

Co-processing: a unique waste treatment solution

Geocycle



Our **waste treatment** solutions

Treating waste is a demanding, complex, costly and time consuming challenge for companies and municipalities. Geocycle offers waste treatment solutions based on a unique industrial process called co-processing, which ensures simultaneous recycling and recovery of waste. This industrial application of the circular economy principles commits to the European and international stringent standards and offers one of the best environmental performance.

Geocycle proposes a wide range of waste management services, starting from assessment and consultation, laboratory analysis and waste characterization, logistics, transportation and finally waste preparation for co-processing in cement plants.



Co-processing: our sustainable and high value-added solution for waste treatment

Co-processing refers to the simultaneous recycling of mineral materials and recovery of energy within one single industrial process: cement manufacturing. The mineral part of the waste replaces primary mineral materials (such as limestone, clay or iron) and the combustible part provides the fuel needed for the clinker¹ production. As a result, 100% of the waste input is recycled or recovered without producing any additional residue^{2,3,4}. The technology used also ensures a performing destruction of toxic components⁵. Developed 40 years ago in Europe, this technology is now widely used and continuously improved all around the world.

“Cement kilns are able to both use the energy and recycle a proportion of material content of waste. In this respect they are a valuable pathway for waste-to-energy” (JRC², 2016)

Co-processing contributes to a more circular economy, as opposed to a traditional “take-make-use-dispose” linear economy. At Geocycle, we transform waste into recycled product and thermal energy while:

- optimizing the use of waste thanks to a unique simultaneous and efficient recycling and recovery process,
- contributing to the reduction of greenhouse gas emissions and to the transition towards a less fossil-dependent industry by reducing the quantity of fossil fuels in cement manufacturing as well as avoiding the emissions of alternative treatments like incineration or landfilling,
- delivering one of the best treatment solutions for non-recyclable waste,
- offering a local waste treatment solution for our stakeholders with reduced investment for municipalities as cement capacity is existing,
- stimulating local economic activity around our facilities by creating new jobs in the waste management sector.

What is co-processed in our kilns?

We only treat waste that has been separated, qualified and sometimes pre-treated. Today, this ultimate waste fraction cannot be recycled in its initial manufacturing process (i.e. glass to glass or plastic to plastic) nor reused, for technological or economic reasons.

Co-processing to foster the transition towards a more sustainable approach of waste treatment in Serbia

The city of Belgrade, alone, generates each year 500,000 tons of municipal waste which are usually landfilled. As regulations required municipalities to send less and less waste to landfill, public officials entered into a partnership with Geocycle in 2015. Thanks to the creation of a sorting line on a landfill site, Geocycle is able to co-process 20,000 tons of waste per year, which provide substitution raw material and energy to a cement plant in Beocin.

Geocycle’s sorting line in Belgrade helps solve the city’s waste challenges and addresses its commitment to move swiftly towards a sustainable alternative for waste treatment. Geocycle is very proud to treat this significant volume of waste with a local and environmentally friendly solution, all the while supporting employment growth by creating 20 jobs and reducing fuels imports.



Our safe and transparent process brings our customers peace of mind. Co-processing represents the final treatment step in a series of integrated waste management processes and procedures that are internationally recognized and regulated. Geocycle activities fully embrace the EU waste regulatory framework and bid an industrial response that supports EU waste policy objectives. This ensures that all selected wastes are assessed, pre-qualified and prepared for an optimal and safe recycling and recovery through pre-processing and co-processing. Pre-processing operation may involve shredding, separating, homogenizing and/or drying of waste materials in dedicated waste management installations.

