# Prospective life cycle assessment of the European cement industry

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## Abstract

Today, cement production accounts for 5-8% of global anthropogenic $CO_2$ emissions. This study investigates the potential reduction in $CO_2$ emissions by implementing measures such as supplementary cementitious materials (SCMs), alternative fuels, kiln efficiency, and background system changes up to 2050 using prospective life cycle assessment (LCA).

## Methodology (LCA Framework)

### Goal and Scope

- Cradle-to-gate LCA (raw material acquisition, transportation, manufacturing stage)
- Functional unit: 1 kg of cement
- Cut-off allocation

### Life Cycle Inventory (LCI)

- Software: Activity Browser
- Data: literature, Getting the numbers right (GNR) and ecoinvent v3.6 database
- Foreground scenarios:
  - SCMs: fly ash, bagasse ash, rice husk ash, granulated blast furnace slag (20% addition in 2020 to 50% addition in 2050)
  - Alternative fuel mix: 45% thermal demand in 2020 and 90% thermal demand in 2050
  - Kiln Efficiency: 3.823 (GJ/ t cement clinker) in 2020 to 3.02 (GJ/ t cement clinker) in 2050)
- Background scenarios : SSP2 Baseline scenario and SSP2 RCP 2.6 scenario

### Life Cycle Impact Assessment

- IPCC 2013, Global Warming Potential (GWP)

