Newest ETA developments making your clinker production more competitive.

Cement producers around the world face pressures to reduce costs, while also improving the environmental sustainability of operations. Balancing the two is no easy task. Which is where the latest generation of ETA cooler from Claudius Peters comes into play.

As a cement producer today, you face an array of challenges to the day-to-day running of your plant and the success of your business. In many markets, overcapacity drives fierce competition: cost control is therefore always at the top of your priority list. But this must never come at the expense of quality or the safety of your equipment nor your workers. At the operational level, this is focusing attention and investment on improving the overall efficiency and reliability of equipment.

ETA Cooler. Plant: Shanshui Pingyin Line #2, Clinker Capacity: 6500 t/d, in operation since April 2020.

This was recognised back in 2015 by McKinsey, which wrote that there were "two prevailing models [of business success in the cement industry] cost leadership and premium selling".[1] The cost leadership model – as the name implies – is based on harnessing the lowest possible cost base to maximise value, including "operational excellence [where] the largest areas for cost improvement are usually thermal and electrical energy consumption, labour, maintenance and logistics." Even within the premium selling model, however, where the focus is more on building trusted brands to leverage premium prices, "cement companies must make cost awareness a fundamental part of their business".

It is no exaggeration then to say that, as a cement producer, cost is king.

Overshadowing all of this is the spectre of climate change. It is now well known that cement production accounts for about 7% of manmade CO_2 emissions each year. This simple fact has placed the industry at the heart of climate action, raising new risks. Investors around the world are increasingly making climate sustainability an important factor in their decision making, while public pressure is likely to drive further tightening of environmental regulation over the next decade.

Reducing the environmental impact of cement production may therefore soon be as vital to the financial viability of a company as controlling the cost base.

View into an ETA cooler including the autogenous layer.

As a long-standing equipment supplier to the cement industry, we recognise these challenges – and also understand that there is no single silver bullet. Rather solutions will come from a broad spectrum of smaller changes and improvements made along the production line – from raw mill to final grinding and dispatch. And that most of this work will be done at existing production lines, rather than at greenfield developments. But as McKinsey noted, there will also be common themes, one of the most important of which will be a focus on improving energy efficiency.

More often than not, it is the mills (for electrical energy) and the kiln (for thermal energy) that make the most headlines here. In contrast, the clinker cooler can sometimes appear to play second fiddle – but every part has a role to play in improving the overall efficiency of the process. And the cooler is no exception.

Listening to our customers: improving electrical efficiency

This was the philosophy that drove development of the latest generation cooler here at Claudius Peters. We'd been asked by customers, notably Anhui Conch in China, to develop a cooler with lower electrical energy consumption, while maintaining the performance of previous iterations of ETA cooler, such as high thermal overall efficiency, low wear, and long service life.

"In the past, we have worked hard at optimising the thermal overall efficiency of the ETA cooler – to the point where our technology is a leader in the market. But the electrical efficiency remained higher than, for example, traditional grate coolers," said Kurt Herrmann, Managing Director Global Sales at Claudius Peters Group. "The number one goal for further development of the ETA cooler was therefore to improve electrical efficiency."

State-of-the-art finite element analysis was undertaken to optimise the design of the aerated lanes that are at the heart of the ETA concept. Each aerated lane comprises a rectangular frame, supported on rollers, with aeration pockets containing sieved pebbles on which the clinker lies. The layer of pebbles (also known as the autogenous layer) protects the air inlet from heat and wear – the key behind the ETA cooler's reliability and long service life.

The further developed ETA cooler maintains this concept – but optimises it by reducing the height of the autogenous layer by 57%. The narrower autogenous layer maintains the excellent heat and wear protection performance of previous

generations of ETA cooler but also brings a major improvement in electrical efficiency. So, how does it do this?

“The reduction in the height of the autogenous layer results in lower pressure drop over the lanes,” explained Andre Vos, Senior Sales Manager at Claudius Peters. “And the lower the pressure drop, the lower the electrical power consumption of the cooling fans. As a rule of thumb, we expect a 15%-20% reduction in electrical energy consumption.”
This is a significant achievement, as Herrmann continued. “With this further development of the ETA cooler, we have reached levels of electrical efficiency that are within the range of the traditional grate cooler but without the challenges, such as grate plate failure and material fall-through. This is what our customers have been asking us for!”

Indeed, the benefits are already being enjoyed by our customers with 16 ETA coolers ordered to date since the new developments have been introduced at locations worldwide. At one such installation, at Shanshui Pingyin Cement, the energy efficiency was improved to a steady recuperation temperature level of 1150°C and a mid-air temperature level of 440°C utilized for waste heat recovery while maintaining a clinker outlet temperature far below 100°C. While operating with an area grate load of 45 tpd/m² the power consumption of the cooling air fans was reduced by 0.7 kWh/t compared to the earlier ETA cooler generation.

