Cement and Building Materials Review
No. 101 September 2025

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FIFTY YEARS OF ACHIEVEMENT

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Arab Swiss Engineering Company
"ASEC"

Dear Readers….

When I started to write the introduction, a quote popped up “Days pass like papers from a press”; isn’t this true?

I would not risk counting the days, for many reasons! However, looking back, all those 25 years of working for every CBMR issue did pass like papers. They were full of very kind mutual messages with contributors, always carrying gratitude and positive feedbacks. Even when mistakes happen, they were met with support.

The magazine gradually progressed, being improved based on feedbacks, till it reached its current “look”. We are continuously working to improve CBMR shape and content with the support of its contributors and readers, as always.

We herewith leave you with the inputs of some of our long-lasting contributors to previous editions all along the past 25 years, and hope you enjoy reading this exceptional issue.

All the best!

Suha Canaan
Managing Editor

25 years of collaboration

ASEC & AUCBM: A Partnership Built on Trust and Shared Vision

The relationship between Arab Swiss Engineering Company (ASEC) and the Arab Union for Cement and Building Materials (AUCBM) is one of enduring partnership, built on mutual trust, professional collaboration, and shared respect. For decades, ASEC has been an active and valued partner in AUCBM's initiatives, contributing expertise, innovation, and commitment to advancing the cement and building materials industry across the Arab region.

This long-standing collaboration embodies more than professional cooperation - it reflects a shared vision for growth, knowledge exchange, and sustainable development. Together, ASEC and AUCBM continue to reinforce their role as leading institutions shaping the future of the industry.

Gebr. Pfeiffer

"We would like to take this opportunity to send our congratulations to the AUCBM on the occasion of the 100th issue of Cement and Building Materials Review (CBMR). For us, a trusting relationship with magazines is just as important as reaching our target group through their readership. CBMR ticks both boxes, as our collaboration runs smoothly and it publishes in a market that is important to us. We wish them every success and look forward to continuing our excellent collaboration!"

INTERMAINT

As a permanent member of the Arab Union for Cement and Building Materials (AUCBM), our long-standing strategic partnership is a multidimensional alliance that powerfully embodies our commitment to advancing the industry. This privileged membership grants us unparalleled advantages, including direct influence on sector standards, access to specialized research and advanced market intelligence, and a premier platform for showcasing innovation and building networks with key decision-makers. Through our active and consistent participation in the Union's premier conferences and exhibitions, we engage directly with the heart of the sector to foster industrial dialogue and co-create the transformative solutions that will define the future of building materials across the Arab world. This deep-rooted collaboration is a testament to our belief that true progress is built collectively, solidifying our role as a cornerstone of the regional industrial ecosystem we serve.

25 years of collaboration

MVW Lechtenberg & Partner

“My sincere thanks for the successful collaboration with the Arab Union for Cement and Building Materials, which has led to many friendships. The annual AUCBM and the Cement and Building Materials Review are an integral part of our work in the Arab world. My special thanks and congratulations go to Eng. Ahmad Al Rousan and Suha M. Canaan.”

AUCBM & RHIMagnesita: Driving Innovation and Building Stronger Partnerships

RHI Magnesita and AUCBM have shared a strong and strategic partnership that has significantly influenced the cement and refractory industries in the region.

Through our active participation in Arab International Cement Conferences & Exhibitions we have showcased groundbreaking innovations, sustainable technologies, and advanced business models that enhance operational efficiency, support CO_2 reduction, and optimize refractory solutions for cement production.

This collaboration has strengthened relationships, connected industry leaders, and fostered an ecosystem of knowledge sharing and innovation across both sectors. Together, we have opened new opportunities and developments that benefit RHI Magnesita, the cement community, and the broader refractory industry.

We are proud of this enduring cooperation and remain committed to driving progress, sustainability, and innovation in our industries.

S.I.G.

“A long-lasting collaboration between AUCBM and SIG that for more than 20 years has been assuring mutual satisfaction for both sides.

Thanks to aucbm organisational team, SIG could have the chance to spread its brand worlwide in the cement industry where our products have always been a synonym of excellent quality.”

25 years of collaboration

BEUMER Group extends its congratulations to AUCBM

“BEUMER Group congratulates AUCBM on the anniversary of the quarterly “Cement and Building Materials Review” (CBMR): Over the past 25 years and 100 issues, CBMR has reported on the Arab cement market, its companies, and key market developments. As a globally active, third-generation family business, we are proud to have supported AUCBM and CBMR throughout these past 25 years and would like to thank you for the excellent and mutually beneficial cooperation so far. We see AUCBM as an esteemed and trusted partner in the region. Our 5,700 dedicated employees worldwide are passionately committed to customer satisfaction every day. BEUMER Group’s material handling solutions provide reliability, efficiency and integration capabilities essential for a sustainable competitive advantage. For example, BEUMER Group optimised the design of the elevator bucket, resulting in a far more efficient machine that delivers major benefits for the cement industry. We were excited and thankful that CBMR reported on our game-changing bucket redesign. BEUMER Group is looking forward to an exciting future together with AUCBM’s CBMR!”

Claus Weyhofen

Head of Sales Cement,
BEUMER Group

Bilal Jabboul

Business Unit Director Product Business,
BEUMER Group, Middle East

About BEUMER Group

BEUMER Group is a global manufacturer of material handling solutions. As a third-generation family-owned business, the company offers high-quality system solutions and comprehensive customer support worldwide and is a “Partner of Choice” for the mining, cement, building materials, petrochemical, consumer goods, postal, e-commerce, fashion, and baggage handling industries. With around 5,700 employees worldwide, BEUMER Group generates an annual order intake of around 1.39 billion euros. In line with the company motto “made different”, BEUMER commits to the highest standards of quality, innovation and sustainability. For more information, please visit **www.beumer.com**

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For almost 20 years, we have partnered with AUCBM and the AICCE conference to exchange knowledge, connect with peers, and advance the future of cement. We are proud to continue our sponsorship and look forward to meeting both familiar faces and new colleagues at this year's event.

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Contents

Articles

The magazine editorial staff welcome the contribution of experts to enrich the contents of the magazine.

Points of view expressed in the magazine do not necessarily express points of view of the AUCBM or the magazine itself. It is rather the opinion of the author.

The AUCBM does not bear legal liability or responsibility from any article.

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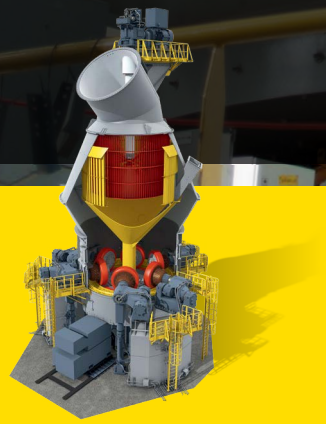

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Dust-Free Cement Plants

Innovative Solutions for Safer, More Efficient Operations

Dust management is one of the biggest challenges in cement plants, affecting worker safety, operational efficiency, and environmental compliance. At **DISAB**, part of the Ferrata Group, we specialize in industrial vacuum technology that helps plants operate cleaner, safer, and more efficiently — from material handling to dust elimination and maintenance operations.

Traditional systems often fail due to limited suction, frequent downtime, and lack of explosion protection. DISAB's solutions address these gaps with **mobile and stationary vacuum systems,** designed to meet the specific needs of cement operations. Mobile units provide flexibility for spot cleaning and targeted interventions, while stationary systems handle high-volume, continuous dust removal.

Customer feedback highlights the tangible impact of our solutions: reduced downtime, improved air quality, and safer work environments. Real-life cases demonstrate how DISAB machines solved persistent dust problems that conventional systems could not manage.

Safety and compliance are at the core of our approach. All DISAB systems for cement applications are **ATEX-certified**, providing explosion protection and peace of mind for operators in hazardous areas.

By integrating dust elimination with other material handling processes — from **bagging and packing to storage, conveying, and silo cleanout** — DISAB enables cement plants to optimize workflows, reduce operational risks, and support the ecological transition. Our solutions combine innovation, flexibility, and proven performance to transform industrial operations and ensure long-term productivity.

DISAB is proud to support AUCBM's Cement and Building Materials Review for many years. Our collaboration has allowed us to share innovations in industrial vacuum technology and dust management with the cement industry worldwide. We look forward to continuing this partnership and contributing to safer, cleaner, and more efficient operations for years to come.

AUCBM's ***Quarterly Cement and Building Materials Review (CBMR)***

EDITORIAL SCHEDULE 2025

ISSUE	THEMES	EVENTS
December 2025 (# 102)	- Coolers - Fans - Air cannons - Occupational health and safety - Comminution - Vertical roller mills - Roller presses - Increasing cement mill output - Crushing - Grinding & grinding aids - Waste heat recovery - Thermal imaging - Thermal recycling - Methods for treating and utilizing bypass dusts - Explosion protection in alternative fuel storage silos - Alternative fuels handling systems - Production and use of Solid Recovered -Fuels	

Deadline for receiving articles, press releases, or advert materials for December issue: **8th December 2025**

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PLACE	Once insertion	Twice insertion	3-times insertion	4-times insertion
Outside Front Cover	1,250	****	****	****
Full Page (A4)	750	950	1,250	1,350
Half Page (A5)	450	550	650	750
Quarter Page (210*75mm)	300	350	400	450

For the **outside cover**, dimensions are: 20 (height) x 20 cm (width)
Aspect ratio 1:1
Resolution: 300dpi
File: PSD, EPS, or PDF

BANNERS (JPG) ON THE FIRST PAGE OF www.aucbm.net

US$ 150 per month
Size is 200pixel w X 75pixel H
Resolution: 300dpi (please send with the requested link)

AUMUND Group expands its portfolio with the integration of ESI Eurosilo B.V.

Strategic addition in the field of Bulk Material Storage

AUMUND announced that, as of June 25, 2025, ESI Eurosilo B.V., headquartered in Purmerend, the Netherlands, has officially joined the internationally operating AUMUND Group. The integration of ESI Eurosilo strengthens AUMUND's strategic position as a full-range provider of high-quality bulk material handling solutions.

Technological and Market-Strategic Synergy

ESI Eurosilo is a globally recognized leader in space-efficient and cost-effective vertical storage solutions for materials such as FGD gypsum, potato starch, sugar, fertilizers, coal, petroleum coke and a variety of other bulk solids. With over 50 years of experience in developing innovative silo technology, ESI Eurosilo's products and expertise perfectly complement AUMUND's existing portfolio of conveying technologies. With the bigger network of global partners, customers will be served even better in all aspects: from enquiries to service and after-sales.

Strengthening Market Position

The integration of ESI Eurosilo marks another important milestone in AUMUND Group's long-term "Move Forward" strategy. With more than 100 years of experience, AUMUND stands for innovation, reliability, and customer proximity. With ESI Eurosilo, the Group is consistently expanding its technological leadership becoming more and more a single source provider in the bulk materials sector.

About the AUMUND Group:

Operating in over 150 countries worldwide, the AUMUND Group is a recognized expert in bulk material handling. Its technically advanced, innovative solutions can be seamlessly integrated into virtually any customer or site-specific setup. AUMUND systems for the safe transport of hot, abrasive materials, optimized cooling processes, advanced storage and blending bed technology, as well as mobile loading and unloading systems, have made the Group a key player in demanding industries. At the same time, AUMUND companies are reliable partners for plant manufacturers and operators – whether for new builds, conversions, or modernization projects. Multiple production sites with engineering and R&D capabilities, strategically located warehouses, in-house spare parts production, international service companies, service centers, and numerous sales locations ensure maximum plant availability for customers worldwide – while supporting resource conservation.

Since 2023 the Aumund Foundation has been the new proprietor of the AUMUND Group with the aim of a long-term and sustainable company development.

Alongside reliable plant availability, customers can also count on the sustainability of solutions from AUMUND. Each Group company and each service provider offers ecological solutions, which are environmentally sound, and follow the principle of the circular economy.

About ESI Eurosilo B.V.:

Headquartered in Purmerend, the Netherlands, ESI Eurosilo B.V. has been designing vertical storage solutions since the early 1970s, starting with silo systems for potato starch. Over the decades, the company has expanded its expertise to provide advanced storage technologies for a wide range of difficult-to-handle bulk materials such as FGD gypsum, potato starch, sugar, fertilizers, coal and petroleum coke and many more. ESI's silos feature integrated systems for controlled material handling, and are known for their compact footprint, high reliability, and automated operation. With more than 190 systems installed in over 25 countries, ESI Eurosilo has built a strong global reputation across the energy, mining, chemical, and agri-food sectors.

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Heidelberg Materials automates Paris plant

Axians successfully implements its VAS Yard Management software at 1,000th plant

Ulm, September 8th, 2025. Axians IAS reached a significant milestone in its company history: its VAS Yard Management solution went live at all Heidelberg Materials France cement plants. With this rollout, the application for digitizing and optimizing loading and logistics processes in the bulk materials industry is now deployed in over 1,000 plants worldwide. This milestone marks the impressive growth of the ICT and logistics solutions specialist over the past decade – back in 2015, the number of installations stood at 180.

The VAS Yard Management solution went live by early 2025 at 14 Heidelberg Materials cement plants in France, including nine production plants and five terminals (depots). Among them is the company's 1,000th plant in Bruneseau, Paris, where the solution manages the fully automated loading of trucks with cement. No on-site personnel are required for the processes, as drivers can handle all steps independently. During the initial week after the go-live, the 14 plants processed over 3,000 delivery notes with trucks and full trains. Jean-Luc Degrange, Project Manager at Heidelberg Materials France, expressed his satisfaction with the project's success: "Planning and executing the rollout of this large-scale project across 14 plants was a unique challenge for our team and Axians. Together, we successfully completed this project. We congratulate Axians IAS on its 1,000th implementation and wish them continued success with the next 1,000 deployments. "

Globally, the VAS solution ensures the smooth processing of over 10 million truckloads per year. As a result, thousands of delivery and loading processes are streamlined daily, depending on the plant's size. Jens Büschl, Head of Operations at Axians IAS, explains: "The successful go-live across 14 cement plants, including the 1,000th plant in Bruneseau, represents a major achievement for our VAS solution. Processing over 3,000 delivery notes in just one week demonstrates how effectively our solution optimizes plant operations. We sincerely thank Heidelberg Materials for their trust and look forward to continuing our collaboration to digitalize additional plants."

For more than 30 years, Axians IAS solution applications have been trusted worldwide and are now used in over 30 countries. Companies of all sizes and industries rely on these solutions, showcasing their flexibility and adaptability across diverse operational environments. A key factor behind this success is the continuous development of Axians IAS products. From the very beginning, the solution has been continuously updated to meet new technological and industry requirements, with additional modules enhancing their functionality. The product portfolio has expanded to include mobile apps for optimized yard management and a solution for centralized logistics workflow. For many years, various bulk material logistics sectors such as cement, aggregates, and asphalt, as well as an increasing number of companies from the recycling industry, have been utilizing the logistics services of Axians.

Since its founding, the company has maintained close collaboration with its clients, ensuring that their needs drive innovation. Customers value not only the company's advanced and high-performing solutions but also the extensive range of services that go far beyond system maintenance and support. Through business process consulting, new module integration, customization, and scalable solutions, Axians empowers companies to evolve – growing alongside them. Throughout this process, customers can rely on the expertise of the Axians team, which provides support across the entire lifecycle of their solutions. Marc Graner, Axians IAS Managing Director emphasizes the high importance of internal and external cooperation: "We see our customers as partners, and I am personally delighted that we can celebrate this achievement with so many long-standing clients and dedicated team members who have been – and continue to be –essential to this milestone and the success of Axians IAS."

The longevity of these partnerships is evident in the fact that many of Axians IAS's earliest customers still rely on its solutions today. This long-term trust underscores the sustainability and reliability of Axians IAS's product portfolio, which is now deployed in over 1,000 plants worldwide.

Click **here** for more information.

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Carthago Brique invests in mega-plant in Tajerouine

It is being developed on a "monstre" surface area of about 130.000 sm and required a total investment of 120 million dinars (about 36 million euros). It will employ 150 people.

Just four years after inaugurating the Briqueterie Jbel Ouest (BJO) plant in Zaghouan, Carthago Brique (a business unit of Carthago Ceramic) has invested in the construction of another high-capacity brickworks in Tajerouine, Tunisia. As the largest and most technologically advanced clay product factory ever built in the region, it is expected to give a major boost to the local and national economies.

The new facility, which involved a total investment of 120 million Tunisian dinars (approximately € 36 million), came into operation in October 2024 and has rapidly achieved excellent levels of production. It covers a vast surface area of around 130,000 square metres and is expected to create around 150 jobs.

The extrusion department was meticulously designed and tailored to the company's production process, raw materials and clay characteristics. The project was overseen entirely by Novi di Modena-based company Tecnofiliere, which proposed the most efficient solution to ensure optimal extrusion performance. The plant is equipped with TFE-J EVO extruder dies, recently upgraded with mechanisms to facilitate clay flow and guarantee maximum abrasion resistance. The cores and liners of each die are made from Tecnocarbide®, a material with a wear resistance of 2000 HV, allowing for long production runs without significant changes in the weight or dimensions of the bricks. The TFE-J EVO system maintains the benefits of wide-exit extrusion, allowing for a larger extrusion cross-section and in turn significantly increasing hourly production capacity while reducing energy consumption. Energy efficiency is further boosted by the installation of innovative pressure heads equipped with special polymer linings, which bring substantial improvements in terms of energy efficiency and ensure almost unlimited service life. Tecnofiliere also supplied a TF 1000 EVO FC top-of-the-range fully automatic die-washing machine equipped with a PLC in the control panel.

Looking ahead, the Carthago Group plans to build a third clay product manufacturing facility called Carthago Sanitaire, which will complete the investment cycle that began in 2016 with the Briqueterie Jbel Ouest (BJO) plant. Including BBM Bir M'Cherga, the group's first production site built in 2009, Carthago will reach a total installed capacity of over 5,000 tonnes of clay products per day, further strengthening its position as an industry leader.

Imerys and Denka Join Forces for the Development of Specialty Binders and Additives

Imerys SA, Paris, France and Denki Kagaku Kōgyō K.K. (Denka), Tokyo, Japan have recently announced their cooperation to co-develop and deliver innovative, low-carbon, high-performance solutions for construction material manufacturers and rollout specialty binder additives. Imerys is known for their high Alumina Cements (formerly: Ciment Fondu Lafarge) and the production and processing of other industrial minerals. Denka produces chemicals, resins and plastics for various industries, and is also known for their specialty Calcium-Sulfo-Aluminate Cements (CSA).