¹ Clinker is a solid grain produced by sintering limestone and aluminosilicate materials during the cement kiln stage (for more information visit www.cembureau.eu)

² Joint Research Centre, Technical and Scientific reports, 2011, “A technical guide to Life Cycle Thinking (LCT) and Life Cycle Assessment (LCA) for waste experts and LCA practitioners”

³ Mutz et al, University of Applied Sciences Northwestern Switzerland, Geo Partners AG, 2007, “Co-processing Waste Material in Energy-Intensive Industries, A global Study with Focus on Europe”

⁴ JRC Science for Policy Report, 2016, “Towards a better exploitation of the technical potential of waste-to-energy”

⁵ The Foundation for Scientific and Industrial Research, Kare Helge Karstensen, 2007, “Formation, release and control of dioxins in cement kilns”

Geocycle contributes to *achieving European environmental policy objectives*

Responding to the legislative framework such as EU Waste Framework Directive and Basel Convention

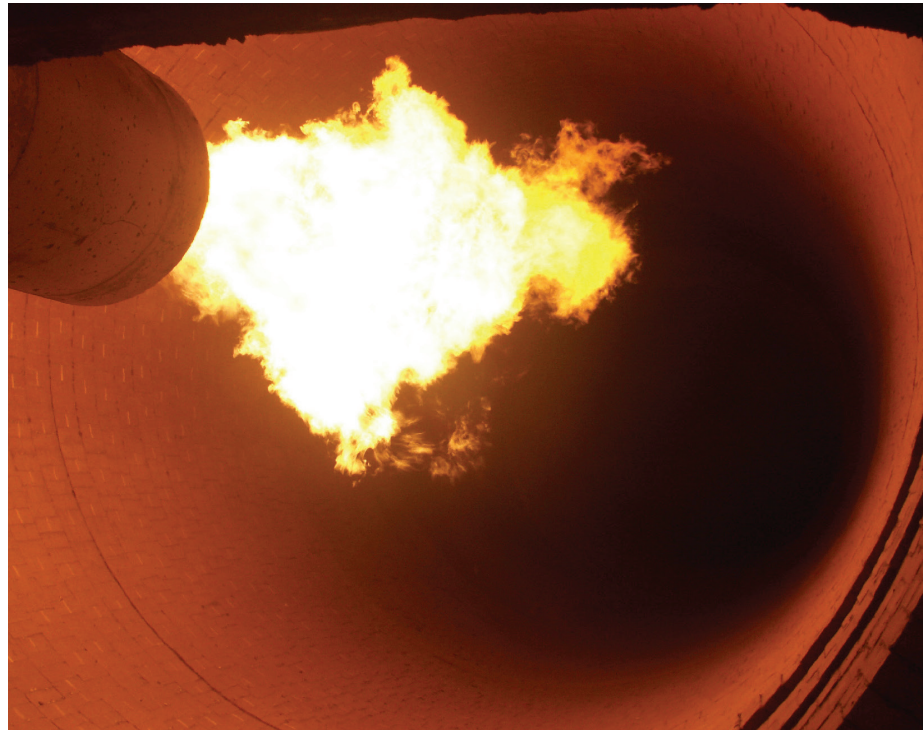
Our co-processing technology is unique because it encompasses both material recycling and energy recovery within an existing industrial process. These two issues are the cornerstones of waste management legislation in many parts of the world and in international frameworks. The advantages of co-processing are widely recognized⁶ and led to the publication of specific guidelines for co-processing under the United Nations' Basel Convention⁷.

Circularity at industrial-scale

Co-processing provides a practical, cost-effective and environmentally preferred alternative to landfills and traditional incineration, especially in regions that still rely heavily on those waste management approaches. The simultaneous recycling and recovery mechanisms of co-processing are an industrial application of the circular economy and industrial symbiosis principles.

High energy efficiency rates

Co-processing operations in cement kilns occur with an optimal energy efficiency rate (above 80%), thereby reducing the dependency on fossil fuels by using locally available resources.



Full destruction efficiency

High temperature (>1,450°C) and long residence time⁸ ensure the full destruction of hazardous organic compounds and the total neutralization of acid gases like sulphur oxides and hydrogen chlorides.

⁶ JRC Science for Policy Report, 2016, "Towards a better exploitation of the technical potential of waste-to-energy"

⁷ www.basel.int

⁸ Residence time is the amount of time the waste material spends inside the kiln

Geocycle Recycling Center closes the loop of construction and demolition waste (C&DW) in Austria

The EU Waste Framework Directive includes a target of 70% of C&DW being recycled by 2020.

In Austria, the Retznei cement plant is among the top performers worldwide in terms of thermal energy substitution (95%) thanks to the energy recovered from waste. In 2016, thanks to the creation of the Geocycle Recycling Center nearby, the plant also set the benchmark in recycling C&DW by processing 100,000 tonnes of C&DW a year.

