Cement Sustainability Initiative (CSI)

The Cement Industry

Creating solutions for safe, resource-efficient waste management

wbcsd

The growth of the world's population and global economic development create a rising demand for resources, and are the main drivers behind the increasing levels of waste worldwide. In parallel, waste is now considered a resource that should be used in a beneficial way. Throughout the world, awareness is rising that landfilling should be a temporary measure or a last resort, and that a more resource-efficient waste management system is needed.

Thirty years ago, cement companies started to treat waste as a source of raw material and energy. Today, the cement industry provides a significant contribution to the waste management practices of many countries. The responsible use of waste as an alternative fuel to heat cement kilns is lowering the industry's consumption of fossil fuels, which is helping to reduce the environmental footprint of global cement production.

Co-processing is the term used to describe introducing alternative fuels and raw materials into a standard cement production process, rather than using conventional fuels and raw materials.

A cement kiln producing clinker (the main constituent of cement), is by its nature an efficient tool for the recovery of minerals and energy from waste. Below are some reasons why.

Kilns allow for complete burn-out of waste-derived fuel due to:

- The high main burner flame temperate of 2,000°C;
- The relatively long time that the waste is burned at 1,000°C (i.e., minimum five seconds, whereas the requirement for waste incinerators is only two seconds);

The high level of oxygen at the kiln burner allows for rapid combustion and complete oxidation and destruction of organic components;

During the burn-out process, ashes are incorporated in the clinker since they consist of mineral elements that are by nature required for the clinker, therefore there is a saving on the use of virgin raw materials;

Emissions do not increase, proven by numerous applications worldwide.

Case study: Cement plants in Poland help country to reduce landfills

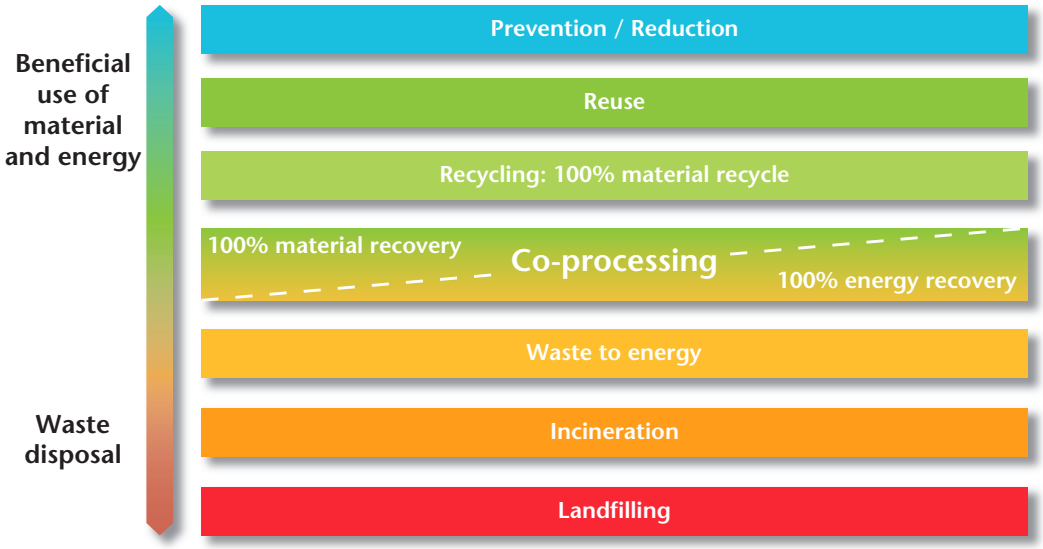
In order to comply with the EU directive related to waste management (Directive 2008/98/EC), the Polish Ministry of Environment has set targets (issued in 2011) to reduce the amount of municipal waste going into landfills by 50% in 2013 and by 35% in 2020.

The cement industry in Poland has actively encouraged waste management companies to develop facilities that treat municipal solid waste (MSW) to produce a residue-derived fuel (RDF) that can be used at cement plants. Nearly all cement plants have received permits from their local regulators and are replacing on average 36% (in 2009) of their coal with RDF. As a result, close to 20% of the MSW is now converted to RDF, which is allowing the cement industry in Poland to lead with the highest contribution to the country's waste reduction targets.