Menzel Elektromotoren and AOI sign agreement for local electric motor assembly in Egypt

A major milestone for industrialization in the region: MENZEL Elektromotoren has signed an agreement with the Arab Organization for Industrialization (AOI) to establish a local ENGINE Factory operated by AOI in Egypt.

As part of this strategic partnership, low, medium, and high-voltage electric motors in medium and large power ranges will be manufactured in Egypt—adhering to international quality standards and in close technical coordination between both partners

Objectives of the collaboration:

- Development and expansion of local manufacturing capabilities
- Technology transfer and capacity building in large electric motors
- Strengthening the export potential of Egyptian electric motors to African and Arab markets

MENZEL contributes its extensive experience in the design and customer-specific adaptation of large industrial motors to this project—from design and manufacturing to testing and quality assurance. A key focus lies in technologies enabling localized production to efficiently meet regional demand and remain close to the market. Motors for the water and irrigation sectors are particularly in demand.

Future motor production will utilize AOI's existing national infrastructure at the ENGINE Factory, in full compliance with the latest international standards for quality, efficiency, and safety.

Sustainable Quarry Rehabilitation in the Cement Industry

Shehab. M. Al-Aryan, ASEC Technical Center

1. Abstract

Cement production begins in the quarry, where raw materials are extracted, often leaving behind large disturbed landscapes. This article explores how modern rehabilitation practices transform these sites into valuable ecological, social, and economic assets. By showcasing innovative restoration methods, it highlights how quarry rehabilitation aligns with global sustainability targets and strengthens the long-term license to operate.

2. Introduction: Turning Quarries from Extraction Sites to Sustainable Landscapes

Cement production starts with quarrying limestone and other raw materials, a process that reshapes the landscape with pits, steep faces, and disturbed soils. Without proper management, these sites can cause erosion, water pollution, biodiversity loss, and visual scars.

Yet quarries also offer a chance for renewal. Leading cement producers now treat rehabilitation as a core sustainability goal and a condition for their social license to operate. Regulators increasingly demand detailed restoration plans before mining begins, and communities expect land to be returned to productive or ecological use.

Modern rehabilitation goes far beyond filling holes or planting grass. By combining ecological science, landscape design, and community input from the outset, former quarries can become wildlife habitats, water reservoirs, farmland, or public parks, providing long-term services such as carbon sequestration and groundwater recharge.

This article highlights the policies, best practices, and innovative techniques that make quarry rehabilitation a cornerstone of sustainable cement manufacturing.

3. Regulatory & Sustainability Drivers

Quarry rehabilitation in the Arab world is driven by national laws, regional policies, and global sustainability goals, making restoration a core requirement rather than a voluntary effort.National Regulations

- **Egypt:** The Egyptian Environmental Affairs Agency (EEAA) requires an Environmental Impact Assessment and an approved closure or rehabilitation plan, plus ongoing monitoring and post-closure reporting.
- **Saudi Arabia:** The 2020 Environmental Law and Mining Investment Law mandate a mine-closure and rehabilitation plan, with strict air quality and dust limits enforced by the National Center for Environmental Compliance.
- **United Arab Emirates:** Federal Law No. 24 (1999) and emirate-level codes (e.g., Ras Al Khaimah) require progressive site restoration.
- **Morocco & Tunisia:** Mining codes demand a rehabilitation plan and financial guarantees to ensure land restoration.

International & Voluntary Frameworks

- **UN Sustainable Development Goals (SDGs):** Goals 12 and 15 link directly to quarry rehabilitation and biodiversity recovery.
- **Paris Agreement & Nationally Determined Contributions (NDCs):** Many Arab countries include ecosystem and land-use targets supported by quarry revegetation.
- **ISO 14001:** Requires planning for post-operation impacts, embedding rehabilitation in certified management systems.
- **Global Cement and Concrete Association (GCCA) Guidelines:** Urge members to adopt biodiversity action plans and progressive rehabilitation.

Market & Community Drivers

Investors now expect ESG disclosures, and local communities increasingly insist on visible, lasting restoration of mined land.

4. Planning for Rehabilitation from Day One

Effective quarry rehabilitation starts before extraction, not after. Building closure and restoration into the earliest design phase meets environmental, social, and economic goals more efficiently and at lower cost.

- **Integrate Closure into Design:** Define final land use—nature reserve, park, farmland, or reservoir—during feasibility studies; plan progressive rehabilitation so mined-out areas are restored while others remain active; use digital terrain models to shape slopes and drainage for stable future landforms.
- **Baseline Studies:** Conduct ecological surveys to guide revegetation with native, drought-tolerant species; assess groundwater to protect scarce aquifers; map cultural and community assets to avoid conflicts and support end-use planning
- **Stakeholder & Partnerships:** Engage residents and municipalities early to build trust and align end-use goals; collaborate with universities, NGOs, and technical experts; embed measurable targets in ISO 14001 systems and ESG reporting.
- **Design for Harsh Climates:** Choose hardy native species such as acacia or tamarix; include rainwater-harvesting basins, soil-stabilization measures, and renewable-powered irrigation to overcome heat and low rainfall.

5. Techniques and Best Practices

Successful quarry rehabilitation blends science, engineering, and local expertise. In the Arab region's arid, water-scarce environments, proven techniques must be adapted to local conditions.

- **Progressive Rehabilitation:** Restore mined areas while extraction continues, reducing disturbed land, spreading costs, and testing vegetation early.
- **Landform & Slope Work:** Re-profile benches to gentle 18–25° slopes and use terracing, rock armoring, or bioengineering to curb erosion during flash floods.
- **Soil Management:** Salvage and store native topsoil for later use; amend poor or saline soils with compost or treated organic matter.
- **Native Revegetation:** Plant drought-tolerant species such as acacia, prosopis, and tamarix; apply seed balls or hydro-seeding to steep slopes.
- **Water & Habitat Creation:** Build rainwater-harvesting ponds for irrigation and groundwater recharge; convert settling basins to wetlands for migratory birds.
- **Biodiversity Corridors:** Link restored sites to surrounding habitats and create green belts that sequester carbon and reduce dust.
- **Renewable Irrigation:** Use solar-powered pumps to water young plants with minimal emissions.
- **Monitoring & Adaptation:** Track vegetation, soil stability, and water quality with drones or satellite imagery, adjusting species mixes and watering as needed.

6. Benefits Beyond Compliance

Quarry rehabilitation delivers far more than regulatory compliance—it is a climate and sustainability strategy that strengthens the cement industry's long-term viability.

- **Carbon & Climate Action:** Re-vegetating quarry floors and slopes creates carbon sinks that lock in atmospheric CO_2, supporting national Paris-Agreement targets and corporate net-zero goals.
- **Community & Economic Benefits:** Restored sites can become parks, grazing lands, eco-tourism areas, or solar farms, generating revenue, boosting local property values, and building trust that eases future permitting.
- **Ecosystem Services:** Native vegetation stabilizes soil, cuts dust, curbs erosion, and improves groundwater recharge, helping buffer climate extremes.
- **Financial & ESG Advantages:** Progressive rehabilitation spreads closure costs, lifts ESG ratings, and attracts green finance or sustainability-linked loans.
- **Innovation & Leadership:** High-impact projects showcase Arab cement producers as climate leaders, foster research partnerships, and set new industry benchmarks for low-carbon development.

7. Challenges and Future Directions

Despite growing momentum, quarry rehabilitation in the Arab region still faces major hurdles. Addressing these challenges—and applying emerging solutions—will define the next era of sustainable cement production.

Key Challenges

- **Harsh Climate:** Water scarcity, flash floods, and temperature swings hinder plant survival and soil stability.
- **Poor Soils:** Thin, alkaline topsoil often requires costly amendments or imported growth media.
- **Weak Regulation:** Inconsistent enforcement and a lack of unified regional standards create uncertainty for operators and investors.
- **Long-Term Funding:** Ongoing monitoring and care remain difficult to finance once a quarry closes.
- **Community Tensions:** Past dust and noise issues and conflicting end-use expectations can slow consensus.

Future Directions

- **Climate-Resilient Planting:** Ultra-drought-tolerant species, biochar, and hydrogels boost survival while cutting irrigation needs.
- **Digital Monitoring:** Drones, LiDAR, and AI predict erosion or plant loss and reduce oversight costs.
- **Circular Economy Uses:** Solar or wind farms, water storage, and recycled-material hubs turn quarry voids into carbon-friendly assets.
- **Regional Standards:** Arab League or GCC guidelines and cross-border training can harmonize best practices.
- **Green Finance:** Carbon credits from reforested quarries and sustainability-linked loans provide revenue for long-term care.

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Every Little Bit Counts

How Upgrades Can Deliver Energy Savings Across the Cement Process

Jacob Brinch-Nielsen, Vice President of Professional Services, Fuller Technologies

Fuller Technologies, brings together recommendations from experts across the flow sheet to demonstrate the role of upgrades in optimising the cement manufacturing process.

The energy challenge in cement manufacturing

Reducing energy consumption is a core goal for all cement producers, sitting alongside alternative fuels, reduced clinker content and carbon capture as one of the four pillars of decarbonisation. As we look to the future, when new emissions abatement technologies will skyrocket energy use once more, that goal becomes ever more important.

While automation and digitalisation have a critical role to play in optimising energy use, advances in mechanical equipment are often focused on reducing energy consumption – meaning there are many equipment upgrades that could help lower your energy bills, providing a relatively swift ROI in exchange for minimal disruption to your process. By optimising key process areas—grinding, dosing, preheating, and more—plants can reduce energy costs while improving operational performance. But where should they start?

Easy upgrades to optimise the grinding process

“One of the biggest sources of inefficiency in cement grinding is overgrinding,” explains Nick Litzenberger, Design Engineer. “Every extra pass through the mill consumes energy but does not necessarily improve product quality. This is especially critical in Type 1L cement, where fine limestone particles can lead to excessive power consumption and reduced throughput. Many cement plants still operate second-generation separators, which lack the precision of modern designs. Upgrading to a third-generation separator can optimise particle size distribution, lower energy use, and boost mill output.”

Third-generation separators for ball mills like the O-SEPA® or SEPAX™ utilise more hard-wearing materials, improving seal performance and separating more efficiently. These types of upgrades require just a 2 – 3-week shutdown, as much of the work can be done while the mill remains operational and deliver a 5 – 10% reduction in power consumption.

Among third-generation separators for VRMs, options like the ROKS-H separator specifically address overgrinding in Type 1L cement, delivering energy savings of about 2 – 3% while improving product quality. Even an upgrade from an early 3rd generation separator, like a ROKS, to one of the latest separator designs, like a ROKS-H, can reduce power consumption and improve cement quality in a grinding circuit.

ROKSH Separator

Separator, like a ROKS, to one of the latest separator designs, like a ROKS-H, can reduce power consumption and improve cement quality in a grinding circuit.

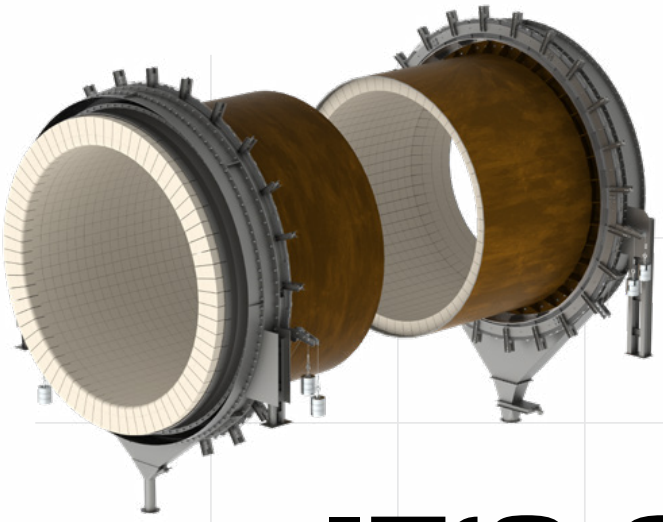
Reducing energy use in feeding and dosing

Even small inefficiencies in feeding and dosing can result in wasted energy and increased operational costs. If your dosing system struggles to maintain consistent feed rates, the inevitable result is instability in pyroprocessing and impacting power consumption.

“We’re continually exploring ways to reduce energy consumption in feeding and dosing applications,” says Peter Norek, Global Product Manager-Feeding and Dosing Technologies. “We’ve introduced digital features like Pfister® Smart Aeration, which reduces compressed air usage by up to 90%, patented FEEDFlex™ technology, which enables much lower fossil fuel dosing, and the FDC controller upgrade, which includes a new motor, enhancing efficiency and reducing electricity consumption. These are all simple upgrades with a positive environmental impact.”

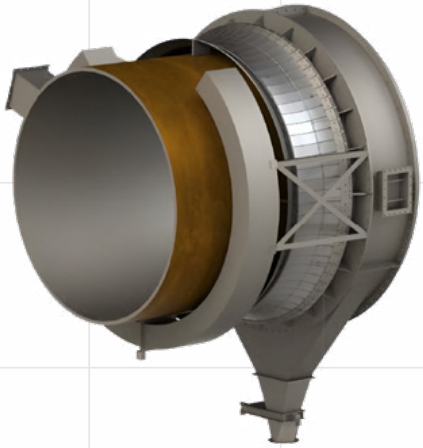
PFISTER® DRW Rotor weighfeeder

FULLER®
TECHNOLOGIES



IT'S ONLY A KILN SEAL

only the difference between wasting energy and conserving it; only the difference between missing environmental targets or exceeding them; only the difference between costly downtime and reliable operation.



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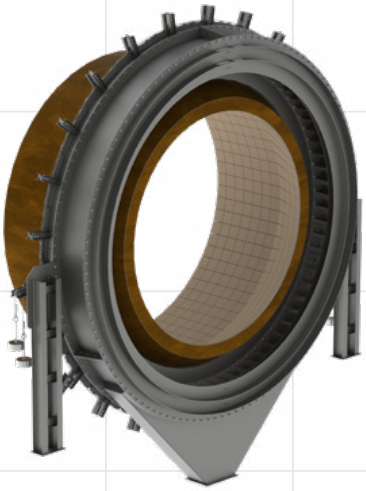

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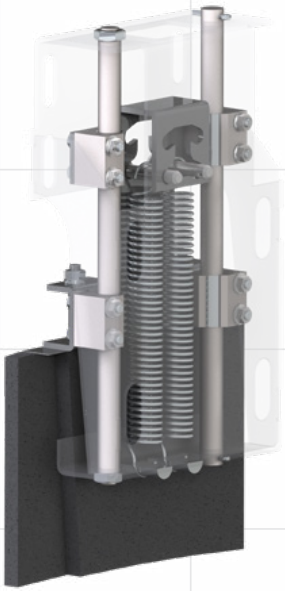

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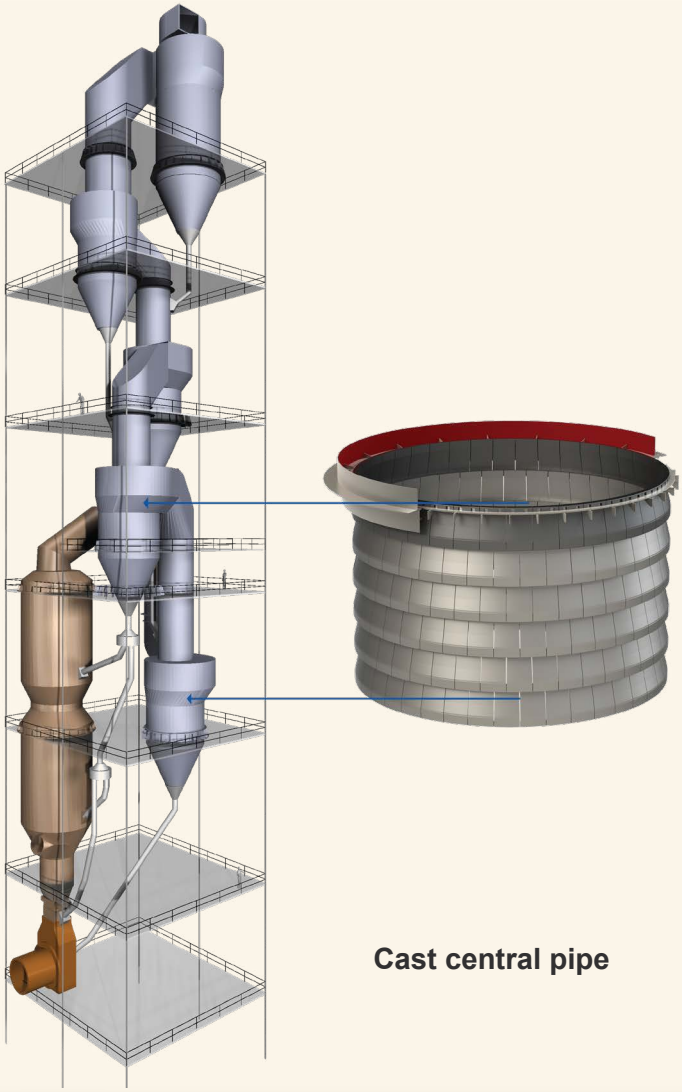
Improving preheater efficiency and heat retention

Preheaters play a critical role in cement plant energy efficiency, but outdated cyclone designs and corroded components can lead to excessive heat loss and higher fuel consumption. Plants that optimise preheater separation efficiency can reduce fuel use by up to 5 – 10 kcal/kg clinker while improving downstream performance.

One area where upgrades can make a difference is in the central pipe elements. By switching to an advanced suspension design, plants can improve separation efficiency and extend wear life — offering both energy savings and operational benefits.

“The cast central pipe is installed in the preheater cyclones to improve separation and thermal efficiency,” explains Muthukumar Muthu, Senior Product Specialist, “Our patented design for the suspension of the cast pipe reduces corrosion (extending pipe life), while also making it easier to carry out maintenance work.



Cast central pipe

Preheater tower

Installation of one cast pipe in the lower cyclone stages can save customers 5 – 10 kcal/kg clinker, reducing power consumption in the ID fan drive by 4 – 8% - a significant energy saving. Customers can choose whether to claim these benefits in cost savings or convert them to a 1 – 2% increase in production. Either way, the cast pipe provides a quick ROI.”