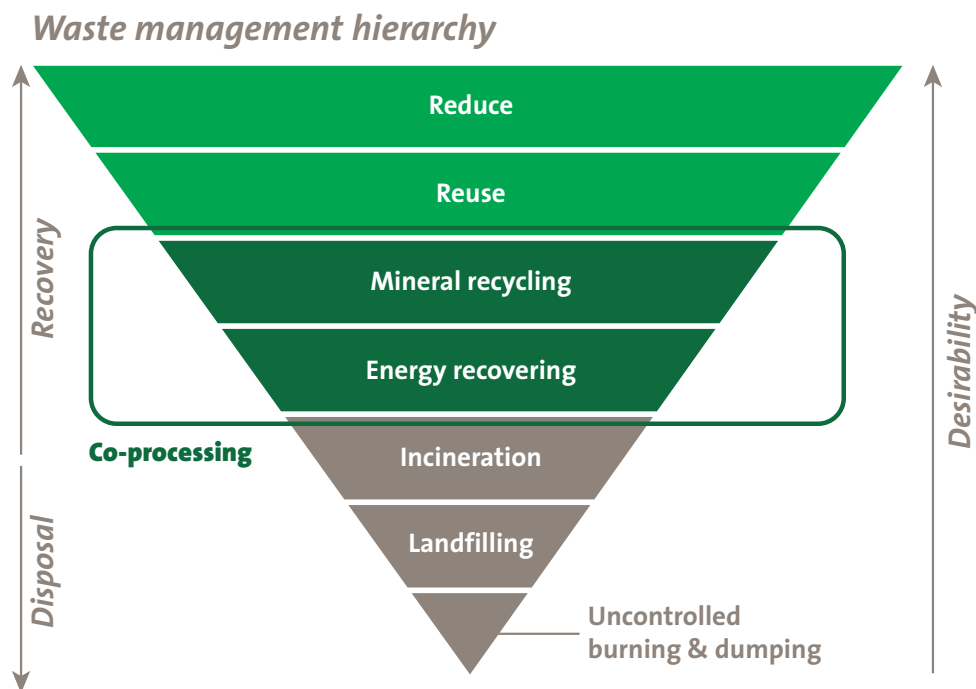
The pre-treatment platform offers a complete solution for a C&DW stream. From this stream, clay bricks, a non-frost resistant material which is usually sent to landfilling, is recovered through co-processing.

Today, 12% of the raw material used to produce cement in Retznei comes from recycled waste. The plant will continue its efforts in giving a second life to discarded C&DW.

This case study has been recognized as circular economy good practice. Read more about it on the platform.



An incentive and competitive EU policy framework



According to EU Waste Framework Directive, “recycling includes any operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes”.

The European waste policy framework brings forward a number of principles that Geocycle embraces. This includes upscaling the EU's ambition for waste treatment. We support the effective implementation of separate collection across EU in order to foster recycling; and the phase out of landfilling of recyclable and recoverable waste.

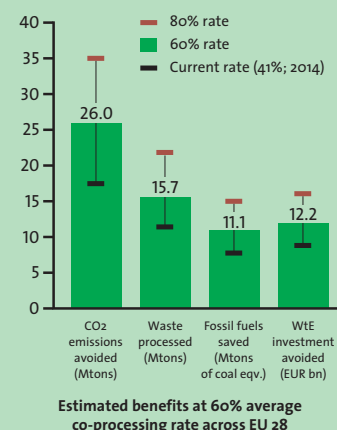
The recent review of the Waste Framework Directive is welcomed as it represents an opportunity to increase the rate of waste recycling and recovery including through co-processing. The Directive precises that co-processing technology allows mineral recycling through the incorporation of minerals of municipal waste in the cement manufacturing process.

We believe that the EU waste management could benefit from an increase use of circular economy approaches like the co-processing technology especially through:

- The wide recognition of the simultaneous combination of mineral recycling and energy recovery for all types of waste co-processed from used tyres to plastic waste,
- The opportunity for Member States to include as material recycling the mineral fraction of waste co-processed in their recycling targets,
- The promotion of more sustainable treatment solutions as co-processing in alternative to landfills and incineration in order to help achieve the EU's waste recycling and resource efficiency targets.

