Smart dosing and weighing for green cement

The cement industry must significantly reduce its emissions, but the path to greater sustainability is technically challenging. Alternative fuels, less coal dust and a reduced clinker content can make a big difference, but they also present plant operators with new challenges. A look at practical examples shows how modern dosing and weighing technology can help to overcome these challenges.

■ *by **Qlar** (formerly Schenck Process), Germany*

Alternative fuels (AFs) such as refuse-derived fuel (RDF) from household and commercial waste, solid recovered fuel as a high-quality alternative with a higher calorific value, biomass and plastics can make a significant contribution to decarbonisation. Such waste products can be integrated into the production process to replace some of the fossil fuel, which means that certain plastics or organic waste that are not suitable for high-quality recycling can also be put to good use instead of continuing to release CO_2 in landfills.

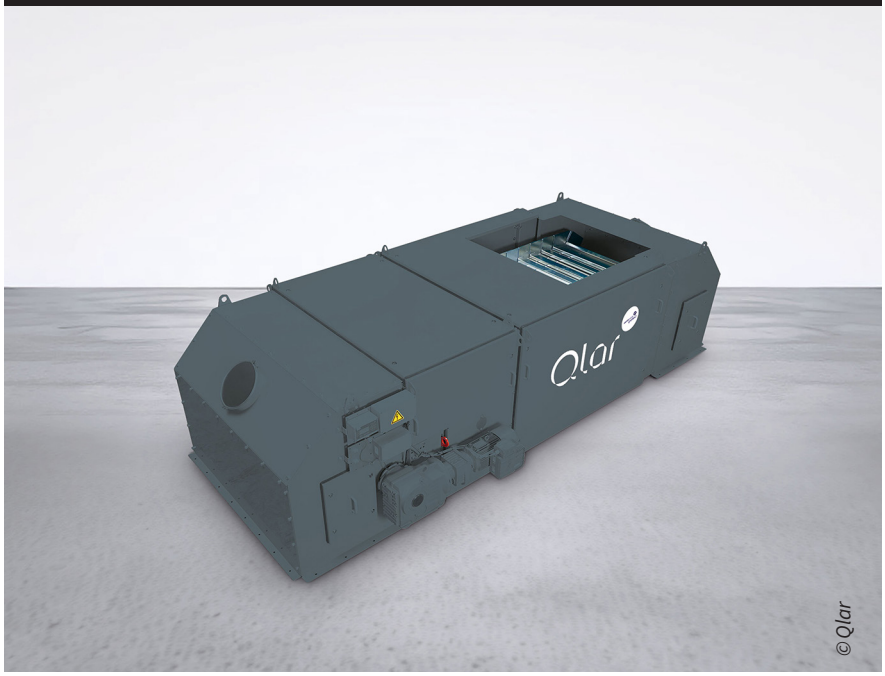
A major problem with the use of AFs is their inconsistent composition. The physical properties of waste materials can vary greatly, making precise dosing and control during the combustion process difficult. Materials with high volume and low weight in particular tend to form bridges and cause blockages. Such fluctuations in the material flow and the varying quality of the fuels can lead to instability in the burner flame and the kiln temperature.

A further issue is the potential deterioration in cement quality when residues are produced in the furnace process. This is a result of inaccurate dosing or uncontrolled combustion of AFs. To meet these challenges, technology providers have already developed solutions that enable precise and stable handling of fuels.

The importance of AF dosing and conveying systems

Modern weighing and conveying systems are essential for stable, precise dosing of AFs. The MULTIDOS, MULTIFLEX and MULTICELL-AF systems from Qlar are designed to meet the challenges of handling these materials. MULTIDOS weigh feeders achieve ±0.5 per cent accuracy when dosing materials with varying densities and properties. Their robust, low-profile design requires minimal maintenance and fits where rubber belt weigh feeders fail due to space or material limitations.

MULTIDOS weigh feeder units feature a robust, low-profile design that requires minimal maintenance. They can be used where rubber belt weigh feeders fail due to space or material limitations



MULTIFLEX handles a wide range of fuels, including RDF and biomass, with continuous, pulsation-free performance. Its dust-tight design protects the environment, and the system offers high accuracy of feeding with deviation under one per cent thanks to automated calibration.

MULTICELL-AF feeds AFs directly into pneumatic systems, ensuring a reliable supply. Optimised for rotary kiln calciners, it features a maintenance-friendly set-up and a service strategy that minimises downtime and costs.

At its Test and Innovation Centre in Prague, Qlar offers customers the opportunity to analyse the quality and physical properties of their waste materials before they are integrated into the plant. This helps to minimise risks and improve process stability. The Test and Innovation Centre features pneumatic conveyors, belt and chain conveyors, flexible feeders and valves, logistical controls and solutions for loading and unloading bulk materials.

The MULTIFLEX feeder handles a wide range of fuels, including RDF and biomass, with continuous, pulsation-free performance

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Case study: process optimisation and increased efficiency in upgrading installations

A leading producer of building materials was faced with the challenge of improving its environmental balance while increasing the efficiency of its production processes. The company had been a Qlar customer for many years and had already installed a feeding system for the use of AFs over a decade ago. However, new technological possibilities and stricter requirements made modernisation necessary. The main challenges included limited space and strict height restrictions imposed by the existing infrastructure, precise and reliable dosing of the fuels, and the prevention of dust contamination. In the past, this had led to impairments of the plant.

