Case Study

Reference

- Switzerland – Holcim plant Untervaz.

Product

- Expert Optimizer 5.0 (employing Model Predictive Control Raw Mix Preparation strategy).

Summary

The Untervaz plant wanted to reduce raw mix quality variability in terms of Alumina Ratio (AR) and Silica Ratio (SR), reduce the associated material costs and increase the useful lifetime of the quarry. This would also allow them to have better process parameters in the kiln, getting closer to the clinker quality targets, increasing production and reducing the risk of process disruptions. In March 2007 ABB successfully extended Untervaz's Expert Optimizer (EO) version 5.0 solution to encompass ABB's new model based Raw Mix Preparation (RMP) solution. The technologies used are Model Predictive Control (MPC) and Mixed Logical Dynamical (MLD) systems. The benefits achieved by the installation are that AR and SR variability in the raw mix has been reduced by almost 20%. The degree of automation has been improved. With RMP it is not longer necessary to start and end the blending bed with different programs.

Project Description

Holcim plant in Untervaz blends up to seven different material sources to create its raw mix. As usual, most of these materials have high variability of chemical composition and are difficult to transport and dose. Furthermore, although a fully automatic laboratory is installed, material samples are often not representative and generate a measurement delay of up to 30 minutes. This mixture of constraints creates a difficult multivariable optimization problem with delays which are difficult, if not impossible, to handle properly under manual control. These were the motivations for Holcim to seek a solution to help them improve the conditions at the plant.

Solution

In March 2007 ABB extended Untervaz's existing EO solutions for kilns and cement mills with their new model-based RMP. RMP was installed to control the seven feeders of the raw mill. The technologies used are MPC and MLD.

ABB's RMP has successfully overcome the challenges that faced the plant by applying a MPC+MLD scheme that includes a unique combination of adaptive first principle mathematical models. The controller detects the gap between what is measured and what is expected, to adapt the model. In order to mitigate quality deviations the system takes into account factors like material, chemical and physical properties, transport delays, grinding and conveyor belt system equipment, etc. Additionally, accurate modeling of the blending process taking place in the mill plays a central role in the scheme.

Benefits

Thanks to the unique features of the MPC+MLD technique, the strategy is able to anticipate the effects of events and take optimal corrective actions both in advance and afterwards. The resulting benefits are that process condition deviations have been reduced without any modifications to the plant hardware. The extension of the EO solution to include RMP is ensuring that raw mill and clinker quality targets are achieved. Further, the use of the blending bed has been simplified significantly.