Potential of co-processing in Waste-to-Energy initiatives

In its recent studies¹⁰, Ecofys highlighted that in Europe “there is no technical limitation at the cement plants to increase the share of alternative fuels from 36% now to 95% EU-wide.” Besides accelerating the above mentioned substitutions, this alone can save up to €15.6 billion in waste management infrastructure expenditures, avoid 41 M tons of CO₂ emissions per year and allow for the recycling of 1.4 M tons of mineral ashes that would otherwise be landfilled.

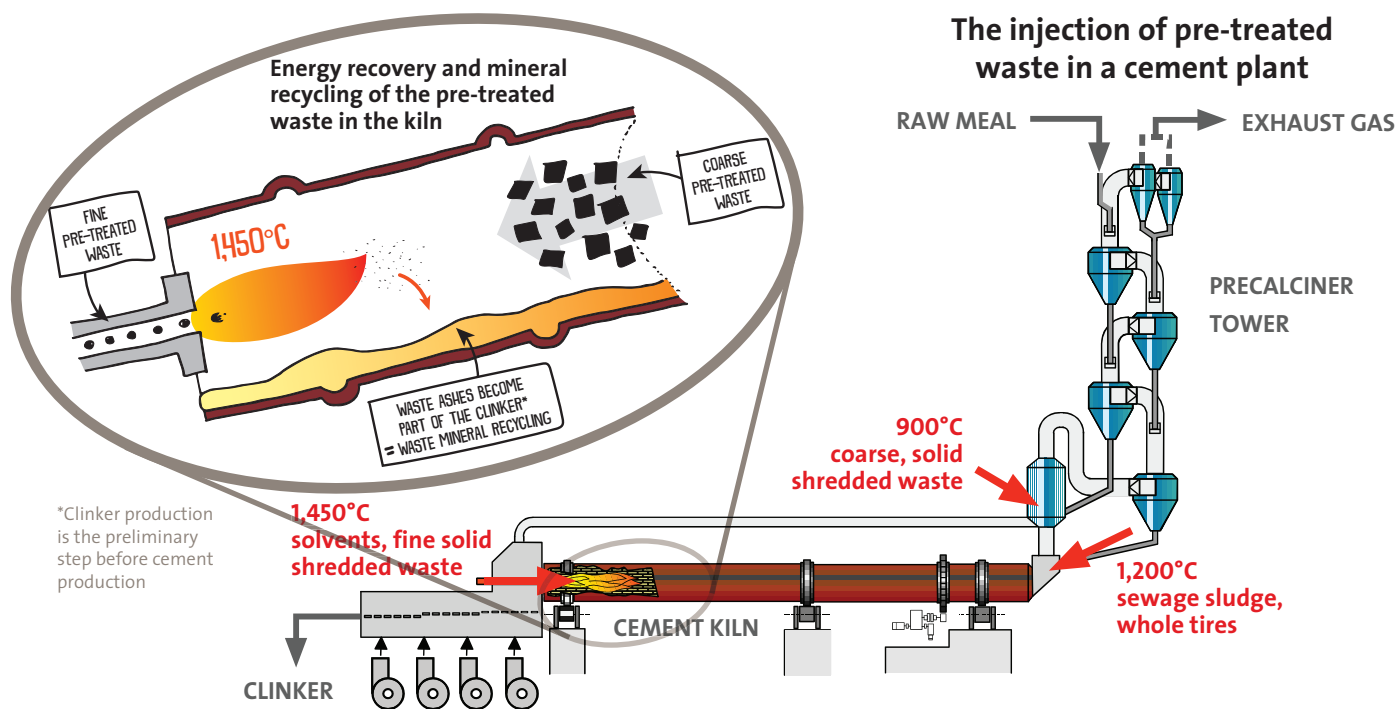


In its recent communication¹¹, The European Commission (EC) advised Member States to take a long-term perspective and carefully assess the available capacity of co-incineration in cement plants among other options. According to EC, “improving the energy efficiency of Waste to-Energy processes, and promoting those processes which combine material and energy recovery can contribute to decarbonizing key sectors (...) and to reducing greenhouse gas emissions for the waste sector”.