But there’s more: benefits beyond electrical efficiency
The changes to the aerated lanes also bring several other benefits. For example, there is an increase in the aerated surface area, which helps to eliminate dead zones in the cooler and optimise cooler performance.

We were also able to redesign the lanes, standardising the parts and reducing the overall weight. The amount of pebbles required has almost halved. Looking at the total flame-off-period for a cooler replacement this can be defined as a detail but it illustrates the commitment of Claudius Peters to push for improvements in its technology. As a result, manufacturing, assembly and installation times are lower with the new ETA cooler than they were with previous iterations, which means we can deliver the benefits of the ETA cooler in a greater variability and within shorter timeframes than before.

Schematic representation of the ETA cooler lanes (left: sectional view lane of previous ETA generation; right: sectional view of newest ETA generation).

One specific example is the design of the longitudinal sealing system. Whereas the previous design requires precise installation, the latest sealing system is “fool proof”, according to Vos. “To guarantee a seal between the moving parts, we have used a spring design. We have also cut the length of the seal by half to make it much easier to handle. And parts have been standardised, so fewer spare parts are needed, which again helps to reduce costs.”

There have also been improvements in the design of the modular lower part of the cooler. “The new design now includes side walls, making conventional side wall construction obsolete,” continued Vos. “For the customer, this again means that the time needed on site for cooler conversion is shorter and the job is much simpler than before. With other improvements to the roller design to enable quick mounting/disassembly, the new modules are now so easy to install, we use it for new plants, as well as conversions.”

The new modules, called lane units, come in two- or three-lane widths and can be flexibly combined for

any cooler width up to twelve lanes.

The updated ETA cooler is also digital-ready and equipped with smart devices that give the customer the ability to send data to our experts in Buxtehude, Germany without permitting external access to their primary networks. This enables us to offer remote support in a safe and responsible manner to customers in terms of cooler operation and optimisation to make sure the cooler is providing the best possible performance.

Schematic representation of the new sealing system.

And what about the environment?

While costs remain the main operational headache, the talk of the cement industry – at conferences and in the pages of trade journals – is now all about environmental sustainability with several major producers pledging to rapidly reduce the carbon intensity of their cement.

For example, members of the Global Cement and Concrete Association (GCCA), which include 40 of the world's leading cement and concrete companies, recently committed to driving down the CO_2 footprint of concrete with an aspiration to deliver carbon-neutral concrete by 2050.[2] As the GCCA's members are primarily cement producers, and cement production is the most significant contributor to the CO_2 footprint of concrete, this will inevitably require substantial reductions in the CO_2 emissions from the cement-making process. Meanwhile, one global player has gone a step further and committed to operating its first net-zero cement production facility by 2030.[3]

Improving the energy efficiency of cement production is a critical part of this push to zero emissions: it is one of the four main strategies identified by the International Energy Agency in its technology roadmap for a low-carbon transition in the cement industry, alongside switching to alternative fuels, reducing the clinker content in cement, and deploying emerging technologies, such as carbon capture.[4]

With its potential to improve electrical consumption, the ETA cooler fits perfectly within the green imperative. "There is a real push for green solutions coming at the top level of the cement industry and at producers around the world," concluded Herrmann. "Showing how a project – be that to the cooler or to any other part of the cement plant – will improve the plant's environmental performance is therefore becoming an increasingly important part of justifying the expenditure and gaining planning approval, not only in regions where environmental regulation has traditionally been tight, such as the EU, but also in China and important emerging markets, such as Vietnam. By improving electrical energy consumption, the ETA cooler is ready to support the industry in reducing its indirect CO_2 emissions and meet its climate ambitions."

Conclusion: cost and climate

The ETA cooler is a response to the industry's needs and the challenges faced, every day, at cement plants around the world. By addressing both financial and environmental sustainability, it represents an investment in the future.

"The cooler market is constantly evolving and now, more than ever, we must be responsive to the needs of and challenges facing our customers," concluded Herrmann. "As a result, we are never standing still but always working to improve. Part

of this is a constant dialogue with our customers to make sure we offer solutions that support their success and make their lives easier. It's something I think we've achieved with the ETA cooler. But we're not resting on our laurels: we're already working on our next development, our next project, our next improvement. So stay tuned!"

References

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2. GCCA Climate Ambition.
3. LafargeHolcim: Becoming a net zero company: Our pledge in numbers.
4. Technology Roadmap – Low-Carbon Transition in the Cement Industry, IEA (2018).