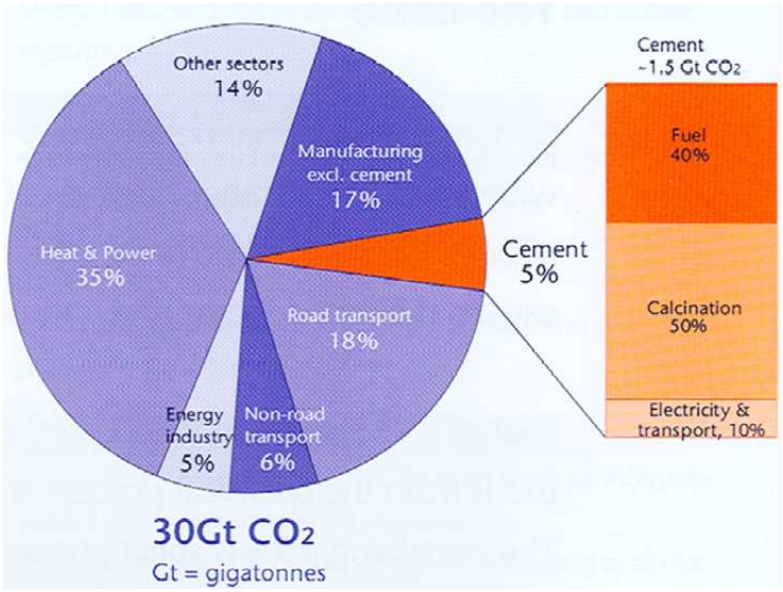
Co-processing waste in the cement industry: A solution to natural resource preservation and total emission reduction

Cement thus concrete plays a vital part in our daily lives. Few people are aware that concrete, with its strength, durability and excellent thermal mass, is a key component in eco-buildings. But the cement industry consumes a significant amount of natural resources and energy. About 1'600 kg of raw material and 200 kg of coal are needed to produce 1 ton of clinker.

On the other hand we have the waste problem. Waste is produced daily and everywhere in the world. Waste is even a bigger issue in emerging countries where no solution is available and thus dumping waste on the road, discharging to sewers or burying it are usual. This pollution causes contamination of soil, to the water resources and to the atmosphere. The consequences of all this is deterioration of population health.

Another fact is that the cement industry produces 5% of global man-made CO2 emissions worldwide. Half of this is a result of the chemical process involved in the transformation of limestone into clinker; 40% is a result of burning the fuel, and the remaining 10% is split between electricity use and transport.



Source: wbcsd – June 2005

The cement industry can turn the waste problem into a value-creating opportunity by using the waste to substitute fossil fuels and natural raw materials: the co-processing.

Co-processing is the use of waste material as raw materials or as a source of energy, or both, to replace natural mineral resources and fossil fuels such as coal, petroleum and gas in industrial processes.

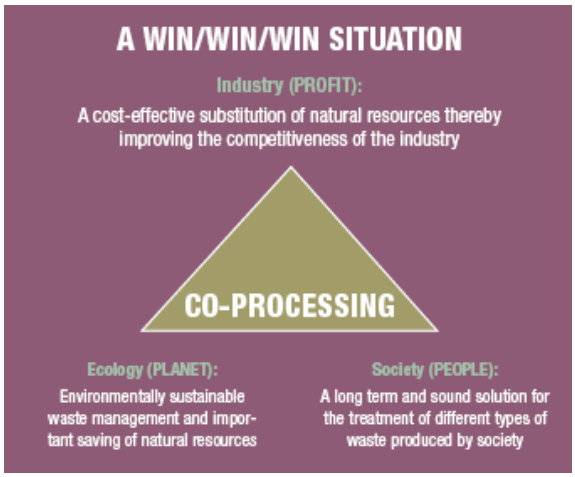
Did you know that the energy content of one ton of used tires is equal to that of one ton of coal, and that tires also include raw materials such as iron and aluminum that are required for cement production? (source: Coprocem)

When looking at the table hereunder, you can find the calorific value of some fuel used in the cement industry and the calorific values of alternative resources.