The improvements to the cast central pipe elements reduce the stress across the element, and make it simpler to manufacture, which results in a more consistent quality, more durable product. This upgrade can be implemented during the annual maintenance shutdown with no disruption to operations.

Maximising efficiency in combustion

False air leaks and inefficient fuel combustion are two of the biggest sources of energy waste in cement kilns. Uncontrolled air ingress forces plants to burn more fuel to maintain operating temperatures, while the inefficient combustion of alternative fuels can create a volatile environment that reduces both efficiency and clinker quality. To address these issues, plants can implement sealing upgrades that prevent air leaks and burner modifications that optimise fuel-air mixing, ensuring more complete combustion and greater flexibility in alternative fuel use.

“We’ve introduced the new Spring Tensioned Graphite Seals to reduce false air entry and increase thermal efficiency – effectively lowering fuel consumption without affecting clinker quality,” says, Karthikeyan Arumugam, Senior Product Specialist.

In addition, advanced burner designs such as a JETFLEX® partial upgrade allow plants to retain the existing kiln burner pipe while improving fuel-air mixing, increasing alternative fuel utilisation and efficiency.

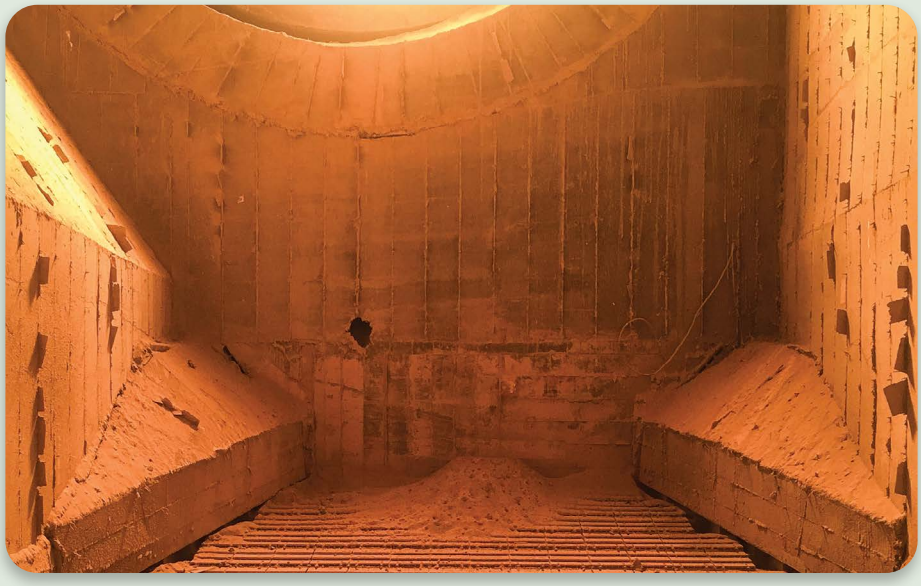
This burner enables cement producers to use pulverised coal or petcoke, anthracite, oil, natural gas – or any mixture of these – as well as alternative fuels (such as plastic and wood chips, sewage sludge) with no difference in performance and minimal volatility in the kiln to support reliable and consistent production of high-quality clinker with low NOx emissions.

Cooling efficiency as easy as ABC inlet

An inefficient or older generation cooler inlet leads to higher fuel consumption. Alternative fuels and petcoke produce dusty, sticky clinker that builds up easily, creating ‘snowmen’ in the cooler that disrupt the system, leading to inefficiencies and even unplanned shutdowns.

“The ABC Inlet upgrade continues to be one of our most successful cooler inlet upgrades because it resolves issues as a result alternative fuels usage and enables better heat recovery back to system,” explains Rene Hede, Cooler Product Specialist. “The ABC Inlet prevents snowmen formation with a patented in-grate design that pushes compressed air up through the grates, blasting agglomerations.”

In addition, the ABC Inlet's rapid quenching process enables faster clinker cooling while maximising heat recovery to the pyro line, resulting in heat consumption savings of 10–30 kcal/kg of clinker. This also enhances clinker quality, providing greater flexibility in cement product formulation and allowing for clinker factor reductions that further improve grinding energy efficiency.



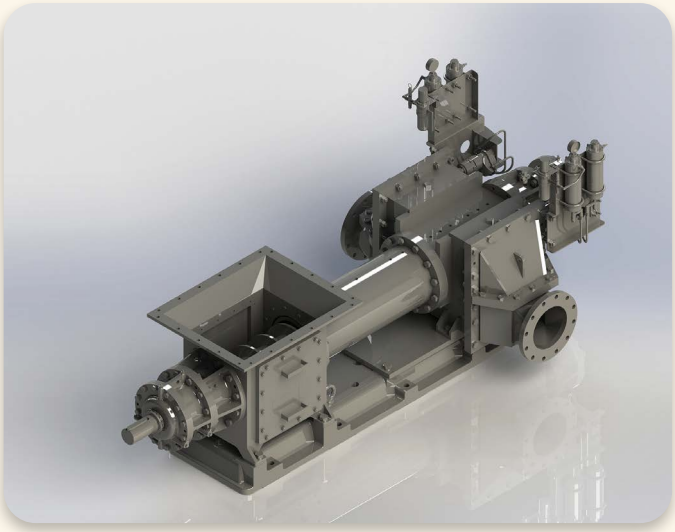
ABC™ Inlet for any Cooler

Improving energy efficiency in material transport

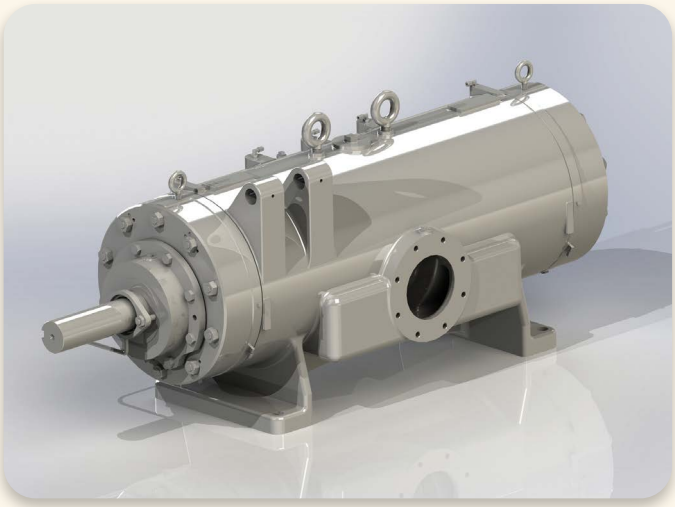
Pneumatic conveying offers a cleaner and more contained alternative to mechanical conveying. However, pneumatic systems can also be energy-intensive, with inefficiencies arising from air leakage, pressure losses, and outdated equipment designs. Optimising these systems can significantly reduce energy consumption and operating costs.

"One major challenge is maintaining efficient air-to-material ratios, as excessive air use leads to unnecessary power consumption," explains Emilio Vreca, Manager of PT Product Engineering "Leaks in piping and inefficient compressors further compound energy losses. To address these issues, upgrading to the latest pneumatic conveying solutions can yield substantial improvements."

The latest pump design—the Fuller-Kinyon® (FK) 'N' Pump—provides power savings of up to 15% thanks to an improved seal, while an extended barrel and screw design have improved volumetric efficiency by more than 15%. Similarly, the latest generation Ful-Vane™ Air Compressor has been engineered for increased energy efficiency, with an improved inlet area for capturing larger air flows and compatibility with variable frequency drives.



Fuller-Kinyon® pump



Ful-Vane™ compressor

Optimising energy efficiency in packing and dispatch

Even minor inefficiencies in bagging and palletising can lead to higher maintenance demands, increased material waste, and unnecessary energy use. Reducing these inefficiencies is yet another lever to improve overall plant performance and sustainability.

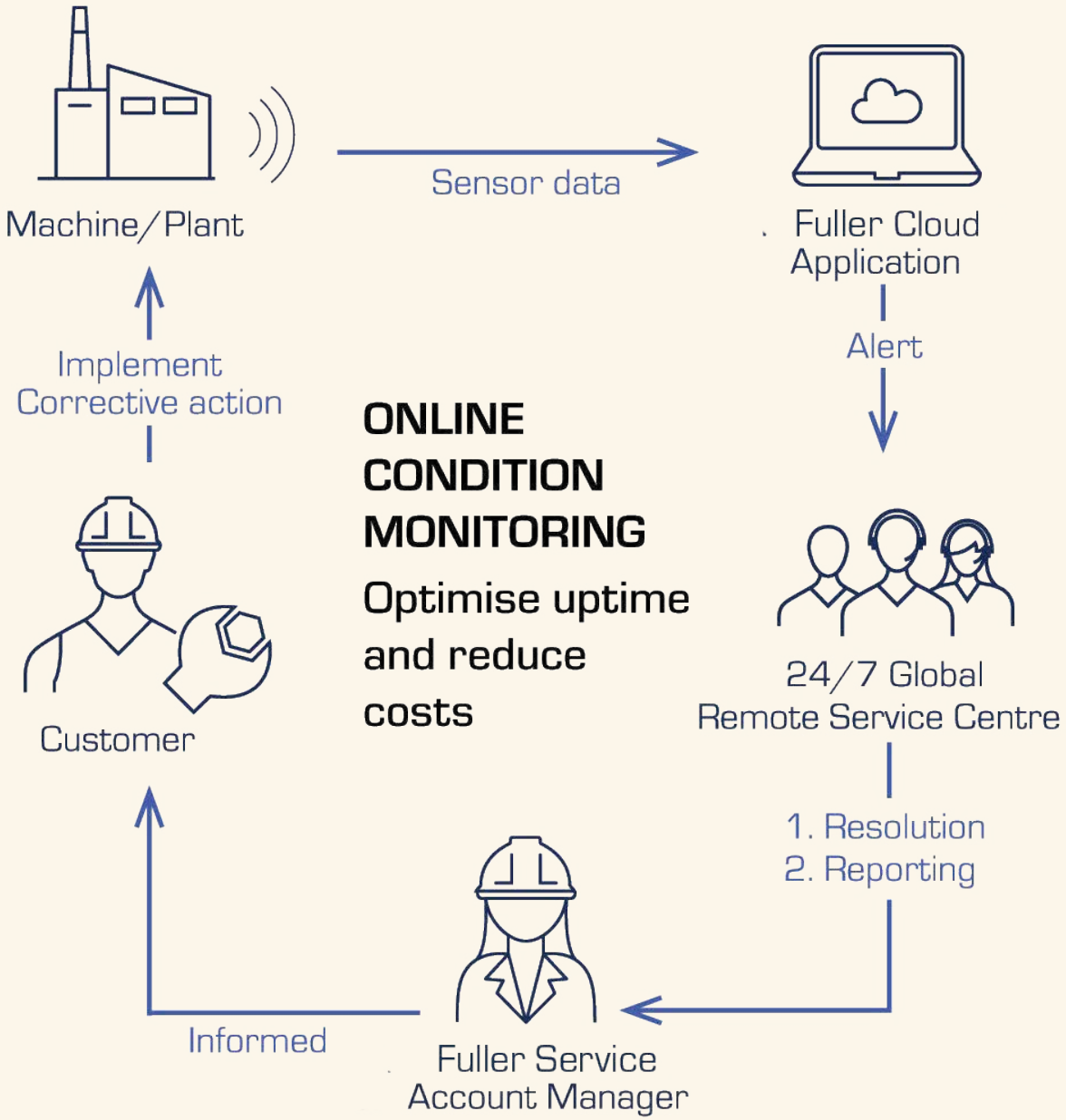
Upgrading rotary packers enhances weighing accuracy, reduces spout-to-spout variations, and lowers reject rates, improving both product consistency and energy efficiency. Similarly, replacing pneumatic drive systems in palletisers with electric alternatives eliminates compressed air dependency, leading to more precise bag handling and reduced energy demand. These targeted upgrades help streamline operations while minimising environmental impact.

A key development in dust control is the FILLPro™ Dust Reduction Kit for GIROMAT® EVO. “By refining material flow and fluidisation, FILLPro reduces dust emissions at the

source, improving bagging efficiency and plant cleanliness,” explains Gabriele Rapizza, Proposal Engineer. “This reduces material loss, prevents blockages, and cuts down on maintenance, helping plants achieve a more stable and energy-efficient packing operation.”

How services contribute to increased energy efficiency

In the past, many viewed the role of the supplier as a “sell-and-move-on” model. Things have certainly changed. As cement producers face challenging markets, heightened competition, and increasingly ambitious decarbonization targets there is little room to tolerate inefficiencies within the plant. The paradigm has shifted such that the value of expert services is as essential as the initial equipment supplied. Furthermore, as digital solutions progress at speed, a fluid, long-term partnership gives cement plants the best platform to take advantage of the latest tools.



Whether it's an audit to identify why energy efficiency has decreased from one year to the next, or even an optimisation package preparing your plant for carbon capture solutions – we are believers in the principle that there is always more we can do to improve efficiency. For example, our Online Condition Monitoring Services (OCMS) provide continuous monitoring of critical equipment such as the kiln, mills, cooler and fans, aggregating data and utilising advanced algorithms to identify potential trouble spots. As the OEM and an experienced full solutions provider, we can support these services with expert advice, not only alerting you to a problem but also providing recommendations as to how to remedy it or attending site to support you in person.

Small upgrades, big impact

Energy efficiency is a critical factor, influencing both operational costs and sustainability goals. While large-scale innovations such as carbon capture will play an essential role in long-term decarbonisation (and steal the headlines), incremental mechanical upgrades offer an immediate pathway to lower energy consumption with minimal disruption.

By optimising key process areas — grinding, dosing, combustion, cooling, and material transport — you can achieve measurable energy savings while improving performance and flexibility. These solutions provide a strong return on investment and pave the way for a more sustainable cement industry.

Decarbonising Middle Eastern cement

demand, clinker scenarios and the role of alternative fuels

Dirk Lechtenberg, Founder and Manging Director of MVW Lechtenberg & Partners

1. Introduction

The cement industry is the backbone of modern infrastructure, producing around four billion tonnes of cement each year [1], but the industry also accounts for around 7 % of global CO_2 emissions. The energy intensive nature of clinker production means that decarbonising cement is crucial to meeting climate goals, yet demand for cement will continue in rapidly urbanising regions. This article summarises business as usual (BAU) projections for cement demand, examines possible trajectories for clinker demand, and discusses how Middle Eastern producers can reduce emissions by adopting alternative fuels such as refuse derived fuel (RDF).

2. Cement production in the Middle East

A snapshot of regional production shows how heavily concentrated cement manufacture is. In 2020 Saudi Arabia and Egypt together produced roughly 100 Mt of cement, with the United Arab Emirates, Algeria and Iraq also producing more than 30 Mt each. Smaller producers such as Jordan, Kuwait, Lebanon and Djibouti produced less than 5 Mt each. Forecasts for 2021–22 suggest relatively flat or moderate growth: Saudi production remains above 55 Mt/year, while Algerian and Egyptian output inch upwards and UAE production stabilises at about 15 Mt/year (Figure 1).

Regional demand is therefore diverse. Countries with large populations and infrastructure programmes—Saudi Arabia, Egypt and Algeria—dominate production, while smaller Gulf states produce cement mainly for domestic building booms. Understanding how this demand evolves under different scenarios is essential to planning decarbonisation investments.

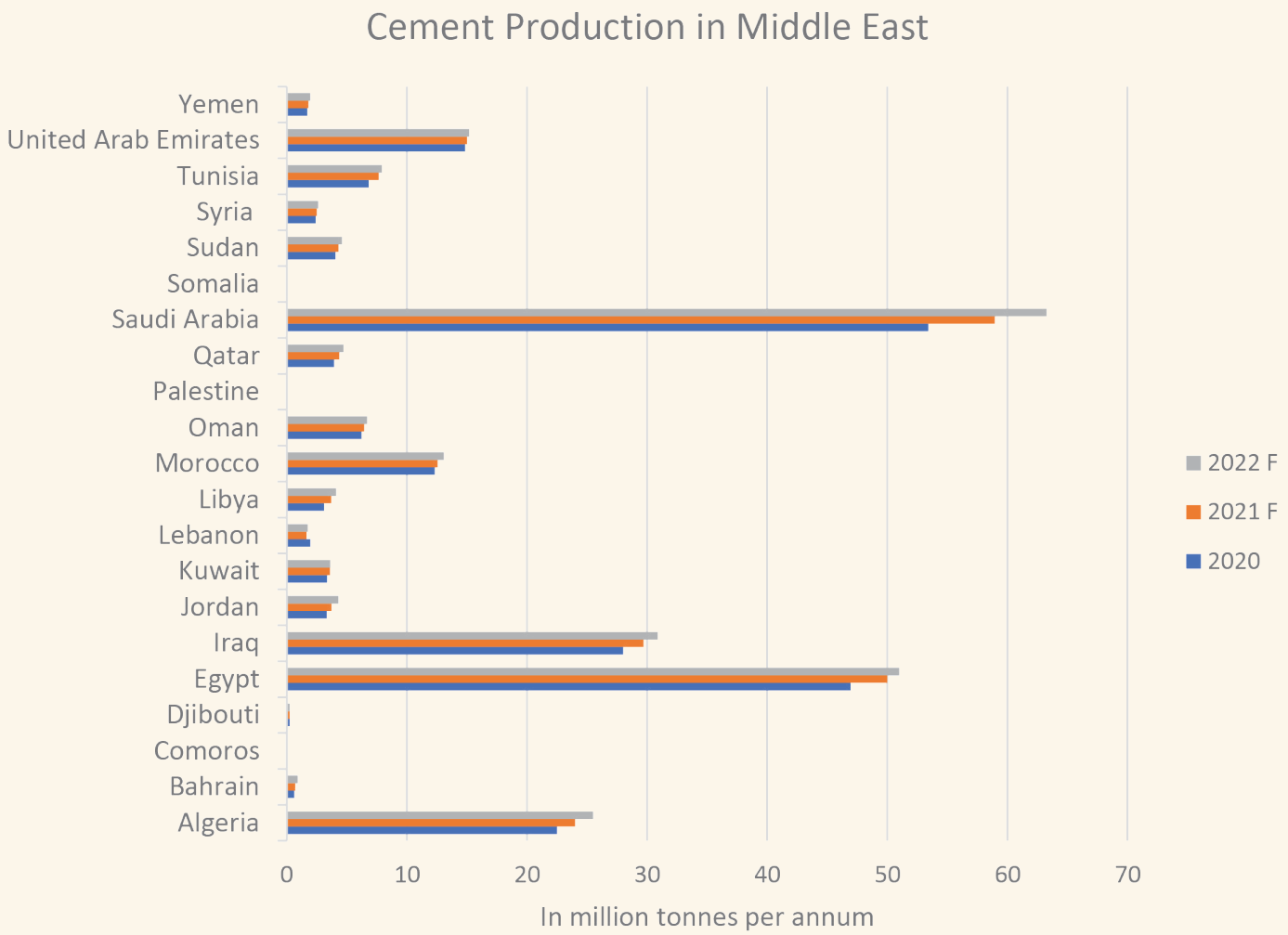


Figure 1: Cement production in the Middle East *[2]*.

