Enabling the connected cement plant

Rockwell Automation process solutions for cement
The world is changing. So are cement needs. Worldwide trends will greatly impact the cement industry in the near future. The world population is expected to grow from 7.6 to 9.7 billion people by the year 2050 — a growth of 22%. Of that growth, an additional 2.5 billion people are expected to live in cities, increasing the demand for solid urban infrastructure.

These changes in world population will directly impact the cement industry. Global cement demand is set to grow between 12 and 23% by 2050. And we can’t ignore the need for green construction and de-carbonization. New investments and policy in place bolster the need to meet these global emissions targets in cement production.
Operational challenges and how they affect profitability

Cement accounts for at least 5% of anthropogenic emissions of greenhouse gases

Energy consumption accounts for up to 40% of production costs

Almost every industrial operation loses at least 5% of its productive capacity from downtime

In average 150 people work in a cement plant

Production costs:
- Energy costs (Electrical and fuel)
- Maintenance costs:
  - Repair and maintenance labor
- Other fixed costs:
  - People
  - Training
  - Offices
  - Depreciation

Energy consumption accounts for up to 40% of production costs

In the cement industries maintenance cost consumes approximately 25% of total production cost

On average 150 people work in a cement plant

Market uncertainties can keep cement prices stagnated

OEE:
- Availability
- Performance
- Product quality

Average sales price

Material produced/sold

Revenue

Earnings before interest and taxes (EBIT)

Invested capital:
- Operating working capital (Inventories, cash)
- Net plant, property and equipment

Objective: Maximize Shareholder Returns
- Return on Capital (ROCE)

Sustainability: Safety
- Energy
- Air

State of the industry
PG 2

The connected cement plant
PG 4

Process solutions
PG 7

Benefits
PG 13

Source: IFC, Energystar.gov, Journal of Quality in Maintenance Engineering, ISA, KEMA
The connected cement plant turns data into business decisions

When you collect, aggregate and analyze data across operations, you can spot trends and interdependencies that are missed when data lives in silos. With this type of information, you can make more informed decisions.

Operational efficiency
Modern technologies improve performance of process, equipment, and people

Knowledge-driven operations
Solutions that enable better decision-making

Connected workforce
Modern digital tools help deliver better insights and improve field experience

Third-party integration
Quarry to market visibility
Remote expert support

Intelligent packaged power
Process solutions
Smart devices
Third-party integration
Quarry to market visibility
Remote expert support

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PlantPAx®: The modern DCS for cement applications

Cement producers have a lot to keep track of. Energy management, asset management and machine and process safety are just a few. PlantPAx DCS is the core system to help you achieve your production goals in a smart way, combining several disciplines in a unified system:

- System architecture
- Control and I/O
- Networks and virtualization
- Engineering
- Operations
- Field device integration
- Asset management
- Batch management
- Information/Production intelligence
- Machine safety
- Process safety
- Model predictive control
- Cybersecurity

of project capital cost comes from the control system, but it is the core of your production
SOLUTION AT A GLANCE

Integrated visualization

CONTENT

HMI, ERP, MES, CMMS
WEB CONTENT
IP CAMERA
USB CAMERA
PANELVIEW PLUS PANELVIEW 5000

CONFIGURATION

Provides secure configuration and content delivery.

THINMANAGER
A ROCKWELL AUTOMATION TECHNOLOGY

CONSUMERS

AREAS

Link content to the terminal by geolocation. Only allow access to screens for the electrical panels from inside the electrical room.

USERS & GROUPS

Prevent operator errors by only allowing access to relevant content. Enhance security by requiring operators to log in with fingerprint ID or a retinal scan.

DEVICES

Accessibile through cell phones and tablets to enhance employee mobility.

- Divide each monitor screen and host content from various sources. Create an operator station with a single 4K monitor instead of multiple smaller monitors positioned next to each other.
- Use the MultiMonitor function to create low-cost video walls. An open solution allows you to connect to multiple softwares.
- Pull together content from multiple systems into a single operating environment. Connect one or more monitors to a single thin client and control them all with one keyboard and mouse.

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Process solutions benefit each application area of your cement plant
Cement plant control

High availability DCS for critical applications

An integrated process control system reduces engineering risks and facilitates smoother operations and simplified maintenance.

Our high availability and scalable DCS is a perfect fit for your cement operations. Its open technology means you can seamlessly integrate process information into your business systems from field instrumentation and third-party equipment.

This means less risk and more productivity for your operations.

