From CO2 to Energy: 
Carbon Capture in Cement Production and its Re-use

KEY CONCLUSIONS

- Processes optimization and integration are required to lower energy and resources consumption
- Economic viability of CCU processes are highly dependent on the assumptions (e.g. price of electricity)
- CO2 reduction may be possible only if renewable energy use as input
- Mitigation potential of CCU to methanol represents 50% of the original emissions of a reference system without CCU

RESULTS

CO2 Capture: Three ways were highlighted for the decrease (↓) of the energy consumption and the cost of CO2 capture for the application to cement flue gases:

1. Partial O2-combustion to increase (↑) flue gas CO2 content: ↓ by 26% of Eregen if YCO2 ↑ to 44%
2. Advanced process configurations: ↓ by 35% of Eregen with solvent MDEA-PZ + RVC + IC
3. Use of demixing solvents for ↓ the regen. flow rate: ↓ by 40% of Eregen (in progress)

CO2 Purification: Efficiency of Sour Compression Unit (SCU) De-SOx/De-NOx process Absorption into pressurized water (15-30 bar) from 2-column to 1-column process


CO2 Conversion: Identification of the most interesting CO2-based conversion pathways

Methanol; Methane; Dimethyl carbonates; Calcium carbonates; µ-algae

CO2 conversion into methanol: global chain was simulated and optimized including energy integration with the CO2 capture → CAPEX: 60 M€ & OPEX: 90 €/tCO2

Environmental study: maximum reduction by 50% of CO2 emissions