3. Business as usual demand projections

The World Cement Association's (WCA) BAU projection divides the world into market types and forecasts cement consumption by region. Table 1 condenses this outlook. China's consumption is expected to decline from 2,411 Mt yr^{-1} in 2020 to about 928 Mt yr^{-1} by 2050 [3]. Developed markets (North America, Western Europe, Eastern Europe/Türkiye, Oceania and North East Asia) remain broadly flat, with each region hovering around 100–130 Mt yr^{-1} throughout the forecast period [3]. Middle income regions such as South East Asia, North Africa, Latin America, the Commonwealth of Independent States (CIS) and the Middle East experience slow but steady growth. For example, Middle Eastern consumption is projected to rise from 196 Mt in 2020 to 254 Mt by 2050—a roughly 30 % increase [3]. South Asia (including India) and Sub Saharan Africa show rapid growth; demand in these regions more than doubles by mid century. Globally, total cement demand declines from 4,194 Mt yr^{-1} in 2020 to around 3,637 Mt yr^{-1} by 2050 [3], driven mainly by the fall in Chinese consumption.

Market type	Region	2020 (Mt yr^{-1})	2024 (E)	2035 (F)	2050 (F)
Decline then stable	**China**	2 411	1 825	1 183	928
Broadly stable	North America	115	120	131	138
	Western Europe	131	126	129	125
	Eastern Europe & Türkiye	120	127	129	98
	Oceania	12	12	13	14
	North-East Asia	97	97	89	85
Slow growth	South-East Asia	236	240	275	297
	North Africa	93	97	111	131
	Latin America	164	176	202	215
	CIS	97	116	127	136
	Middle East	**196**	**208**	**235**	**254**
	South Asia (incl. India)	392	537	771	908
Rapid growth	Sub-Saharan Africa	130	153	207	308
TOTAL		**4 194**	**3 834**	**3 602**	**3 637**

Table 1: BAU projections for regional cement demand.

Forecasts are from the World Cement Association *[3]*. Numbers are rounded and some rows are aggregated for clarity.

These BAU projections underline two messages. First, the Middle East forms part of a middle income group of regions where demand grows slowly but does not decline. The region's population continues to expand, and mega projects such as Saudi Arabia's NEOM and Iraq's reconstruction keep cement consumption buoyant. Second, because China's decline outweighs growth elsewhere, global demand plateaus; producers elsewhere must therefore compete for a shrinking global pie.

4. Clinker demand and decarbonisation scenarios

Demand for cement does not equate directly to clinker production because clinker content is projected to fall as supplementary cementitious materials replace Portland clinker. There are four scenarios having been evaluated for clinker demand, one by IEA, and three by WCA (Figure 2) [3]:

- **IEA scenario** – The International Energy Agency's reference technology scenario assumes modest improvements in clinker efficiency. Clinker demand falls only slightly by 2050.
- **Scenario 1 (Slow change)** – Minor reductions in clinker factor and modest substitution by alternative binders. Clinker demand drops to around 1.8 billion tonnes by 2050.
- **Scenario 2 (Central forecast)** – Full realisation of new technologies in developed markets by 2050, with gradual adoption elsewhere. Clinker demand falls to ~1.5 billion tonnes.
- **Scenario 3 (Rapid change)** – Rapid adoption of timber construction, supply chain waste reduction, design optimisation and clinker free cements. Clinker demand plummets to ~1 billion tonnes by 2050.

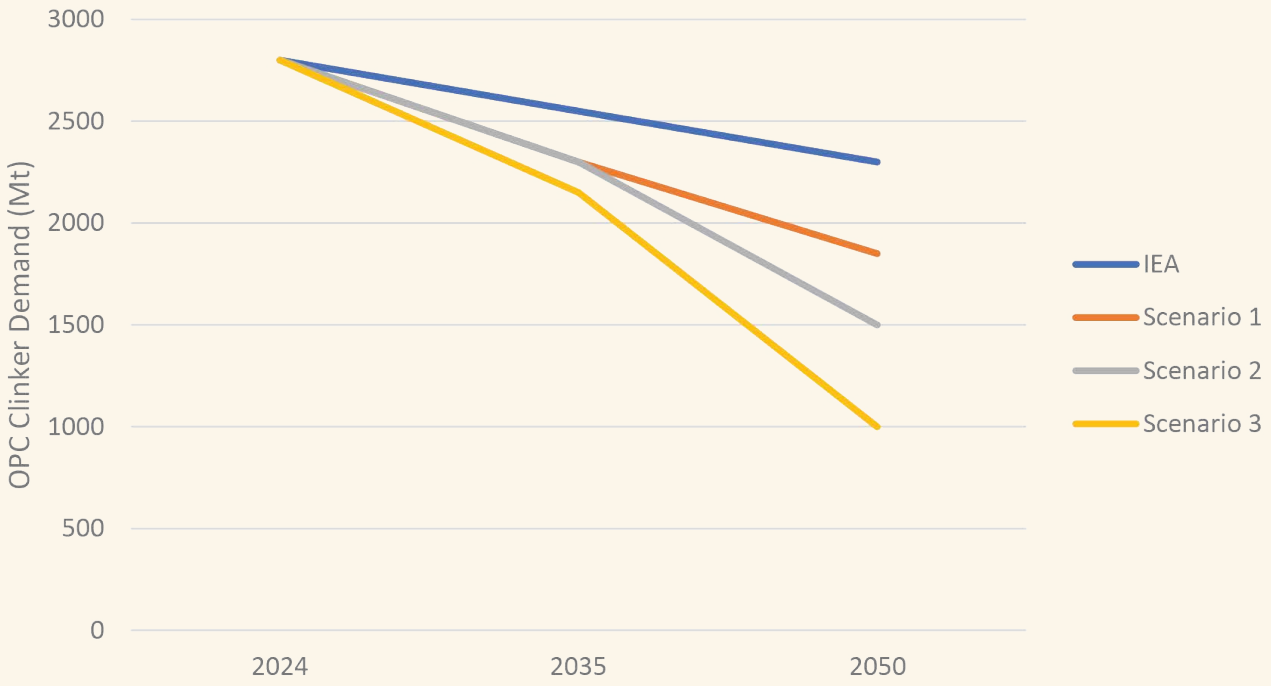


Figure 2: Projected global clinker demand to 2050 under IEA and WCA scenarios *[3]*

The WCA notes that clinker production was about 2.8 billion tonnes in 2024 and predicts it could decline to less than 1.9 billion tonnes by 2050 [3], potentially reaching as low as 1 billion tonnes under the rapid change scenario. Such a decline would drastically reduce fuel consumption and CO_2 emissions. It also has economic implications: plants built today may be underutilised in 25 years, which argues for caution when expanding clinker capacity.

5. Why alternative fuels matter

The rationale for switching to alternative fuels is multi-dimensional: -

- **Economic pressures** – Oil and natural-gas prices have risen sharply over the past five years, thus increasing production costs. In Saudi Arabia, energy subsidies are being reduced; the government's Mandatory Energy Efficiency Programme aims to cut domestic energy consumption [4]. Only four Saudi plants currently co-process AF and their contribution is <1 % of total clinker capacity, indicating large untapped potential.
- **Environmental imperatives** – Each tonne of cement emits roughly 0.8–0.9 t of CO_2. Switching to AF such as RDF, biomass, tyres and sewage sludge reduces fossil-fuel emissions and diverts waste from landfills. In Europe, high thermal substitution rates illustrate the benefits: the region supplies about 52 % of kiln energy from AF, saving about 21 million tonnes of CO_2 and about 7.8 million tonnes of coal every year [5]. Germany's cement industry substitutes roughly 69 % of its energy with alternative fuels [5].
- **Circular-economy benefits** – Saudi Arabia generates over 110 million tonnes of waste annually. The National Center for Waste Management aims to divert 94 % of all waste from landfills by 2035. Using RDF in cement plants supports this goal. In Egypt, new regulations require cement plants to use 20–30 % alternative fuels as a condition for importing coal [4].
- **Social and strategic gains** – Waste-to-energy projects create jobs and reduce reliance on imported fuels.

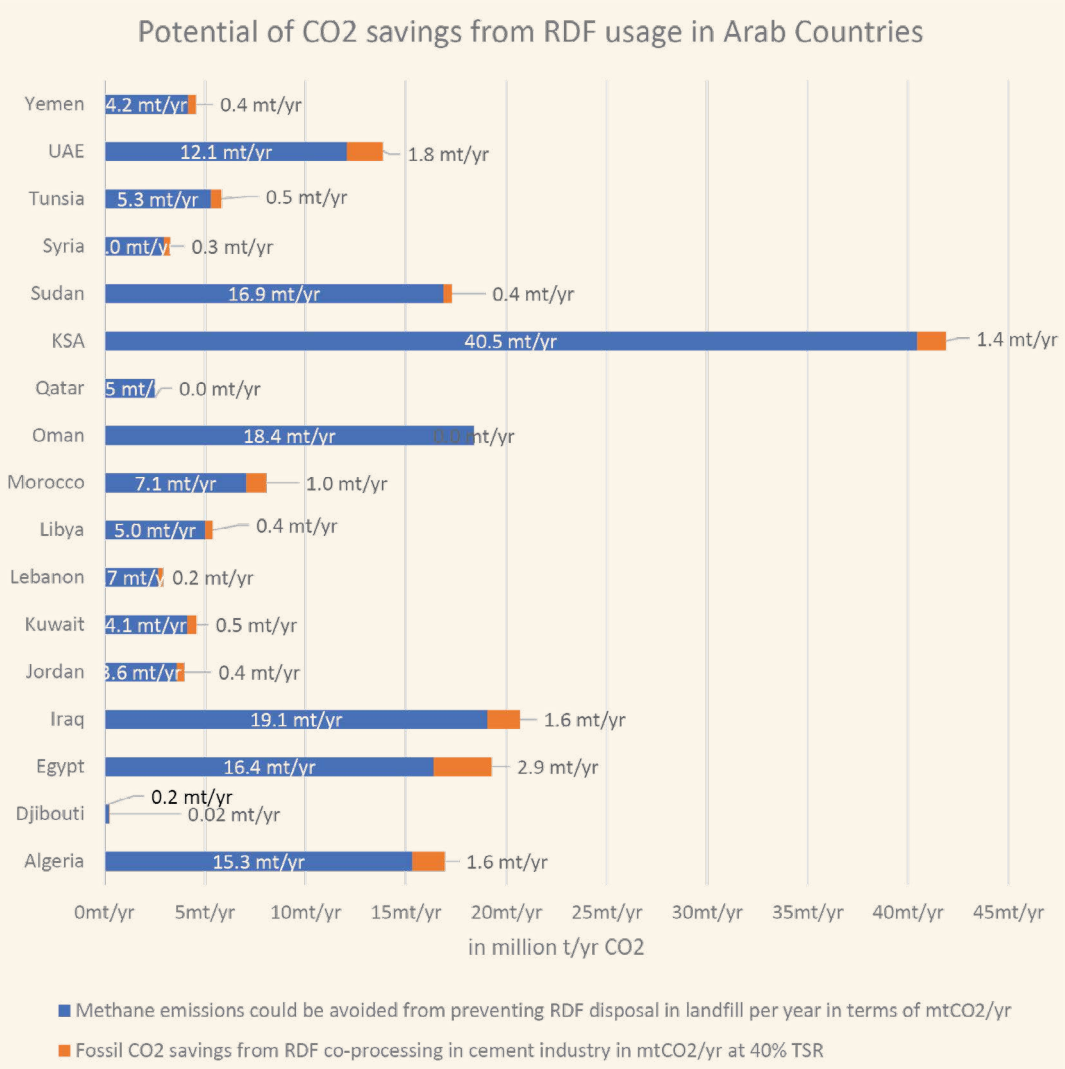


Figure 3: Potential CO_2 savings from RDF usage in the Middle East.

6. What-If Scenarios: Switching to Alternative Fuels

If Middle Eastern clinker production facilities achieved a 40% substitution rate with waste-derived fuels, a yearly reduction of around 39 million tonnes of CO_2 equivalents would be possible.

Waste utilization: MSW could sufficiently supply RDF to achieve the target. Landfill diversion: Preventing RDF from landfilling would mitigate methane emissions and support circular economy. The benefits are twofold: methane emissions from landfill decomposition are avoided, and fossil fuel emissions are replaced by lower carbon fuel. Figure 3 shows estimated CO_2 savings from RDF usage if Arab cement plants reach a 40 % TSR. The blue bars represent methane emissions avoided by diverting RDF from landfills; the orange bars show fossil CO_2 savings achieved by co-processing RDF in cement kilns.

Saudi Arabia offers the largest mitigation potential: preventing landfill disposal of RDF could avoid about 40.5 Mt CO_2 yr^{-1} and co-processing at 40 % TSR could save a further ~1.4 Mt CO_2 yr^{-1}. Substantial savings are also possible in Egypt (16.4 Mt and 2.9 Mt, respectively), Iraq (19.1 Mt and 1.6 Mt) and the United Arab Emirates (12.1 Mt and 1.8 Mt). Even smaller countries like Tunisia, Sudan and Jordan could avoid 3– 16 Mt CO_2 yr^{-1}. These figures highlight the scale of emissions reductions available through better waste management and fuel substitution.

7. Policy and implementation considerations

Government policies are central to accelerating AF adoption. International precedents—Europe's landfill ban and such as:

- **Egypt** – After the 2011 energy crisis, Egypt authorised cement plants to import coal on condition that they co-process alternative fuels. The law requires plants to use between 20 % and 30 % AF. Several plants have achieved thermal substitution rates above 40 % in Alexandria and above 30 % in Beni Suef, demonstrating feasibility [4].
- **India** – The Indian cement industry has a low starting point; its thermal substitution rate was about 0.6 % in 2010 and 4 % in 2016. Industry roadmaps target a 25 % TSR by 2025 and 30 % by 2030. India's cement demand, expected to reach 550 Mt by 2025, underscores the importance of decarbonisation. The Indian government, through initiatives such as the Solid Waste Management Rules (2016) and Ministry of Urban Development's guidelines on RDF co-processing, is actively promoting the use of refuse-derived fuel in cement kilns, encouraging industries to shift from fossil fuels to alternative fuels [6].
- **Saudi Arabia** – A Mandatory Energy Efficiency Programme is encouraging energy-intensive industries to reduce fuel use. Under Saudi Vision 2030, Saudi plans to divert 94 % of waste from landfill by 2035 and energy-price reforms, these policies create conditions conducive to AF adoption. However, only four Saudi plants currently use alternative fuels, indicating that regulatory enforcement and investment will be critical.

8. Industrial Projects and Case Studies

Momentum is building across the regions:

- **Oman** – In February 2025, Oman Environmental Services Holding Company (be'ah), Raysut Cement, and Germany's MVW Lechtenberg & Partner signed a memorandum of cooperation to advance waste-to-energy solutions. The agreement focuses on developing refuse-derived fuel (RDF) from municipal solid waste (MSW), supporting Oman's strategy to divert waste from landfills, reduce methane emissions, and promote sustainable cement production. Pilot-scale assessments are expected to pave the way for a long-term supply of RDF to domestic cement plants.
- **Saudi Arabia** – City Cement Company – MVW Lechtenberg & Partner helped City Cement build the first RDF production facility in the Kingdom, capable of producing about 30,000 t per year and saving roughly 27,000 t of CO_2 emissions.
- **Saudi Arabia** –Terra Fuel JV – The Saudi Investment Recycling Company (SIRC), in partnership with Green Solution and Lechtenberg Middle East, has launched the joint venture "Terra Fuel" to establish one of the region's largest waste treatment facilities. The planned plant will process 3,000 tonnes of MSW per day—equivalent to 1.09 million tonnes annually. From this stream, the facility is expected to produce around 370,000 tonnes of RDF for cement industry and recover nearly 98,000 tonnes of valuable recyclables, including metals, plastics, and paper/cardboard. This project is a cornerstone in Saudi Arabia's circular economy strategy, demonstrating large-scale integration of waste recovery and energy substitution.

These projects illustrate how partnerships among waste authorities, cement producers and technology providers can catalyse decarbonisation.

9. Conclusions

Business as usual projections suggest that Middle Eastern cement demand will grow slowly over the next quarter century even as global demand plateaus or declines. To align with the decarbonisation pathways implied by IEA's and WCA's scenarios, regional producers must adopt a multifaceted strategy. Deploying alternative fuels—particularly RDF derived from municipal waste—can significantly reduce both methane and fossil CO_2 emissions.

Lessons from Europe show that high thermal substitution rates are achievable when supportive policies, reliable waste supply chains and investment in modern kilns are in place. Governments are beginning to legislate and incentivize AF adoption, while companies are investing in infrastructure to secure long-term competitiveness. By integrating alternative fuels, the region can reduce carbon emissions, enhance energy security, and create thousands of new jobs. More importantly, the transition positions the Middle East as a potential leader in sustainable cement production—a model for balancing economic growth with environmental stewardship.

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CEO 360° ROADMAP TO THE FUTURE CEMENT PLANT

AFR, EFFICIENCY, AND DIGITAL TOOLS FOR A RESILIENT NET-ZERO PATHWAY

SEPTEMBER 2025

Decarbonization

Introduction

The cement industry faces a dual imperative: rapidly reduce greenhouse-gas emissions while maintaining cost competitiveness in volatile energy and carbon markets. With carbon border adjustments, rising energy costs, tightening air-emissions standards, and stricter disclosure expectations, transformation toward the Future Cement Plant is now a strategic necessity.

