

VALUE PROPOSITION

CEMENT INDUSTRY

SOLUTIONS

Integrated Architecture
from Rockwell Automation®

- PowerFlex™ 7000 medium voltage variable frequency drives: 4160V, 2000 Hp and 1460V, 800 Hp
- 20 Allen-Bradley® low voltage variable frequency drives
- 152 Allen-Bradley IntelliCENTER® low voltage motor control center sections
- Allen-Bradley ControlLogix® programmable controllers
- 500 Allen-Bradley E3 Plus electronic overload relays
- Six Entek® 6600 vibration monitor systems

RESULTS

- Surpassed production goal in first six weeks following start-up
- Maintenance cost per ton decreased by almost 10%
- 20% cost savings on wiring
- 20% start-up time-saving

Integrated Architecture Helps Phoenix Cement Reduce Maintenance Costs by 10%

IN THE COMPETITIVE CEMENT PRODUCTION MARKET, TECHNOLOGY IMPROVEMENT IS VITAL TO INCREASE PRODUCTION AND REVENUE.



In production for almost five decades, the Phoenix Cement Company in Clarkdale, Arizona, modernized its control systems with help from Rockwell Automation.

BACKGROUND

Phoenix Cement™ Company is an enterprise integrated with the Salt River Sand and Rock Company under the Salt River Materials Group (SRMG) trade name in Arizona. The company's lone cement plant in Clarkdale, Arizona was originally built by American Cement Corporation in 1959 to supply the construction of the Glen Canyon Dam. It had three cement kilns, a capacity of 336,000 tons per year and supplied more than one million tons of cement over nearly five years to complete the dam.

The plant was expected to sit idle following the dam construction, but demand in Phoenix, northern Arizona and areas of New Mexico, was sufficient to justify continued operation for the next three decades. The Clarkdale plant underwent several changes over the



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From the Phoenix Cement Company's control room, operators can access plant and production data, and monitor motors using Integrated Architecture technology from Rockwell Automation.

years until it reached its maximum rated capacity of approximately 650,000 tons per year in the early 1990s.

CHALLENGE

Throughout the 1990s, Phoenix Cement™ saw its market share drop steadily as its aging equipment technology resulted in capacity limits and high unit costs that threatened the company's ability to remain competitive.

To accommodate increased sales, reduce regulated emissions, and reduce per ton production costs, the management of Phoenix Cement™ sought to modernize the plant and increase production capacity. The company began negotiations in 1998 to build a state of the art new kiln line with a five-stage preheater/precalciner, a vertical raw mill, and a vertical cement finish mill with an annual capacity of over 1.1 million tons - an increase of more than 65%.

"The challenge was to find an automation control system that would

meet the plant's goals of high reliability, system program flexibility, and provide as much equipment operating information as possible," said Gregg St. Clair, Vice-president Cement Operations for Salt River Materials Group at the Phoenix Cement™ Plant.

The upgrade required automation control systems to run its induced draft (ID) fans, main processing equipment, material handling conveyors, and a smart diagnostic and communication system that would help save time and money.

SOLUTION

Phoenix Cement™ turned to Rockwell Automation for innovative control system solutions. Rockwell Automation recommended an Integrated Architecture design to enable Phoenix Cement™ to reduce development time and costs, improve control and monitoring, respond more quickly to customer or market demands, and easily access plant and production data from business systems.

The Phoenix Cement™ team was already comfortable with the Allen-Bradley PLC-5® (programmable logic controllers) running on the existing line, and was impressed with the ControlLogix capabilities demonstrated at an Automation Fair® trade show. The team also saw the benefits of the Allen-Bradley IntelliCENTER motor control center using DeviceNet™ to access critical motor data via the E3 Plus electronic overload relay and the DeviceNet Starter Auxiliary (DSA).

By using the Logix platform, Phoenix Cement™ was able to span multiple control disciplines in a single, easy-to-use programming environment. Using the networks with the Allen-Bradley ControlLogix system helped to reduce wiring and installation costs. In addition, maintenance costs were reduced because it is easier to access data used for analysis.

The control system utilizes six ControlLogix processors for each major functional area: the raw mill, preheater, coal mill, cement mills and storage. ControlLogix programmable controllers provide the required tight integration between the programming software, controller and I/O to reduce development time and cost at commissioning and during normal operation.