¹⁰ Ecofys, May 2016, “Market opportunities for use of alternative fuels in cement plants across the EU”, April 2017, “Status and prospects of co-processing of waste in EU cement plants”

¹¹ Communication from European Commission, January 2017, “The role of waste-to-energy in the circular economy”

Co-processing: *how it works*



Offering high value solutions to local authorities for used tires in France

In Saint-Pierre-la-Cour in France, the cement plant is one of the leading European performers in thermal energy substitution and avoids 100,000 tons of fossil CO₂ per year. Among the Solid Shredded Wastes co-processed, the plant offers a dual recovery and recycling solution for local used tire streams. Tires are used for their energy fraction (rubber) and their alternative raw material content (steel).

These used tires are originating from farming activities. They are non-hazardous waste but can pollute the land and be dangerous in case of fire. As they are not part of an Extended Producer Responsibility chain, the farmers are asked to eliminate them. With the aim of helping farmers, local authorities organized a tire collection and choose a high value co-processing solution to treat them.

Co-processing: a key contribution to plastic waste challenge !

Geocycle draws a wide range of non-recyclable waste including industrial and municipal plastics. These waste are previously separated from the recyclable part that return to plastic manufacturing. Indeed, plastic waste co-processed are contaminated by pollutants, mixed with other plastics or streams that impede their recycling into new plastic products.

Co-processing of these plastic waste offers an optimal treatment as 100% of energy is recovered and the full mineral fraction is recycled into cement. This mineral content varies from 15% (plastic mixed with other waste) to 60% (i.e. carpet waste) according to the type of waste.

Our solution is fully aligned with the EU waste treatment principles as it offers a more sustainable alternative to landfilling or incineration of non-recyclable plastic waste. It also contributes to the reduction of plastic leakage and environmental contamination.



Co-processing as one of the best practice for municipal waste treatment

Benefits of co-processing compared to the most commonly used treatment solutions in Europe for the non-recyclable fraction of the municipal waste

Treatment in cement plants



A "2 in 1" process:

- ☑ treats the waste & produces cement,
- ☑ recycles the mineral content of the waste,
- ☑ recovers 100% of waste energy,
- ☑ final treatment, no residue
- ☑ thermal destruction up to 1,450°C

Incineration



An elimination process:

- recovers part of the energy,
- no recycling,
- thermal destruction: 800°C, 2 sec. residue 20% ashes,
- heavy investment for municipalities.

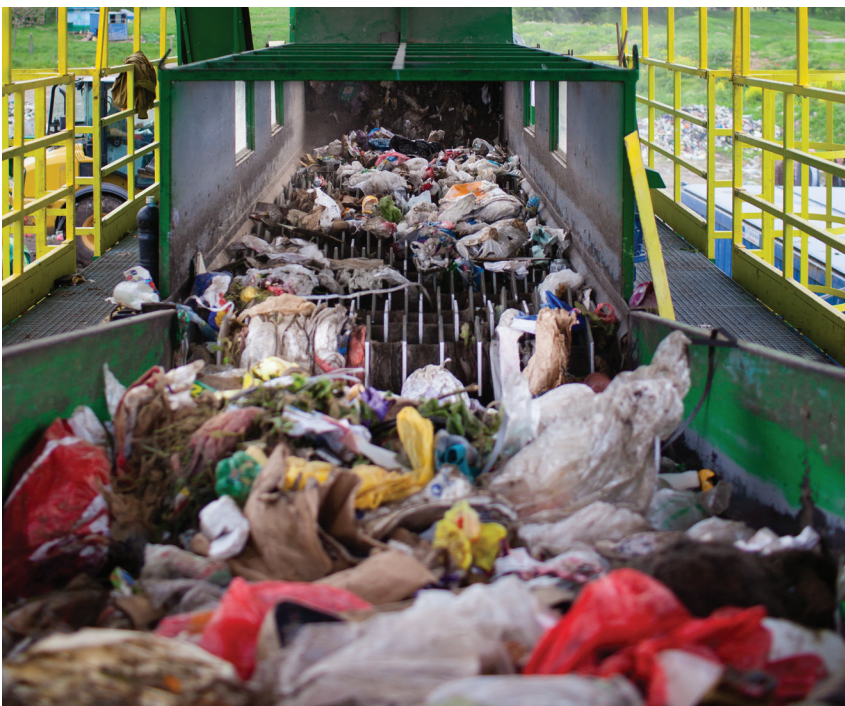
Landfilling



A disposal solution:

- No waste recovery.
 - No recycling.
- In case of illegal dump:**
strong impact on the environment (ground, water, soil) and local community (health, odour), risk of open fire, strong GHG emissions.

