

# CCS and CCU in cement industry

## Some projects

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6<sup>th</sup> April 2017



# Overview

- **Relevancy**
  - WBCSD / International Energy Agency - Roadmap
- **Some CCU and CCS projects in cement industry**
- **Economic effects**

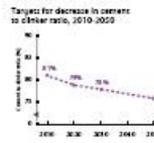
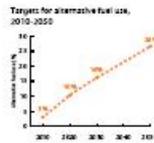
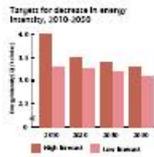
# WBCSD/IEA cement technology roadmap 2009

## 4 Levers for CO<sub>2</sub> emissions reductions (global)

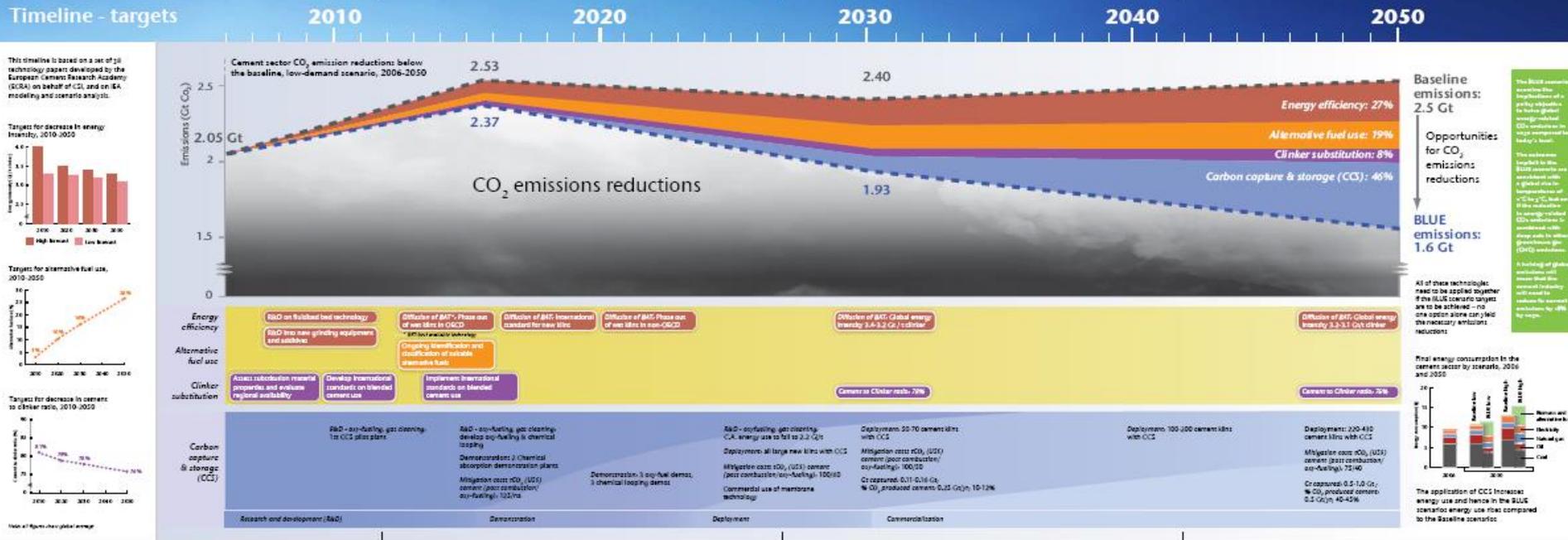
- Energy efficiency 27%
- Alternative fuels (biomass) 19%
- Clinker substitution 9%
- Carbon Capture and Storage 46%

### Timeline - targets

This timeline is based on a set of 11 technology papers developed by the European Cement Research Academy (ECRA) on behalf of CEI, and on ICA modelling and scenario analysis.



