Cement 4.0

With the cement industry looking to access the benefits of Industry 4.0, ABB’s Cement Lead, Max Tschurtschenthaler discusses current trends in the implementation of digital technologies within the sector.

by ABB Ltd, Switzerland

In recent years, rapid advancements in Big Data and digital technologies have begun a revolution in industrial processes, commonly known as Industry 4.0. This revolution is defined by the application of disruptive technologies such as the Internet of Things (IoT), augmented reality (AR) and artificial intelligence (AI) to industrial settings to optimise process performance, reduce operating costs, and enable safer and more secure production.

Within industry – including traditional industries such as cement – digitalisation has become a key factor to business success, encompassing physical assets, plants in multiple geographies, industry domains and regulatory frameworks. Early adopters can realise competitive advantages by leveraging digital technologies to identify and propagate best practice throughout their organisation, creating value for stakeholders.

With over 50 years of experience in the cement industry, ABB is able to support producers in digitalising their operations. Through its ABB Ability™ CementOptimize suite of digitally-connected products, services and solutions, the digitalisation specialist offers four building blocks for digital cement operations:

1. designing a digital plant (optimised engineering)
2. electrically and digitally integrating equipment (optimised solutions)
3. software solutions to use the data captured for plant optimisation (digital applications)
4. services for remote assistance, predictive maintenance and performance optimisation (collaborative services).

“Customers can pick and choose the elements that they need, but of course the biggest enabler bringing the most benefit to the customer comes from the complete suite,” explains ABB’s Cement Lead, Max Tschurtschenthaler.

ABB Ability CementOptimize in action, India

One of the most comprehensive adoptions of the ABB Ability CementOptimize suite of solutions is at a cement site in India that was facing high cost of ownership on a diverse and non-integrated systems landscape comprising multiple plants.

To improve operational performance, the cement business set the following aims:

• improved yield, quality, production costs and energy efficiency
• improved reliability, availability, and residual life of process and electrical assets
• seamless integration of quality information.

The solution included horizontal and vertical integration, creating information technology-operational technology (IT-OT) convergence, as well as an integrated plant-wide approach, covering the critical processes and electrical assets; and an interface with quality (LIMS) and business (ERP) systems. To achieve this, various elements of the ABB Ability CementOptimize suite were adopted, including:

• ABB Ability™ Expert Optimizer (EO):
  ABB’s advanced process control system for controlling, stabilising and optimising industrial processes. EO uses advanced process techniques, including linear and non-linear model predictive control, fuzzy logic and neural networks, to manage critical plant components, including the kiln, alternative fuels, mills and blending.
  • ABB Ability™ Optimax aggregates and optimises decentralised energy resources to help reduce energy costs and emissions.
  • ABB Ability™ Collaborative Operations connects the customer to ABB, providing continuous access to ABB experts.
  • ABB Ability™ AssetVista asset management pulls together previously-disparate data on the condition of equipment to provide a complete picture of asset health, helping to increase process efficiency and avoid unnecessary maintenance.
  • ABB Ability™ Knowledge Manager information management system provides analytical insight to identify best practice and improve overall operations at plant and corporate level. This resulted in a 1-5 per cent increase...
in thermal and electrical energy efficiency, a heat rate improvement of 1-2 per cent, a 2-5 per cent increase in productivity and up to a 15 per cent improvement in quality and consistency, as well as more reliable cement and power plant assets.

**Information management is key**

“One of the key elements for cement customers is to have an information management system that allows transparency across your operation,” notes Mr Tschurtschenthaler. “There is currently significant demand on the customer side to be able to integrate different sources of information into one platform to have a complete and holistic view of plant operations – or, if you are a larger company, across multiple plant operations.”

There is a particular need in companies with multiple cement plants to understand why one plant is performing well, while another one is performing less well. “What is the reason behind this and how can the improvement of the lower-performing plant be improved by transferring knowledge or process methodology from the higher-performing plant? An integrated information management system, such as ABB Ability Knowledge Manager, allows such questions to be answered,” he adds.

LafargeHolcim has adopted the ABB Ability Knowledge Manager as the groupwide backbone for technical information management across its cement plants. At LafargeHolcim the system monitors and helps to improve emissions at many of the company’s sites, while the Cement Production Scheduler module significantly lowers the cost of the electrical energy used during cement grinding and increases cement mill utilisation. In addition, the tool helps to coach and support process personnel and operators remotely.

“Of course, every cement plant is unique,” underlines Mr Tschurtschenthaler. “We provide solutions to basically analyse the situation or performance of the specific plants and then evaluate the cross-relationships between plants – what solutions and assets are similar. The more data available across the fleet that we can analyse, the better we can support the customer in transferring best practice throughout the organisation,” he adds.

‘Faster and easier’ access to data

Enhancing transparency across a plant or fleet of plants, ABB Ability Knowledge Manager is also available via a mobile app for smart phones or tablets, enabling plant and company managers to view operational performance at any time and from anywhere.

“The installation of ABB Ability Knowledge Manager and digitalisation of our plant data is really helping us optimise our short-term production processes and long-term operations,” said Kim Tran, quality and environment performance manager of Switzerland-based producer Ciment Vigier SA, another user of ABB’s information management system. “It provides a better view into our process and has given us faster and easier access to our data. The instantaneous reports, trends and the data collection tools help us to make studies and take decisions. This new tool has already lead to real process improvements,” Kim adds.

**The future cement plant**

Looking ahead, ABB and its cement industry clients are looking to further develop the benefits offered by cutting-edge digital technologies, such as AI and digital twins, to achieve total plant availability and, ultimately, the autonomous cement plant.

“A cement plant is a continuous operation, which means every time there is an unplanned disruption, there are consequences in terms of loss of production and loss of sales,” highlights Mr Tschurtschenthaler. “Therefore, industry is working to achieve total availability through predictive maintenance, which helps our cement customers understand the current status of specific assets – not just electrical equipment but complete assets – and to plan and prioritise their maintenance accordingly, also considering customer demand trends.”

Digital twins are also starting to be talked about within the cement industry, as a way of training new operators and maintenance personnel on a specific plant’s equipment and process. This has the benefit of not risking disruption to the actual production process, while also being an attractive way into the industry for young engineers. “The cement industry, like the mining industry, is seen as an old industry. The integration of new technology into the industry helps make it attractive to the younger generation,” explains ABB’s Cement Lead.

AI is also being looked at by the industry, although there is still work to be carried out to find the best application. “Currently, we are looking at using it at an Indian cement company to analyse mill start-ups to discover the most efficient way of starting up a specific mill at a specific plant,” continues Mr Tschurtschenthaler. “Is a quick start or a slow start best to save energy costs? Do different circumstances require different approaches to a mill start-up?”

Looking further into the future, Mr Tschurtschenthaler states: “We are working towards the autonomous cement plant, with fewer operators and maintenance staff on site to run a plant. This will mean digitalising each and every piece of equipment – including the mobile equipment in the quarry – to gather as much process data as possible to facilitate the best decision making.”