Cement industry contributes to an economical waste management network

The principles of reduce, reuse and recycle - the "3Rs"- are the accepted principles in most waste management systems. Where waste materials cannot be managed technically or economically by one or more of the 3Rs, the cement industry provides the most resource-efficient alternative: 100% of energy and material is recovered by co-processing waste in the cement manufacturing process.

The following diagram shows the position of co-processing in the waste hierarchy.

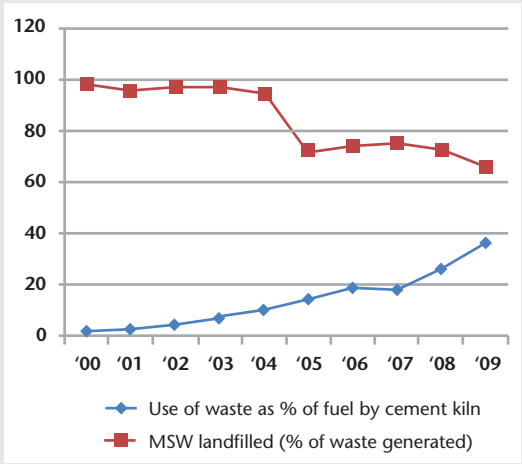


The *Guidelines for Co-Processing Fuels and Raw Materials in Cement Manufacturing* describes how unwanted emissions can be avoided and the related *Guidelines for Emissions Monitoring and Reporting in the Cement Industry* describe how members responsibly control their emissions.

The cement industry also offers an existing infrastructure of high temperature thermal processing plants that have the capability to recover a wide range of waste materials. This infrastructure offers an alternative to using landfills, reduces the environmental footprint and can be implemented in any country in a short period of time. It also reduces the need to spend public money on establishing waste incinerators and landfills.

For wastes requiring treatment before being used, the cement sector has, in close cooperation with waste management companies, developed pre-treatment technologies. Regulators in Europe have defined best available technology guidelines for these pre-treatment plants.

In order to be a reliable partner in the waste management network, cement plants fix comprehensive supply contracts with waste generators, indicating a clear specification for the waste-derived alternative fuel or raw material they can use. The equipment, pre-processing and operating costs necessary for the cement plant to process the waste may be partially or totally offset by the natural resource or fuel-cost savings from using the processed material. Therefore the gate-fee (an either positive or negative payment to the cement plant per ton of material supplied) may vary largely depending on the characteristics of the waste material and the geographical regulations and circumstances.



MSW landfilled and waste used in kilns

The Cement Sustainability Initiative (CSI)

Member companies of the Cement Sustainability Initiative (CSI) are committed to using waste materials only where it can be done safely (i.e., without harm to employees, neighbors and the environment), while maintaining the high quality of cement products. CSI members fulfill the requirements set out in the *membership Charter*, including the monitoring, reporting and verification of emissions and other environmental impacts.

In 2005, the CSI published its first set of *Guidelines for the selection and use of fuels and raw materials in the cement manufacturing process.* In 2014, the CSI published a revised version of these guidelines. The update draws on the experience gained since the first guidelines were published and takes into account international guidance documents subsequently issued, most notably those published by the Secretariat of the Stockholm Convention[i], the European Commission[ii] and more recently, the technical guidelines adopted by the Conference of the Parties to the 2011 Basel Convention[iii].

i Secretariat of the Stockholm Convention on Persistent Organic Pollutants. 2007. Cement Kilns Firing Hazardous Waste. Available from http://chm.pops.int/Implementation/BATBEP/Guidelines/tabid/187/Default.aspx

ii European Integrated Pollution Prevention and Control Bureau. 2010. Available from ftp://ftp.jrc.es/pub/eippcb/doc/clm_bref_0510.pdf

iii Secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. 2011.. Available from http://archive.basel.int/meetings/cop/cop10/documents/06a3r1e.pdf

Case study: Brazilian cement company recovers residues from oil well drilling

Stockpiled over several years and waiting for an economically and environmentally acceptable solution, the gravel from Petrobras oil drilling operations began to be co-processed in 2007 in a cement plant in Brazil.

Between 2007 and 2011, the cement plant was able to replace around 57% of its total natural clay supplies with waste gravel. This means that 150,000 tonnes of natural clay were saved, representing a case of eco-efficiency in resource use.

Cement waste management reduces industry's environmental footprint

The cement manufacturing process requires the use of raw materials such as limestone and additives to control the alumina, silica and iron content. In addition, a relatively high amount of energy is needed to convert the limestone to calcium-oxide and to solidify and compress the material at 1,450°C.