## Results

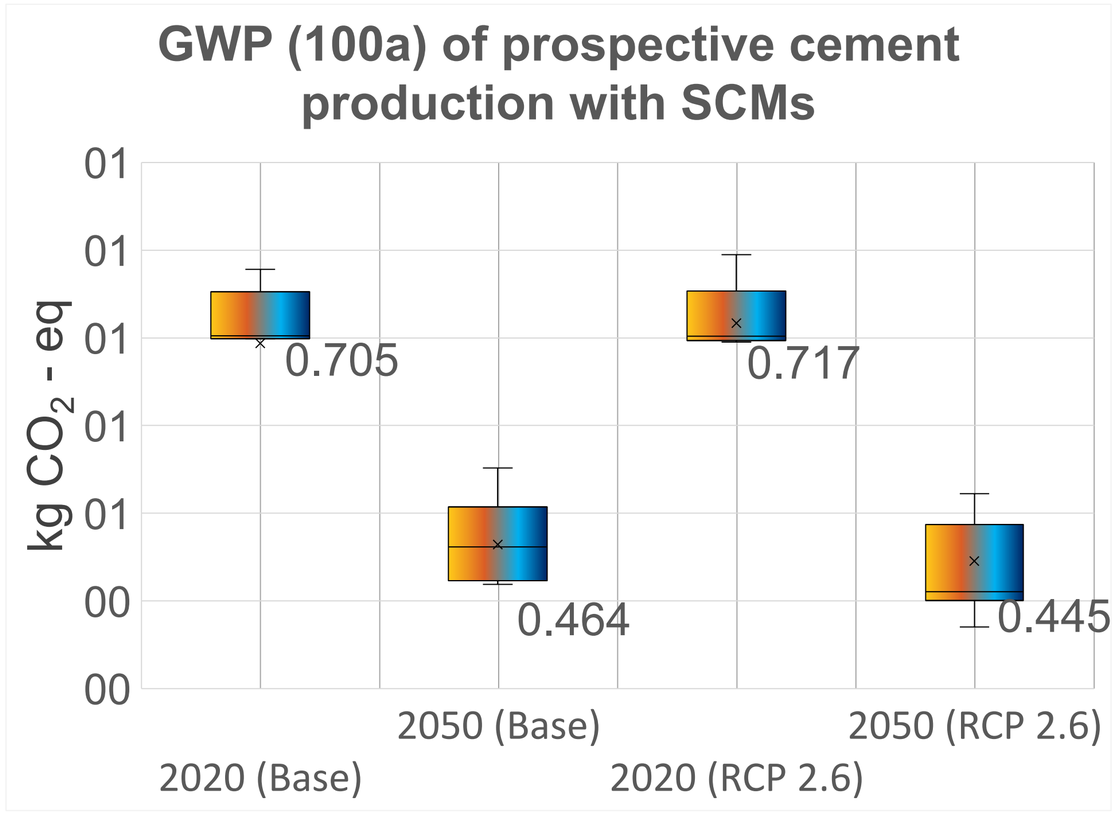


Figure 1: Environmental impact of prospective cement production with SCMs

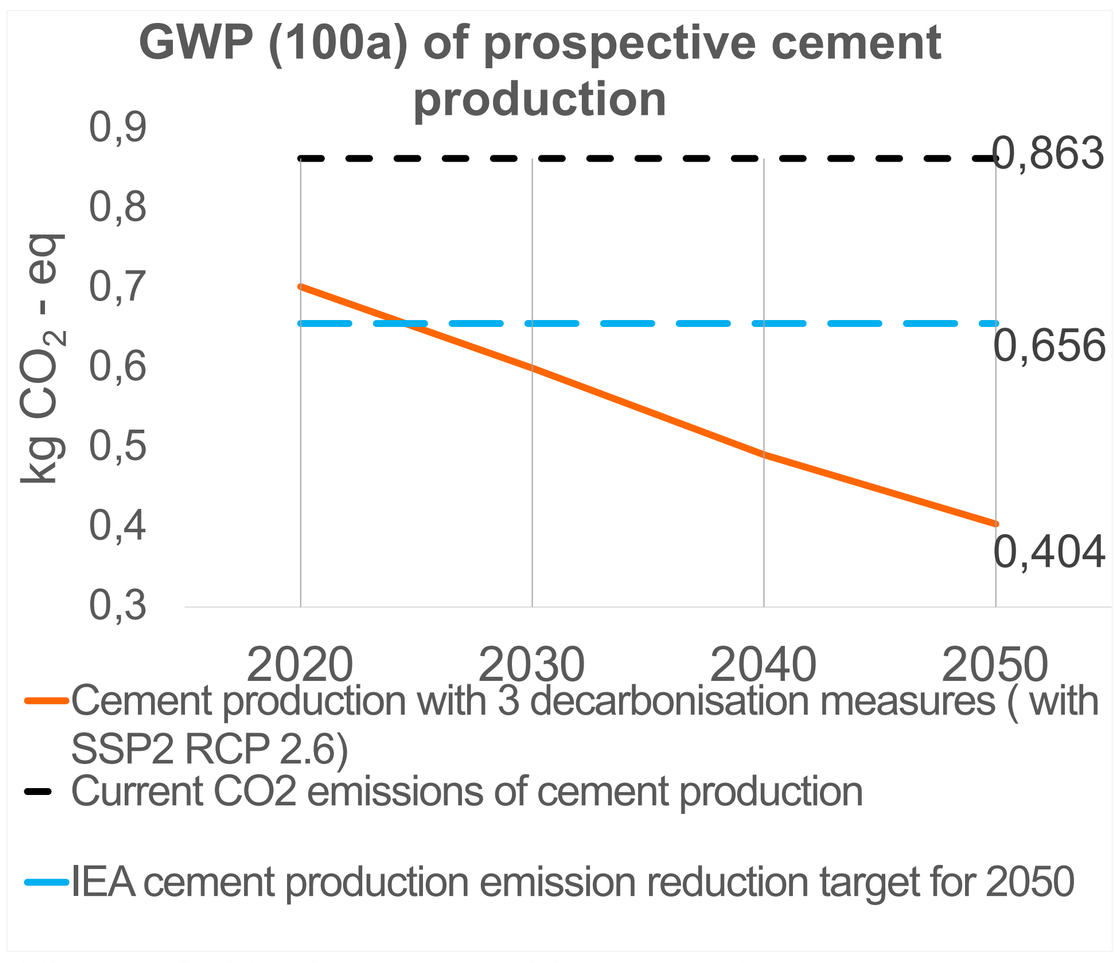


Figure 2: Environmental impact of current cement production, IEA target for 2050 and prospective cement production.

## Conclusion

- SCM addition has the greatest potential (46%-48%) relative to other measures (alternative fuels: 23%-32%, kiln efficiency: 11%-14%) studied.
- The IEA target (28% emission reduction) can be met with introducing these 3 decarbonisation measures which, can reduce up to 50%-53% of the associated $CO_2$ emissions.
- Background scenarios (SSP2 Baseline, SSP2 RCP2.6) did not change the results significantly.

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