

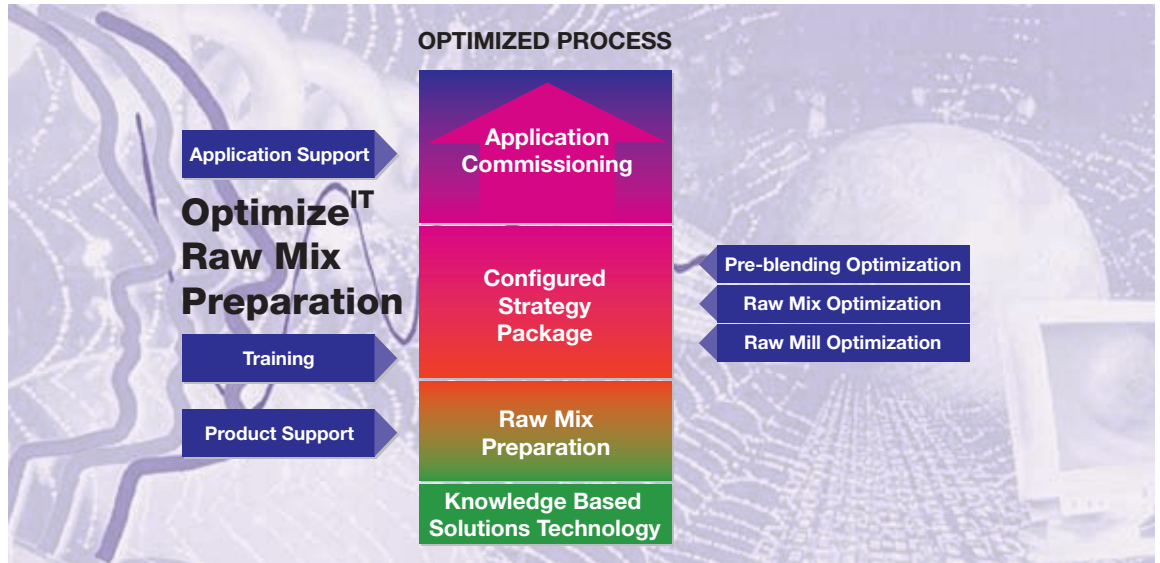
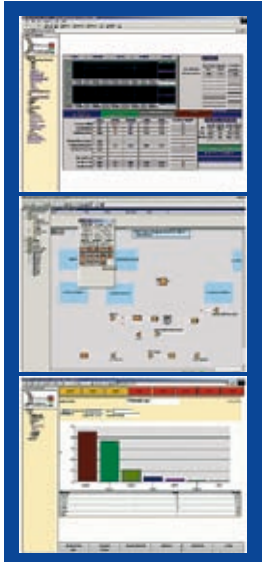
# Raw Mix Preparation

Industrial<sup>IT</sup> Solutions for the Cement Industry



**ABB**

# Optimize<sup>IT</sup> Raw Mix Preparation



Optimize<sup>IT</sup> Raw Mix Preparation is ABB's answer to feed quality problems. Our whole experience and know-in the field of cement production and advanced process control has been merged to create real solutions for our customers.

## What is Optimize<sup>IT</sup> Raw Mix Preparation?

The consequences of poorly prepared raw meal are well known. High lime causes meal to be burned harder and refractory life drops. High alkalines may cause cyclone blockage and restrict the use of the cement produced. Moisture content rises and so does energy consumption. And of course, oversize meal brings low reactivity and burnability.

