



Innovative ways to reduce CO₂ emissions from the cement industry

Technological advances in European cement production could reduce energy consumption by up to 10% and CO₂ emissions by 4%, according to a new analysis. The research suggests that initial costs of some of the pending technological improvements could be recouped in as little as a year.

Cement production is responsible for around 5% of global CO₂ emissions. The European industry constitutes around 10% of global cement production and is therefore a key industry under EU targets¹ to reduce emissions. The burning of fuels such as petroleum coke or coal in the calcination process that turns limestone into clinker, causes emissions of CO₂ to the atmosphere. Almost twice as much CO₂ is actually produced by the calcination reaction itself. Since the basic chemistry cannot be changed, the industry has had to find other ways to reduce the CO₂ output. Nevertheless, emerging innovative products like the carbon negative cement Novacem, based on magnesium silicate, might reduce the energy consumption during the manufacturing process and push innovation in the 'green' low-carbon segment of the building materials sector².

In Europe, in order to reduce energy consumption and CO₂ emissions, the industry is focusing on increasing the use of clinker substitutes in cement, the use of alternative fuels and energy efficiency measures. The new research assessed the cost-effectiveness of several other energy efficiency measures, including modifications to the reaction chamber (kiln), recycling waste heat and carbon capture and storage (CCS) of CO₂ from the waste gases. Cost-effectiveness was estimated using a computer model to calculate how long it would take for the savings from each measure to match the cost of the initial investment, known as the Pay Back Period. The model individually assessed 477 kilns in 294 production facilities within the European Cement Association (CEMBUREAU)³. For some measures, the Pay Back Period was less than a year. This included converting kilns from traditional 'wet' facilities to 'dry' facilities, which require half as much energy.

When all measures with Pay Back Periods of less than two years were considered, total energy consumption (across all cement facilities) decreased by 9.2%. This figure was 10.8% for Pay Back Periods of less than three years, and 15% for Pay Back Periods of less than 9 years. CO₂ emissions were reduced by 3.4% for processes with Pay Back Periods of less than two years, and up to 5% for Pay Back Periods of less than 9 years. The energy efficiency gap, that is, the lack of deployment of all potential improvements at hand, independent of the decision criterion considered (the payback period, the net present value or the internal rate of return) requires a conducive policy environment that combines support for both technology development and its deployment.

The results also demonstrate that recycling waste heat is close to being cost-effective as the market price of electricity will affect the decision on investment. The project's required minimum electricity price to make a worthwhile investment would be €0.08 per kWh.

Cement production could be an ideal candidate for CCS, since the concentration of CO₂ in the waste gases is very high. But at present, CCS is far from being cost-effective (this is dependent on factors such as electricity and CO₂ allowance prices) and is not expected to be available before 2025. The urgency of climate change action means that there is little ground for further delaying implementation of at least the most cost-effective measures. First steps could include encouragement for phasing out 'wet' facilities, say the researchers. The use of alternative raw materials and fuels and the decrease of clinker to cement ratio are also likely to influence the industry in the future.

Additional information: To learn more about low-carbon technology innovations in the cement industry, please see: <http://setis.ec.europa.eu/>

1. See: EU Climate and Energy Policy, Europe 2020 Strategy. Available from: http://ec.europa.eu/energy/index_en.htm
2. See: <http://novacem.com/>
3. See: European Cement Association (CEMBUREAU) www.cembureau.be

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