

PROGRESS *IN REAL-TIME*

Len Eros, ABB Motion, outlines how digitalisation can improve safety, reduce costs and maximise production uptime in cement plants.

The escalating importance of reliability, availability and efficiency is driving operators in the cement industry to seek new developments that will help improve productivity. In fact, there are few industries where the pressure to achieve maximum operating efficiency is so intense. One approach that offers a real opportunity to meet this challenge is the implementation of advanced condition monitoring.

Producing consistent, high-quality cement, as well as being able to manage information effectively to maintain reliable operation is high on the agenda for cement operators. Advanced measuring, information and optimisation systems now make it possible to capture any deviations in standards and ensure reliable quality control. Digitalisation based on the integration of data and real-time optimisation of processes across the value chain is the critical next step.

For cement producers, the impact of plant and equipment failures can be enormous. Many operations in a cement plant occur in series, not in parallel. Unlike other industries that may have several production lines, such as food and beverages, a cement plant usually only has one.

If that line goes down, it brings production to a complete halt. Therefore, a single breakdown often has a domino effect that may result in production stoppages in multiple areas, which can significantly impact productivity. Downtime, and more specifically, unplanned downtime, is the single largest source of lost production. Most crucially, it has a direct impact on the company's bottom line.

The cement industry has a long history of regularly monitoring what has been regarded as critical equipment. This is not a complete solution however, as experience has shown that the failure of apparently non-critical or smaller pieces of equipment can be just as problematic and cause an equal amount of downtime. The challenge has always been that it was not economically viable to extend monitoring to a much greater scope of equipment across a plant. That has now changed with the introduction of a new generation of wireless smart sensors.

The availability of cloud computing, data analytics, and mobile data transmission, has paved the way for the arrival of low-cost, IoT-based wireless sensors. With no hard wiring requirements, they allow for permanent monitoring at a fraction of the cost of traditional condition monitoring systems. In an industry



Digital solutions that integrate data and real-time optimisation of processes throughout a cement plant can help boost productivity and reduce unplanned downtime.



Smart sensors (shown here as the white cylinder on the bearing) allow equipment to be monitored in locations which may be difficult or dangerous to reach.

particularly sensitive to unplanned downtime, smart sensors can help improve plant reliability.

The next step in the digitalisation story is the digital powertrain, a customisable, scalable approach that connects drives, motors, mounted bearings, gearing and applications such as pumps. The aim is to improve uptime, safety, and productivity of critical process equipment such as kilns, conveyors, crushers, dust collectors, and mills. Another key element is variable speed drives (VSDs) that are equipped to control high-efficiency motors. They are connected via the cloud gateway, while traditional, fixed-speed motors, mounted bearings, and pumps connect wirelessly with the smart sensor.

Digital powertrain and condition monitoring

The ABB Ability™ Digital Powertrain combines a range of products and services including smart sensors, monitoring tools and an interactive portal. The sensors, together with the data collected by the drives, measure key parameters which enables users to 'see' operational variables and health indicators. At the system level, these include availability, environmental conditions, load levels, run times, energy consumption and other parameters. At the component level, it includes health and performance data such as drive faults, temperature and vibration information on mounted bearings, motors and gear reducers as well as pump performance data.

This data is made visible to operators and maintenance teams on a simple dashboard accessible by a laptop, tablet or smartphone. Powertrain assets that show up green on the dashboard are functioning correctly; yellow indicates that something needs to be checked, and red shows up a malfunction. The operator could also decide to integrate the data into a standalone system for deeper analysis, or move it to the cloud. This approach offers flexibility to the users as it gives them the option to start simply and progress into more advanced usage as they develop confidence in the process.

Wireless smart sensors also enable remote, continuous monitoring from a safe distance of equipment that is either dangerous to be around or hard to access. This is a significant improvement on traditional methods of data collection, such as handheld vibration monitoring probes, that can expose employees to safety hazards.

Condition-based monitoring as a key business benefit of digitalisation

The traditional approach to maintenance in the cement industry runs on a preventative basis. This is like changing the oil in a motor vehicle every six months – whether the change is needed or not. This fixed schedule does not account for actual operating conditions, which means some lightly used equipment is being serviced more often than needed, and while this is a conservative approach, it may

increase maintenance costs. Furthermore, other more heavily loaded equipment may require servicing more frequently, leading to a potential risk of an unplanned shutdown.

Instead of working to a fixed schedule, real-time health information ensures that maintenance is only carried out when needed. In many cases this will extend service intervals, saving on labour and component costs. It will also reduce the risk of an unplanned shutdown by providing an early warning of an imminent failure. This information can be used by the maintenance team to make a fully informed decision on the best course of action to maintain business continuity. This could be a shutdown and replacement at the first opportunity, or the team might decide to manage the situation by adjusting load and speed to keep the equipment in a safe operating range until the next scheduled shutdown.

In the past, failure prediction was not all that dependable – it was known that bearings overheated before failure, but there was not enough statistical data to be very accurate. Condition-based maintenance, however, provides highly targeted predictive maintenance reporting, which presents new opportunities to analyse big data and track trends more accurately.



With visibility and optimisation across operations now possible, the digital powertrain allows data to be turned into actions, preventing downtime and extending equipment lifetime.



Smart sensors monitor key parameters to provide detailed insights into the performance and health of motors. As a result, maintenance can become predictive rather than reactive.

Customisation and scalability

The customisable approach of the digital powertrain allows operators to monitor a single powertrain or multiple powertrains, offering a low-cost introduction to digital monitoring. This comprehensive overview enables plant operators to identify any performance abnormalities quickly. It allows them to act before the problems escalate, improving the performance, reliability and efficiency of their powertrain components.

The data collected from each powertrain can be used at a basic level, or it can be combined with other data and analysed with powerful analytics tools to improve overall system performance. This makes it possible to analyse the situation rapidly and make immediate recommendations to solve the issue. The bottom-line benefits are highly focused maintenance activities that ensure the highest possible asset reliability and life. The detailed analytics also help OEMs to gain useful insight about specific support their customers may require as their operations become more digitalised.

Most importantly, scalable digital services for powertrains allow plant operators to assess, manage and optimise powertrains without having to be physically present. The key advantages are improved safety, production uptime, use of manpower, and a reduction in unplanned downtime.

The future of digitalisation

As smart sensors provide information in real-time about production assets and the process itself, stakeholders can use it for immediate decision-making, and for learning and modelling. Production plans are also updated in real-time, including maintenance and production schedules.

Highly skilled outside experts can help minimise fault-tracing time remotely, and guide on-site teams through the repair process. Plant managers can have peace of mind that production time is maximised and focus on meeting delivery schedules instead. Digitalisation is here to stay, and its use is set to proliferate as the success in predictive maintenance and preventing downtime becomes more and more evident.

Conclusions

Thorough cement plant maintenance today includes proper planning, the utilisation of expert skills, and digital monitoring. These elements will increase the lifespan and efficiency of the cement plant refractory, leading to less downtime, fewer costs, increased plant profitability, and optimised energy consumption. ■

About the author

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