

Pathway to Zero Emissions at Cement Plants



Using Cryogenics to Reduce Global Emissions

Second in the Hero to Net Zero Series

Concrete is an integral component of our society. Few can doubt the importance of cement production. In this article, the cement industry is presented as just one of the many industrial Heroes in modern society. Cement supplies one of the essential elements for concrete, which provides the infrastructure for highways/roadways, housing, hospitals, public transport, urban spaces, and more.

After water, cement ranks second in the list of the highest-used substances in the world. Think of cement as the glue keeping all the ingredients in concrete together. The history of cement dates back nearly 2,000 years to ancient Rome and Greece, when lime was mixed with volcanic ash and water to form a binder.

The approximate 2,275 cement plants across the globe produce around 3.5 billion tonnes of Ordinary Portland Cement, and this production alone accounts for an estimated 5-8% of the global CO₂ emissions. Like many critical industries, such as the production of iron, steel and various chemicals, cement is pursuing multiple options to achieve zero emissions by 2050.

Enter Cryogenic Carbon Capture™ (CCC), developed by Chart's Sustainable Energy Solutions (SES), to treat the flue gases. The patented process technology diverts the exhaust gas stream and applies the thermodynamics of pressure and temperature to freeze the carbon while releasing the clean, treated air into the atmosphere. This post-combustion capture technology removes up to 95-99 percent of CO₂ emissions without using chemicals or membrane technologies. The years of research provides documented evidence that CCC uses less energy than other carbon capture strategies.

OSTI.GOV/Conference: Cryogenic Carbon Capture Techno-economic Analysis - The Cryogenic Carbon Capture™ (CCC) process significantly decreases cost and energy demands for CO₂ separation and pressurization to 150 bar compared to alternatives. Cryogenic Carbon Capture™ Technoeconomic Analysis (Conference) | OSTI.GOV

The US Department of Energy (DOE) provided funding for 9 months of onsite CCC testing at a commercial cement plant in the United States. During this testing, the system captured CO₂, converted it to merchant liquid form, stored and transported it in a LCO₂ liquid cylinder. For the downstream CO₂ demonstration, the liquid form of carbon was used to cure concrete. The CCC Re-use integration was the first field test showing that capturing CO₂ from cement production can be sequestered in its main product stream – concrete.

Kicking Carbon to the Curb

A potential game-changing solution for cement and other industrial CO₂ emissions is the Reuse application pioneered by CarbonCure and used in hundreds of plants worldwide. Their technology injects the ‘recycled’ CO₂ into fresh concrete, permanently embedding the carbon without compromising performance. www.CarbonCure.com.



In September 2021, Chart signed an agreement with FLSmidth to advance carbon capture in the cement industry. FLSmidth provides engineering, equipment, and service solutions to the cement industries and mining. [Carbon Capture Collaboration | Chart Industries](#)

Jill Evanko, CEO, and President of Chart, said: “We are delighted that FLSmidth has entered into this important agreement with Chart to advance our carbon capture technology in the cement industry. FLSmidth’s strong reputation and knowledge of the global cement industry will facilitate our growth and place Chart at the heart of the cement industry’s efforts to reach Net Zero.”

Deploying CCC and CCC Re-use technologies can be part of the solution to achieve deep emission reductions post-combustion to near zero, bringing the cement sector emissions to near zero by 2050. Cement plants are a decisive part of economic and social development—an essential **Hero** industry working to achieve **Net Zero** emissions.

For more information on CCC - [Carbon Capture | Chart Industries](#)
(www.chartindustries.com/ccc)