome the barriers preventing the larger scale-up of co-processing end-of-life composite materials. These include a lack of visibility on the relevant waste streams which now fall under various waste streams including 'construction & demolition waste' and a subsequent lack of a stable and consistent supply of end-of-life composite materials. Both are essential to ensure a reliable and constant flow of secondary materials to the cement industry.

We therefore call on European policymakers to:

- Recognise co-processing as a Recycling Process according to the Waste Framework Directive 2008/98/EC for its raw material recyclability.
- Develop an EU-wide harmonised model for a separate waste collection scheme for end-of-life composite materials to simplify waste management, improve efficiency of resource flows, and ensure better access to secondary materials for the cement industry.
- Establish dedicated waste codes for end-of-life composite materials. This is an essential pre-requirement to improve visibility of and access to the relevant waste streams (including volumes and location) and attract investments. A position paper dedicated to this topic is currently under preparation.
- Phase out the landfilling of end-of-life composite materials from the wind energy and boating sectors and promote the development of sustainable recycling alternatives for all composite materials.

Closer look at cement co-processing

Over the last decade the composites industries have been working on solutions to improve the circularity of composites. Today, co-processing of end-of-life composite materials in cement clinker production offers a unique waste management solution, extracting the full value of end-of-life composite materials in a single process, that is both commercially and technically proven for treating end-of-life glass reinforced composite materials. During co-processing the end-of-life composite materials are simultaneously used as both a source of energy and a source of mineral raw material:

- The glass fibre mineral fraction is recycled in the cement clinker composition, preventing the extraction and use of equivalent quantities of mineral raw material input for cement manufacturing.
- The polymer fraction is used as alternative fuel in cement kiln, saving the extraction and use of more than equivalent quantities of fossil sources of energy (e.g., coal, pet coke, etc.) and their associated greenhouse gas (GHG) emissions.

A new Life Cycle Analysis (LCA) of cement co-processing is under preparation and will further substantiate the quantification of the environmental advantages of cement co-processing.

¹ EuCIA – CEMBUREAU Position Paper, <https://eucia.eu/wp-content/uploads/2023/05/Position-paper-co-processing-of-composites-CEMBureau-EuCIA-for-JRC-study-final.pdf>

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Composites

Composites are durable, engineered materials characterised by long service life, high mechanical strength, excellent chemical and heat resistance properties, and freedom of design in a wide range of end use applications. Thanks to those exceptional properties, composites deliver significant material and energy savings helping us to achieve today's energy and climate goals. In 2022, the global composites market reached € 37 billion or 12,7 million tons (of which the EU accounted for 19%). It is estimated that the composites market will continue to grow and, in this way, accelerate the implementation of new policy measures in Europe, including the European Green Deal agenda and REPowerEU.

Composite materials are widely used in the energy sector. They are the prime material in wind turbine blades; Composites are the material of choice for lightweight, durable solutions in transportation and infrastructure, and contribute to reducing energy demand in these sectors. Furthermore, they are instrumental for ensuring continuity of operation in many industrial processes. Composites are obtained by the combination of two (or more) different materials, usually a polymer matrix and reinforcement fibres such as glass or carbon fibres. It is the strong adhesion of the fibres to the polymer matrix that imparts their exceptional mechanical properties to composites, but also explains the technical challenge to separate end-of-life composite materials into fibres and polymer to facilitate their recycling.

Although thermoset end-of-life composite materials volumes are relatively small (approximately 440 kt/year²), less than 0.05% of total EU waste volumes, they are going to increase over time with the expected end of life of widely used products (e.g., automotive components, aircraft and boats) and first-generation products (e.g., wind turbine blades installed in the period 2000 - 2020, and before). EuCIA estimates that 40-70% of end-of-life composite materials today is still ending up in landfills or is incinerated without energy recovery. The amount of composite waste recycling capacity in the EU is about 50 kt per year, which is around 5% of the total current waste stream (Thermoset + Thermoplastic). However, the existing capacity of the European cement industry which is utilising over 220 million tons of raw materials and 25 million tons of fuels per year is more than enough to cover all the volume of the end-of-life composite materials.