Note: All figures are global average



# The Carbon Capture project in Brevik, Norway

Four technologies tested at the kiln stack between 2012 and 2015

Basic research project for Carbon Capture was carried out at cement plant Brevik operated by HeidelbergCement

Amine scrubber technology was identified as “most appropriate and reliable” to enhance CO<sub>2</sub> concentration from about 30% to > 98%

Funding mostly via subsidiary NORCEM and Norwegian government (Σ €9m)

The project in Brevik was the kick-off for intensive “Carbon Capture Research” in the cement industry



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**NORCEM**  
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# The ECRA Oxyfuel project utilizes CO<sub>2</sub> as process gas

Cooperation spear-headed by European Cement Research Academy

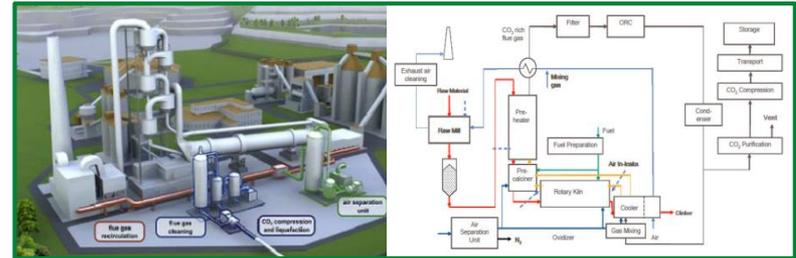
Oxyfuel technology enriches flue-gases with CO<sub>2</sub>: enhances proportion in flue-gas stream in kiln from about 30% to >75%

Funding via industry as well as national and international mechanisms (~50m€)

Great R&D contribution by HeidelbergCement

- Prototype cooler by HeidelbergCement
- Prototype calciner by Italcementi

Oxyfuel utilizes solely CO<sub>2</sub> as process gas.  
In order to burn primary and secondary fuels, pure oxygen is added



