Cement manufacturer reduces carbon footprint & GHG emissions

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Cement plant in Yiyang reduces energy usage and carbon footprints

Introduction:
A leading cement producer in China producing 5000 tons of clinker each day in its plant in Yiyang, introduced a "model predictive control" solution to optimize its process, decrease fuel consumption and contain costs.

Key Objectives: Decrease coal and energy consumption and related greenhouse gas emissions.

Background: Cement production is an energy intensive industry with a heavy reliance on coal e.g. to heat kiln to very high temperature. The Yiyang plant consumed approximately 165,000 tonnes of coal per annum which costs about $16.5 million.
The manufacturer was looking to reduce its energy costs and at the same time also adhere to environmental regulations.
The production of cement involves multiple stages, including:
- The pulverizing and mixing of limestone and other materials
- The processed material is then exposed to high temperature of about 1200°C (2200°F) within the kiln in order to transform it to clinker
- This is transferred to a finishing mill where the final product is produced.
Although the company knew that the energy is lost across each stage of the process, but it faced challenges in optimizing process to avoid losses.

Challenges: A significant challenge with cement production is the number of variables involved in the process, including:
- Variability of the heat value of the coal
- Differing quality of the input material
- Recirculation of hot air into the kiln – which whilst improving the efficiency of the process creates additional inconsistencies to the process

These factors can create challenges in controlling fluctuations in the temperature of the kiln and as such its efficiency. The company found that standard PID loops weren't able to optimize the process due to the high number of variables involved in the process. As such, operators were having to monitor and manually react to changes, which accounted for 50-70% of their time.

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Cement plant in Yiyang: Solution and implementation

Solution & Implementation: To address these challenges, the cement producer introduced Rockwell Automations' model predictive control software (MPC) - Pavilion8, a process modelling, advanced control, and optimization software platform. The solution was able to:

- Monitor multiple production variables and processing goals

- Use machine learning algorithms to create models of multivariable processes

- Bring together historical data, trends in production, along with data from current processes and laboratory data

- Analyzes production trends and compares it with current performance.

- Integrate with pre-existing control systems

- Enable operators to anticipate performance issues and proactively manage equipment limits.

- In one application, adjust the addition of coal based on predicting the impact of recirculating hot air on the kiln temperature.

Optimization Architecture Overview
MPC

Source: Rockwell Automation

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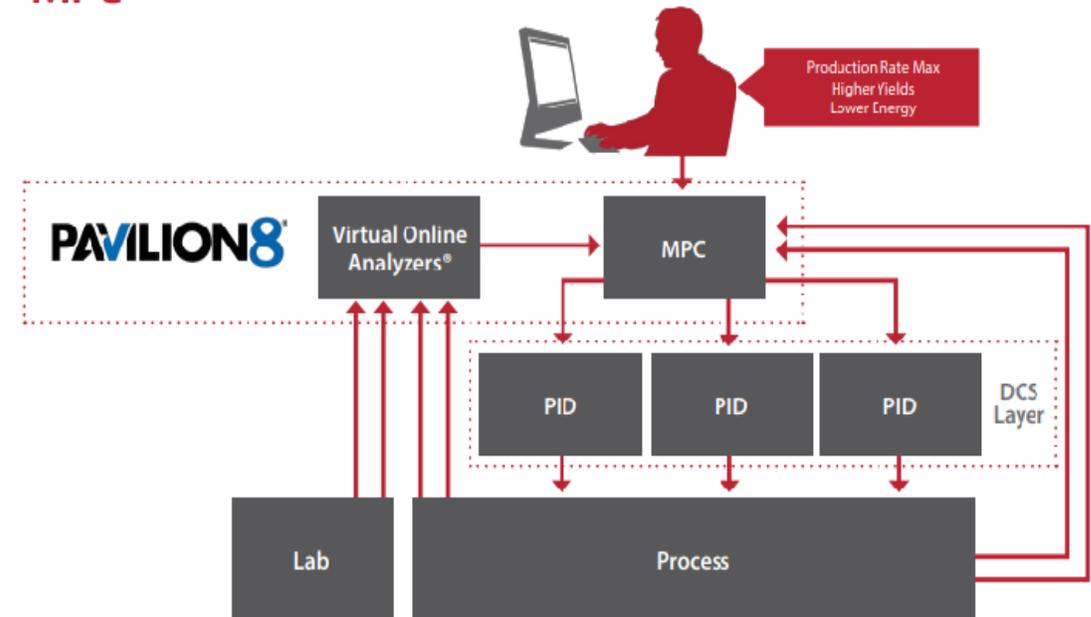
Cement plant in Yiyang: Results

Results from these investments included:

- Optimized mill performance
- Eased operator workload
- Reduced CO2 and NOx emissions.
- Improve product quality and thermal efficiency of the system

2%

Reduction in kiln coal and energy consumption

US$330K

Annual fuel cost savings

50-70%

Reduction in operators time in monitoring and adjusting the temperatures and fuel additions

Increase operational efficiency

Design / build / upgrade with confidence

Get the most out of your assets

Quarry to packaging visibility enables better business decisions

Modernize and empower your workforce

Source: Rockwell Automation - MPC

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