Natural resources	Alternative resources
▪ Coal = 28 MJ/kg	▪ Animal Fat = 37 MJ/kg
▪ Heavy oil = 40 MJ/kg	▪ Waste oil = 30 - 40 MJ/kg
▪ Petcoke = 33 MJ/kg	▪ Waste tires = 30 MJ/kg
	▪ Palm nut shells = 19 MJ/kg
	▪ Car shredded waste = 15 MJ/kg
	▪ Dried sewage sludge = 10 MJ/kg

The use of waste into the cement industry does not only replace traditional fuel but can also recover valuable raw material. For example the foundry sand which is a waste of the foundry industry can easily replace the Silicates required in the cement industry. Many other examples exist and we could strive to a sort of industry ecosystem where the wastes of some industries become alternative resources for others.

Co-processing is a triple “win” situation



Source: Cembureau

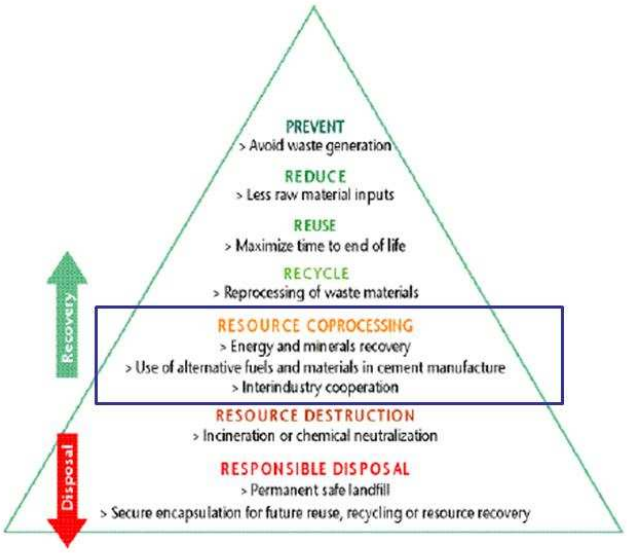
Through co-processing, the cement industry will:

- Improve it's industrial competitiveness by reducing its overall manufacturing costs through the substitution of fossil fuels or natural raw materials and additional income from the service such action provides.
- Contribute to the preservation of natural resources and to the reduction of the global emission
- Lead to sustainably solve local waste management problems.

When talking about reducing manufacturing cost doesn't mean that the waste has to be bought by the cement plant. We have to be aware that allowing to use waste into a cement kiln needs capital expenditure thus investment. Moreover driving a kiln with alternative resources is much more difficult than without. The "polluter pays" principle should be always applied.
The cement industry is sometimes one of the only solutions to society waste issue. For example, in 1999, an urgent solution for the treatment of thousands of tons of animal meal and fat from potentially contaminated animal products was required in Belgium. The federal authorities identified the co-processing of the contaminated meat & bone meal in the cement industry as the best way of resolving this crisis. Belgian cement plants were, therefore, requisitioned to treat the contaminated animal meal. This process provided a safe and environmentally sound solution as it allowed for the complete destruction of the contaminants in the kiln.

The waste hierarchy helps the cement industry to show to authorities, NGO's or the neighborhood that co-processing is a "recovery" process.

The waste hierarchy has to be respected for any waste disposal option. Co-processing is ranked after prevention, reduce, reuse and recycle but before resource destruction, land filling and uncontrolled burning or dumping.



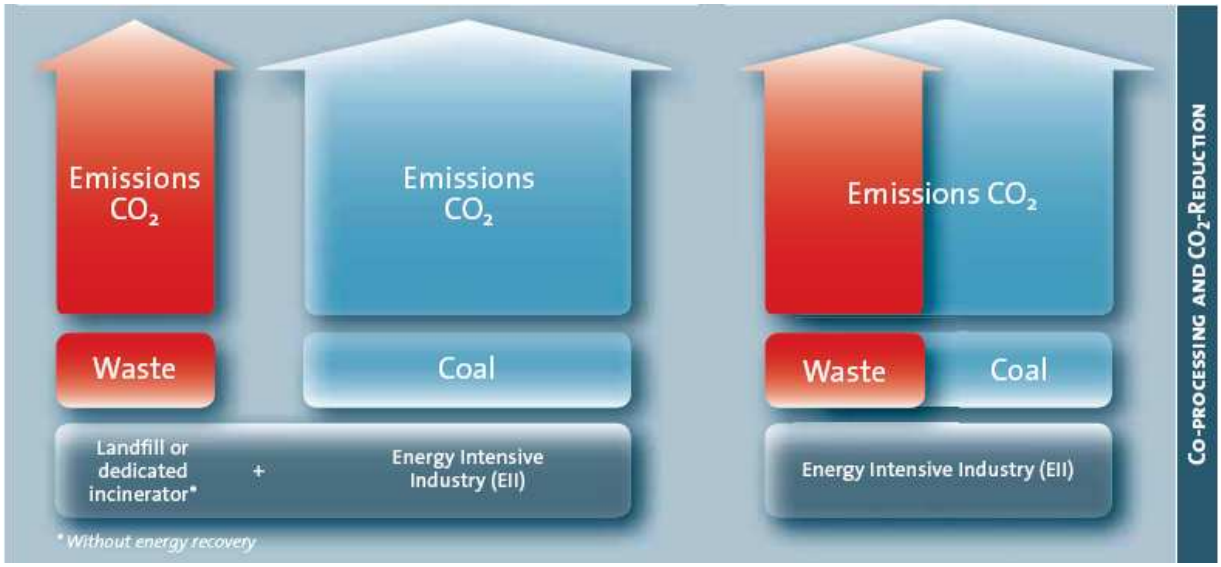
The co-processing of waste has been recognized as a recovery operation under EU legislation.