ecra

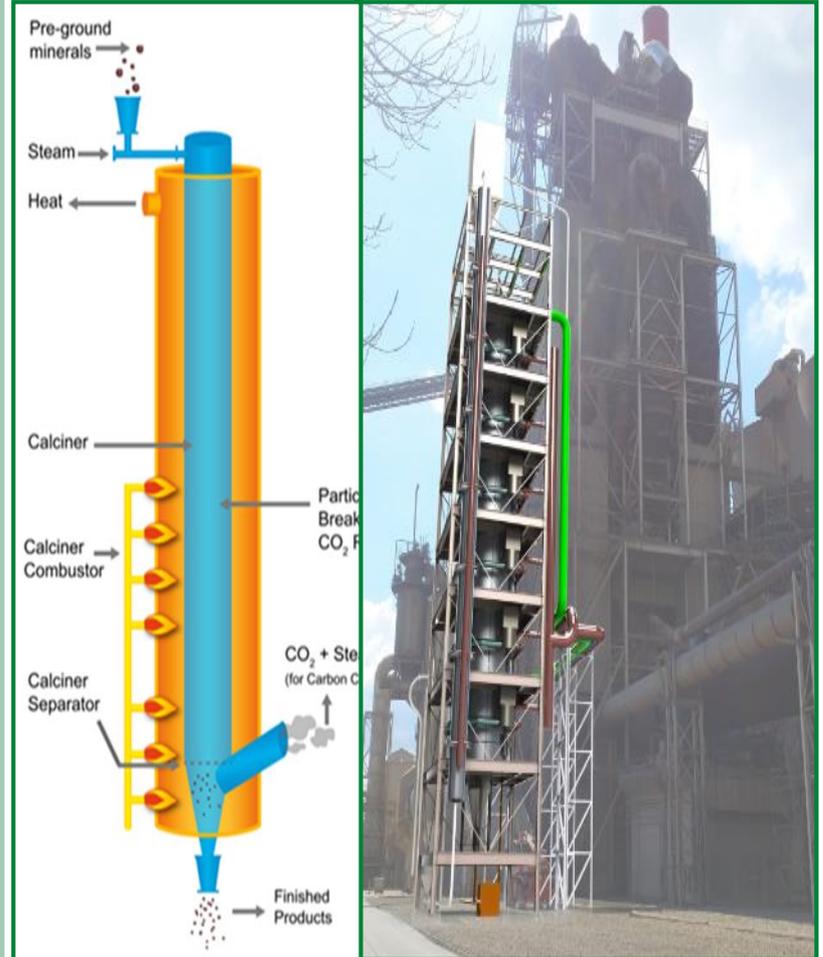
european cement research academy

# CO<sub>2</sub> separation @ calcining at LEILAC

LEILAC plant separates CO<sub>2</sub> from calcination from other flue-gas

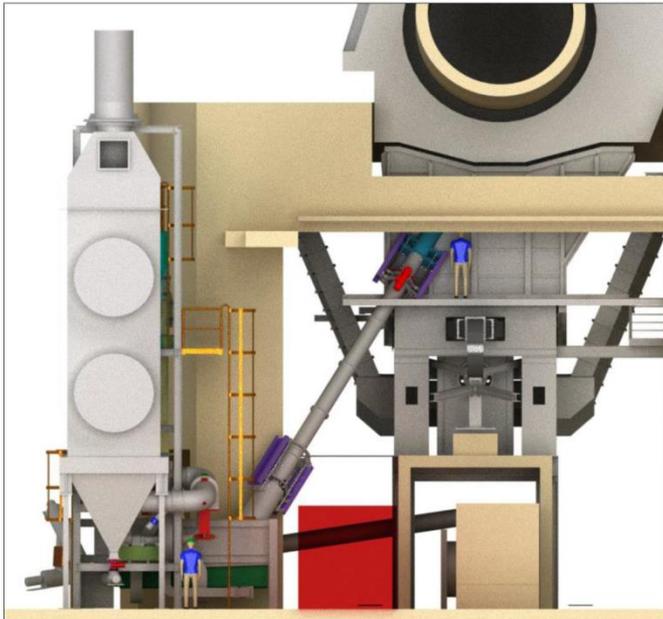
Rawmeal is indirectly heated to about 900°C . Proven process for MgO production.

Funding via EU (Horizon 2020) of over €12m, demonstration plant in Lixhe, Belgium with 10 tph capacity.



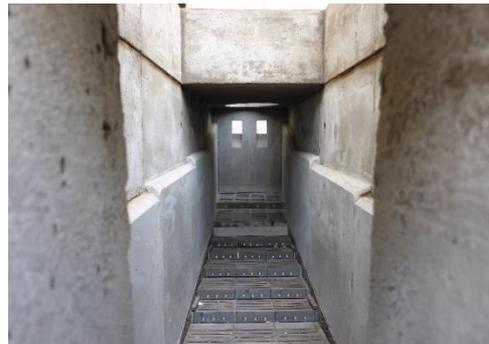
# CEMCAP PROJECT: PILOT SCALE CLINKER COOLER IN CO<sub>2</sub> RICIRCULATION

This pilot scale test has been organized in the Heidelberg cement plant of Hannover while the project and the installation are supplied by IKN.