Attached to the ControlLogix via DeviceNet are two Allen-Bradley Powerflex 7000 medium voltage drives rated for 2000 Hp and 800 Hp; 20 Allen-Bradley low voltage drives; 152 Allen-Bradley IntelliCENTER motor control center sections with over 500 Allen-Bradley E3 Plus electronic overload relays; and six Entek 6600 vibration monitor systems on critical fans - all supplied and networked by Rockwell Automation to

work together with the control systems. Integrated DeviceNet network communication capabilities allow Phoenix Cement™ to access data in its intelligent sensors and actuators.

The PowerFlex 7000 medium voltage variable speed drives allow improved process control and reduce costs through energy savings, reduced maintenance and increased life of mechanical equipment. Soft starting and speed control of the fan at the optimum operating point provide maximum efficiency, resulting in substantial energy savings.

The low voltage drives use the latest in Insulated Gate Bipolar Transistor (IGBT) power technology and sophisticated control algorithms to provide smooth performance, exceptional torque at any speed, and quiet, efficient operation.

The Entek 6600 vibration monitor system monitors and protects machinery against high vibration and the resulting damage. It also monitors associated process parameters such as temperature, pressure, and flow, as well as Turbine Supervisory Instrumentation (TSI) parameters including thrust, differential and case expansion, valve position, and eccentricity.

The IntelliCENTER motor control centers integrated many controlling devices into one package. Multi-function, solid-state microprocessor-based electronic E3 overload relays were used to protect induction motors and provide ambient compensated overload protection. The E3 overload relays also include advanced features such as warning diagnostics, variable frequency, true RMS current sensing,



PowerFlex 7000 medium voltage variable speed drives improve process control and help provide maximum efficiency and energy savings.

and I/O capabilities to allow for remote monitoring and diagnostics via IntelliCENTER software.

RESULTS

Civil work began in May of 2001 with the first cement produced from the new kiln line on October 18, 2002. After implementing this new system, Phoenix Cement™ surpassed its production goal in the first six weeks following start-up. In the first two full years of operation, operational and maintenance cost per ton decreased by almost 10%. The process is now more efficient and able to meet future challenges.

With the increase in cement demand accelerating in 2004, the company's modernization has been critical to its long term future and its ability to keep pace with rapid growth in Arizona. The Allen-Bradley control and power products are a major contributor in this achievement. Start-up time savings has been estimated at 20% due to DeviceNet capabilities and elimination of the electrical contractor

change orders that can add significant cost. Rockwell Automation engineers performed an efficient start-up and provided training on the operation of the Allen-Bradley control systems and drives.

Rob Prouty, Electrical Engineer at Phoenix Cement™, said, "It was the smoothest, easiest startup of a project this size that I have ever been involved in."

The majority of the motor starters connected to DeviceNet, so wiring between the marshalling panel and the MCC was greatly reduced or eliminated, resulting in additional up-front cost savings of 20%, as estimated by Phoenix Cement™.

Operation and maintenance staff at the plant have come together too, as a result of the intelligent motor controls and the associated information available. Electrical technicians can quickly assess the status of any motor through four input lights on the E3 Plus or check alarm status or current values using a

terminal connected anywhere in the Integrated Architecture system, making it easier to access critical maintenance data from anywhere in the plant.

New maintenance techniques and processes have also resulted from the use of the information coming from the E3 Plus overload relays. For instance, an operator, through use of a threshold alarm, can pinpoint the location of a plugged air slide as a particular motor current draw is reduced due to the lack of loading. Also, operators can gather source data on a fault such as a tripped pull cord and often remedy the situation without involving maintenance. The maintenance supervisor can trend motor current on a motor in a troublesome process area to better understand the root cause of problems and initiate process improvement.

Effective use of information from the intelligent motor control centers has resulted in a more cohesive operation and maintenance team that works together. Using DeviceNet to troubleshoot motor and equipment problems from the control room has also helped improve safety.



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The control room supervisor can determine problems with the equipment and alert the field personnel on what to expect before they begin working on it. The facility and control system upgrades implemented in almost every phase of Phoenix's cement operation have led to improvements in quality, production, and safety.

"Working with Rockwell Automation on this project has been a win-win for Phoenix Cement," said Gregg St. Clair, Vice-president Cement Operations.

"With costs rising dramatically in virtually every area from energy to health care, the cost efficiencies and increased capacity we've achieved through this modernization have completely redefined our future. From day one through almost seven years of operation, Rockwell Automation's equipment, customer service, and innovative solutions have been superior and helped establish Salt River Materials Group's Phoenix Cement™ plant as one of the premier cement plants in the United States."

The results mentioned above are specific to Phoenix Cement Company's use of Rockwell Automation products in conjunction with other products. Specific results may vary for other customers.

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