This paper introduces the CEO 360° Roadmap—a holistic, sequenced framework that integrates alternative fuels and raw materials (AFR), energy efficiency, digital technologies, and lifecycle cost orchestration into a cash-positive decarbonization and value-creation pathway. Building on A³&Co.® flagship solutions—CDS® (Complete Decarbonization Solution), the Digital Maturity Model, and the Cement Professional Development Program (CPDP)—we demonstrate how cement companies can unlock measurable gains in both emissions' intensity and unit economics.

Key messages

- AFR & fuel flexibility are immediate, scalable decarbonization levers.
- Efficiency & modernization are the first-fuel abatement.
- Digital maturity is the bridge from kilns to cockpits.
- Lifecycle cost orchestration is the CFO logic of decarbonization.

Through technical cases, regional benchmarks, and an implementation-ready roadmap, CEO 360° positions the cement plant not just as an industrial facility, but as a platform for sustainable growth and resilience under a net-zero trajectory.

Context and challenge

Cement contributes an estimated 7–8% of global CO_2 emissions, primarily from:

- **Process CO_2** (≈60–65%) during limestone calcination in clinker production; and
- **Fuel CO_2** (≈30–35%) from thermal energy in kilns and calciners.

1.1 Market and Regulatory Drivers

CBAM (EU Carbon Border Adjustment Mechanism). Transitional reporting runs from 1 Oct 2023 to 31 Dec 2025; the definitive regime starts 1 Jan 2026, when importers must purchase and surrender CBAM certificates for embedded emissions. The phase-in aligns with the EU ETS free-allocation phase-out toward full coverage by 2034. Cement is covered.

Clinker ratio headwinds. The global clinker-to-cement ratio rose from 0.66 (2015) to 0.71 (2022), reversing earlier progress and increasing embodied carbon unless offset by SCM substitution and performance-based standards.

MENA context. The region lags Europe on thermal substitution rate (TSR), digital maturity, and integrated lifecycle costing, yet has substantial AFR potential (MSW/RDF, sewage sludge, biomass) and is commercially exposed to EU and African routes—hence to CBAM.

1.2 A³&Co.® Philosophy

Guiding principle: **"Reduce Carbon while Reducing Cost."**

The **CEO 360° Roadmap** integrates:

- **CEO 360:** holistic baseline + cockpit across operations, energy, carbon, and finance.
- **CDS®:** quantified cost–carbon abatement curve to prioritize levers by €/tCO_2 and NPV.
- **Digital Maturity:** staged Industry 4.0 adoption to unlock predictive value.
- **CPDP:** the people program—skills, incentives, and governance for sustained performance.

Lever 1 — Increasing alternative fuel use (AFR)

2.1 AFR in a fuel-flexibility strategy

Fuel flexibility is the engineered ability to pivot across coal, petcoke, RDF, biomass, industrial/hazardous wastes, hydrogen, and emerging e-fuels without sacrificing clinker quality, throughput, or emissions compliance. AFR provides immediate CO_2 and cost relief by displacing fossil fuel and—where available—earning gate fees for co-processing.

2.2 Regional TSR benchmarks

- **Egypt:** TSR ≈ 10–15% (RDF contracts and sludge projects).
- **Morocco:** TSR ≈ 20–25% (RDF, biomass, industrial residues).
- **UAE:** TSR ≈ 8–12% (RDF supply from Sharjah/Abu Dhabi WtE programs).
- **Europe:** 50% TSR in 2021; ~53% average recently reported; ~60% by 2030 targeted. Best-in-class plants periodically exceed 80% (calciner).

2.3 Process challenges to manage

- **Chlorine (Cl):** promotes buildups/rings—mitigate with kiln-inlet bypass and/or controlled CKD bleeding.
- **Sulfur (SO_3):** unbalanced cycles destabilize the kiln—balance via raw-mix sulfate and operating set-points.
- **Moisture & LHV variability:** common in RDF/biomass—requires robust preparation (drying, sizing, blending) and stable combustion control.

2.4 Technology enablers

Thermal AFR preparation

- **MBT** (mechanical-biological treatment): drying, shredding, RDF stabilization.
- **Torrefaction:** upgrades biomass to higher LHV and hydrophobicity.
- **Pyrolysis/gasification** produces syngas or liquids for staged combustion.

Feeding & combustion (coarse AFR, high TSR)

- **KHD PYROROTOR®** — rotary combustion chamber integrated in the calciner; enables very high TSR with minimal preprocessing across a broad fuel window (coarse RDF, tyre chips, sludge).
- **FLSmidth HOTDISC®** — slow-rotating disc for bulky fuels (whole truck tyres, coarse RDF) combusted in the calciner; designed for 50–80% calciner fuel substitution (and higher in some projects), subject to site conditions.
- **polysius® materials-handling/dosing** — moving-floor style dosing for heterogeneous AFR; for modernization the **polytrack® eco** cooler offers higher recuperation efficiency and reduced power draw.

Hydrogen enrichment (UTIS UC3® / UCHP®)

- **UC3®** is a hydrogen-assisted continuous-combustion concept: inject precisely metered H_2 and O_2 into the combustion stream to enhance burnout and stability in continuous processes (cement kilns, incinerators, glass, etc.).
- **UCHP®** provides on-site hydrogen production, up to 99.999% purity, reducing storage complexity and enabling stepwise H_2 co-firing scenarios.

2.4.1 Refined Comparison and Integration

TECHNOLOGY/ SYSTEM	TYPE & PURPOSE	KEY ADVANTAGES	CONSTRAINTS	BEST-FIT SCENARIO
UTIS UC3® + UCHP®	H_2-enriched continuous combustion with on-site H_2	Retrofit-friendly; improves burnout/combustion stability; reduces CO/unburnt; allows gradual H_2 blending	Economics depend on hydrogen cost & electricity mix; flame/NO_x behaviour must be tuned with interlocks	Plants targeting higher TSR with stable flames; sites with renewables/PPAs; stepwise H_2 co-firing roadmap
KHD PYROROTOR®	Calciner rotary reactor for coarse AFR	Handles low-LHV/coarse fuels with long residence; robust burnout; very high TSR with minimal preprocessing	Mechanical complexity; calciner integration space	Coarse RDF availability; limited fine-preprocessing infrastructure
FLSmidth HOTDISC®	Calciner combustion of bulky fuels	Ideal for tyres/coarse RDF; stabilizes calciner load; 50–80% calciner substitution typical (project-dependent)	Lower turndown; slower response; refractory wear in some duty cycles	Access to tyres/large residues; need for high, steady calciner heat input
polysius® moving-floor dosing	Dosing/feeding of heterogenous AFR	Stable dosing; mitigates bridging; supports moist RDF	Requires preconditioning; footprint; upkeep	Variable feed quality where dosing reliability is the bottleneck

2.4.2 UC3® Within a Fuel-Flex Strategy (How to Use It)

- **Blending & transition:** model H_2 co-firing initially; scale as LCOH falls or green PPAs mature.
- **Flame stability & quality:** H_2+O_2 enrichment can improve oxidation dynamics at high TSR; monitor free lime and SM/AM envelopes closely.
- **Retrofit & disruption:** injector additions and control-logic updates avoid full burner replacement; integrate with BMS/SIS for interlocks.

2.5 CEO 360° integration for AFR

The CEO 360° cockpit orchestrates AFR via:

- TSR (%) and fossil substitution factor,
- €/t-clinker fuel OPEX and gate-fee revenues,
- tCO_2/t-clinker avoided vs CBAM-exposed netbacks,
- risk mapping for Cl/S cycles, ash chemistry, flame stability, clinker quality,
- CAPEX–OPEX–Carbon interactions in a unified board-level view.

Lever 2 — energy efficiency & direct co_2 cuts

Efficiency is the lowest-cost abatement. A practical rule-of-thumb: every 50 kcal/kg-clinker saved typically yields ~3–5% fuel-CO_2 reduction and ~$2–3/t-clinker OPEX savings (site-specific).

Where the world is: global kiln thermal intensity ≈ 3.6 GJ/t-clinker (2022), on a trajectory to ~3.4 GJ/t by 2030. **Typical modern plants consume around 90–110 kWh/t-cement** (regional variation). VRM conversions for finish grinding generally save 10–24 kWh/t-cement, and APC programs frequently deliver ~1–5% specific-energy and ~5–12% throughput improvements when correctly scoped and tuned. Compressed-air optimization often unlocks ~20–50% system savings.

3.1 Incremental measures (rapid paybacks)

- Kiln sealing & false-air reduction, preheater balancing, cooler optimization (air distribution, recuperation, bed control).
- Separator tuning to curb over-grinding and stabilize Blaine/residue.
- VFDs on large fans/pumps; demand-based control.
- Compressed air: leak audits, pressure set-points, heat recovery—often 20–50% savings potential.

3.2 Modernization measures (programmatic upgrades)

- Material handling: replace pneumatics with mechanical conveying.
- Burners: low-NO_x, multi-fuel designs compatible with AFR + H_2 enrichment.
- Calciners: dual-fuel/HOTDISC-ready configurations.
- Preheaters: low-ΔP cyclones; improved gas–solids contact.
- Coolers: higher heat recuperation (e.g., polytrack® eco).
- Electrification: auxiliaries and drives tied to renewable PPAs.
- Fans: high-efficiency impellers; variable-pitch where applicable.
- Online analysis: real-time XRD/XRF for clinker mineralogy; avoid overburning.
- Hydrogen enrichment: use UC3® to stabilize high-TSR operation and improve burnout (site-specific trials).

3.3 Quantification & targets (set in CEO 360°)

- Thermal intensity: 3.6 → 3.4 GJ/t-clinker by 2030; BAT ~2.9–3.3 GJ/t for modern PH/PC lines.
- Electrical intensity: 90–110 kWh/t-cement typical.
- Grinding delta (VRM/HRP): 10–24 kWh/t-cement saved.
- APC: ~1–5% energy, ~5–12% throughput.
- Compressed air: 20–50% system savings potential.

CEO 360° translates these into site-specific targets, sequencing no-regrets first, then modernization by NPV/tCO_2 avoided.

Lever 3 — digital technologies: AI, digital twins, and the CEO 360° cockpit

4.1 Digital Maturity Model (A³&Co.®)

Manual → Automated → Optimized → Predictive → Autonomous. Most plants secure >50% of the digital value by reaching Predictive (APC + predictive quality + reliability analytics), without needing full autonomy.

4.2 Priority applications

- Digital twins: what-if simulations for high TSR, chlorine cycles, and fuel-mix shocks; safe operator training.
- ERP/TIS integration: bridge real-time operations with SAP/Oracle finance so leadership sees €/t by line & shift with embedded carbon for CBAM dossiers.
- Predictive quality: ML forecasting of free lime, early strength, setting time from raw mix/kiln/cooler variables for predictive dispatch approvals.
- Predictive maintenance: RUL (remaining useful life) on fans, gearboxes, bearings; tie spare parts and downtime risk to EBITDA.
- APC scope: kiln & grinding circuits to stabilize conditions, lower energy and improve throughput.

4.3 CEO 360° cockpit

A single "cockpit" for operations + energy + carbon + finance:

- TSR% ⇄ OPEX and gate-fee netbacks,
- SHC trend ⇄ €/t-clinker,
- Throughput (t/h) ⇄ EBITDA,
- APC benefits (variability/energy/quality indices),
- Predictive maintenance (risk heat-map, avoided downtime cost),
- CBAM exposure (embedded CO_2 by batch/lot and export route).

Lever 4 — Lifecycle Costing, Smart Upgrades, and Hidden Margins

5.1 Lifecycle costing & MAC framework

Evaluate each lever i using marginal abatement cost (MAC) and NPV/tCO_2 avoided:

- **Capital Recovery Factor (CRF):**

$$\mathrm{CRF}(r,n) = \frac{r(1+r)^n}{(1+r)^n - 1}$$

- **Annualized CAPEX:**

$$\mathrm{CAPEX}_i \times \mathrm{CRF}(r,n)$$

- **MAC:**

$$\mathrm{MAC}_i = \frac{\text{Annualized CAPEX}_i + \Delta\text{OPEX}_i - \text{Annual Benefits}_i}{\text{tCO}_2\text{ avoided}_i}$$

This normalizes choices across mechanical, thermal, digital, and procurement actions.

5.2 Standard cost structures (illustrative)

- **Clinker $20–25/t:** Fuel 35–40%, Power 15–20%, Raw 10–15%, Labour 10–12%, Maintenance 12–15%.
- **Cement $30–35/t:** Clinker 70–75%, Grinding 8–12%, Additives 8–10%, Distribution 10–12%.

CEO 360° continuously compares actual vs standard to expose hidden margins.

5.3 ERP limitations & CEO 360° overlay

Traditional ERP is batch-oriented and lacks real-time unit-cost + carbon orchestration. CEO 360° adds an operational-finance layer for:

- real-time €/t by line/shift,
- tCO_2/t product by batch (for CBAM),
- scenario analysis (AFR mixes, fuel prices, H_2 adoption) and stage-gates (NPV/tCO_2 avoided).

AFR platform engineering & operations (practical playbook)

Feedstock strategy: waste mapping (municipal/industrial/agri), quality specs (LHV, moisture, metals, Cl), volumes/seasonality, contracting (gate-fee MOU, penalties/bonuses).

Combustion & quality: primary/secondary air balance, O_2 set-points, residence time; adjust LSF/SM/AM; monitor Na_2Oeq/volatiles; design bypass fraction via mass balance.

Safety & compliance: HAZOP/LOPA for pre-treatment/dosing/burners; BMS/SIS interlocks; permitting for NO_x/SO_2/CO/TOC/dust/HCl/HF and waste codes.

6.1 End-to-end AFR value chain design

An effective AFR platform aligns supply, preparation, feeding, and combustion as a single controlled process:

- **Supply portfolio:** diversify across MSW-derived RDF, industrial residues, tyres, biomass residues, and sewage sludge. Use **tiered specifications** (Tier A/B/C) for LHV, moisture, ash, metals, and chlorine, with price/gate-fee curves that reward quality.
- **Pre-treatment line sizing:** based on **peak-to-average** ratios, not just annual tonnage. Buffer with **covered storage**, drying capacity, and **blending bunkers** to smooth LHV and moisture variability.
- **Material logistics:** design **push-to-pull** flow with FIFO reclaim, automatic sampling, and **lot traceability** from weighbridge to burner.
- **Process integration:** ensure the dosing system communicates with the DCS/APC so **AFR feed-forward signals** adjust primary and tertiary air automatically to maintain calciner and kiln stability.

6.2 Specifications and quality assurance

Establish a Supplier Quality Manual covering:

- **Sampling & testing:** representative belt samplers or truck sampling with composite methods; routine tests for LHV, moisture, ash, Cl, S, and metals.
- **Acceptance criteria:** decision trees for **accept/rework/reject** at the gate; dynamic pricing or penalties for off-spec.
- **Blending logic:** rules for combining feeds to hit target **LHV bands** (e.g., 15–18 MJ/kg) and moisture ceilings.
- **Traceability:** lot IDs tied to **daily TSR and emissions,** so non-conformances are traceable back to supply.

6.3 Pre-processing configurations

- **MBT-RDF:** shredders (primary/secondary), ballistic separators, wind sifters, magnets, eddy-current separators, dryers.
- **Biomass upgrading** torrefaction or low-temperature dryers using waste heat from the cooler/WHR.
- **Sludge handling:** solar or belt dryers, cake pelletizers, dedicated feeding screws with purged hoppers.
- **Metals & inerts removal:** protect downstream equipment and limit ash buildup.

6.4 Feeding, metering, and control

- **Dosing technologies:** moving floors, rotary feeders, weigh-belt feeders, and **mass-flow hoppers** designed for cohesive materials.
- **Purge and inerting:** nitrogen or dry air purging on enclosures where dust/solvent vapours may accumulate.
- **Combustion control:** AFR mass flow, measured LHV, and instantaneous **oxygen demand** feed a control block that adjusts **secondary/tertiary air, calciner split,** and **preheater draft.**
- **APC integration:** kiln and calciner APC ingest AFR variability to stabilize free lime, burning zone temperature (via shell scanners), and CO/NO_x emissions.

6.5 Chemistry and kiln health

- **Chlorine & sulfur cycles:** deploy **bypass systems** sized from mass balances; maintain alkali/sulfur ratios; manage CKD bleed with controlled return rate.
- **Minor oxides:** watch Na_2Oeq and heavy metals in ash; adjust raw-mix and gypsum strategy accordingly.
- **Build-up prevention:** online coating thickness monitoring (acoustic/thermal) and **water cannon/air blasters** sequenced by APC to avoid rings.

6.6 Environmental management

- **Emissions:** ensure continuous monitoring for **NO_x, SO_2, CO, TOC, dust, HCl/HF;** keep **rapid-shutdown** logic tied to CO spikes or unburnt fuel.
- **Odour and dust:** enclosure and aspiration, negative-pressure halls, and high-efficiency bag filters with spark detection.
- **Residues:** safe handling of fines and screening rejects; return to fuel cycle only when within spec.

6.7 Economics and contracting

- **Gate-fee models:** index to LHV and moisture so suppliers are incented to deliver higher-quality RDF/biomass; consider revenue-sharing for recyclables recovered in MBT.
- **Take-or-pay** protect base supply for minimum TSR, with **force-majeure** clauses and seasonal buffers.
- **Performance KPIs:** TSR, € per GJ thermal input, avoided fossil tonnes, and **€/tCO_2 avoided,** reviewed monthly.

6.8 O&M and skills

- **Maintenance:** predictive strategies on shredders, feeders, and conveyors (vibration, thermography).
- **Safety:** ATEX zoning, explosion vents, hot-work permits near AFR lines, and periodic **combustible-dust hazard analyses.**
- **Operator training:** AFR combustion science, visual LHV cues, alarm rationalization, and response playbooks.

6.9 Ramp plan

- **AFR 1.0 (0–6 months):** stable dosing, metering, and QA; achieve **10–15% TSR** with consistent RDF.
- **AFR 2.0 (6–18 months):** integrate coarse-fuel technologies (HOTDISC®/PYROROTOR®), diversify supply, add **UC3®** pilots; **15–30% TSR.**
- **AFR 3.0 (18+ months):** optimize with **digital twins** and **APC** for **>50% TSR** where ecosystem allows.