**2 m<sup>2</sup> aerated area**

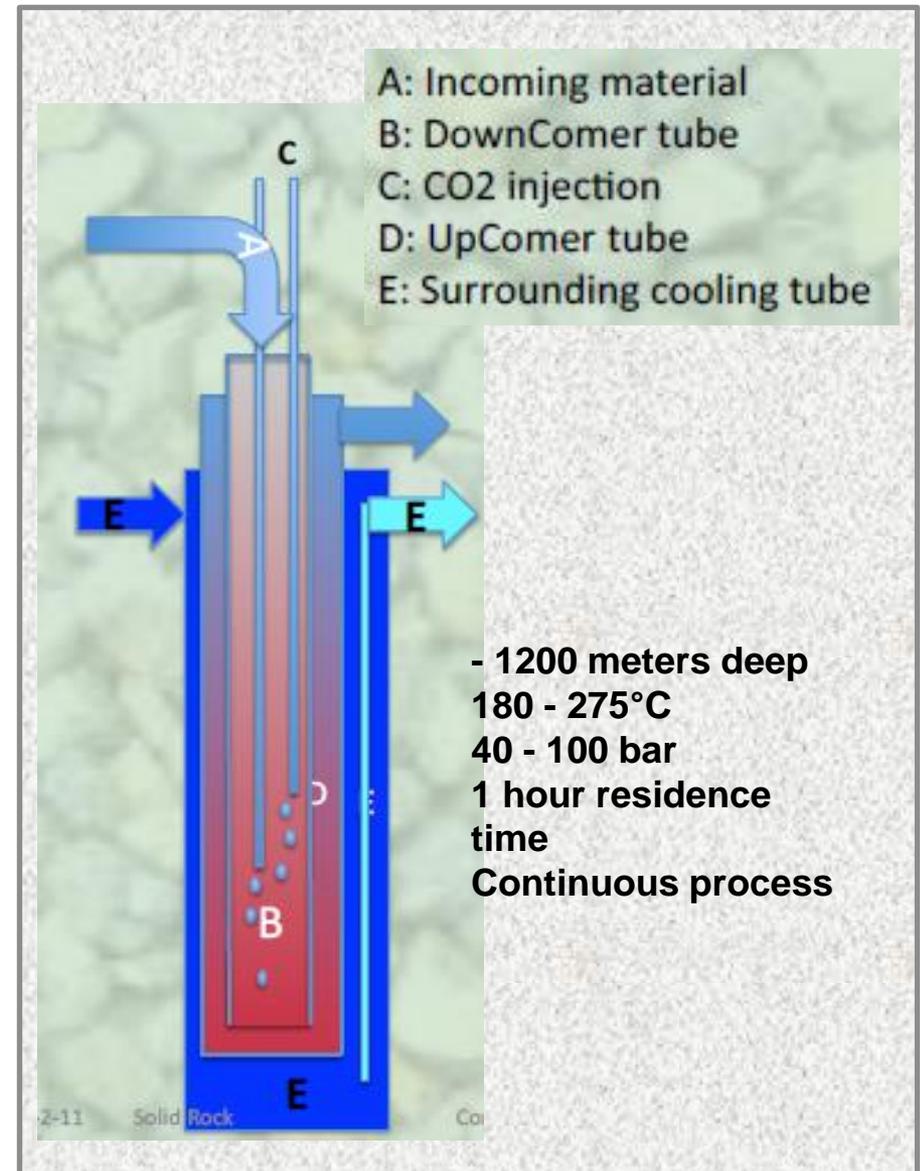
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# Natural mineral carbonation

- **CO<sub>2</sub>-uptake by mineral products like basalt, olivine and steelslag**
- **Generated products (high in blaines):**
  - amorphous silica
  - crystalline magnesium-carbonate
- **R&D program will start in 2017**
  - Funding might come from BMBF
  - Therefore German based partners from RWTH Aachen and IASS Potsdam



# R&D Sweden micro-algae growing on CO2 from flue-gas

## RESULTS

- Microalgae react positive to flue-gas of cement kilns
- Algal biomass meets criteria for healthy fishfeed

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# Economics

## ■ HeidelbergCement investments in last 10 years

- > 4 b€ in improvement/expansion of installations: all BAT level
- > 800 m€ in R&D, of which > 50% carbon related

## ■ Research partners

- Mainly European based universities (Italy, Germany, etc.)
- European research institutes: Sintef, TNO, etc.
- European equipment suppliers: FLS, ThyssenKrupp, FCB, etc.

## ■ Innovative cement and concrete equipment producers are all located in Europe

## ■ Cement plant of 2050 will have an additional chemical plant attached to it, for example:

- CO<sub>2</sub> capture
- Oxygen production
- Methane/Methanol/Algae production facility

**Thank you for your attention !**



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