An integrated system reduces engineering risks and facilitates operations, maintenance and operational changes.
# Model predictive control

Process stabilization, production quality, emissions reduction, energy efficiency

## Utilities
- Reduce energy costs
- Manage use of alternative fuels
- Decrease energy cost
- Increase throughput
- Reduce energy costs
- Improve product grade quality
- Smooth transitions between cement types

## Mills
- Reduce energy cost
- Increase throughput
- Reduce blend costs
- Improve raw material resource usage
- Improve downstream performance

## Material Blending
- Reduce blend variability
- Reduce blend costs
- Improve raw material resource usage
- Improve downstream performance

## Pyroprocessing
- Increase throughput
- Decrease product variability
- Reduce energy costs
- Improve product quality
- Reduce emissions
- Improve heat recovery
- Longer campaign run and refractory life

## Analytics
- Production metrics
- Production accounting
- Efficiency measures

## Quality
- Software virtual analyzer
- Predicts quality or process variable

## Environmental
- Improve environmental compliance
Process automation and control

Integration between critical areas of your plant is essential to optimizing your cement plant. Our cement solution connects process, discrete, power, information and safety control into one plant-wide infrastructure. An integrated system reduces engineering risks and facilitates operations, maintenance and operational changes.

Engineering and operations efficiency: standards and libraries for the cement industry

We worked with leading cement companies to develop process libraries and functionalities to serve the cement industry. These tested libraries and functionalities enable faster commissioning, and provide opportunities to recognize operational efficiencies through robust standardization. All this adds up to cost savings for new plants and plant expansions.
Improved operator situational awareness

Screen example shows a specific cement customer. Standards can change according to specific company requirements.

- Effective displays
- Library of contextual display
- Objects to drive productivity

Simple and more intuitive operation
Simplified color scheme for better operator awareness
Intuitive alarm area

Working area: alignment to industry standards
Language switching

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Objects to support cement processes

Enhanced or new logic instructions and faceplates

Motor control
- Single-speed motor reversing motor
- Runtime and start counter
- Restart inhibit for large motor
- Two-speed motor
- VSD LV/MV PowerFlex® Drives
- Smart motor controller

Valves
- Motor-operated valve
- Solenoid-operated valve
- Analog/pulsed control valve
- Two-state valve statistics

Procedural control
- Sequencer object

Cross-functional
- Speed switch support
- Interlocks by type
- Analog input channel with snap-band
- Advanced analog input with separate control limits
- Discrete two, three or four state device
- N-position device
- Command source with external enable via HMI
Benefits from system design to expansion
Process solutions
Solutions across the lifecycle

design
Easy to design and configure
Streamlined workflows
Consistent project delivery

build
Easy to integrate

sustain
Operations and maintenance centric
System-level decisions
Safe and cybersecure

improve
Scalable
Future-ready technology
Analytics enabled
Easy to design, configure and integrate

Save engineering costs and reduce commissioning hassles

• Characterized systems and validated architectures for optimal performance of the DCS servers, controllers and required memory.

• Speed and ease of programming and system configuration including preconfigured virtual templates and process libraries.

• Embedded process instructions reduce system footprint, drive consistent product delivery, and streamline workflows (reduce tasks and clicks).

• Premier integration with motor control and field instrumentation.

• Easy to integrate main processes with other OEMs (no data remapping).

• Reduce rework by simulating plant response — identify and mitigate operational problems before being brought online.
Improve operations
Empower operators and reduce training costs

- Graphics focused on simplicity and situational awareness allow users to understand the state of equipment immediately.
- Real-time display of all process variables, alarms and trends provide up-to-date information. Integrated reporting tools convert data into information on a real-time basis.
- Multilingual support and multiple user modes cater to user roles.
- View need-to-know trends with optimized display of event information with real-time and historical data.
- Effective alarm management directs the operator’s attention to their job.

Improved maintenance
Maintain availability in critical areas

- High-availability servers, controls and networks and out-of-the-box diagnostics for system issues.
- Seamless visibility of devices for asset management, motor control and other instruments.
- Breadcrumbs highlight modules that are in an abnormal state and quickly determine what has been changed or needs attention.

The average loss of revenue is $12,500 per hour during an outage.
Source: Bricking Solutions

To fully master the requirements, cement control room operators need 2-3 years of on-the-job training and practical experience.
Source: KFW DEG
Enable decisions at the system level

Vast availability of in-chassis capabilities

- Artificial intelligence/machine learning
- Model predictive control
- Compute module (for custom applications)
- Embedded historian

Cybersecure

Enhances security and compliance with ISA99/IEC62443

- Certifications for product development
- Certifications for system components
- Validated system reference architectures
- Projects delivered by Rockwell Automation following process and certifications for cybersecurity

In March 2019, one of the largest aluminum producers in the world experienced a crippling cyberattack by the LockerGoga malware. It paralyzed the company’s computer networks, forcing it to isolate plants and switch some operations to manual.

Variation in raw materials and fuels is likely to result in changes in kiln conditions and consequently, changes in the cement.
Scalable
Future-proof technologies

• Same system for process, equipment, large and small systems
• Easy to evolve and expand
• Open Ethernet IP uses standard open hardware/software network infrastructure
• Analytics-enabled solutions