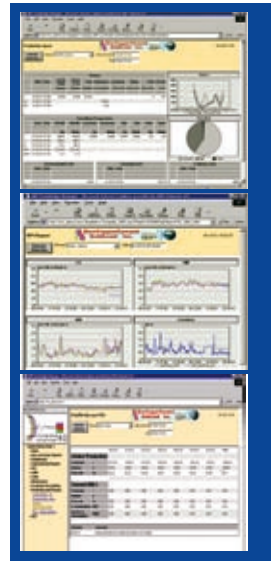
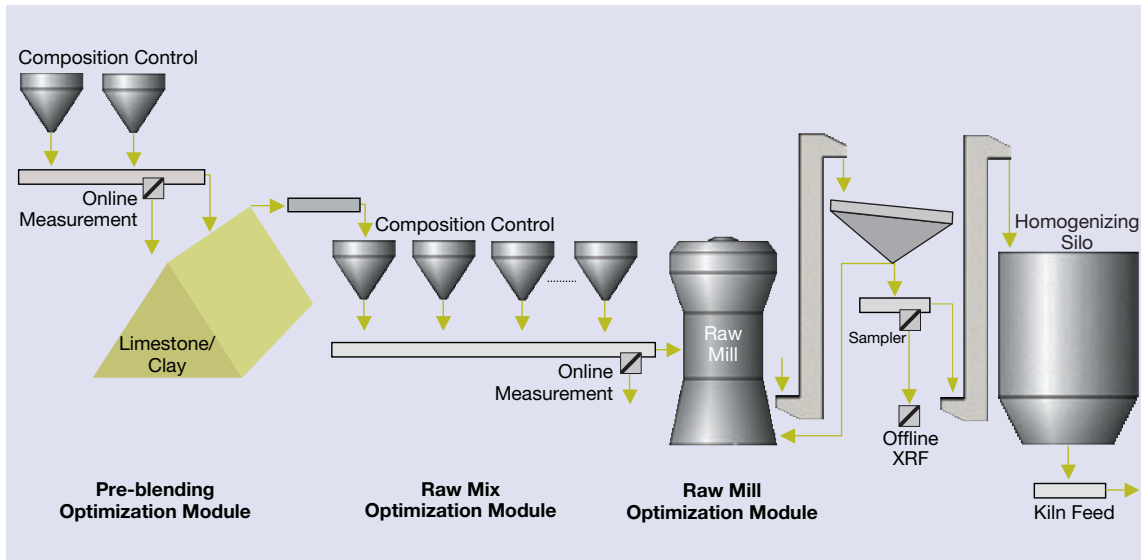
As leaders in kiln control and optimization using Optimize<sup>IT</sup> Expert Optimizer, ABB understands the woes of ill-prepared raw meal entering the kiln – and the joys of well-prepared meal. Fluctuations in the chemical composition of excavated raw materials are unavoidable at the start of the manufacturing process. However, if undetected or left uncorrected, stable kiln operation becomes difficult.

That is why ABB has developed **Optimize<sup>IT</sup> Raw Mix Preparation (RMP)**: to offer raw mix quality assurance to the leaders of the cement industry. Optimize<sup>IT</sup> Raw Mix Preparation (RMP) depicts a comprehensive set of software solutions that cover all stages of the raw mix blending, from the quarry to its grinding, making sure that your quality targets are reached at the lowest possible cost.

RMP is a fully integrated solution in ABB's CPM cement portfolio, consisting of Knowledge Management Systems, Laboratory Information Management Systems, AutoLab and of course our solutions for kiln and mill optimization. Thus RMP is creating the basis for the modular growth and development of your system, adapted to your plant's needs.

## BENEFITS

- Increased profits (5%–10%)
- Increased production (3%–10%)
- Energy savings (3%–7%)
- More stable product quality (10%–20%)



## How does Optimize<sup>IT</sup> Raw Mix Preparation work?

RMP achieves the goal of minimization of feed chemistry fluctuations at the lowest possible cost by concatenating three strong functional modules. These modules produce value to our customers as standalone solutions, but the maximum benefits and synergies are reached when deployed together. They conform a unique solution in its strength, performance and completeness.

### Pre-blending Optimization

The quarry fluctuations are smoothed early in the raw meal preparation process, namely at the pre-blending beds. Optimum proportioning of the different raw materials on the combined pre-blending bed is achieved with the ABB Pre-blending Optimization Module. Model Based Control

technology is used to its full strength in order to cope with the challenges posed by the material properties variability and the time delays inherent to the system.

### Raw Mix Optimization

The Raw Mix Optimization Module reduces and controls short-term fluctuations to the target values by optimizing and controlling the raw meal material proportions in the raw mill feed. As in the former module, Model Based Control technology plays here a crucial role to attain the desired quality targets. With the help of mathematical models this module is able to foresee coming quality deviations in the mill or silos, or for instance find remedy to feeders malfunctions. This permits implementation of predictive actions rather than reactive ones.

### Raw Mill Optimization

The Raw Mill Optimization Module achieves stable mill operation at the maximum economic production rate for the fineness, moisture, and chemical composition required. Short-term fluctuations are dampened. The optimization therefore supports both the operators and those responsible for quality alike..

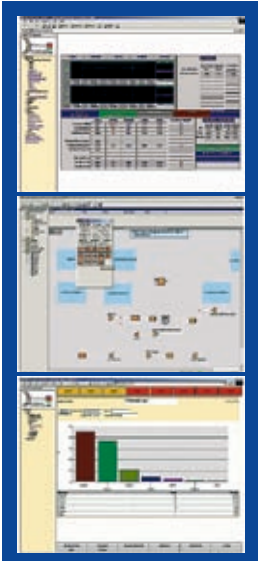
## BENEFITS

- Tirelessly supervises desired process parameters
- Unchallenged reaction speed
- Consistently takes the best decision
- Executes many small changes as opposed to few large changes
- Immediately recognizes abnormal conditions and acts accordingly

Three optimization modules work in concert to help the cement plants to achieve their desired quality, cost and safety targets.