Waste-derived fuels and raw materials can replace virgin raw materials when properly treated and controlled. The benefits of this circular economy regarding the environmental footprint of a cement plant include:

- **Increasing resource efficiency;**
- **Avoiding the mining of natural resources such as coal and limestone;**
- **Reducing CO_2 emissions from cement kilns;**
  - **due to the portion of biomass in waste fuels;**
  - **incorporation of calcium-oxide (CaO) portion of the ashes in the waste material reduces the requirement to process limestone to generate CaO;**
- **Reduction of CO_2 emissions per ton of cement by replacing clinker by materials such as blast furnace slag, fly-ash and waste gypsum.**

In addition to this, another significant environmental benefit is realized by avoiding less favorable waste treatment solutions such as landfilling, which creates methane and risk of water pollution, or dedicated incinerators, which create CO_2 emissions and ash-disposal.

During co-processing, ashes are captured in the clinker, replacing some mineral components. Extensive testing has proven that cement made with waste from kiln co-processing exhibits the same physical and chemical characteristics as cement produced with conventional resources. In addition, the distances of long-haul waste transport are decreased due to the fact that the extensive cement kiln network can be utilized for managing locally-generated waste streams.

Some impressive waste management figures from the global cement industry in 2011:

CSI companies on average substituted 13% of primary fuels with waste-derived fuels

CO_2 emissions saving due to waste co-processing totaled 17 million tonnes per year

Amount of waste-derived fuels co-processed by CSI companies totaled 18 million tonnes per year

100 incinerators with 500 tonnes per day capacity not required due to the energy recovery in cement kilns

Coal saving by waste co-processing totaled 11 million tonnes per year

Cement industry engages with stakeholders on new regulations and technologies

The cement industry actively supports authorities in the development of national and regional regulatory frameworks for the co-processing of waste. A clear set of regulations is the foundation for transparent and professional engagement with all stakeholders, including neighbors, employees (unions), customers, national, regional and local authorities, NGOs, and waste generators.

Addressing stakeholders' concerns is an important part of the engagement process. These issues can range from concerns about stack and airborne emissions, odor, noise, and health and safety, to truck movements in neighborhood near plants, quality management of alternative resources, and transparent access to information.

As an energy-intensive industry, the cement sector has made significant progress in all areas of sustainable development and continues to work on further reducing major impacts.

The cement sector remains fully committed to meeting all its health and safety, environmental and social obligations, and to sustaining its position as a responsible member of the global community.

Further information

Guidelines for the Selection and Use of Fuels and Raw Materials in the Cement Manufacturing Process
(WBCSD Cement Sustainability Initiative, 2013)

Guidelines for Emissions Monitoring and Reporting in the Cement Industry
(WBCSD Cement Sustainability Initiative, 2012)