Hydrogen enrichment (UTIS UC3® / UCHP®) — integration deep dive

Technical rationale. Hydrogen's high laminar flame speed can enhance ignition and combustion stability at high TSR. UC3® injects H_2 + O_2 into the flame/stream to intensify oxidation and burnout in continuous processes.

Integration considerations. Injector placement vs main flame; mixing with primary air; flashback avoidance; BMS integration; O_2-trim logic; NO_x/CO feedback; ATEX zoning; purge sequences; ESD plans. Economics hinge on LCOH and power price; align with PPAs. UCHP® provides up to 99.999% purity.

When it pencils. In CDS®, UC3® becomes more competitive as fossil prices rise and LCOH falls (site-specific). Gate fees for AFR can materially strengthen the business case.

7.1 Process design and controls

- **Injection geometry:** multi-point injectors around the burner quarl with **swirl-assisted mixing** to avoid hot spots.
- **Control loops:** closed-loop H_2 and O_2 flows slaved to **load, excess O_2, CO slip, and NO_x;** hard limits under BMS/SIS.
- **Transition logic:** ramp H_2 addition along **S-curves** tied to kiln thermal load and AFR fraction; instant spill-back on interlock trips.

7.2 Combustion chemistry and emissions

- **Stability:** hydrogen shortens ignition delay and broadens flammability limits—useful with **wet, low-LHV AFR.**
- **NO_x risk:** manage with staged air, moderated peak temperatures, and **low-excess-air** strategies; coordinate with SNCR/SCR if present.
- **CO/unburnt reduction:** higher radical pool improves burnout at calciner and kiln main flame.

7.3 Safety envelope

- **Detection:** hydrogen sensors near injectors, pipe racks, and burner platforms; double-block-and-bleed valves with position feedback.
- **Purge sequences:** automated pre-purge/post-purge; inerting as per SIL rating.
- **Training:** operator drills for **loss-of-H_2, flashback,** and **emergency stop.**

7.4 H_2 supply options and economics

- **On-site production:** aligns with UCHP®; pairs well with **behind-the-meter PPAs.**
- **Delivered gaseous/liquid:** bridge option while on-site builds; evaluate logistics and storage.
- **Cost drivers:** electricity price, electrolyser efficiency, capacity factor, compression/drying; blend-share targets and **dispatchable operation** matter.

7.5 Commissioning and performance testing

- **Pre-commissioning:** leak tests, instrument calibration, BMS/SIS validation.
- **Hot commissioning:** staged H_2 ramps under **trial plans;** record SHC, NO_x, CO, free lime, and TSR impacts.
- **Acceptance criteria:** defined in advance—e.g., **SHC reduction at constant clinker quality,** max NO_x increase limits, and **H_2 system availability.**

7.6 Risk and mitigation register (H_2 specific)

- **Risk:** injector fouling or drift → **Mitigation:** periodic borescope inspection and calibration.
- **Risk:** unexpected NO_x spikes → **Mitigation:** staged air optimization and rule-based APC constraints.
- **Risk:** supply interruption → **Mitigation: fail-safe reversion** to baseline combustion map; inventory buffers.

7.7 Integration with AFR and APC

- **AFR synergy:** use short H_2 spurts during **high-moisture RDF** batches to maintain temperature and limit CO spikes.
- **APC link:** AI/ML models detect conditions warranting temporary H_2 enrichment; **cockpit** displays marginal € and $kgCO_2$ impacts in real time.

Digital execution: from signals to decisions

Architecture. Edge PLC/DCS + analyzers (XRF/XRD), vibration/thermography → OPC-UA/MQTT → historian → feature store → model serving (APC, predictive quality, maintenance) → CEO 360° cockpit with role-based dashboards.

High-value use cases. Kiln/mill APC stabilization; predictive quality (1–6 h horizons); RUL for critical assets; tariff-aware energy scheduling.

Governance & change. CPDP training; cockpit-linked incentives (CO_2, kWh/t, $/t); MOC for models (versioning, rollback, audit trail).

8.1 Reference data architecture

- **Tag model:** standardize names/units for flows, temperatures, pressures, analyser outputs; include **data lineage** and calibration records.
- **Time-series backbone:** high-resolution historian for **second-level** signals; retention tiering to control storage.
- **Context layers:** shift, line, campaign, AFR lot, product grade; essential for **unit-economics** and **CBAM dossiers.**

8.2 Integration and interoperability

- **OPC-UA gateways** for PLC/DCS; **MQTT** for lightweight edge devices.
- **API layer** to ERP/TIS so costs, tariffs, and order books inform **dispatch and grinding** decisions.
- **Master data alignment:** common product/grade codes across LIMS, ERP, MES.

8.3 MLOps and model governance

- **Lifecycle:** data exploration → feature engineering → training → validation → **shadow mode** → production → monitoring → drift remediation.
- **Controls:** model versioning, performance SLAs, **bias checks** (e.g., raw-mix drift), and reproducibility.
- **Rollbacks:** one-click fallback to last-known-good model.

8.4 APC strategies (pyro and grinding)

- **Kiln APC:** multivariable control to stabilize burning zone (shell scanner), free lime, back-end O_2/CO; constraint handling for draft and ID fan.
- **Calciner APC:** manage AFR/tertiary air split, residence time, CO spikes; maintain stable temperature profile.
- **Grinding APC:** mill load model, separator speed optimization, Blaine/residue targets with **minimum kWh/t.**

8.5 Predictive quality and lab integration

- **Models:** free-lime prediction from temperature/oxygen/pressure signals; strength models from clinker mineralogy (XRD) and grinding parameters.
- **Closed-loop:** recommend kiln temperature set-point shifts or gypsum adjustments; **soft interlocks** to prevent overcorrection.

8.6 Predictive maintenance

- **Signals:** vibration (RMS, kurtosis), motor current signature, bearing temperatures, oil particle counts.
- **Outputs:** RUL (days) and **risk heat-maps;** auto-generate job plans and spares reservations.
- **Value:** fewer unplanned stops, **higher line availability,** and spare-parts optimization.

8.7 Energy optimization and market coupling

- **Tariff arbitrage:** shift finish grinding to **off-peak windows;** curtail ventilation/compressed air during price spikes.
- **PPA orchestration:** match renewable generation with **electrified auxiliaries** and H_2 production where present.

8.8 Cybersecurity and reliability

- **Segmentation:** ISA/IEC 62443 zones, **air-gapped** safety systems, MFA, and least-privilege.
- **Monitoring:** anomaly detection on network traffic and device logs; **golden image** baselines for HMIs and servers.

8.9 Cockpit design and user experience

- **Role-based dashboards:** CEO (EBITDA, tCO_2/t), COO (TSR, SHC, throughput), CFO (€/t by shift/grade, CBAM exposure), Plant Manager (OEE, stability indices).
- **Alerting:** tiered alerts, escalation matrices, and **explainability** on AI recommendations.

8.10 Implementation playbook (12 sprints)

- **Sprints 1–4:** data plumbing, historian hardening, tag governance, first KPIs live.
- **Sprints 5–8:** APC pilots on kiln and one grinding line; predictive quality model in shadow mode.
- **Sprints 9–12:** scale to plant-wide APC, predictive maintenance, cockpit for executives, and ERP/TIS coupling.

Sequenced roadmap — the A³&CO.® integrated plan

9.1 How the pieces fit

- **CEO 360 (baseline & cockpit):** performance/carbon baselines (fuel mix, SHC, SEC, clinker factor, TSR) and value-leak mapping.
- **CDS® (decarbonization engine):** abatement curve mixing no-regret and CAPEX items—VRM/HRP, VFDs/fan retrofits, AFR platform, WHR, SCM sourcing, H_2 enrichment readiness/CCUS readiness—sequenced by €/tCO_2 and payback.
- **Digital Maturity (enablement):** deploy APC + AI early (pyro, mills, AFR blending); integrate quality, energy, emissions, and finance KPIs in one cockpit.
- **CPDP (people):** upskill kiln/mill operators for AI-assisted decisions; train planners/reliability on predictive workflows; train finance on abatement-curve economics and CBAM accounting.

9.2 Example 24-month sequence (brownfield, 1.0–3.0 Mt/y)

- **Q0–Q1:** Baseline with CEO 360; stand-up cockpit; reliability fixes.
- **Q2–Q3:** Efficiency sprint—kiln seals/false air, ID-fan set-points, separator tuning; deploy APC on kiln + one grinding line.
- **Q4–Q6:** AFR platform—RDF contracts, pre-processing, burner retrofit; stabilize TSR to 15–25%; evaluate UC3® enrichment.
- **Q7–Q8:** Grinding upgrade—HRP or VRM where justified; compressed-air optimization + VFDs on large fans.
- **Q9–Q12:** Scale digital—extend APC/AI plant-wide; predictive maintenance across critical assets; SCM supply MOU; PPAs for green power.

9.3 Expected outcomes (directional, site-specific)

- **Fuel CO_2:** −8–20% via 15–30% TSR (EU experience demonstrates sustainable >50% TSR under robust ecosystems).
- **Thermal intensity:** −0.1 to −0.3 GJ/t-clinker from sealing/balancing/APC.
- **Electrical intensity:** −10–24 kWh/t-cement via VRM/HRP & VFDs; compressed-air programs add double-digit % savings.
- **Quality & throughput:** reduced variability; +5–12% throughput common after APC adoption.
- **Financials:** lower energy OPEX; CBAM exposure reduced via lower embedded carbon and clinker-factor management.

CFO logic of decarbonization

- **CBAM & embedded carbon.** From 2026, importers must surrender CBAM certificates for embedded emissions; CEO 360° simulates routing, product mix, and intensity reductions to minimize exposure.
- **Abatement-portfolio design.** Stack the curve—efficiency, AFR (with gate fees), digital/APC, grinding upgrades, H_2 enrichment, PPAs, SCMs—and rank by NPV/tCO_2 avoided.
- **Contracting & finance enablers.** Gate-fee contracts; performance-based EPC; sustainability-linked loans aligned to intensity KPIs; where applicable, carbon-credit revenues.

People and capability — CPDP as a multiplier

Technology fails without people. CPDP develops:

- Operator skills in AI-assisted kiln/mill control and high-TSR operation,
- AFR combustion science & quality assurance,
- Predictive maintenance culture and reliability engineering,
- Finance literacy for abatement economics and CBAM accounting.

Cockpit-linked incentives ensure daily decisions translate to CO_2, kWh/t, and $/t outcomes.

11.1 Competency framework and roles

- **Kiln & calciner operators:** APC literacy, AFR combustion envelopes, free-lime control, and interlock logic.
- **Grinding & quality teams:** separator tuning, predictive quality interpretations, Blaine/residue management.
- **Reliability engineers:** condition-monitoring analytics, RUL interpretation, shutdown planning.
- **Energy managers:** tariff strategies, load shifting, compressor/fan optimization.
- **Finance & procurement:** NPV/tCO_2 logic, gate-fee economics, CBAM compliance, supplier scorecards.

11.2 Curriculum architecture

- **Foundation (2–3 weeks):** cement chemistry, mass/energy balance, emissions basics, safety culture, and data literacy.
- **APC & digital (4–6 weeks):** MIMO control basics, model explainability, alarm rationalization, and human-in-the-loop decision-making.
- **AFR & hydrogen modules (2–4 weeks):** AFR QA/QC, kiln health, UC3® operations and safety; case-based learning with simulators.
- **Finance & CBAM (1–2 weeks):** abatement curves, standard vs actual cost, embedded carbon accounting.
- **Leadership (ongoing):** change management, coaching, and performance dialogues.

11.3 Training and delivery

- **Simulators:** kiln and mill digital twins for scenario-based practice (TSR ramps, chlorine spikes, power curtailments).
- **Do-then-learn cycles:** assign **on-shift experiments** under safe bounds (e.g., separator speed trims) and review results in weekly "learning huddles."
- **Micro-credentials:** stackable badges leading to **CPDP Bronze/Silver/Gold** certifications.

11.4 Adoption and change management

- **Champions network:** one per shift/discipline; maintain a **playbook** of best practices.
- **Shadow mode → active mode:** run APC in shadow for 2–4 weeks; migrate to active with clear **stop rules.**
- **Incentives:** team bonuses linked to cockpit KPIs (e.g., SHC, TSR, OEE, tCO_2/t).
- **Governance:** monthly **Operations Council** to review targets, incidents, and learnings; quarterly **Business Review** with CEO/CFO/COO.

11.5 Knowledge systems

- **Lessons learned** database with searchable tags; video snippets of control-room interventions.
- **Communities of practice:** operators' forum and reliability guild to sustain peer coaching.

Case illustrations (methodology-based, anonymized)

Case A — AFR ramp with H_2 enrichment

Baseline: TSR 8%; SHC 3.55 GJ/t; fuel-CO_2 850 kg/t-clinker (illustrative).

Interventions: MBT-RDF supply; moving-floor dosing; UC3® enrichment.

Outcome (9 months): TSR 26%; SHC −0.18 GJ/t; fuel-CO_2 −16%; kiln stability retained; NO_x −8% with staged air; EBITDA +$4.3/t via OPEX + gate fees (site-specific).

Case B — Efficiency + APC + HRP

Baseline: 118 kWh/t-cement; over-grinding variability.

Interventions: separator tuning; APC load control; HRP retrofit.

Outcome: −17 kWh/t; +9% throughput; strength variability narrowed; product mix supports lower clinker factor.

Risk register & mitigations

RISK	LIKELIHOOD	IMPACT	MITIGATION
AFR LHV/Moisture Variance	Med	High	Contract specs; blending silos; feed-forward control
Cl/SO_3 Cycles (Rings/Buildups)	Med	High	Bypass sizing; CKD bleed; raw-mix tuning
NO_x Excursions With H_2 Enrichment	Low–Med	Med	O_2 trim; staged air; closed-loop NO_x control
RDF/Biomass Supply Disruption	Med	Med	Multi-supplier strategy; inventory buffers
Digital Adoption Resistance	Med	Med	CPDP training; incentives; shadow-mode rollouts
CAPEX Overrun/Lead Times	Low–Med	High	Stage-gates; EPC guarantees; owner's engineer
CBAM Methodology Changes	Low	Med	Policy watch; flexible cockpit scenarios

Measurement, Verification & Reporting (MRV)

- **KPIs:** TSR%, SHC, kWh/t, tCO_2/t product, NO_x/CO, clinker quality indices, EBITDA/t.
- **Baselines:** locked with audit trails; weather/production-normalized where relevant.
- **Verification:** periodic third-party checks (meters, analyzers, model performance).
- **Reporting:** line/shift dashboards; monthly CEO/CFO packs; CBAM dossiers by route/customer.

Practical playbooks

15.1 90-day efficiency sprint

Leak sealing & preheater balance • compressed-air audit • fan-curve checks + VFDs • separator/Blaine tuning • APC "lite" stabilization.

15.2 AFR 1.0 → 2.0

RDF contracts + dosing reliability + QA → add coarse-AFR reactors (HOTDISC®/PYROROTOR®) + UC3® pilots + analytics-driven AFR blending.

15.3 Digital step-ups

Predictive quality (free-lime, strength) • RUL on fans/gearboxes • cockpit roll-out to CEO/CFO/COO with cross-functional KPIs.

Technical appendix — numbers that matter (reference ranges)

- Clinker-to-cement ratio: 0.71 (2022) global.
- Kiln thermal intensity: ~3.6 GJ/t-clinker (2022) → ~3.4 by 2030; BAT ~2.9–3.3 GJ/t for modern PH/PC lines.
- **Electrical intensity (plant): 90–110 kWh/t-cement typical.**
- Grinding delta: VRM vs ball mill/HRP saves ~10–24 kWh/t-cement; capacity often rises.
- AFR in EU: 50% TSR (2021); ~53% average recently reported; ~60% by 2030 targeted.
- APC benefits: ~1–5% energy, ~5–12% throughput (scope-dependent).
- Compressed air: 20–50% savings potential via leaks/controls/heat recovery.

Conclusion — a resilient path to net-zero competitiveness

- **AFR & fuel flexibility** deliver immediate, scalable CO_2 and cost reductions.
- **Efficiency & modernization** are the cheapest, most reliable abatement.
- **Digital maturity** turns signals into decisions and EBITDA.
- **Lifecycle costing** aligns CAPEX/OPEX/Carbon/Revenue for CFO-grade choices.

The **CEO 360° Roadmap**—powered by **CDS®, Digital Maturity, and CPDP**—offers a structured, cash-positive pathway to the **Future Cement Plant:** efficient, digital, resilient, and CBAM-ready.

17.1 Executive synthesis for leaders

The winning plants in the next decade will be the ones that **sequence** interventions, not just **select** them. Start where the physics and the P&L intersect **efficiency first,** then **AFR scale-up,** then **digital stabilization,** under a **lifecycle-cost guardrail.** This order compounds: lower SHC widens margin for TSR, stable operations improve digital model accuracy, and cockpit visibility accelerates capital recycling into the next tranche of abatement.

17.2 Investor and lender readiness

An integrated roadmap reduces **earnings volatility** by diversifying energy inputs, lowering exposure to carbon pricing, and improving asset reliability. It also strengthens the **sustainability-linked financing** narrative: clear KPIs (tCO_2/t, TSR, SHC, OEE) with auditable baselines and independent verification. Plants with **credible, sequenced** plans typically access **lower cost of capital** and tap **green finance** baskets for capex-light upgrades.

17.3 Policy and market posture

CBAM formalizes a price on **embedded carbon** at the border. The practical defence is a **measurable drop** in intensity tied to export lots and **route optimization.** A CEO 360° cockpit that packages **batch-level carbon, supplier contracts,** and **customer routes** turns carbon compliance into a **commercial lever** rather than a reporting burden.

17.4 Ecosystem partnerships

No plant decarbonizes alone. The top performers forge **RDF consortia** with city waste authorities, **PPA partnerships** with renewables developers, **SCM agreements** with adjacent industries, and — where appropriate — **technology alliances** for H_2 enrichment and coarse-fuel platforms. The guiding rule: build **optionality** into supply and technology choices, so the portfolio adapts as fuel and power markets evolve.

17.5 Call to action (first 100 days)

- **Lock the baseline** (CEO 360) and publish line-by-line targets.
- Execute a **90-day efficiency sprint** with verifiable savings.
- Sign at least one **AFR offtake** and commission metered dosing on a pilot line.
- Launch **APC** on kiln or one grinding line; run **shadow mode** for quality models.
- Stand up the **cockpit**, integrate finance KPIs, and tie **shift incentives** to it.

