JUNE 2022

International Cement review

The next generation

ICR speaks with Vivek Kapoor, VP and regional segment leader at Schneider Electric, about the company's collaboration with Nanjing Kisen of China to deliver next-generation sustainable cement plants and accelerate the industry's digital transformation.

■ *by **ICR Research**, UK*

ICR: Schneider Electric has signed a partnership with China-based Nanjing Kisen (CNBM group) to deliver next-generation sustainable cement plants. How would you define "next-generation sustainable cement plants"? How will they compare to existing best-in-class cement plants?

Vivek Kapoor (VK): The goal of Schneider Electric and Nanjing Kisen's collaboration is to empower cement manufacturers and accelerate the digital transformation of organisations by leveraging Schneider Electric and Nanjing Kisen's digital capabilities.

Both Schneider Electric and Nanjing Kisen's objectives are in alignment, seeking to establish standardised architecture and assessment systems for intelligent plants to empower digital capabilities to the cement customer. The strategic partnership will improve the operational efficiency of intelligent cement plants through innovative digital modernisation.

ICR: What will Schneider Electric and Nanjing Kisen each bring to the partnership, and how will the combination of the companies' support advance the goal of creating more sustainable cement plants?

VK: Schneider Electric will deliver expertise in digital transformation, energy management, automation and best practices to the cement industry. In the partnership, Nanjing Kisen will collaborate with its expertise in the industry, as well as its vast experience in cement plant software development.

Schneider Electric recently signed a partnership with Nanjing Kisen, China

Drivers for next-generation plant design

ICR: Is carbon reduction the primary driver of these new initiatives and are you seeking to align with the existing industry roadmaps to net zero?

VK: The three primary goals of cement manufacturers is to drive efficiency, which in turn leads to the further goals of greater sustainability and profitability. Carbon reductions are vital in this collaboration, due to both the companies' commitment to sustainability and government mandates.

Cement plants could achieve high operational efficiency and reduced product cost throughout the process by using certain modern technologies, equipment, and solutions, which ultimately lead to higher profit levels. As a result, carbon reduction initiatives are both required and beneficial in the cement industry.

It will be challenging for the cement sector to achieve net zero in the very short-term. The thermal decomposition of $CaCO_3$ produces a large amount of CaO and CO_2 that cannot be compensated by decarbonisation methods. Measures include the use of alternative fuels, improved energy efficiency, or the use of new energy sources.

Carbon capture, utilisation and storage (CCUS) is a promising technology to reduce carbon emissions but is still currently in the early stages of development and its commercial viability is unknown. Overall, the first step for the cement industry is to become carbon neutral.

ICR: Do you intend to explore carbon capture technologies. If so, which one?

VK: Not in the near future. CCUS is an important tool for reducing process

Vivek Kapoor, VP and regional segment leader at Schneider Electric

industry. In fact, most of the world's cement giants want to implement this technology as soon as feasible to achieve carbon neutrality.

Large organisations such as Holcim, HeidelbergCement and Conch of China have already invested in this field. Others will follow suit.

ICR: What role will the digital transformation and plant automation play in next-generation cement plants?

VK: Digitisation and automation are essential tools that can help cement plants improve efficiency, reduce energy consumption and control costs.

However, the management of people and the company's management philosophy is the most critical aspect for a successful cement plant. The value and purpose of digitisation and automation might be excavated and displayed by effective strategy and efficient management.

ICR: You are aiming to establish a standardised architecture and assessment systems for next-generation intelligent plants. How radical will these new changes be?

VK: Launched by the World Economic Forum and McKinsey, the philosophy is

"After integration with specific plant application situations, artificial intelligence technology will be used increasingly in the cement sector. Depending on industry efforts, fully-autonomous kilns and plants will be commissioned in the future."

We anticipate that in the future, there will be defined criteria for the design and evaluation of intelligent cement plants. Many sub-items on different areas of the plant, such as production, equipment, energy, quality, safety and environmental protection, should be included in the criteria.

Based on the criteria system, every cement plant should be able to identify its shortcomings in comparison to the typical intelligent factory. The plant will be able to see where it needs to invest more and how to improve quickly as a result of this.

Building evaluation criteria is, of course, a major undertaking. It must incorporate a wide range of expertise and know-how. Schneider Electric is the global leader in digital energy management and automation, with four Lighthouse Factories throughout the world.

The team has cutting-edge technology and extensive experience in digital consulting for intelligent manufacturing. We propose collaborating with other exceptional ecosystem partners, such as Nanjing Kisen, to empower cement makers and expedite their organisation's and business' digital transformation.

ICR: Do you foresee fully autonomous kilns and plants and, if so, how soon?

VK: Fully autonomous kilns and plants will exist in the future. In fact, some of the technology required to support completely autonomous cement plants is already in place and in use.

