CEMEX – Climate Change Strategy and CCS

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CEMEX – a Global Building Material Company

- World’s #1 in aggregates, ready-mix concrete
- #3 in cement
- 2007 CO₂ emissions: 57 mln t (only cement production)
- 13.1 mln t CO₂ under the EU ETS
- Exposure in Croatia, US, Mexico
Future Challenges for CEMEX in the Field of CO2

• EU Emissions Trading Scheme
  – Phase 1 and 2: CEMEX is net seller
  – Phase 3: ???
    • Will depend largely on whether cement is considered trade-exposed industry
  – In any case, carbon price creates incentives for reduction measures

• Other jurisdictions
  – US: emerging schemes
    • Federal legislation
    • State / regional initiatives
  – Croatia: ETS to be implemented soon
    • Compatible with EU ETS
  – Mexico: potential pressure from different sides
    • UNFCCC
    • NAFTA
    • State-level / regional movements
Cement production contributes around 5% of total man-made CO₂ emissions.

Sources of CO₂ emissions:
- Direct Emissions from Clinker Kiln (90%):
  - Chemical reactions in raw meal (around 55%)
    - Only small variance from plant to plant
  - Fuel emissions (around 35% of total)
    - Influenced by energy efficiency and fuel mix
- Other emissions:
  - Mining equipment, transport, electricity (indirect emissions) (around 10% of total)
CO2 Reduction Potential in the Cement Industry

Process emissions (chemical conversion of raw minerals)
- Practically no potential to reduce process emissions per unit of clinker

Combustion emissions (use of fuels)
- Switch to natural gas very costly (typically >100 EUR/t CO2)
- Alternative fuels (wastes) offer certain reduction potential but impose challenges
  - Mainly availability, sometimes acceptance
- No significant improvements for energy efficiency to be expected

Clinker factor
- Using less clinker to produce the same amount of cement is possible but requires
  - Availability of suitable clinker substitutes
  - Regulatory approval and market acceptance of blended cements

Without CCS, reduction potential in the cement industry is fairly limited.
CEMEX Activities to Manage Carbon

- **Europe**
  - Increase share of alternative fuels
  - Optimize use of clinker substitutes
  - Financial transactions (e.g. swaps)

- **CDM projects**
  - Projects in cement plants and upstream processes (electricity)
    - 3 projects registered with a total of around 800 kCERs/y

- **R&D**
  - Traditional cement and concrete technology
  - CCS
Calcium Looping for CO2 Capture

Idea:
Use lime (calcium oxide, CaO) as a sorbent to separate CO2 from the flue gas

Scheme

Step 1: carbonation to limestone (CaCO₃)
\[
\text{CaO (s) + CO}_2\text{ (g) }\rightarrow \text{CaCO}_3\text{ (s) + Energy}
\]

Step 2: calcination in separate reactor
\[
\text{CaCO}_3\text{ (s) + Energy }\rightarrow \text{CaO (s) + CO}_2\text{ (g)}
\]

- Step 2 takes place in an oxyfuel atmosphere
- Due to degradation of sorbent over the number of cycles the process requires significant amounts of limestone and produces lime
- Considerable potential to generate power from waste heat
CEMEX Involvement in Calcium Cycle Development

2003 – 2005: CEMEX, Alstom Power Boilers, University of Haute Alsace in Mulhouse, France: ADEME-sponsored project to experimentally study the kinetic and thermodynamic basics of the process

2005 – 2008: C3-Capture project under FP6 (with University of Stuttgart, Alstom, Endesa, INCAR (National Coal Institute of Spain) and others); the study confirms the technical feasibility of the concept

2008: CEMEX starts to operate a test reactor at its Monterrey, MX, cement plant

Starting 2008: CEMEX co-sponsors a Ph.D. thesis on the Calcium loop at the Imperial College

2009 – 2012: LIME-MOD (model of process, feasibility study); submitted to the EU Research Fund for Coal and Steel; led by the University of Stuttgart, the project consortium includes CEMEX, EnBw and CanMet, among others
What is CEMEX’s Interest in Calcium Looping?

CEMEX sees two different ways how it can profit from carbon capture via the calcium looping process:

1. Partner for power plant that uses calcium looping
   1. Business opportunity
      1. Supply of limestone
   2. Disposal of spent lime as raw material for cement plant
   2. Reduction of CO2 emissions due to calcined raw material
      1. Reduced process emissions
      2. Reduced fuel consumption

2. Retrofit of cement plants
   1. CO2 capture
   2. Electricity generation from residual heat