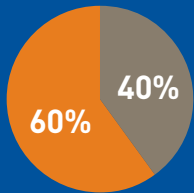


CLINKER:

The key chemically reactive ingredient used to produce cement.

The first step to making cement is producing the key ingredient: clinker. Clinker is produced from quarried materials such as limestone, clay, shale, and sand.



The key chemical reaction in cement manufacturing happens during the creation of clinker and is a major source of CO₂ production.

This reaction, our chemical fact of life, is responsible for more than 60% of CO₂ emissions from cement manufacturing. The other 40% comes from the combustion needed for this chemical fact of life.

What can we do?

We can reduce the energy required to produce clinker, thanks to the following:



Decarbonated Raw Materials

- Heating limestone to produce clinker releases CO₂. To reduce emissions, manufacturers can use decarbonated raw materials as opposed to virgin raw materials. Decarbonated raw materials have already been processed and no longer contain CO₂.
- These decarbonated materials often end up in landfills. By using them in cement production, materials are diverted from landfills and brought back into the circular economy.
- **Today, these materials represent less than 5% of cement manufacturers' raw material input. With policy changes, the percentage could double.**



Lower-Carbon Fuels

- Clinker production requires temperatures of nearly 3,000 degrees Fahrenheit. Using lower-carbon fuels and biomass in place of traditional fossil fuels reduces CO₂ created in the combustion process.
- Today, the industry's fuel mix includes 60% fossil fuels. The industry wants to reduce the percentage by a factor of five, with a goal of no more than 10% fossil fuel use by 2050. While cement plants are equipped to use lower-carbon fuels, they need the right policies and regulations to increase their use.
- **Displacing traditional fossil fuels with natural gas in the near term can cut CO₂ emissions by 24%.**



Improving Energy Efficiency

- Since 1990, the cement industry has improved energy efficiency by 20%.
- Cement manufacturing is already one of the most energy-efficient industrial processes, with technologies operating above 80% thermal efficiency. Many plants are U.S. EPA ENERGY STAR certified for performing in the top quartile.
- **Our goal is to reduce energy use by more than 25% through modernizations, upgrades, machine learning, and artificial intelligence.**



Carbon Capture

- A critical part of cutting emissions in cement production will be Carbon Capture Utilization and Storage (CCUS).
- CCUS captures CO₂ so it can either be used to produce new materials or be safely and permanently sequestered.
- **Dozens of cement plants around the world are undergoing research and testing for CCUS projects—there are four in the U.S. and more to come with additional funding from the Department of Energy.**