ABB Ability™ Expert Optimizer for grinding
Increasing throughput, reducing liner wear and maximizing profitability

- Up to 5% output improvement
- Fuel consumption reduced by up to 5%
- Electricity use reduced by up to 5%
An advanced process control application specifically designed for grinding, that controls, stabilizes and optimizes key variables, is helping plant managers achieve profitability and sustainability targets, often with payback in less than four months.

ABB Ability™ Expert Optimizer (EO) for grinding is an advanced process control solution for both the mining and cement industries. It effectively closes the loop between condition monitoring of liner wear and critical grinding angles with model predictive control, fuzzy logic and data driven analytics such as neural networks. By coordinating the setpoints of the key process drivers and immediately detecting deviations within the operations, EO delivers accurate and consistent system decisions. It avoids the inevitable variations incurred when performance is controlled manually, thereby minimizing shift-to-shift variations as well as minimizing human workload. This releases operators to focus on other tasks.

ABB Ability™ MineOptimize
ABB Ability™ MineOptimize is a four-pillar framework that takes a deep dive into all aspects of the plant to identify ways in which to fine-tune and optimize every process, every sensor and device, every application and every service. The four-pillars include optimized solutions, optimized engineering, digital applications and collaborative services. With digitalization at its heart, ABB Ability™ MineOptimize relies on advanced application libraries, software solutions and digital platforms to reduce process complexity while promoting safe and secure production. By ensuring that the right people have the right information at the right time, the plant maximizes reliability, productivity and energy efficiency while optimizing planning and visibility across operations and the entire enterprise.

Within the digital applications pillar sits ABB Ability™ Expert Optimizer for mining: an advanced process control technology that helps the mining industry reduce costs and increase yields.
INCREASING THROUGHPUT, REDUCING LINER WEAR AND MAXIMIZING PROFITABILITY

Key focus

Grinding circuits present multivariable control challenges, whereby several inputs directly impact on various outputs. Ore variability means operators constantly need to strike a balance between required throughput and stable grinding. Grinding circuits are energy intensive which is a critical factor in determining a plant’s efficiency. EO combines advanced process control technologies with ABB's extensive expertise to stabilize grinding processes and maximize profitability. This is achieved by optimizing all key variables including grinding angles and liner wear rate.

Shoulder and toe angle
EO continuously targets shoulder and toe angles whilst maximizing throughput and grind quality. This minimizes steel ball on liner contact as well as reducing overload scenarios. Improving overall grinding stability and efficiency.

Liner wear
During production the liners wear out. Over time, under the same operating conditions such as speed and throughput, change in grinding angles are detected. Combining these additional pieces of information with ABB Ability™ Predictive Maintenance for grinding data analytics, we are now able to estimate liner lifting efficiency, critical liner height and expected liner life more accurately.

ABB Ability™ Cascade monitoring with its online vibration sensor and liner wear analytics enables Expert Optimizer to control and improve grinding conditions. For example - ball strikes on liners are reduced by targeting more consistent grinding angles, improving overall grinding efficiency. We now have the tools and technology to better tackle the challenges of “what is going on inside the mill?”

• Is the mill operating at maximum grinding efficiency?
• Are operating conditions ensuring minimum liner damage?
• What date will I need to schedule liner replacements?

The vibration sensor is attached to the mill shell and provides continuous wireless operating analytics to the EO system. EO closes the loop between information from Cascade monitoring and grinding performance.

ABB Ability™ Cascade monitoring converts vibration data into meaningful, controllable analytics
Benefits and features

Typical benefits of implementing EO in grinding is evident across all grinding application types. Benefits arise from increasing throughput and production whilst minimizing cost. The additional benefit associated with reducing particle size is a possible increase in mineral recovery downstream.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Targets</th>
<th>Enhancements</th>
<th>Autopilot for operators</th>
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<tr>
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<tr>
<td>Load</td>
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<tr>
<td>Shoulder &amp; Toe Angle</td>
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<tr>
<td>Liner Wear</td>
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<tr>
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An EO application focuses on typical variables with tuning features set by operations with ABB engineering guidance.

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Results from ABB Ability™ EO optimizing a grinding line in Sweden
Integration with ABB Ability™ System 800xA

EO can be integrated into ABB Ability™ System 800xA distributed control system (DCS) or as standalone application, connecting to any other third-party PLC or DCS. Integrating directly into System 800xA provides the same usability and interface as the rest of the control system. Cyber security is strengthened while ensuring less hardware to maintain and introducing a common historian and information management system.

Model builder functionality
- Neural networks
- Analytics
- Model predictive control
- Open/close loop simulation
- Controller diagnostics
- Fuzzy logic
- Soft sensors
- First principle model construction

Other ABB technologies, such as the secure remote access platform (RAP) and KPI monitoring, enhances the collaboration between the user and ABB, making it easier to maintain applications during process and optimization strategy alterations.

Customer-oriented delivery

Every plant’s advanced process control system needs to be tailored to that facility’s specific production needs. EO brings the flexibility to adapt to each plant. As such, an end-user only pays for what they really need.

- **Software only**: EO software licenses can be purchased by those that prefer to build their own application

- **Turnkey solution**: EO can be obtained from the ABB portfolio, including engineering and commissioning, and benefit from ABB’s proven expertise around grinding units.

In either case, users can purchase a single license or sign up for software license subscription which automatically benefits from the latest functionalities and software improvements at a fixed annual fee.
A road map for successful installation

- **Mine performance fingerprint:** ABB collects information on-site to ensure smooth engineering and implementation. Potential applications are identified based on current performance, base level health and plant economics. A baseline and road map for digital applications is then defined. This forms the business case for implementation where applications with the fastest return on investment are scheduled first.

- **Implementation:** ABB engineers model the process using plant knowledge, historical and step test data to construct the multivariable controller. The controller is then tuned to exploit the plants’ constraints to maximize profit and minimize cost. Commissioning is performed on site together with operators and process engineers to ensure a successful change management.
Collaborative service offering

ABB has a proven track record in sustaining the benefits over the lifecycle of the plant. In today’s complex minerals environment, it is impossible for anyone to be an expert on all products and processes. Therefore, ABB offers several support packages to provide maximum long-term performance of an EO installation.

- **System support**: Assistance in case of hardware faults to minimize shutdown frequency.
- **Strategy support**: Maintenance of EO applications to meet optimal performance. Includes an onsite visit and remote support.
- **Subscription services (SaaS)**: With subscription services, the initial capital expenditure is minimized, and benefits sustained via ongoing controller maintenance. This ensures a rapid return on investment for the end user with sustained benefits.