THE ROLE OF RETROFITTING

Michael Lindbichler, CEMTEC, considers the benefits of retrofitting and how it can help cement plants be more sustainable.

In the cement industry, the focus on decarbonisation is paramount, but it is not the only concern driving daily operations. Closely related to decarbonisation is the concept of sustainability, particularly through retrofitting. Many cement plants worldwide have been operational for decades. As requirements for product fineness and quality evolve – driven by the increasing substitution of clinker – older systems often reach or exceed their operational limits, necessitating optimisation or upgrades. Additionally, wear material fatigue and the end of the useful lifetime of individual machines or entire plants demand predictive and preventive actions to maintain competitiveness and ensure a secure supply chain.

Addressing these requirements can involve significant investments in new processing lines

or, alternatively, the replacement of single items or assembly groups of affected equipment. From a sustainability perspective, the logical solution in many cases is to retrofit plants to state-of-the-art technology, thereby optimising capital expenses (CAPEX), reducing operational costs (OPEX), and achieving the lowest total cost of ownership (TCO). Retrofitting can extend the operational life of existing plants, improve energy efficiency, and reduce emissions, aligning with global environmental goals. This approach not only supports the environment but also ensures that cement plants remain competitive and economically viable in an increasingly challenging market.

Defining retrofitting and its scope

Retrofitting involves adapting existing equipment or plants to meet current requirements. This can range from upgrading small components to replacing complete assembly groups and, in some cases, may involve exchanging all plant equipment constrained only by existing foundations or building dimensions. These extensive projects often necessitate customised solutions derived through reverse engineering. Reverse engineering in combination with retrofitting not only replaces insufficient or broken items but also allows for the incorporation of improvements in rigidity, performance, and safety. Safety has become increasingly crucial in every plant, often serving as the impetus for retrofit projects. Enhanced safety features can reduce the risk of accidents and ensure compliance with the latest regulatory standards, which are constantly evolving to address new challenges and risks.

Challenges and innovations in retrofitting

A significant challenge in executing retrofit projects is the frequent lack of information, such as incomplete documentation or missing drawings. This can stem from various reasons, including never having received proper documentation, loss of documents, or invalidation due to numerous on-site modifications. However, the engineering phase of retrofitting offers the opportunity to include internals, wear and spare parts, simplifying future maintenance. The ability to reverse-engineer components and systems plays a critical role in overcoming these challenges, enabling the creation of accurate and reliable designs based on existing conditions.

In the past, collecting missing information and dimensions was laborious and time-consuming. Today, technologies like 3D laser scanning facilitate this process. Scans can be easily converted into 3D model files compatible with most CAD systems, providing a solid foundation for new engineering. Scanning entire buildings, including installed equipment, steel structures, and foundations, can be accomplished in just a few days, depending on the required accuracy. This innovation significantly reduces the time and cost associated with the initial assessment and planning stages of retrofit projects. The accuracy of 3D scanning ensures that retrofits are precisely tailored to existing structures, minimising the risk of errors and costly modifications during implementation. Moreover, 3D scanning can be used for regular monitoring and maintenance checks, helping to identify wear and tear before they become critical issues.

Retrofit benefits.

Condition monitoring and system upgrades

Older machines often lack sufficient condition monitoring or interlocking systems that help extend the lifespan of critical parts such as drives, bearings, and other sensitive components. The cost of investing in such monitoring systems is relatively low when considering the reduced maintenance and

repair costs. Incorporating systems like vibration or temperature monitoring in retrofit projects extends the lifetime of exchanged equipment, contributing to resource savings and sustainability. These monitoring systems can provide real-time data and alerts, allowing for proactive maintenance and reducing the likelihood of unexpected failures. Advanced condition monitoring can also integrate with digital platforms, allowing for remote monitoring and predictive maintenance strategies, thus reducing downtime and increasing operational efficiency.

Every cement plant typically undergoes annual maintenance shutdowns during low sales seasons, often in winter. These shutdowns, lasting between four and eight weeks depending on market demand and project urgency, provide a window for planning and executing critical replacements. During these periods, core equipment like ball mill components, drive systems, mill shell segments, and even complete separator circuits can be replaced or upgraded. The strategic planning of these shutdowns is crucial to minimise the impact on production and ensure that all necessary upgrades are completed efficiently. Effective project management during these shutdowns can lead to improved operational reliability and performance for the rest of the year. Additionally, detailed scheduling and logistics planning can further optimise the use of shutdown periods, ensuring that every minute is effectively utilised to enhance plant performance.