Source: wbcsd

Waste prevention is any activity that avoids or eliminates waste at its source. Example: using less paper, cardboard, plastic,…Reduce is any initiative that can change consumers habits related to packaging for example. Reuse is to use an item more than once. Best example is the refillable glass bottles. Recycling involves processing used materials into new products. Example: paper or glass.

A study conducted by the Netherlands Organization for applied Science Research (TNO) compared the environmental impacts of using waste as an alternative fuel and raw material in the cement industry, and burning waste in hazardous waste incinerators while recovering electricity and steam. This assessment used the complete life-cycle assessment of the different waste streams and all the environmental impact categories. It concluded that, for the vast majority of environmental impacts, using industrial waste as alternative fuels in the cement industry was better for the environment than treating them in waste incinerators.

As said above, the cement industry is responsible for 5% of global man-made CO2 emissions worldwide but is committed to managing and reducing its CO2 emissions. The industry produces. Co-processing can significantly reduce the CO2 emissions by replacing the amount of fossil fuel used in the process with biomass and wastes that would otherwise have been burned without energy recovery, and other materials having lower carbon content.



Source: wbcsd

There are three main techniques available to the industry in reducing net total and per ton CO2 emissions:

1. Maximize the efficiency of the manufacturing process and associated equipment to use fuels and materials as efficiently as possible but this has a limit because more and more cement plants are becoming efficient.

2. Reduce the amount of fossil fuel used in the process by replacing it with biomass and wastes that would have otherwise been burned without energy recovery. This is the co-processing.

3. Replace a proportion of the clinker in cement with alternative materials (which do not require thermal processing such as slag, pozzolana or fly ash), reducing the CO2 emissions per ton of cement produced. This option forces the cement industry to review its product portfolio and to reduce the famous clinker factor (% of clinker into cement).

In order to make all those initiatives a success, some rules of the game from the cement industry as well as from the authorities have to be defined.

For the cement industry they are:

- Co-processing shall respect the waste hierarchy
- The use of suitable alternative materials shall not have any negative impact on emissions
- No negative impact on the environmental and technical quality of the final product

- Co-processing in the cement industry shall not have a negative impact on the health & safety of the workers neither in the plant nor on the people living in the neighbourhood
- The cement plant shall comply with the relevant regulations, shall monitor and control the inputs, process, products and emissions and finally shall communicate transparently
- The cement industry shall promote dialogue with local authorities

For the authorities they are:

- Creation and interpretation of waste statistics
- Development of a national waste management strategy
- Creation of an appropriate legal framework for waste
- Enforcement of the national regulations and permissions
- The “polluter-pays” principle must be the basis
- Keep in mind the waste hierarchy but sometime LCA (life cycle analysis) can invert the latter because it can conclude on the advantages of different waste management solutions
- Authorities need to be qualified to authorize, control, and monitor co-processing
- National emissions standards shall be applied by the relevant authorities

But as a summary, these initiatives will never work without open discussions between the cement industry and stakeholders like authorities, NGO’s, employees and others. Moreover it will never be sustainable without a proper enforcement of the legal framework for all waste management activities combined with monitoring by the authorities. The polluters pay principle must be also applied to make it a long term success.