17.6 What success looks like (24–36 months)

- **TSR 20–35%** sustainably, with seasonal buffers and supplier scorecards.
- **SHC reduced** by **0.15–0.30 GJ/t-clinker;** plant **kWh/t** down double digits.
- **Throughput** up **5–10%** at constant quality; fewer unplanned stops.
- **Embedded carbon** per export batch trending down; **CBAM exposure** mitigated via product mix and routing.
- A workforce capable of **reading the cockpit, trusting APC,** and **owning** daily optimization.

Acknowledgments & scope note

Focus here is operational decarbonization (AFR, efficiency, digital, SCMs). CCUS, calcined-clay activation, and novel binders are evaluated within **CDS®** where site conditions and economics warrant.

Developments in CO_2 reduction from clinker and cement - a trip around the world!

Mark Mutter, Managing Director, JAMCEM Consulting Limited

Introduction

Time is passing by and whilst the industry is talking about CO_2 reduction, on the face of it there is very little progress. This can be attributed to a number of reasons such as:

- Implementation of carbon capture projects takes time, so even if projects have been announced and funded, it takes several years before they are actually operational.
- Certain areas of the world do not have any type of carbon trading scheme or carbon tax to motivate cement producers to invest in carbon reduction.
- Some producers are not promoting the savings that they are making on CO_2.

However, despite this apparent lack of activity, some areas of the world are making progress and there are interesting developments in the world of cementitious materials which may signal a change in the future requirements for cement. This article is a summary of some of the developments – both positive and negative – in relation to CO_2 emissions reduction.

Europe – leading the way

It seems to be most logical to start with a review of events in Europe, which has the longest standing emissions trading scheme in the world. Cement producers – as well as other large emitters of CO_2 – have participated in the EU Emissions Trading Scheme ("ETS") since around 2005. Although the scheme had little impact on overall emissions reductions in its early phases - mainly due to the over-allocation of carbon credits - more recent iterations have seen industries paying significant amounts to purchase carbon credits. Some of the funds received from the ETS have been put aside into the "Innovation Fund", which is used to subsidise the cost of expensive carbon reduction schemes such as carbon capture and storage. Cement producers can apply for partial funding from the Innovation Fund for their projects, although they are not only competing with other cement producers but also other industries for the allocation of capital.

Figure 1: CO_2 transport from Brevik plant in Finland

The first large scale carbon capture project in the cement industry – with around 80% funding from the Norwegian government - is currently being commissioned. The system is located at the Heidelberg Brevik Cement plant in Norway, with CO_2 captured at the plant being liquified and transported by ship to the Northern Lights storage facility, which uses depleted oil wells in the North Sea. The storage facility has been developed by the Norwegian Government as a long term commercial venture for the storage of CO_2 from a wide range of CO_2 producing industries. Whilst the project will produce the worlds first carbon-neutral cement, it came at a high cost – with the Brevik carbon capture system estimated to have cost €400 million and the Northern Lights project over €2.1 billion. All this for 400,000 tonnes of CO_2 capture – half of that produced by the plant.

In addition to the Brevik plant that is close to complete commissioning, there are a significant number of other carbon capture projects in the cement industry that are in the construction phase. The projects are not all identical to Brevik – in fact it would appear that technology has already moved on from amine absorption, with cryo-technology appearing to be the currently favoured option due to the lower energy requirements compared to amine absorption. It may well be the case that by the time these plants are built, other technologies be cheaper in terms of both OPEX and CAPEX. The map below shows the location of the Innovation Fund cement industry projects that are planned to be in full scale operation by 2030.

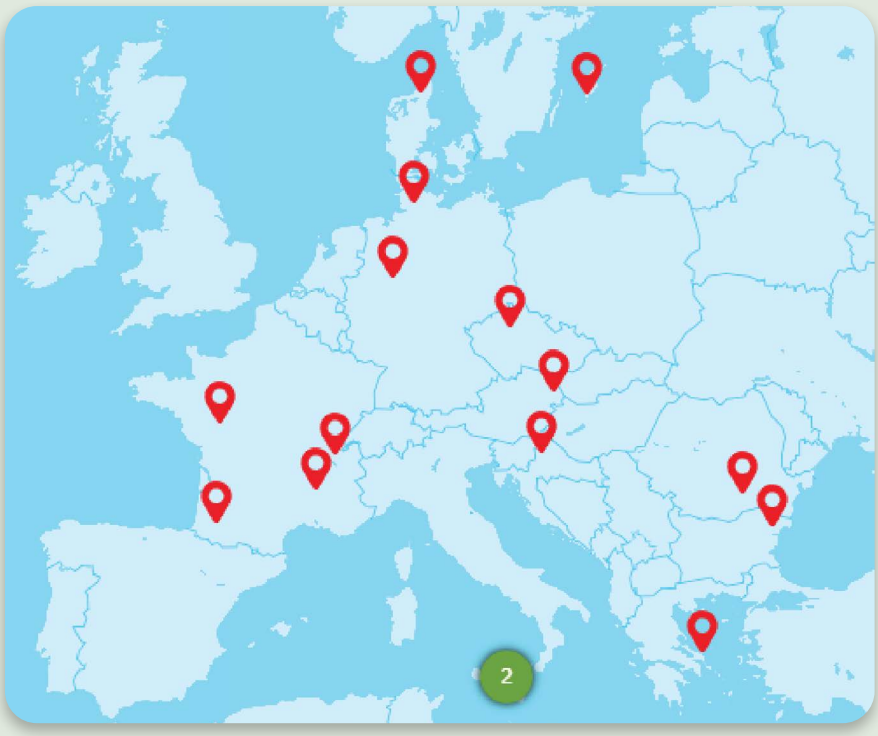

Figure 2: Location of EU-backed cement industry CCS projects

One consequence of the EU ETS is that the cost of production of cement has increased. So far, the additional cost of CO_2 has been passed onto customers, at a level that has been accepted by the consumers. However, the next 5 years are expected to see all of the free allowances for cement producers to be eliminated, meaning that all of the CO_2 emitted will have to be paid by purchasing carbon credits. As an example, a 1 million tpa cement plant would expect to pay around €50 million in CO_2 costs, adding €50 per tonne of cement. And these costs are at current carbon market prices and therefore the costs are expected to be significantly higher as the price of carbon credits increases. Those few cement plants that have invested in or had their carbon capture systems part funded will be at a significant advantage over those that have to pay for their CO_2, which could potentially lead to plant closures. Already the closure of two smaller plants in Europe have been announced by Heidelberg.

In addition, any market that has high pricing for cement will become a target for importers and therefore one consequence of the EU ETS and the removal of free allowances will result in increased cement pricing and therefore a threat of imports from low cost of production countries such as those in the MENA region. In order to combat this, the EU has introduced the Cross Boarder Adjustment Mechanism (CBAM). The aim of CBAM is to avoid cheap cement from countries that do not have an emissions trading scheme or carbon tax from entering into the EU, thereby penalising the EU producers. The scheme will apply the same tariff to imports as the cement producers are paying in the EU i.e., as the free allowances in the EU decrease, the cost paid by the importers will increase to ensure a level playing field. However, with CBAM not coming into effect until 2026, some countries are already suffering from the import of cheap cement – the United Kingdom and Romania just two examples of this effect – in the latter case the Romanian Government officially requesting the EU to investigate and limit imports from non-EU countries. In the longer term, it remains to be seen how effective CBAM will be stopping imports into the EU – especially from countries where the cost of production is so cheap due to subsidised fuel and power, where even with the addition of the carbon cost, the landed cost of cement is still cheaper than local production.

USA – business as usual

Under the Biden Administration, funding was committed to a number of different projects in the USA in an effort to demonstrate the feasibility of such installations as an example to the industry. These included:

- $500 million for VICAT in California to part fund the installation of a calcined clay plant, increases in alternative biomass fuels and a carbon capture project to capture 950ktonnes of CO_2 from the plant.
- $500 million towards the project for a carbon capture and storage project at the Mitchell plant in Indiana. The project would have used on-shore storage of CO_2, burying the gas in geological formations below the plant.
- Funding for both Sublime and Brimstone – two start-ups aiming to produce alternative binders. The funding for both companies was for the construction of commercial size production facilities to prove the concept of the technologies.

However the return to power of the Republican party has led to all of the funding for these projects being removed, leaving the projects in limbo. It is highly unlikely that the companies themselves will have the financial resources to complete these projects without government support, setting the USA back compared to European countries.

From a Corporate perspective, there have been some interesting developments. The first of these is the spilt of Holcim into two separate entities. The USA business has been split off into a new company – Amrize – whilst the rest of the world will stay with the Holcim brand. Whilst the company has stated that the US assets are outperforming the rest of the group and that the US markets command a higher valuation than European markets, this move could also be interpreted from an environmental perspective. With an emissions trading scheme unlikely in the US (despite some states such as California, Washington and Oregon having their state-level schemes) and therefore no drive for carbon capture, Holcim may have opted to spilt off the assets where minimal capex is required (Amrize) and leave the older assets where carbon capture will be required (Holcim and in particular Europe) in a separate company.

A further interesting development is the recent purchase of ECO Materials by CRH for $2 billion. Whilst CRH are known for their large dealmaking, it is a major investment in a country where the company already has significant clinker production. ECO Materials specialises in the manufacture and supply of cementitious materials – mainly fly ash and pozzolan – as well as “green cement” formulations coming from these materials. This move by CRH could signal that they believe that at least part of the future of cement for the USA lies in cementitious materials as opposed to clinker based cements.

American cement producers have across the board switched their production from OPC to Portland Limestone Cement (PLC). Whilst this could be perceived to be a positive switch in terms of CO_2 per tonne of cement, if clinker production remains the same and more cement is produced due to a reduction in the clinker factor, then the overall effect on CO_2 emissions from cement plants is zero. However, more production in the USA may result in a reduction of imports from Europe and South East Asia, thereby at least eliminating the CO_2 emissions relating to the sea freight of cement.

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Africa

Whilst we might imagine that Africa would have very little concern with CO_2, as countries are still developing their infrastructure needs and aiming to increase the standard of living, there have been some positive developments relating to CO_2. There are many countries – especially in West Africa – where there is no limestone for clinker manufacture. These counties rely completely on imports of clinker for the manufacture of cement in grinding plants. Whilst these countries have no limestone, they generally have good mineral deposits of clay that is suitable for the manufacture of calcined clay. Projects that have either been commissioned or are being built are as follows:

- 400ktonne per annum in Ivory Coast for CIMPOR in 2020.
- 250ktonne per annum in Cameroon for Oyak in 2023.
- 400ktonne per annum in Ghana for Heidelberg JV in 2024.
- 300ktonne per annum in Burkina Faso for CIMAF in 2026.

Whilst calcined clay cannot be used on its own, the material can substitute clinker at high replacement levels and has a lower carbon footprint than clinker. In these specific African markets, the cement is predominantly 32.5 class cement - with some 42.5 - and therefore the addition of calcined clay is perfectly suited to these markets, where high strength is not required. The installation of these plants will both lower the overall CO_2 per tonne of cement sold in these countries as well as reduce CO_2 from clinker freight due to the reduction in the requirement of clinker imports.

Figure 3: Calcined clay flash calciner in Ghana

Middle East

Countries in the MENA region have yet to implement any kind of Emissions Trading Scheme and therefore the financial “carrot and stick” for the reduction of CO_2 is not currently in place. Whilst close in geography, there are very significant differences in the cost structures, with some countries using cheap local fuel while others have to import expensive coal. Therefore making generalisations across different countries is challenging. However, there are still some success stories as described below:

- Emirates RDF was established in 2020 as a supplier of RDF to the Northern Emirates of the UAE. Despite a challenging start, the plant is now sold out with almost all of the producers in those Emirates using RDF as an alternative fuel. Whilst the use of alternative fuels still produces CO_2, it is part of the circular economy being put in place, can avoid methane emissions from landfill and will reduce the requirement for coal to be imported to the UAE.

- Emirates Cement, part of EMSTEEL Group, at the Al Ain Cement factory in Abu Dhabi, has been conducting trials to use ladle slag from steel production as an alternative raw material. The slag, refined by Magsort of Finland to remove steel elements, is highly valuable as it contains CaO instead of $CaCO_3$. This creates a double CO_2 -saving effect: first, by reducing emissions from raw materials since part of the mix is already calcined, and second, by lowering fuel consumption during production.

  Looking ahead, the plant also plans to use EAF slag as a raw material, further cutting CO_2 emissions.

  Longer term, EMSTEEL Group confirms its full commitment, through this innovative initiative, to reduce CO_2 emissions in its Cement division by 30% by 2030. Using EAF slag from Emirates Steel as raw material is a pioneering example of circular economy, not only in the UAE but across the global cement industry.

Global – new (old) materials, new technologies, new cements

There are also some new developments in both materials and manufacturing that could significantly change the structure of the industry – or certainly the volumes of clinker required – as well as the costs that are involved with carbon capture. Some examples of these are as follows:

- ECOCEM ACT technology: The company focuses heavily on R and D and has developed a new cement formulation that uses high proportions of limestone with low clinker content for the same strength performance, delivering up to 70% CO_2 reduction compared to conventional cement. The product has received ATSM certification in the USA and more recently an EPTM certification in France – a stepping stone to full certification for widespread use in France.
- Fly ash beneficiation: Supplies of fly ash for use as a cementitious material have been dramatically decreasing over recent years as coal fired power stations have been replaced by renewables. However, there are millions of tonnes of dumped slag located around the world which could be beneficiated and used as a replacement for clinker and cement. Companies such as Titan and PEEL NRE in the UK and Eco Materials in the USA are leading the way in beneficiation of fly ash, ensuring that the material meets current standards for concrete.
- Oxyfuel technology: Developments in the method of clinker manufacture have been few and far between in the last 50 years. However, this year will see the commissioning of the first industrial scale oxyfuel plant at Mergelstetten in Germany. The plant has been built by Thyssen Krupp and funded by a consortium of cement manufacturers – VICAT, Heidelberg, Schwenk and Buzzi/ Dykerhoff. The system will use oxygen instead of air within the pyro-processing system, which will lead to the exit gases from the system having a purity of CO_2 which is sufficient for direct compression and pumping to storage, thereby drastically reducing the cost of carbon capture and storage. Whilst the addition of new clinker capacity in not required, it may well be more cost efficient to build a complete new oxyfuel line as opposed to retrofitting a line with a carbon capture system.

Summary

Whilst it may appear that the industry is making very little progress in reducing CO_2, there are developments happening that will accelerate over the few years. Projects such as carbon capture will make the largest contribution, but other initiatives such as use of alternative raw materials as part of the solution will set the example for others. In the medium term, the reclamation of useful materials and the development of new binders will influence the global requirement for clinker and therefore the emissions for the cement industry. The development of these technologies and materials could affect the MENA region cement producers by limiting potential export markets or the lower-carbon products being preferred in large projects compared to conventional cements.

New silo shell to upgrade your old silo for the next generation

Martin Wuerth (Wuerth Consulting Engineers) discusses a silo repair method which has after execution a lifetime of more than 30 years.

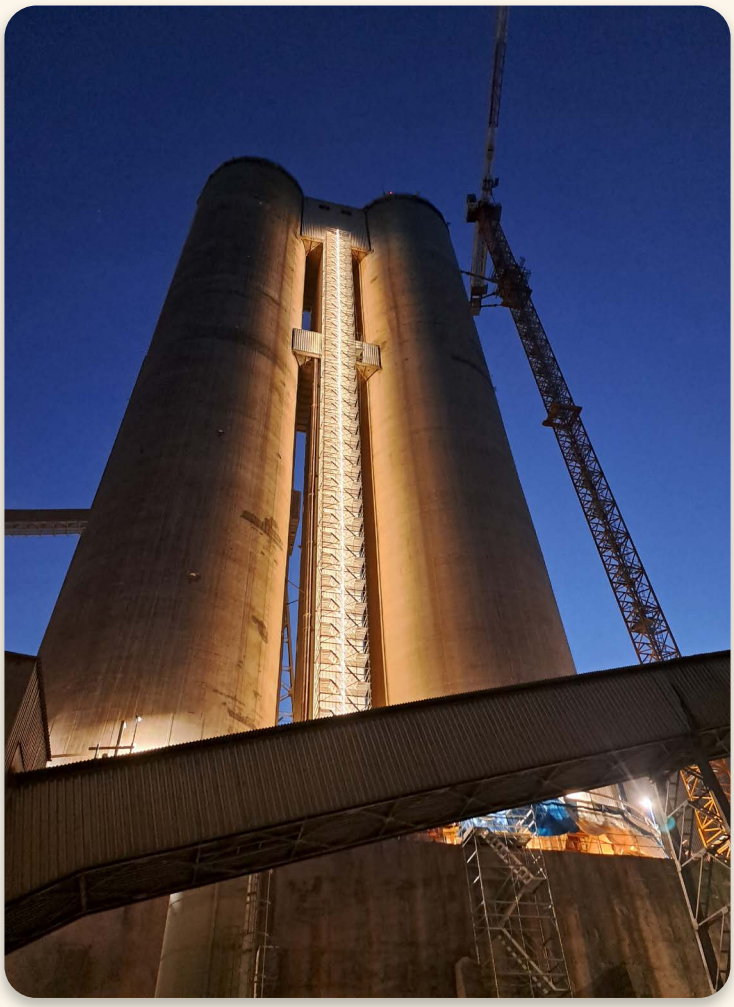
Introduction:

Every single building has a service lifetime. If you don't manage them, one day this time is running out and your structure will collapse. In percentage, silo structures collapse three times more often than bridges or all other civil structures and this phenomenon is to watch worldwide. Even very sophisticated structures like soccer stadiums, bridges and sky scrappers are safer buildings than silos!

There are two main reasons for that:

First: The live load of a silo is approx. 90 % of the total load, the live load of a bridge or building is less than 50 %. In other words, a silo structure is used much more at the service limit than other buildings.

Second: Maintenance is different. buildings & bridges are used by people. People often detect cracks and corrosion in an early stage. Public or private buildings are also observed by facility managers which take care on their buildings. Who is taking care of silos in a cement plant? Nobody, as long as your equipment is running, everything is all right. Maintenance budgets were shortened, and silos are not priority because they made no problems in the past decade.