Examples include intelligent laboratories, which have already achieved automation for sampling. Online equipment monitoring systems, which ensure that patrol inspectors are no longer required while automatic packing and loader machines means that no labour is needed for packing and loading. Cement plants can also implement manufacturing operations management (MOM) technologies, which include an energy management system that can produce timely carbon emissions data.

Finally, an advanced process control (APC) system helps to achieve near-autonomous kiln operations with minimal operator intervention. Schneider's APC system, installed at CNBM's Qilianshan plant (China) in 2017, has already achieved 99 per cent online operation.

After integration with specific plant application situations, artificial intelligence technology will be used increasingly in the cement sector. Depending on industry efforts, fully-autonomous kilns and plants will be commissioned in the future.

Energy and emissions in the next-generation plant

ICR: Which electrical and thermal fuel sources do you see next-generation cement plants relying upon?

energy, wind energy and waste heat recovery (WHR) power generation are sources that next-generation cement plants will rely upon to cut carbon emissions.

In terms of thermal energy, cement plants will also rely on fossil fuels (coal, natural gas, oil and petcoke) as well as on alternative fuels such as biomass, municipal waste, tyres and rice husks.

ICR: How will new plants accommodate alternative fuels and what thermal substitution rates do you expect to prevail in the industry?

VK: To achieve the heat balance and product quality requirements for various types of alternative fuels, plants must modify current processes and crucial equipment.

It is not a common solution when it comes to thermal substitution rates. For many alternative fuel types, it is dependent on local policy and related supply chains.

For example, if one form of alternative fuel supply chain is working, that fuel can be used more broadly. Take tyres as an example: several Western countries, such as Canada and the UK, already use tyres as an alternative fuel for the cement industry, but most Asian and African countries have yet to do so due to the lack of a complete supply chain. Plants are unable to source suitable tyres from the right supplier on the market.

ICR: What targets will next-generation cement plants expect to meet in terms of emissions reduction, including CO_2 emissions?

VK: Dust, CO_2, SO_2 and NO_x are the most common emissions in cement plants. It would be acceptable, according to the best-in-class plant in the world, if cement plants achieved the following emission data:

- dust: <5mg /Nm^3
- CO_2: <0.6kg/kg clinker
- SO_2: < 50mg/Nm^3
- NO_x: < 50mg/Nm^3.

ICR: How will you approach energy-saving and how can digitalisation support this aim? What scope is there to reduce opex and maintenance costs in cement plants?

VK: I would take a two-pronged approach to energy conservation. Firstly, by using more energy-saving equipment, including mechanical equipment. This includes having a higher efficiency fan, a baghouse with a lower pressure drop to reduce a lower outlet temperature to lower heat consumption.

Additionally, electrical equipment that has a permanent magnet motor and a variable speed drive will help reduce energy consumption.

Secondly, providing smarter options such as improving operator skills and avoiding overcooling, over-grinding or over burning equipment will ensure energy is saved and will keep maintenance costs down.

Digitalisation has a large role to play in reducing overall energy consumption. APC will reduce coal and power consumption while EMS will reduce power and improve efficiency. Lastly MOM will integrate all production dates and will achieve seamless connections to all submodules while enhancing production efficiency and reducing cost.

Product innovation

ICR: How do you envisage product development, such as new clinkers and lower-clinker cements, impacting plant design going forward?

VK: The most practical way to achieve large-scale CO_2 reductions is to use blended types of cement in which extra cementitious ingredients replace some of the energy-intensive clinker. Limestone calcined clay cements (LC3) – blended cements made from a combination of limestone, calcined clays and ordinary Portland cement (OPC) – provide a solution with equal mechanical performance to OPC, greater chloride resistance and a 40 per cent reduction in CO_2 emissions from the alkali-silica reaction.

Furthermore, they are less expensive than OPC already on the market. Due to the similarities with OPC, it is a material that can be adopted globally in the future with the same construction equipment and workforce.

The key process design for LC3 appears to be like that of the classic OPC product. This new product is being developed by several global cement manufacturers.

ICR: Where do you envisage the greatest challenge will be in making smart cement plants low-energy, with a reduced carbon footprint, virtually maintenance free and fully intelligent factories?

VK: Achieving a fully intelligent factory is difficult for any industry. However, Schneider Electric has extensive expertise in integrating world-leading processes and energy technologies to achieve maximum efficiency and sustainability.

Based on our previous experience, the greatest challenge is integrating advanced technologies into operation application scenarios in specific industries. This is an iterative process that requires a lot of practice to demonstrate that new technology/solutions are effective and offer value to customers and industries.

Schneider Electric has worked in the cement industry for more than 20 years, gradually developing capabilities and know-how to the point where we can now offer a complete portfolio of EcoStruxure-based solutions to customers. We hope to have more opportunities to work with cement customers in the future. ■

Schneider Electric and Nanjing Kisen aim to establish standardised plant architecture and assessment systems for intelligent cement plants