Cement Manufacturing

CLEAN AIR TASK FORCE

Sector Overview

Concrete is the most widely manufactured material on Earth. Cement acts as the essential binder in concrete and is therefore an essential input to nearly all infrastructure construction, including buildings, roads, and bridges. Cement is produced by crushing limestone and other minerals, then heating the mix to ~2,600 °F in a kiln through a process called calcination, forming clinker. About 60% of emissions come from this chemical process, with the rest from fuel combustion and electricity. Finally, the clinker is ground with gypsum to make cement.

Data Overview

Number of employees	Annual payroll ($ billion)	High-Emitting Facilities[1]	GHG Emissions (MMT CO2e)	GHG Emissions (% of total U.S. Emissions)
12,301	0.82	92	69	1.1%

Note 1: High emitting is defined as greater than 0.025 MMT CO2e/year

1. EPA FLIGHT 2. U.S. Census Bureau CBP 3. EPA GHG Overview

Leading Decarbonization Technologies

Feedstock substitutions and alternative production processes

Innovations in cement chemistry and process engineering allow for entirely new production pathways that rely on non-traditional raw materials and lower-temperature processes that avoid using a kiln entirely. These approaches aim to eliminate the need for limestone and high-heat processes altogether, reducing both process emissions and energy demand. Two startups receiving DOE funding (Sublime Systems and Brimstone Energy) are actively building demonstration plants to field-test these technologies, with full production planned as early as 2026.

Clinker substitution

Replacing traditional clinker with alternative materials like slag, fly ash, calcined clays, and limestone can significantly lower the carbon footprint of cement. These substitutes reduce the need for energy-intensive clinker production while maintaining comparable performance in many applications. Many clinker substitutes are already viable today (limestone), while others are rapidly approaching commercial availability (calcined clay).

Carbon capture, utilization, and storage (CCUS)

CCUS technologies capture CO_2 from cement plants before it reaches the atmosphere. The captured CO_2 can either be stored underground or reused in industrial processes, helping to decarbonize production even when traditional materials and processes are used. This technology pathway has the potential to massively reduce cement sector emissions, but requires significant investment into new infrastructure.

Policy Recommendations

Industrial Capital Financing

Offer low-interest loans or direct financing for cement plants investing in low-carbon technologies like CCUS, electric kilns, or alternative feedstocks. Reducing capital risk accelerates project deployment.

Funding for Industrial Pilot & Demonstration Projects

Create or co-fund state pilot and demonstration programs to support emerging cement technologies like electrochemical reactors and advanced clinker substitutes. States can partner with federal agencies, universities, and national labs to scale innovations faster.

Industrial Capital Financing

Use CfDs to cover the cost gap between conventional and lowcarbon cement, ensuring price stability during early market adoption. CfDs are technologyneutral and phase out as clean products scale.

Industrial Capital Financing

Adopt procurement standards for cement and concrete in public construction. Start by requiring Environmental Product Declarations (EPDs) and rewarding bids with lower embodied carbon, creating consistent demand for cleaner materials.