Digitalisation and sustainability

Digitalisation-driven plant optimisation within the cement industry can offer significant benefits to cement producers - whether implemented at brownfield sites or incorporated within greenfield plant development. ABB discusses the company's cross-functional and enterprise-wide approach to digital transformation, and the benefits this brings to both plant operation and plant sustainability.

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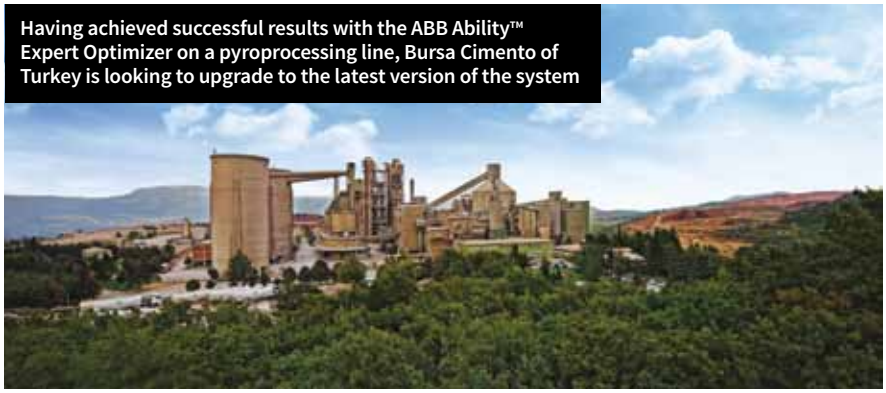
The benefits of digitalisation-driven plant optimisation in the cement industry span not only improvement in process, asset, plant- and enterprise-wide performance but can have an important positive impact on sustainability values. High levels of digitalisation result in higher efficiency gains, reducing energy consumption, while allowing higher utilisation of alternative fuels and renewable energy sources.



Having achieved successful results with the ABB Ability™ Expert Optimizer on a pyroprocessing line, Bursa Cimento of Turkey is looking to upgrade to the latest version of the system

A cross-function and enterprise-wide approach

Such high levels of digitalisation are best achieved through a unified, cross-functional and enterprise-wide approach to digital transformation, such as that offered by ABB. This approach offers digital process/asset and enterprise-level optimisation technologies (Figure 1), as well as effective training of plant personnel to use these technologies, to provide targeted business benefits to cement customers:

- process optimisation: optimise the process through the use of advanced control, artificial intelligence and machine learning
- asset optimisation: improve overall equipment effectiveness by reducing downtime
- quality improvement: improve quality via in-line quality control, including feedback loops to process parameters
- planning efficiency: improve planning accuracy by comprehensive planning across fleets
- logistics productivity: improve workforce efficiency with in-plant logistics and warehousing.

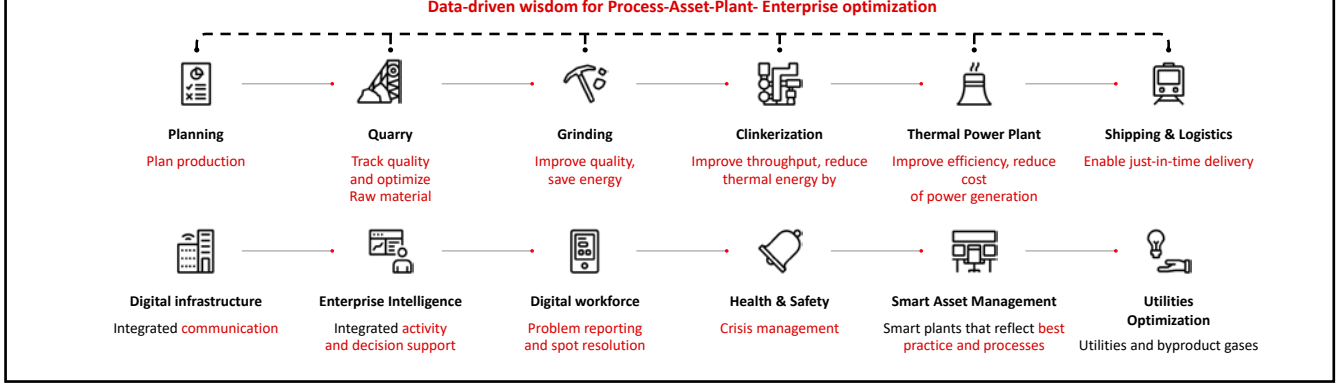
The process begins by identifying a plant's pain points through, for example, a value discovery workshop with plant personnel representing the various departments from production to maintenance, quality control, and management. This first step looks for the plant's weaknesses and how digital technologies could help operators to eliminate them, building up a roadmap to installation and implementation of the possible ABB solutions that ensures optimal potential benefit to the plant and maximum buy-in from the personnel.

Typical targets include an increased use of alternative fuels, lower energy consumption, reduced emissions levels, reduction in consumables, increased throughput and reduced quality variability.