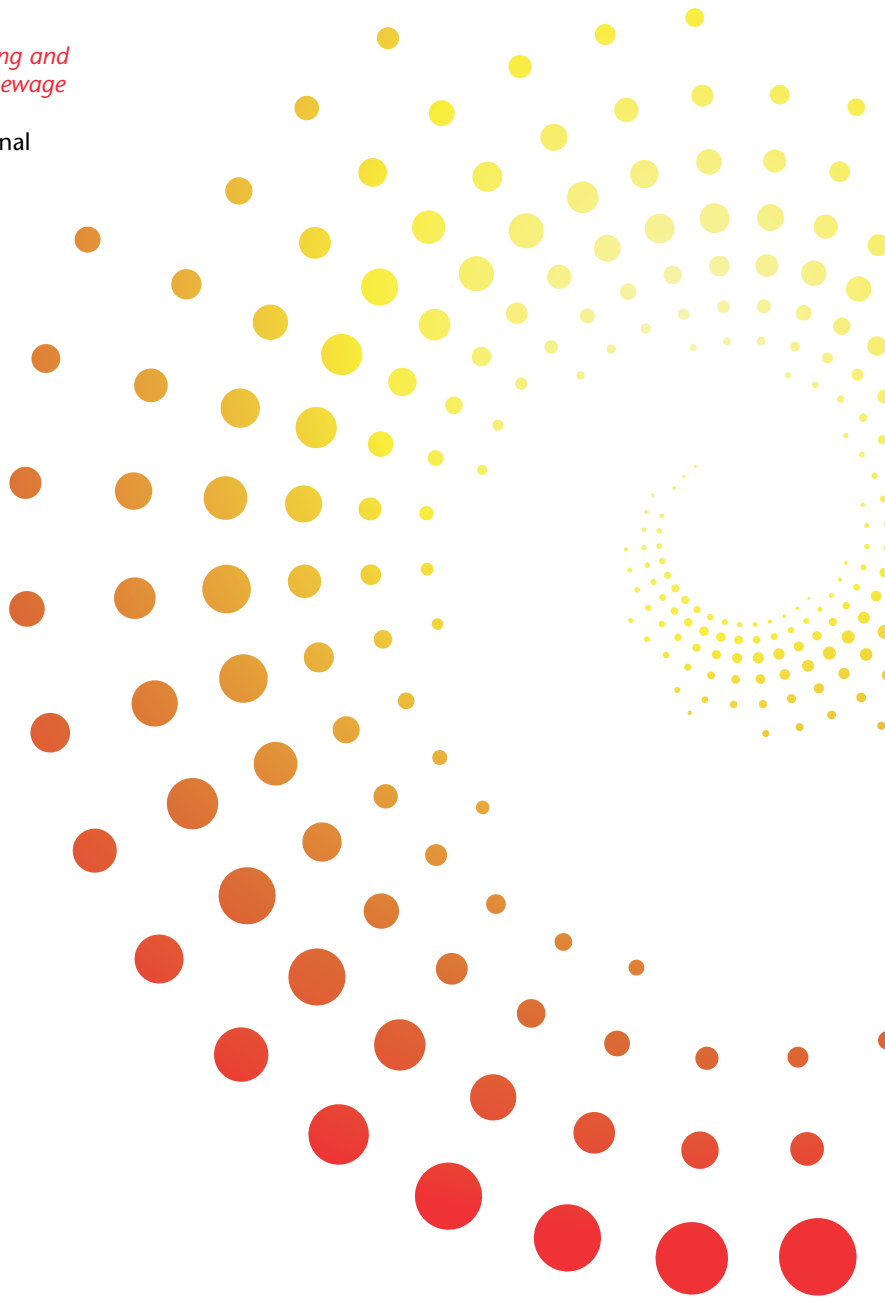
Reference Document on Best Available Techniques in the Cement, Lime and Magnesium Oxide Manufacturing Industries
(European Commission, May 2010)

Guidelines on Co-processing Waste Materials in Cement Production
(The GTZ-Holcim Public Private Partnership, 2006)

Technical guidelines on the environmentally sound co-processing of hazardous wastes in cement kilns
(Basel Convention, November 2011)

Cement Kilns Firing Hazardous Waste
(Secretariat of the Stockholm Convention on Persistent Organic Pollutants, 2007)

International Best Practices for Pre-Processing and Co-Processing Municipal Solid Waste and Sewage Sludge in the Cement Industry
(Ernest Orlando Lawrence Berkeley National Laboratory, July 2012)



About the World Business Council for Sustainable Development (WBCSD)

The World Business Council for Sustainable Development (WBCSD), a CEO-led organisation of some 200 forward-thinking global companies, is committed to galvanising the global business community to create a sustainable future for business, society and the environment. Together with its members, the council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action. Leveraging its strong relationships with stakeholders as the leading advocate for business, the council helps drive debate and policy change in favor of sustainable development solutions.

The WBCSD provides a forum for its member companies - who represent all business sectors, all continents and a combined revenue of more than $7 trillion - to share best practices on sustainable development issues and to develop innovative tools that change the status quo. The council also benefits from a network of 65+ national and regional business councils and partner organizations, a majority of which are based in developing countries.

www.wbcsd.org

About the Cement Sustainability Initiative (CSI)

The CSI is a global effort by 24 leading cement producers, with operations in more than 100 countries. Collectively, these companies account for around 30% of the world's cement production and range in size from very large multinationals to smaller local producers. All CSI members have integrated sustainable development into their business strategies and operations, as they seek strong financial performance with an equally strong commitment to social and environmental responsibility. The CSI is an initiative of the World Business Council for Sustainable Development (WBCSD).

www.wbcsdcement.org

www.wbcsdcement.org/fuels

Disclaimer

This report is released in the name of the WBCSD. It is the result of a collaborative effort by members of the secretariat and executives from member companies participating in the CSI. Drafts were reviewed among CSI members, so ensuring that the document broadly represents the majority view of this group. This does not mean, however, that every member company agrees with every word.

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