# Pre-blending Optimization Module



**The Pre-blending Optimization Module tackles quality problems very early at the root cause by helping to achieve the best possible bed of raw materials.**

The Pre-blending Proportioning Module balances the analysis values with the corresponding quantity values of the combined pre-blending bed. Target values are usually  $\text{CaO}$  and/or  $\text{Al}_2\text{O}_3$ . The crushed materials are analyzed using an on-line analyzer, or alternatively, samples regularly taken, automatically processed and analyzed. In automatic mode the feeders receive calculated set-points values.

The Pre-blending Modelling Module tracks the raw material flow. A mathematical model is built using the chemical composition and the location of the raw material in the pre-homogenization bed. During the reclaiming process, the module delivers the chemical composition of the reclaimed raw material to refine the performance of the Raw Meal Proportioning Module.

The control algorithms are designed to deal with long term disturbances making sure that most of the problems can be corrected at their origin. On the other hand, the solution is such that a maximum of robustness and reliability is guaranteed at all times.

This module is the first step towards homogenization of the material chemistry. Its aim is to reduce medium term fluctuations of the material properties and to prepare the ground for further improvements using the subsequent modules available in the system.

## BENEFITS

- Early smoothing of long- and medium-term compositions
- Mathematical modelling of pre-blended structures
- Correlation with modelling when reclaiming

# Raw Mix Optimization Module



The Raw Mix Optimization Module aims for the lowest possible deviations from the quality targets at the conveyor belts, the mill and homogenization silos. This is achieved via online control of the weigh feeder rates active at the plant.

The optimization is adapted to produce stable raw meal characteristics entering the kiln, using regularly taken samples from laboratory or online analysers, feeding a digital control algorithm.

The raw mix chemical composition corresponds to the quality requirements expressed either by the specific lime standard (LS), silica module (SM) and alumina module (AM), or by the potential clinker phases  $C_2S$ ,  $C_3S$ ,  $C_4AF$ ,  $C_3A$ . Both groups of magnitudes can be derived from the main raw mix oxides  $CaO$ ,  $SiO_2$ ,  $Al_2O_3$  and  $Fe_2O_3$ .

The control algorithm is based on the latest control technologies like Model Predictive Control (MPC) using Mixed Logical Dynamic (MLD) processing and graphical model building. This allows explicit consideration of time delays, actuator dynamics, plant topology, etc. The result is the best ever solution in the market place.

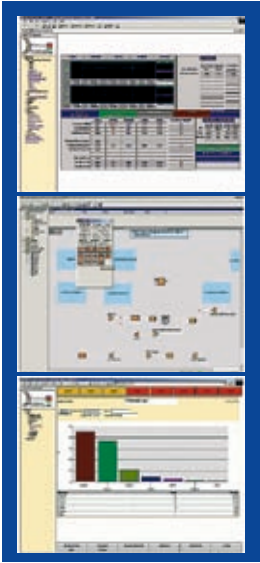
The optimization allows the prioritization and tuning of different goals like raw material cost optimization and achievement of desired quality targets. It also allows you to reduce the sensitivity to measurement noise, specify feeder variability, etc.

The Raw Mix Optimization Module executes online control of the weigh feeders in order to guarantee the optimal trade-off between deviations from quality targets and material costs. Based on state-of-the-art control technology, it offers optimal results and highest robustness.

## BENEFITS

- Optimization of raw mix chemical compositions
- Minimize raw material costs
- Reduce manufacturing costs downstream
- Internationally recognized quality standards

# Raw Mill Optimization Module



**Rely on the Raw Mill Optimization Module in order to obtain maximum operational stability, highest throughput and safety.**

The Raw Mill Optimization option controls both the temperature, the feed rate to the mill and the separator speed in order to achieve the required throughput for kiln. When starting the mill requires dampers to be moved, to change gas flow paths, the module will also respond to these effects to keep the system stable.

The Raw Mill Optimization Module stabilizes mill operation and then continuously optimizes its main process variables of throughput, particle size and energy consumed – relieving operators of tedious corrective actions. Stability control uses a feed control strategy to obtain a stable grinding process. Fresh feed optimization determines the mill power consumption setpoint that gives the highest fresh feed rate. Fineness and moisture control are included.

The principle by which this module provides benefits is as follows. First, stabilization of the key process parameters is achieved. Note that the module implements small actions frequently, as opposed to the infrequent large actions typical of human operator, the result is a more smooth operation, larger productivity, less wear and tear, etc.

In a second step, the Mill Optimization Module moves the process towards its constraints, seeking optimal setpoints in the economic sense while still meeting all the constraints of the process.