Enhancing process engineering and energy efficiency

Switching focus from mechanical issues to process engineering reveals additional benefits. Higher productivity can be achieved by adapting machine sizes, and energy efficiency becomes a critical factor in any mineral processing plant. Given the volume of production – often several thousand or million tons per year – every kilowatt-hour saved per ton translates to significant financial savings. For instance, upgrading from an older generation separator circuit to a latest-generation system can achieve a return on investment within two years or less. Improved separators can enhance the quality of the final product and reduce energy consumption, leading to more sustainable operations.

Moreover, optimising the entire production process can yield significant energy savings. This includes not only upgrading major equipment but also fine-tuning control systems and optimising operational parameters. For example, implementing advanced process control systems can stabilise operations, reduce variability, and improve overall efficiency. Energy audits and assessments can identify areas of inefficiency, providing a roadmap for targeted improvements. In addition, the integration of renewable energy sources, such as solar or wind power, into the plant's energy mix can further reduce carbon footprints and operational costs.

Benefits of retrofitting and broader impacts

The advantages of retrofitting are not limited to cement plants but extend to other mineral processing plants and mining companies. Effective project planning often requires multiple discussions between customers and potential suppliers to fully understand the requirements. The goal is to collaboratively find and offer the best solutions in terms of functionality, quality, and budget. Success begins with professional consulting requiring years of experience and expertise in various disciplines such as mechanical engineering, electrical and automation engineering, and plant and process engineering. Considering the entire grinding plant with all its interrelations is crucial. Detailed analysis of the interrelations between different plant components can lead to more comprehensive and effective retrofit solutions. This holistic approach ensures that all aspects of the plant are optimised, resulting in more cohesive and efficient operations.

Flexibility and customised solutions

Flexibility is essential for suppliers as most projects demand customised solutions rather than standard equipment deliveries. This flexibility extends from organisational style and decision-making processes to the ability to bypass internal procedures throughout the supply chain, from engineering to commissioning and beyond. Tailored solutions can address specific operational challenges and align with the unique goals of each plant, ensuring maximum benefit from retrofit projects. Suppliers must be agile and responsive, able to adapt to changing project requirements and deliver solutions that meet the precise needs of their clients.

Given the rarity of new plant projects or new grinding terminals for cement in Europe and the USA, the retrofit market offers significant opportunities for companies like CEMTEC. Decades of experience in selling ball mills, dryers, cooling drums, and other process-relevant equipment form the basis for executing tailored retrofit projects. CEMTEC also develops digital products that can be implemented, automated, and visualised to optimise and enhance the efficiency of the cement manufacturing process. Continuous condition monitoring and analysis of collected data enable better predictive and preventive maintenance measures, helping to avoid unplanned plant stops and production interruptions which are critical

during high sales periods when produced cement is often dispatched immediately without storage.

CEMTEC refers to this type of operation as 'Smart Grinding'. This approach, combined with the installed base of each original equipment manufacturer (OEM), boosts the aftersales and spare parts business, strengthening customer loyalty and relationships. The integration of digital technologies in retrofitting projects can lead to smarter and more responsive plant operations, enhancing overall productivity and sustainability. Digital twins, for example, can simulate plant operations and predict outcomes, allowing for optimisation before physical changes are implemented.

Sustainability and future prospects

In conclusion, the concept of sustainability through retrofitting presents a viable and often preferred path for cement plants facing evolving product requirements and ageing equipment. By leveraging advanced technologies, comprehensive planning, and flexible, customised solutions, the cement industry can achieve significant improvements in efficiency, cost savings, and overall sustainability. The retrofit market, particularly in regions with limited new plant projects, provides substantial opportunities for companies to enhance their offerings and support the industry's transition towards more sustainable operations. The ongoing innovation in retrofitting techniques and technologies promises a future where cement plants can continually improve and adapt, meeting both economic and environmental goals. The role of retrofitting will only grow in importance as industries worldwide strive to reduce their carbon footprints and enhance their sustainability credentials.

Furthermore, the integration of circular economy principles into retrofitting projects can maximise resource efficiency and minimise waste. By reusing and recycling materials and components, cement plants can reduce their environmental impact and create more sustainable production cycles. Collaboration with other industries to repurpose by-products and waste materials can also contribute to this effort, creating a more interconnected and sustainable industrial ecosystem. ■

About the author

Over the last 20 years, Michael Lindbichler has worked on the supplier side for cement and mineral processing plants in various disciplines like machine and plant engineering, occupied the position of mechanical supervisor, and has worked in the sales department at different management levels. Michael is now trying to implement his experience in the most challenging but always interesting field of customised retrofit solutions at CEMTEC.