ABB Ability™ digital solutions

Among the suite of digital solutions that may be considered during this value discovery process are the ABB Ability™ Knowledge Manager information management system and ABB Ability™ Expert Optimizer advanced process control

Figure 1: ABB's holistic approach addressing industry value chain through value map. Process – asset – plant – enterprise ecosystem loop



system for controlling, stabilising and optimising industrial processes.

ABB Ability Knowledge Manager

The core function of the ABB Ability™ Knowledge Manager is to provide the basis for data aggregation, consolidation and online analysis including:

- validation and approval mechanisms for data consistency
- long-term alarms statistics
- interactive reports and trends
- self-diagnostic and auditing reports.

As a result, ABB Ability Knowledge Manager provides information consistency across multiple business levels. It can also be used to consolidate and centralise information from multiple sites in one system, bringing into play a new level of regional and corporate performance indicators, and allowing performance comparisons between operations.

The latest version of the system, ABB Ability Knowledge Manager 9.1, which was released in November 2019, includes enhanced user experience with a new set of dashboards that provide more interactive functionality. Users are now better able to keep track of plant performance wherever they are via laptop, PC, tablet or mobile device. The new dashboards also make it easier to configure reports and view the actual status of the plant, enabling real-time decision-making to improve performance.

The latest version is also tightly integrated with the ABB Ability System 800xA process control system and Minerals Library, supports engineering based on ISA-95 standard equipment models, and provides engineering synchronisation with other ABB solutions such as ABB Ability™ AssetVista.

ABB Ability Expert Optimizer

ABB Ability Expert Optimizer is ABB's advanced process control solution for the cement, mining and minerals industries. It takes data from the plant and then uses various technologies – most notably model predictive control – to build a model of whichever part of the plant is the focus. This model allows the prediction of what is going to happen in the plant or specific areas of the plant based on the real-time data.

This model – effectively a digital twin of the plant or process – can be used to create setpoints that enable the plant to achieve its goals. Initially, this means stabilising the process but will move on to optimising plant performance according to various metrics, such as achieving higher production, lowering energy consumption, or stabilising product quality, depending on what the plant operator has decided and what the initial pain points of the plant are. When the targets have been set, ABB Ability Expert Optimizer is able to take the actions required to meet them without the intervention of the operator.

Figure 2: ABB Ability™ Knowledge Manager plant health dashboards

In the latest releases of ABB Ability Expert Optimizer, ABB has added the ability to monitor the operation of the plant remotely to ensure that the targets are being met – and to inform the plant whenever there is any variation. It helps to ensure that ABB Ability Expert Optimizer is not switched off by operators and continues to sustain the benefits realised during commissioning.

Case study: Bursa Cimento

Bursa Cimento is located in the Marmara region of Turkey and has a clinker capacity of 1.5Mta across two kiln lines and 2.85Mta of cement capacity. It has been using alternative refuse-derived fuels since 2011 and in 2013 installed a 7.5MW waste heat recovery facility.

In 2015 the company approached ABB to begin the next phase of plant optimisation through the installation of the ABB Ability Expert Optimizer on one of the pyroprocessing lines (comprising calciner, kiln and cooler), as well as raw and cement mills. The results on the pyroprocessing line were particularly significant as the process had been experiencing greater instability following the implementation of alternative fuels. ABB Ability Expert Optimizer enabled a much tighter control of calciner temperature, as well as lower distribution of oxygen in the preheater. Cooler operation was also much more stable, enabling the recovery of more heat via the waste heat recovery facility.

These process improvements resulted in a reduction in energy requirements through the pyroprocessing line, as well as more consistent clinker quality. These benefits ensured the buy-in of the plant operators and utilisation of the system has been over 95 per cent. Effectively, when the kiln is up and running, ABB Ability Expert Optimizer is used 100 per cent of the time.

Since the company is pleased with the results, Bursa Cimento has been operating the system since 2016 and is looking to upgrade to the latest version.

Journey to sustainability

Digital solutions – when used well and with buy-in from plant operators – offer significant benefits to plants in terms of overcoming pain points and creating optimal production conditions. Furthermore, the economic benefit is only one aspect; digital solutions are also key elements in enabling cement plants to meet their sustainability goals as efficient plants use less energy, are better able to maximise use of alternative fuels and optimise use of raw materials, and ultimately operate with a smaller carbon footprint.

This is most obviously of value in regions with the tightest sustainability goals, such as within the EU, which has committed itself to reaching carbon neutrality by 2050 with Sweden pushing to reach it by 2030. This desire for greater sustainability is not however limited to Europe and is likely to spread and speed up around the world on the back of the now global push to control climate change. With its unified, cross-functional and enterprise-wide approach to digital transformation – encompassing ABB Ability Knowledge Manager and ABB Ability Expert Optimizer among many other solutions – ABB is ideally placed to support the cement industry in this journey to sustainability. ■