Qlar developed a solution that was precisely tailored to the customer's individual requirements. Two MULTIFLEX dosing units and four MULTICELL-AF rotary valves were used. The feeders enable flexible, precise and continuous feeding of the AFs and thanks to their compact design and the option of ceiling mounting, they could be optimally integrated despite the limited space available. Each feeder has two outlets, so that four inlet points can be served simultaneously with only two devices – this saves space and reduces investment and operating costs. The new solution is based on a completely dust-tight design: the MULTIFLEX dosing units feature a closed system with special seals. Prior to installation, the customer was able to examine the dosing units at the Qlar Test and Innovation Centre and analyse specific data based on the exact materials to simulate the optimal process.

The four rotary valves are responsible for reliably feeding the material into the pneumatic conveying stream. They are specially designed for use with AFs and offer high operational reliability. The blow-through principle ensures that the material is fed directly and evenly into the conveying line, effectively preventing blockages and material bridges.

As a result, the required targets in terms of consistency, accuracy and sustainability were achieved. The new solution is significantly more energy-efficient and economical than the previous technology and, thanks to the dust-tight design and optimised conveying system, operational disruptions and maintenance costs are now reduced to a minimum.

Challenges and solutions in reducing the clinker factor

Although the cement industry is continuously working to improve its firing and transport processes, calcination remains one of the biggest challenges for decarbonisation. A promising approach is to reduce the clinker content by using additives. Commonly used additives include fly ash, granulated blastfurnace slag, recycled concrete and finely ground limestone. However, to ensure that the cement continues to achieve the required strength and hardening values, the additives must be fed and processed in precise mixing ratios. This is where the MULTICOR S and MULTICOR H mass flow meters, both based on the Coriolis principle, come into play. The material falls freely into the rotating measuring wheel. Centrifugal force pushes the material particles outwards along the guide vanes and the Coriolis force acts on the material on the measuring wheel due to the acceleration in the circumferential direction. As a measured variable, this force is directly proportional to the gravimetric throughput, even with

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MULTICELL-AF feeds alternative fuels directly into pneumatic systems, ensuring reliable supply

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different bulk densities and grain sizes.

The material is mixed directly into the process according to the "just-in-time" principle, with a rotating measuring wheel bringing the main components and additives together. This not only reduces the need for intermediate storage systems and silos but also eliminates the need for separate mixers, resulting in significant cost savings. Measurement is accurate to ±0.5 per cent, despite any fluctuating physical properties in the bulk materials. MULTICOR S is particularly suitable for applications where large quantities of bulk materials need to be conveyed continuously and precisely, such as in the dosing of dust or the measurement of material throughput in production processes. The compact design and simple in-line installation make the system extremely economical for both initial installation and retrofitting existing systems. It also offers high flexibility and low maintenance costs. The MULTICOR H system is designed for higher throughput rates and is ideal for more demanding applications.

The high-precision volumetric and gravimetric LIW Feeder MET CF is ideal for handling materials with different densities and particle sizes. The special geometry of the dosing container with an axially symmetrical container inlet, flexible wall and external discharge aid ensures reliable product flow into the dosing element and prevents bridging and deposits. The specially shaped Coni-Flex screw conveyor enables a uniform mass flow – even with sensitive or difficult-flowing materials. The LIW Feeder MET CF doses reliably and extremely accurately for specific applications with a value of better than ±0.5 per cent.

The MULTICOR mass flow meter is based on the Coriolis principle and measures the material flow with an accuracy of ±0.5 per cent

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Material tests under real conditions

The precise dosing and mixing of clinker substitutes pose technical challenges for cement manufacturers, especially when different raw materials have to be combined in exact proportions. To enable well-founded decisions to be made in this area, the expanded Test Centre in Darmstadt supports the targeted testing and optimisation of formulations under realistic process conditions. Among other things, the MULTICOR S mass flow meter and the LIW Feeder MET screw feeder are available for this purpose. The combination of both systems enables reliable control even of complex mixing ratios, while the closed-loop system of the Test Centre allows throughputs of up to 7tph. This means that new material combinations can be tested under realistic conditions and, based on the analysis of the mixed samples, well-founded conclusions can be drawn for later production. The aim is to stabilise processes, ensure product quality and efficiently integrate the use of clinker substitutes into everyday production.

Replacing coal dust with AFs in the cement manufacturing process can also help to reduce CO_2 emissions. Although carbon remains a necessary component in many modern cement plants, because it helps to stabilise the kiln temperature and compensate for fluctuations in fuel quality, the ecological balance can be significantly improved by continuously minimising the amount of coal dust. Advanced dosing systems and mass flow meters are also required here to control the flow of coal dust precisely and without pulsation, thereby ensuring consistent process quality.

This shows that if the cement industry wants to produce more sustainably, it needs not only the right materials, but also reliable processes – and precise technology that brings both together. ■