Cement and Lime

Cement sector

The increasing global population, the urbanization patterns and the infrastructure development will increase global cement production, by 12-23% by 2050 compared to 2014. Concrete's remarkable properties make it a vital element and are the reasons that made cement so widespread. More importantly, cement and concrete are pivotal to building a climate-neutral Europe.
According to Eurostat data, the cement manufacturing industry in the EU represented an estimated €15.2 billion turnover and €4.8 billion in value-added and in 2019, the sector offered employment to more than 47,000 persons in Europe, distributed over around 350 enterprises.

The cement industry has been one of the highest energy-consuming and CO_2 emitting sectors, rated third worldwide, while the sector has the second-largest share of total direct industrial CO_2 emissions, at 27% (2.2 Gt CO_2 / yr.) (Reference year: 2014). Almost 50-60% of the total production cost is linked to energy costs of which thermal energy accounts for about 20–25% of the cement production cost, corresponding to 110–120kWh per ton of cement consumption and requires 60 to 130 kg of fuel oil or its equivalent, depending on the cement type.
Improved techniques and modern technologies have brought an increase in the efficiency of production, reduced energy consumption, and, reduced CO_2. Reports show that across the inventory of all concrete, an average of up to 25% of the process emissions emitted during cement manufacture is reabsorbed by concrete during its lifetime. "5C approach" promotes a collaborative approach along the clinker-cement-concrete-construction- carbonation value chain involving all actors to help turn the low carbon vision into reality.

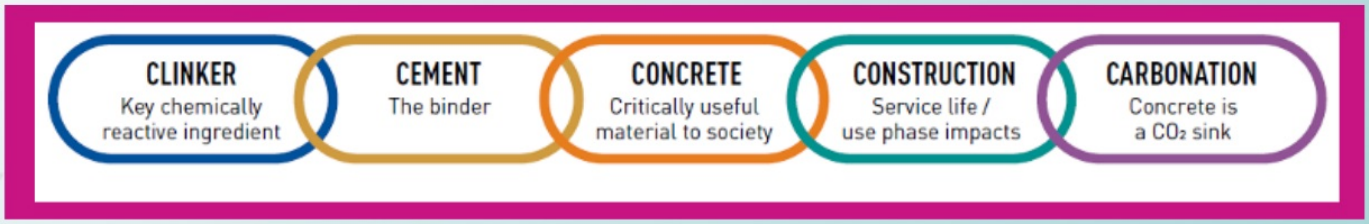

Figure.1 The 5C approach.

The European cement industry has actively worked on reducing emissions for a long time. Since 1990, it has reduced its CO_2 relative emissions by about 15% via technological innovation, both in manufacturing to reduce their release in the first place, and through carbon capture technology.

Lime sector

The European lime industry currently employs around 11,000 people directly and produces around 23 Mt of lime and dolomite. The key sustainable development issues for the extraction of the main raw materials for lime production reside in the access to high-quality limestone and dolomite deposits to secure geological reserves for the long-term future.

According to European Lime Association (EuLA) in 2022, the total CO_2 emissions of the European lime industry accounted for 400Mta of CO_2. The lime industry is searching for more options, with a focus on carbon capture since the bulk of the emissions come from limestone and it is inevitable to reduce such emissions. The main environmental concerns of lime production are associated with the use of energy and the production of CO_2 emissions, 68% of total emissions are an inevitable by-product of the calcination process. In 2010, the average fuel consumption was 4.25 GJ/tonne of quicklime with the theoretical minimum energy required to be 3.18 GJ/t lime and the CO_2 emissions reaching 0.751 t CO_2/ t lime and 0.807 t CO2 / t dolomite. In 2010 the total direct CO_2 emissions of the European lime industry, based on EUTL, the EU-ETS emissions registry, are around 26 Mt CO_2. Potential measures for the CO_2 reduction emissions can be divided into four main categories, presented in the table above.

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Category	Measures For CO_2 Reduction	Results
Energy Efficiency	A. Fuel Savings by new and efficient vertical kilns (PFRK suggested) B. heat exchangers in the existing horizontal C. Energy heat recovery from waste D. Motor systems efficiency	A. fuel intensity reduced by 8% by 2030 and 16% by 2050 B. ~25% fuel savings D. ~10% electricity savings
Low Carbon Sources	i. Fuel switch to the wood powder firing and biomass gasification, methanol, turpentine and tall oil ii. Solar heating and H_2 via alkaline electrolysis	i. Only for support fuel ii. Technology under developmer expected to be a good support fuel
CCS-CCU	CCS: end of pipe solution CCU: production of fuels/hydrocarbons	CCS:~ 94€/tonne of avoided CO maximizing cost CCU: potential source of financia benefit
Carbonation	Reverse reaction of lime production. An industrial example of the carbonation mechanism is Precipitated Calcium Carbonate (PCC)	2% of CO_2 emissions that produced in the calcination step could be absorbed

Table 1. Potential measures for the CO_2 reduction emissions can be divided into four main categories.

In order to continue EU lime industry to play an important role, it is vital for EU to make a long-term policy certainty and by this way to support the maintenance and competitiveness of its plants. In addition, European Commission should focus on innovation, stimulating research, reducing barriers for subsidies, and by developing adequate financing systems for the early adoption of energy efficient and low carbon techniques.

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