



The U.S. cement industry is dedicated to manufacturing a superior product while continuously challenging manufacturing policies and procedures to improve energy efficiency and minimize emissions. The industry's commitment has paved the way for similar efforts around the world.

### **Four Steps to Produce Cement**

Portland cement manufacturing is a four-step process:

1. Virgin raw materials, including limestone and small amounts of sand and clay, come from a quarry usually located near the cement manufacturing plant.
2. The materials are carefully analyzed, combined and blended, and then ground for further processing.
3. The materials are heated in a very large kiln, which reaches temperatures of 1,870 degrees Centigrade (3,400 degrees Fahrenheit). The heat causes the materials to turn into a new marble-sized substance called clinker.
4. Red-hot clinker is cooled and ground with a small amount of gypsum. The end-result is a fine gray-colored powder called portland cement. This cement is so fine that one pound of cement powder contains 150 billion grains.

### **Maintaining Quality While Adding Efficiencies**

Reducing the use of virgin raw material in the manufacturing process while maintaining superior quality is a long-standing priority for cement and concrete manufacturers. The industry has been able to reduce their reliance on virgin raw materials by utilizing industrial byproducts as part of the manufacturing process. These materials include:

- Foundry sand, a byproduct of metal casting
- Mill scale, a material recycled from the iron and steel industries
- Fly ash, a byproduct of coal combustion at electric power utilities
- Lime sludge, a waste product generated by recycling paper

Most recently, the industry successfully advocated a change in the U.S. portland cement manufacturing standard (ASTM C 150) to permit the use of up to five percent ground limestone. The added use of ground limestone will significantly reduce emissions and provide key environmental benefits such as reducing carbon dioxide emissions by approximately 2.6 percent per ton of cement produced, with an annual reduction of 2.5 million tons.

Additionally, the industry has been able to recycle most of the byproduct produced through its own manufacturing processes. The industry recycles more than 75 percent of cement kiln dust – nearly eight million tons each year – directly back into the cement kiln. By recycling this dust, the need for limestone, raw materials and energy is reduced.

## Improving the Global Environment

Since 1975, the cement industry has improved energy efficiencies by 33 percent. Today, the cement industry accounts for less than 1.5 percent of U.S. CO<sub>2</sub> emissions, well below other sources such as electric generation plants (33 percent) and transportation (27 percent). According to the Department of Energy, U.S. cement production now accounts for only 0.33 percent (1/3 of 1 percent) of energy consumption — the lowest level compared to petroleum refining at 6.5 percent, steel production at 1.8 percent, and wood production at 0.5 percent

The concrete and cement industries were among the first groups to tackle the issue of climate change. Beginning in the mid-1990s, the industry strengthened its commitment to improve manufacturing processes to minimize emissions, waste, energy consumption and the use of raw materials.

Cement and concrete manufacturers worked in tandem with the U.S. Environmental Protection Agency (EPA) and the agency's Climate Wise Program to develop a way to measure and record carbon dioxide emissions. Subsequently, the industry adopted a voluntary goal to reduce carbon dioxide emissions from cement manufacturing by 10 percent per ton produced below the 1990 baseline level by 2020.

To achieve this goal, the cement industry is focusing on three areas:

1. Taking advantage of new technologies by integrating state-of-the-art equipment to improve energy efficiency of the manufacturing process
2. Improving product formulation to reduce energy of production and minimize the use of natural resources. For example, introducing crushed limestone and industrial by-products such as fly ash in cement.
3. Conduct research and develop new applications for cement and concrete that improve energy efficiency and durability

To track industry progress towards realizing these goals, each year PCA releases a Report on Sustainable Manufacturing. The Report provides a comprehensive overview on the cement industries efforts to minimize its environmental footprint, providing insight on emissions, sustainable manufacturing practices, sustainable building practices, community outreach and health & workplace safety. This can be found at the PCA website [www.cement.org](http://www.cement.org) under Sustainability, or at [www.ConcreteThinker.com](http://www.ConcreteThinker.com) under Sustainable Solutions/Stewardship.