GLOBAL ENERGY SOLUTIONS

global-energy-solutions.org
office@global-energy-solutions.org
Lise-Meitner-Straße 9, D-89081 Ulm

CO_2 capture in the cement industry

Hans-Peter Sollinger

April 4, 2025

Schwenk-Zement test plant in Baden-Württemberg

Background and objectives

The four European cement manufacturers Buzzi SpA - Dyckerhoff GmbH, Heidelberg Materials AG, SCHWENK Zement GmbH & Co. KG and Vicat S.A. joined forces in 2019 to form the research company CI4C GmbH & Co. The aim of the joint

catch4climate" project is the development and implementation of an innovative CO_2 capture technology for the cement industry. To this end, a test facility was built on the site of the SCHWENK cement plant in Mergelstetten, which uses the pure oxyfuel process for the first time.

With an investment volume of over 120 million euros, the company is building its own rotary kiln line with a clinker production capacity of 450 tons per day. It will be used exclusively for research and development purposes in order to investigate the technological feasibility and efficiency of CO_2 separation under real conditions.

The pure oxyfuel process (oxy= oxygen, fuel= fuel) is an innovative process for CO_2 separation in cement production. In contrast to conventional clinker burning processes, pure oxygen is fed into the kiln instead of ambient air. This has the advantage that atmospheric nitrogen is excluded. This enables almost complete separation of the CO_2.

The overarching goal of the project is to capture 100 per cent of a cement plant's CO_2 emissions in a cost-efficient manner and thus significantly advance the decarbonization of the cement industry.

Potential use and significance of the captured CO_2

The amount of CO_2 captured as part of "catch4climate" can be reused for various industrial applications or stored permanently (CCU - Carbon Capture and Utilization / CCS - Carbon Capture and Storage). Carbon is an essential raw material for numerous branches of industry, for example:

- Fertilizer production

- Production of synthetic fuels

- Plastic-based medical hygiene products

To date, this carbon has mainly been extracted from fossil fuels. By capturing CO_2 from the cement industry, a sustainable alternative can be created that closes the industrial carbon cycle and significantly reduces CO_2 emissions.

The cost side

The implementation of CCUS technologies in the cement industry is associated with considerable costs. According to a study by DECHEMA, the costs for CO_2 capture amount to around 50 to 80 euros per tonne of CO_2. As the production of one tonne of cement generates around 600 kilograms of CO_2, these capture costs correspond to around 30 to 48 euros per tonne of cement. Transport costs of 10 to 60 euros and storage or usage fees of 5 to 20 euros per tonne of CO_2 are also incurred. Overall, this results in CO_2 avoidance costs of 65 to 160 euros per tonne of CO_2, which can lead to a price increase of 40 to 95 euros per tonne of cement.

Rising CO_2 prices under the European Emissions Trading System (EU ETS) increase the economic attractiveness of CCUS technologies. At a CO_2 price of €85 per tonne, cement plants would have an incentive to reduce their emissions by around a third in order to avoid the costs of purchasing emission certificates. At a price of 141 euros per tonne of CO_2, almost complete decarbonization could even be economically viable.

The implementation of CCUS in the cement industry leads to considerable additional costs per tonne of cement. However, rising CO_2 prices are making investment in such technologies increasingly economically attractive, as they help to avoid costs for emission certificates and ensure competitiveness in the long term.

Outlook and significance for the cement industry

The aim of "catch4climate" is lay the foundations for the large-scale use of CO_2 capture technologies in the cement industry. The knowledge gained will help to further develop the process and transfer it to an industrial scale. The project thus represents an important milestone for the decarbonization of cement production and the reduction of global CO_2 emissions.