The European Boating Industry has recently launched its [“Roadmap on the implementation of the circular economy for end-of-life boats”](#) in which it commits to phase out landfilling and energy recovery by 2030. It is estimated that there are over 6.5 million boats in European waters, mostly smaller than 7.5 meters. They have a lifetime of up to 50 years or more. The number of boats reaching their end-of-life by 2030 is now projected at more than 30,000 boats per year in the EU. This would result on average in over 23,100 tons of end-of-life composite waste per year. Recreational and commercial marine make up about 2-3% of the total composite use in Europe.

² GDP model developed by EuCIA (interpolation 2015-2020)

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According to WindEurope the wind sector could generate about 15,000 tonnes of blade waste in Europe each year in the period 2020-2023. By 2030 this could amount to 60,000 tonnes a year. In the same year close to 67 GW of wind energy installed capacity could reach the end of its designed lifetime of 20 years. However, the timing of decommissioning wind turbines is not uniform. The amount of annual decommissioned turbines will largely depend on the policies and incentives being implemented as well as on the wholesale electricity price. To accelerate the circularity of wind turbine blades,



WindEurope has called for a Europe-wide landfill ban on decommissioned wind turbine blades by 2025. This means the industry commits to re-use, recycle or recover 100% of decommissioned blades. The landfill ban should also apply to other large composite components that can be found in the nacelle.

Cement Industry's Contribution

Cement and concrete materials play an essential role to help Europe achieve its strategic objectives on growth, innovation, social inclusion, and climate and energy for its use in houses, industrial facilities, office buildings and infrastructure. More importantly, cement and concrete are pivotal to building a climate neutral Europe. Foundations of wind turbines, hydro-electric dams, passive housing, tidal power installations, and new transport and maritime infrastructure all rely on the unique qualities of concrete. Cement production is energy intensive and has a historically high carbon footprint. Fundamental for the cement industry's operations is the quality of the product (cement) in combination with the environmental impact. According to CEMBUREAU's [Carbon Neutrality Roadmap](#), by 2050 the European cement sector pledges to become climate neutral. The cement sector also committed to an intermediate 2030 target to reduce the carbon footprint by almost 40% to an average 0.47t CO₂ per tonne of cement. Recycling of end-of-life composite materials through cement Co-processing will contribute towards reaching this goal.

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List of signatories

	<p>WindEurope is the voice of the wind industry representing over 500 organizations from across the whole value chain of wind energy. www.windeurope.org</p>
	<p>EuCia, the European Composites Industry Association is composed by European national composites associations and industry-sector groups. 10,000 companies and 150,000 employees. www.eucia.eu</p>
<p>Unsaturated Polyester & Vinyl Ester Resins</p> <p>EPOXY Tomorrow's technology, today</p> <p>An industry sector of Cefic </p> <p>European Chemical Industry Council - Cefic aisbl</p>	<p>UP/VE The UPR/VE Resin Association, a Cefic Sector group, represents unsaturated polyester (UPR) and Vinyl Ester (VE) resins producers of Europe. www.upresins.org</p> <p>EPOXY EUROPE, a Cefic sector group, represents the interests of the major European epoxy resins manufacturers since the early 1980s. www.epoxy-europe.eu</p> <p>Cefic, the European Chemical Industry Council, was founded in 1972, and is the voice of large, medium and small chemical companies across Europe, which provide 1.2 million jobs and account for 16% of world chemicals production. www.cefic.org</p>
	<p>Glass Fibre Europe: Founded in 1987, is the voice of the European continuous filament glass fibre industry. The continuous filament glass fibre industry is the cornerstone of the glass-based composite materials and technical textiles value-chains. www.glassfibreeurope.eu</p>
<p>EBI European Boating Industry</p>	<p>EBI, the European Boat Industry represents the recreational boating and nautical tourism industry in Europe. It encompasses all related sectors, such as manufacturing, services, infrastructure and tourism. www.europeanboatingindustry.eu</p>
<p>CEMBUREAU The European Cement Association</p>	<p>CEMBUREAU, the European Cement Association is the representative organization of the cement industry in Europe. Currently, its Full Members are 23 national cement industry associations and cement companies of the European Union plus Norway, Switzerland and the UK. www.cembureau.eu</p>