More than half of the waste produced in Europe in 2016 were landfilled or incinerated

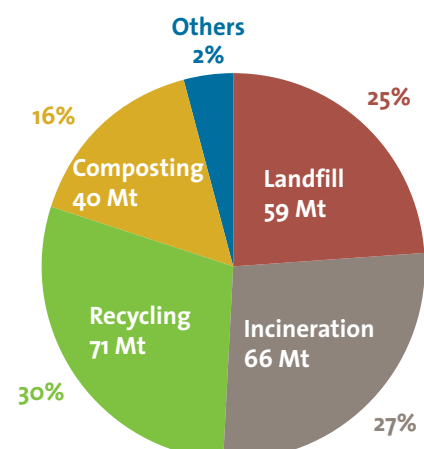


Municipal waste treatment in Europe in 2016

On 240 million tons of household waste, 59 million were landfilled in 2016.

Half of the European countries still landfill more than 50% of their municipal waste.

Source : Eurostats 2016.



International and national bodies bring credit to co-processing activity



United Nations Environment Programme, through the Basel Convention, has developed technical guidelines on the environmentally sound co-processing of hazardous waste in cement kilns.



Various researchers at SINTEF, the largest independent research organization in Scandinavia, consider co-processing as a problem solver and support the use of local cement kilns for the environmentally sound destruction of hazardous organic chemicals like toxic pesticides and persistent organic pollutants in several countries.



GIZ operates worldwide and assists the German government in achieving its objectives in the field of international cooperation, especially regarding sustainable development and resource management. In 2018, the organization together with LafargeHolcim, updated their guidelines for an efficient and environmentally sound pre-processing (preparation of the waste to make it suitable for its treatment in cement kilns) and co-processing (recycling and recovery process) activities.



The French Environment and Energy Management Agency has approved the technical reliability of co-processing. ADEME promotes this waste treatment solution for public bodies in charge of waste management.



In 2016, the Indian Ministry of Environment, Forest and Climate Change (Central Pollution Control Board) recognized that “there is dual benefit in co-processing waste in cement kilns, in terms of utilizing the waste as a supplementary fuel as well as an alternative raw material” and stated that “co-processing in cement kilns is considered an environmentally friendly option for managing different kinds of waste (...)” - (Guidelines on “Pre-processing and Co-processing of Hazardous and other Wastes in Cement Plants”)



In the context of setting up the 13th Five Year Plan on Ecology and Environment Protection (November 2016), the Chinese government encourages the development of waste treatment infrastructures. Within this framework, the co-processing of municipal solid waste and hazardous waste is promoted. By 2020, the aim is to significantly increase the number of cement plants equipped to co-process waste.

9 <https://www.geocycle.com/our-processes>





Co-processing with **Geocycle Europe**

Through Geocycle, we serve over 10,000 customers worldwide in more than 50 countries on all continents. Our primary clients are industrial and service companies, municipalities, and waste management firms.

In Europe, Geocycle offers waste management services in more than 20 countries with more than 40 co-processing facilities. In 2017, we treated over 4.5 million tons of waste in Europe, including solid shredded waste, spent solvents, used tires, waste oils, animal meals, contaminated soils, industrial and sewage sludges, demolition waste, etc. All those waste participate to the saving of natural resources that would have been used for the production of cement.

Thanks to our co-processing activities in Europe, we avoid:

- producing 1.5 M tons of CO₂*
- extracting 1.3 M tons of raw material*

-  LafargeHolcim cement plants
-  Geocycle pre-processing platforms
-  Cement plant & pre-processing platform together
-  Joint Venture pre-processing platforms



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