ENERGY STAR®
INDUSTRIALINSIGHTS™

Cement Manufacturing Plants

US Cement Manufacturing

NAICS: 327310

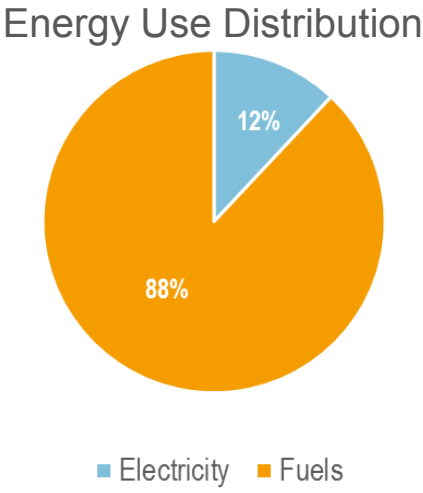
- 101 Cement Plants
- 26 Companies
- 38 States & Territories with Plants
- 27 ENERGY STAR Plants (2014)

Cement manufacturing plants process limestone and other raw materials to produce *clinker* that is either ground to make finished cement or shipped to clinker-grinding mills that produce blended cement products. Cement is a key ingredient in concrete, mortar, and other building products. Cement manufacturing is one of the most energy-intensive industries in the United States.

The US Environmental Protection Agency's ENERGY STAR partnership has worked with the cement industry since 2002 to promote energy efficiency and best practices within the sector through the ENERGY STAR Industrial Focus initiative.

Energy Use Profile

Coal, pet coke, and electricity are the dominant energy sources used in cement plants, although plants will burn a variety of other fuels, including tires and other waste fuels.



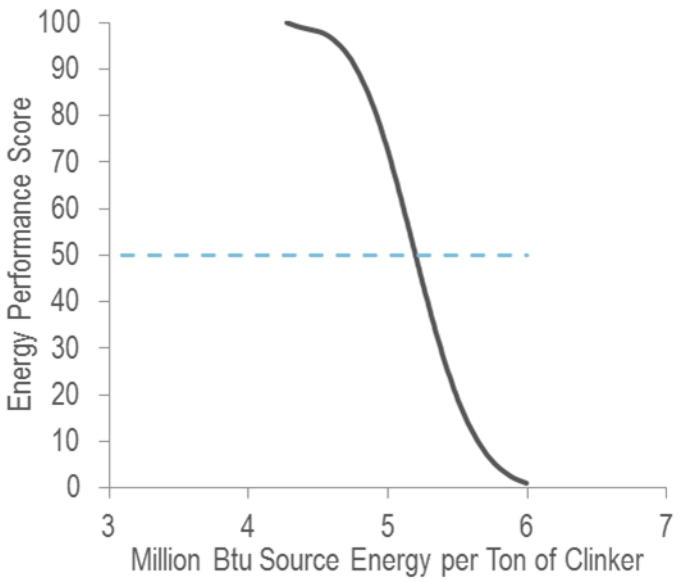
Electricity and fuel use in cement plants vary by kiln type and number. The table below provides an estimate of total energy use for each plant size category.[1]

Plant Energy Use	Electric (MWh)	Fuels (MMBtu)
Small	~63,900	~1,633,060
Medium	~124,000	~2,906,400
Large	~221,000	~5,546,030

Fuel is the largest energy cost, representing 54% of energy costs. In 2012, cement plants spent over $680 million on fuels and over $570 million on electricity.[2]

Distribution of Energy Performance

EPA, through the ENERGY STAR Cement Manufacturing Industrial Focus, has benchmarked the energy performance of cement plants. The curve below, generated from the ENERGY STAR Energy Performance Indicator (EPI) for Cement Plants benchmarking tool, shows the normalized distribution of energy performance for a representative cement plant. The dashed line corresponding to the performance of an average plant is provided for reference. An Energy Performance Score (EPS) of 75 or higher is used by EPA as the threshold for efficient plants.



This curve shows that the greatest energy efficiency opportunities are in plants in the lowest percentiles (< 20%). Here, improvements are likely to be found optimizing systems and operations. The range of performance for plants in the middle and upper quartiles (> 50%) is fairly narrow, meaning there are less opportunities for major improvements. New technologies will be needed to drive greater efficiencies in the upper quartiles.

