



THE PREMIER AGGREGATE

CemStarsm process: Slag Usage Raises Productivity, Operational Efficiency, Lowers Emissions

Environmental regulations place increasingly stringent demands on cement production, while optimizing process efficiency is vital for sustainable profitability. The patented CemStarsm process offers the capability to boost production and improve kiln operations while lowering emissions.

Challenge:

During the past several years, the U.S. cement industry has been faced with significant increases in demand while production capacity has remained below this market level. While several capacity expansions projects across the country are working to narrow the gap, imports of cement and clinker to the USA have increased to around 22.7 mm Mt (25mm short tons) annually. Along with this, there has been an increasing focus on emissions from cement production facilities, primarily resulting from heightened awareness of the potential impact that greenhouse gas can have on the environment as well as regulatory requirements to address ground-level ozone levels.

Solution:

Texas Industries, Inc. (TXI), a U.S. producer of cement, aggregates, concrete, steel and other construction materials, has developed a process technology that enables cement producers to address issues concerning both production and emissions. CemStar, the patented process that uses the chemical and physical characteristics of blast furnace and steel furnace slags to augment cement clinker production, evolved from a project that set out to investigate synergies between cement manufacturing and steel making.

The basis of the CemStar process is slag and its direct addition to the cement clinker manufacturing process. The result is an increase in production of up to 15% with no net increase in emissions. Due to the chemical composition of the slag, the material requires little or no additional fuel to convert it into cement clinker, resulting in lower total fuel consumption per ton of clinker. The result is not only a production boost, but also a net reduction of carbon dioxide (CO₂) and oxides of nitrogen (NO_x) emissions per ton of clinker produced.

The U.S. Patent Office issued two patents for the CemStar process in 1995 and 1996 and a number of foreign patents have subsequently been issued as well. Since that time, TXI has achieved significant production increases at its own plants, implemented a commercial program and has licensed CemStar to a number of cement producers in the U.S.

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Production Benefits

CemStar provides a significant increase in production, and in strong markets, more production helps improve profitability. Figure 1 uses data from a CemStar plant to illustrate the sustained production boost from the process.

Adding CemStar to an existing operation will positively impact not only production, but other operational benefits include improved kiln stability, fine tuning of clinker chemistry, consistent quality, and better recovery from kiln upset conditions.

Finally, traditional ways of expanding clinker production capacity are resource-intensive and time consuming. Conversely, installation of a CemStar process system can be

accomplished in a relatively short period of time, with minimal disruption in continuous kiln operations, all at a significantly lower cost than required for more traditional process capacity upgrades.

Environmental Benefits

Implementation of the CemStar process has been shown to have a beneficial net effect on emissions from the cement manufacturing process, namely an overall reduction of CO₂ as well as NO_x emissions. Extensive testing has been conducted to quantify the emissions reductions gained from implementation of the CemStar technology, showing significant decreases of NO_x and CO₂ emissions when compared to baseline data:

- ⊗ Reductions of NO_x on a pound/short ton clinker or a g/kg clinker basis ranged from 25% to 45%.
- ⊗ CO₂ reductions achieved ranged between 5% to 10% on a ton of CO₂/ton clinker (kg/kg clinker) basis.

In 1999, the United States Environmental Protection Agency recognized the emission-reducing CemStar process by presenting the company with the International Climate Protection Award as well as a Special Recognition Award in association with EPA's Climate Wise Partner Program. The technology has also been cited by the EPA as a recognized alternative method for reducing NO_x emissions in the cement industry.

Overall, CemStar offers producers simultaneous means to produce more clinker, improve operational efficiency and stability while providing significant net emissions reductions.