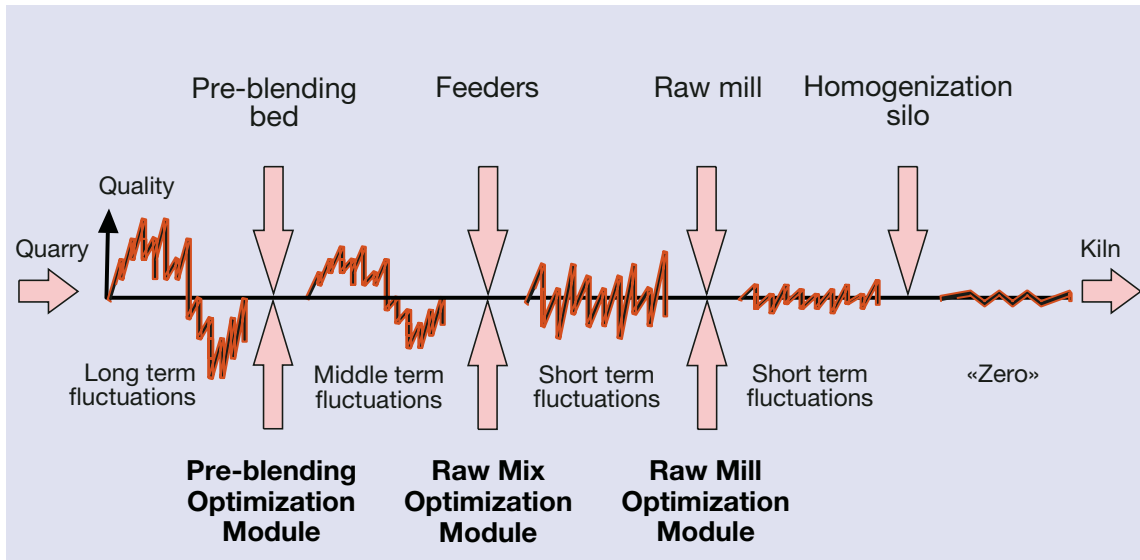
Process safety issues are taken into account automatically making sure that the plant technical and human assets are not jeopardized at any point in time.

## **BENEFITS**

- **Stable operation of raw mills**
- **Maximum economic production rates**
- **Fine tuning of particle size and moisture content**
- **Operator Support and Training**



# RMP Control Technology



RMP is based on the most modern control technologies available. The system

- Uses a mathematical models of feeders, conveyor belts, mills, and silos, etc to predict into the future the effect of different control moves
- picks the optimal ones for application in the plant.

For creation of the mathematical model a library of components (feeders, conveyor belts, silos, mills) is available to configure the customer application. This is done using highly efficient graphical tools that via drag and drop operations create the overall plant layout. Generation of the overall process model, optimization problem solving and simulation of results is taken over by the software!

## FEATURES

- **Enhanced process stability**
- **Better response to disturbances**
- **Compensation for delays in conveyor belts**
- **Handling of delays in sampling, X-Ray analysis, etc.**
- **Recognition and correction of weigh feeder errors**
- **Prediction of moduli values in the mill and the silos**

## RMP software key facts

RMP is based on the most modern software technologies available: web servers, thin clients, graphical model building, OPC, latest Windows version, etc. This ensures maximum performance and lowest possible ownership costs.

- Data acquisition and Storage
  - Standard interfaces to process and online analyzers
  - Industry specific Oracle database structure
  - Data backup and restore functions
- Control
  - Raw mill control
  - Closed loop control of feeder set points
  - Cost minimization
  - Constraint satisfaction
- Human Machine Interface
  - Latest web technology: server-thin client architecture
  - Basic set of standard reports, process displays, trends and menus

Optimize<sup>IT</sup> is an outstanding robust solution for quality issues at the cement plant. It puts the most modern software and control technology at the service of our customers.

## Optimize<sup>IT</sup> Raw Mix Preparation

Raw mix preparation is the quality key control parameter upstream for stable, continuous manufacture of high quality clinker and cement. Downstream quality and up to 5%

- stable coating in the kiln with stable raw meal fed to the kiln
- formation of favourable clinker phases grown from raw meal with consistent properties
- kiln optimization has fewer fluctuations to cope with

Consult ABB on how to optimize your upstream operations.

production increases or savings originate from ABB's quality assurance system Optimize<sup>IT</sup> Raw Mix Preparation. The reasons are clear:

- cement is ground to high quality from consistent clinker quality with well-balanced phases
- ABB assures quality with a comprehensive set of solutions for the automation and optimization of raw meal preparation.



**ABB Switzerland Ltd**  
CH-5405 Baden 5 Dättwil  
Switzerland  
Phone: +41 (0)58 586 84 44  
Fax: +41 (0)58 586 73 33  
process.industries@ch.abb.com  
www.abb.com/cement