Major Energy Uses

There are two main types of cement manufacturing processes: dry and wet. Most US plants use the dry process. Fuels are used primarily for heating kilns to produce clinker. The largest electricity use is in powering the grinding mills.[3]

Use / Process	Share of Energy Use
Kiln feed preparation	2 to 5%
Clinker production	90 to 93%
Finish grinding	5%

While companies report conducting a variety of energy projects, often they focus on non capital and short payback projects given the large cost of capital projects. The table below outlines common projects by cost:

No Capital Cost	Short Payback	Capital Intensive
Preventative maintenance	Control systems	Efficient grinding mills
Kiln seal replacement	High efficiency classifier	Roller mill upgrade
Shell heat loss reduction	Combustion optimization	Grate cooler
Compressed air repairs & optimization	Indirect firing	Low-pressure drop preheaters
Intergrinding limestone	Grate cooler optimization	Multi-stage preheaters
Reduce cement fineness	High efficiency motors	Precalciner upgrades
	Adjustable speed drives	

ENERGY STAR Resources

The ENERGY STAR Cement Manufacturing Industrial Focus, a collaborative effort between EPA and the industry, has developed the following tools for energy efficiency in cement plants:

- **Energy Performance Indicator** (EPI): Benchmarks and rates plant energy performance.
- **Energy Guide**: Technical guidance on energy saving opportunities.

ENERGY STAR Certified Plants

EPA's ENERGY STAR program certifies cement plants that demonstrate energy performance in the top quartile nationally. In 2013, 20 plants earned ENERGY STAR certification by scoring 75 or higher on the Cement Plant EPI.

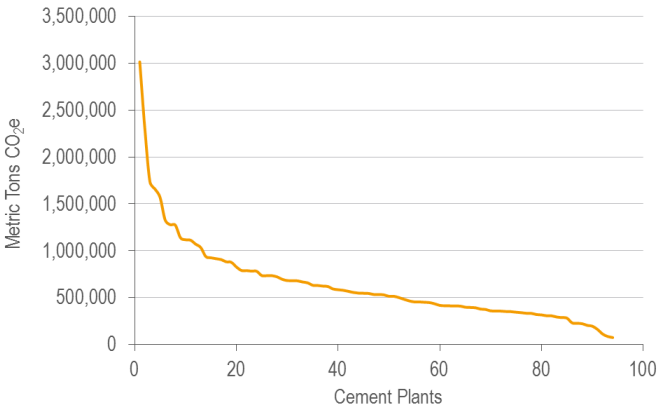
References:

1. Based on data used to develop the Cement EPI. For more information, see: Measuring Improvement in the Energy Performance of the U.S. Cement Industry, Boyd and Zhang (2011). The Plant Energy Use table was complied to show plant-level consumption for representative small (10th percentile), medium (median), and large (90th percentile) plants.
2. 2012 Economic Census
3. ENERGY STAR Energy Efficiency Improvement and Cost Saving Opportunities for Cement Making
4. EPA Greenhouse Gas Reporting Program Database (ghgdata.epa.gov)
5. Estimate calculated from purchased electricity in 2012 Economic Census
6. Estimate based on 2008 electricity data used to develop the Cement EPI

Greenhouse Gas (GHG) Emissions

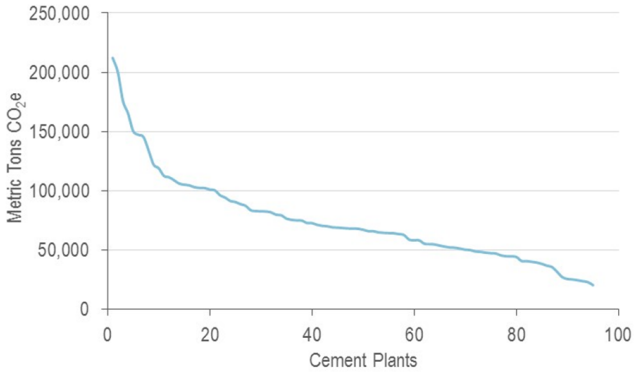
Direct GHG emissions from cement plants come from the limestone calcination process and on-site fuel use. Ninety-four plants reported direct emissions to EPA's Greenhouse Gas reporting program in 2012, totaling 60.0 million metric tons of CO_2e ($MMTCO_2e$).[4] As shown below, emissions ranged from 3,015,918 to 72,673 $mtCO_2e$ and averaged around 638,000 $mtCO_2e$.[4] Four plants reported no emissions since they were idle.

Direct Emissions Distribution



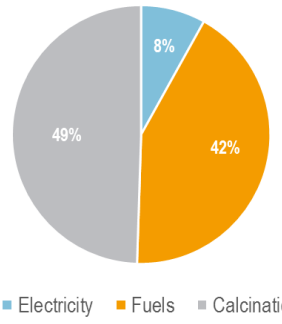
Indirect emissions from purchased electricity were around 5.6 $MMTCO_2e$ in 2012.[2] The distribution of indirect emissions is

Indirect Emissions Distribution



Total emissions from cement plants were 65.6 $MMTCO_2e$ in 2012.[2,4] The calcination process is the largest source of GHG emissions, as shown below.

GHG Emissions by Source



United States Environmental Protection Agency