Old silos before repair

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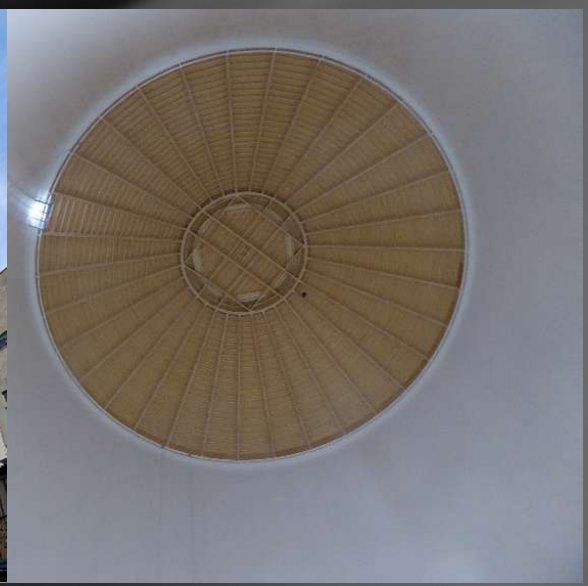


WuerthConsultingEngineers

Rischweg 12 · 5035 Unterentfelden (Switzerland)

www.wuerthconsulting.com

Definition of service lifetime:

This is the time which the rebars & post tensioning can hold back the bulk material inside a silo.

Bad concrete quality, high and low temperature, acid rain, wrong design or corrosion will limit the service lifetime.

A proper concrete layer over the rebar overlapping make sure, that the tension force in the rebars can be transmitted between one rebar to the other. The chosen concrete cover is not only important for this transmission, the concrete cover is also important for the protection of the rebars from acid environmental influences.

One important item to calculate the remaining service lifetime is the depth of carbonation in the concrete cover. Carbonation is the zone of concrete at the surface which has changed from naturally base to acid. Air pollution, salt water and acid rain are speeding up this procedure.

If the carbonation zone is reaching up the rebars, the steel starts to corrode until there is no iron left.

Depending on the results of the investigation, the remaining service lifetime can be calculated and estimated.

In average the carbon depth of a 50-year-old concrete surface is around 20 mm, because this 20 mm was also used in the past for the concrete cover of the rebars, the lifetime of old silo structure is limited to 50 years in average.

This process is easy to detect because after the carbon dept reaches the rebars, the rebars are not protected anymore and start to corrode. Because corroded steel needs more space, the concrete cover will flake off. This is the moment anybody can see that the condition of that structure will be limited…

What kind of repair solution is required?

If the owner is not satisfied with the calculated remaining service lifetime, the structure must be reinforced. For the repair concept, the results from the design analysis and the concrete cover & carbonation depth are required. If the design analysis is not to satisfaction, the rebars must be reinforced in combination with a concrete repair solution or without.

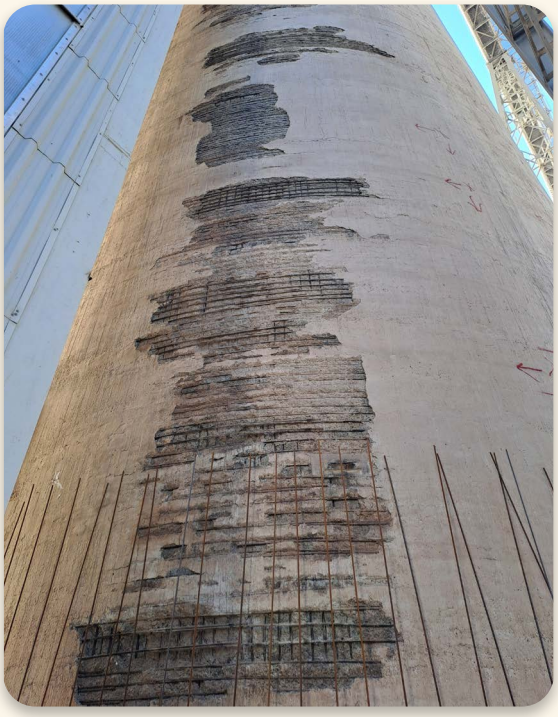
Not only the condition of your existing silo is important to select a repair concept, but also the height of a silo is important to choose the most economic concept. A traditional soft repair with hydro jetting the concrete surface and sandblasting the corroded rebars and backfill the missing concrete cover with modified mortar or shotcrete has a limit in height. The costs for scaffolding, hydro jetting as well as for sandblasting increase with height squared. Up to a height of 25 m, a soft repair is cheaper than a new shell. Over a silo height of 35 m, a new shell is cheaper and much quicker than a soft repair. For a height between 25 and 35 m it is worth checking on the local market, what solution is more economic.

soft repair	new shell (Reinforced)	new silo
service lifetime 10 - 15 years	service lifetime 25 - 35 years	service lifetime > 50 years
civil costs approx. 15 %	civil costs approx. 30 %	civil costs 100 %

Repair overview

New shells for homosilos in Turna (Slovakia):

Danucem Slovakia ask Wuerth Consulting Engineers for a repair concept of their unusual two 105 m high homosilos build around 1965 in Turna, East Slovakia. The condition of the silos after running the plant over 60 years were as follows:



View on Homosilo in Turna (Slovakia)

Just a short view on the outer concrete surface of the shell (see pictures above) and it is obviously that the silo has some major safety problems:

- Concrete cover flaked off
- Rebars are corroded
- Rebar overlapping was made without end hooks and without the concrete cover, the rebar anchoring for tension forces is not given anymore
- Rebars where not bended and joints have no offset (->zip effect)

The design recalculation of the silo shell based on the current silo codes showed also that the safety factor against shell collapse during operation was below 1.0 instead of 1.5 – 1.75! Because the owner decided years before only to use the storage silo up to a filling level of 50 % a collapse did not happen.

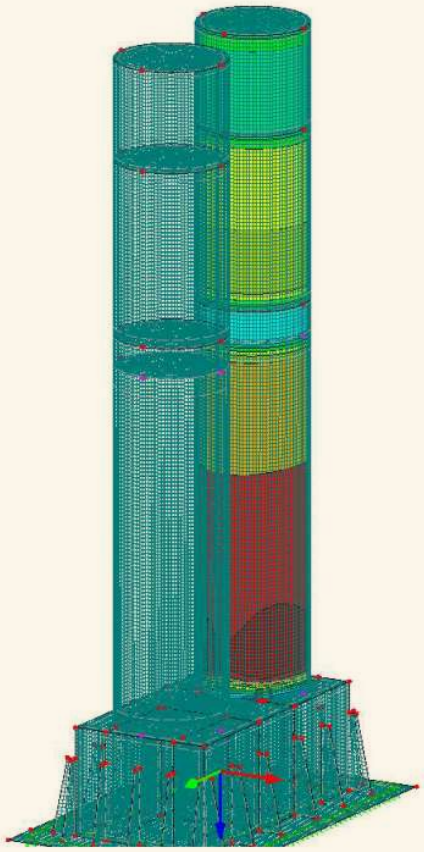
The reduction of the safety factor was based on the corroded rebars, the missing concrete cover for the rebar overlapping joints as well as the ‘’new’’ code regulation for the load case discharge bulk material.

The client must use these homo silos for the clinker production. Kiln shut down for more that 2-3 weeks during wintertime is not possible. In summertime the plant is running 24 hours by 7 days a week.

The client checked out a location next to the existing homosilos to build new ones and send the raw meal later on over these new homosilos. In theory everything was perfect with this replacing project but the costs for such a solution came to 10 million Euros more than a heavy silo repair! This circumstance made it easy for the client to decide to add new shells on the existing silos to use them for the next 25 to 35 years.

A soft repair with mortar was not adequate because of the height of the silo (scaffolding costs) and the fact, that the structure must be reinforced to full fill the current codes (safety factor > 1.50) and the several structural imperfections.

Silos during slipform procedure



3D model with intermediate platforms

A redesign of the silo structure was required to calculate the reinforcement in the new shell as well as to check the foundation if this has been reinforced or not according to the additional dead load weight of the new shell.

The execution of this silo repair took 4 weeks for these two very high silos plus lead and follow up time of approximately one month. Start of slip forming was September 1st and slip form finish is foreseen for the end of September 2025.

The idea to add to the old silos a second shell outside (or inside if required) is simple and easy but there are a lot of problems to realize such an idea! The main problems to solve are the deviations of the existing silos and the available space around the silo.

Because slipform work 60 years ago was different to the one we have today and the fact, that the procedure of a one-sided slide platform (slipform) is technically very sophisticated makes such a job to a professional task!

The new shell made by a quite stiff formwork (required because of only one-sided scaffolding platform) must follow the existing deviations in vertical and circumferential direction made many decades before with a flexible formwork system fixed in the centre of the silo circle by cables.

The slipform procedure needs cleared space around the silo structure. What to do with existing platforms, supports, nearby columns and pipelines? This is the main target for the engineering team to find easy and possible solutions for these questions. Understanding the process of slip forming with one-sided platform formwork is the main key for a successful project implementation.

The numbers of engineers and slipform contractors for such projects are limited on the market but because they have together only around 15 to 20 % of the contract value, the local market with different civil contractors can still compete and will bring the client in a good position for negotiation.

Conclusion:

Many cement producers are in the situation that they had to replace or repair old silos but need them for production. Space nearby the production line is not available for a new building and transport the bulk material away & back is expensive and the investment costs for the civil and equipment part is high.

In just 2 to 3 weeks, you can change the status of your silo from old to new and this under fully operation your plant!

Looks easy, but this is a task for professionals to handle all the obstacles!

Retrofit your old silo structures with a new shell can solve your problem quick, cheap and does not disturb your production capacity. With such an investment you can operate your old facilities safe and easy for the next 25 to 35 years. Just a fraction of the costs you must invest to operate your silos for the next generation instead of building new facilities.

RHI Magnesita – Cementing Partnerships Through Innovation in META

Senad Kapic, Head of Cement & Lime (Middle East & Africa)

Florian Voina, Regional Head of Technical Excellence & Solutions (Industrial)

The cement industry in the Middle East and GCC stands at the intersection of tremendous growth and unprecedented challenges. While rapid urbanization, infrastructure expansion, and large-scale development projects drive demand, supply chain disruptions, volatile energy prices, and geopolitical uncertainty continue to test operational resilience.

RHI Magnesita, the global leader in refractory products and solutions, has established **Middle East, Africa, and Türkiye (META) as a dedicated business unit** that brings the company closer to its cement customers, offering faster decision-making, localized support, and reliable service in one of the world's most dynamic markets.

At the heart of this effort lies **4PRO** – our unique partnership model built on Performance, Partnership, People, and Planet. More than a supply agreement, it redefines how value is created: aligning long-term outcomes, leveraging digital tools, and accelerating sustainability goals together with our customers.

META – A Business Unit Built Around Customers

The META business unit unites Middle East, Africa, and Türkiye under one umbrella, creating a hub that is both global in capability and regional in focus.

Hakimuddin Ali, Regional President META:

"With META as a dedicated business unit, we are closer than ever to our cement partners. This structure is not just about geography, it's about speed, agility, and trust. We want our customers in the Middle East, Africa, and Türkiye to feel that RHI Magnesita is right beside them, ready to act and ready to deliver."

This proximity allows the company to better understand plant-specific needs, reduce delivery complexity, and tailor solutions directly to the challenges of the region. By embedding 4PRO into its regional strategy, META ensures **Performance** through reliable supply, **Partnership** through collaboration, **People** through local expertise, and **Planet** through efficient, sustainable practices.

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Global Network, Local Reliability

Refractory performance is mission-critical for cement producers. Any instability in kiln linings risks costly downtime and reduced productivity. RHI Magnesita secures continuity by drawing on a **global network of 65 main production sites (including raw material sites) and 70+ sales and service offices worldwide.**

From premium refractories in Austria, Germany, Slovenia, and the Czech Republic, to large-scale production in India and China, and redundancy from the Americas, the company ensures an uninterrupted supply. Türkiye further strengthens META's position as a strategic hub. Specifically for the cement industry, we bring valuable mineral resources and strong vertical integration. With our recent acquisitions, we have further expanded our capabilities in alumina-based products, including both bricks and mixes.

Building Resilience in an Uncertain Market

The challenges faced by the cement industry today are complex and interlinked. Fluctuating raw material costs, volatile fuel markets, and shifting geopolitical landscapes all impact daily operations. RHI Magnesita helps customers navigate this by combining global resilience with regional agility.

Through multi-origin redundancy, optimized logistics, stable pricing strategies, and proactive collaboration, the company enables plants to stay focused on production. This partnership-driven approach ensures customers always have a trusted ally to lean on, no matter the market conditions.

Bruno Juncioni, Head of Industrial Sales (META):

"Cement producers today face mounting challenges — from volatile energy costs and sustainability pressures to unpredictable geopolitical and logistical disruptions. At RHI Magnesita, our mission is to give them stability and confidence through reliable supply, strong technical service, and tailored innovations. Thanks to our global footprint and multiple sourcing options across the globe, we can secure continuity and overcome any logistics disruption the world may bring. With our Regional Headquarters in the Middle East, we are closer than ever to our partners, ensuring long-term resilience and trust."

Picture – There for you, wherever you need us – RHI Magnesita's global footprint

LES – Redefining Kiln Inspections

While supply reliability is essential, innovation is equally vital. RHI Magnesita is committed to going beyond products to deliver smarter, safer, and more efficient solutions. A prime example is the **Lining Evaluation Scan (LES).**

Traditional kiln inspections are often slow, risky, and imprecise. LES revolutionizes this process by offering a **fully digital, non-invasive laser scan** that generates precise 3D data in record time.

In just 30–45 minutes, an entire cooled rotary kiln can be scanned. Within hours, the customer receives a comprehensive report with panoramic images, heat maps, cross-sections, and precise thickness data. This allows maintenance teams to plan relining actions accurately, optimize refractory use, and extend the lifetime of their equipment.

Eduardo Matos

Head of Marketing & R&D (META)

"Digital tools like the Lining Evaluation Scan show how refractories can go beyond products. By combining high-definition data with expert analysis, we help cement producers optimize maintenance, extend kiln life, and improve safety. LES is a true example of how innovation supports efficiency and resilience."

Picture – LES technology at work

From Data to Decisions

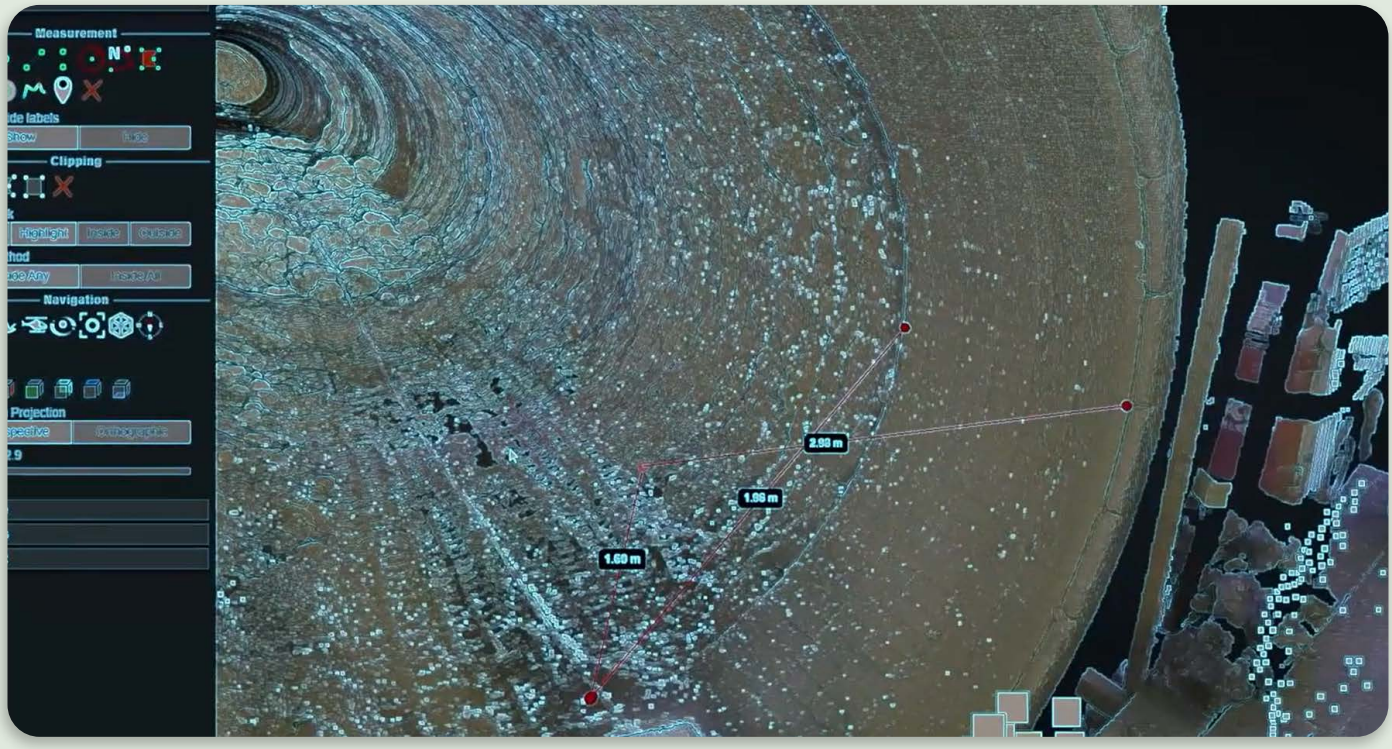
LES is not just a one-time inspection — it's a platform for continuous improvement. All scan results are securely stored in an online customer portal, giving plants access to historical data, trend analysis, and virtual kiln tours. Custom thresholds can be defined for wear levels, and multiple scans over time create a detailed performance history.

This transparency empowers customers with insights, strengthens collaboration with RHI Magnesita experts, and ensures that decisions are always data-driven. The result is a smarter, safer, and more predictive way to manage refractory linings.

Building the Future Together

The META business unit and innovations like LES underline RHI Magnesita's long-term commitment to the cement industry in the region. By combining global production strength with regional agility and by anchoring every solution in the 4PRO model, the company is redefining what it means to be a true partner.

Whether it is delivering reliable refractory supply, embedding local expertise, or introducing cutting-edge digital tools, RHI Magnesita's message is clear: **the future of the cement industry in META will be built on trust, resilience, and innovation — together.**



Picture – Results from the scan

The ETA Cooler

Boosting Efficiency. Cutting CO_2

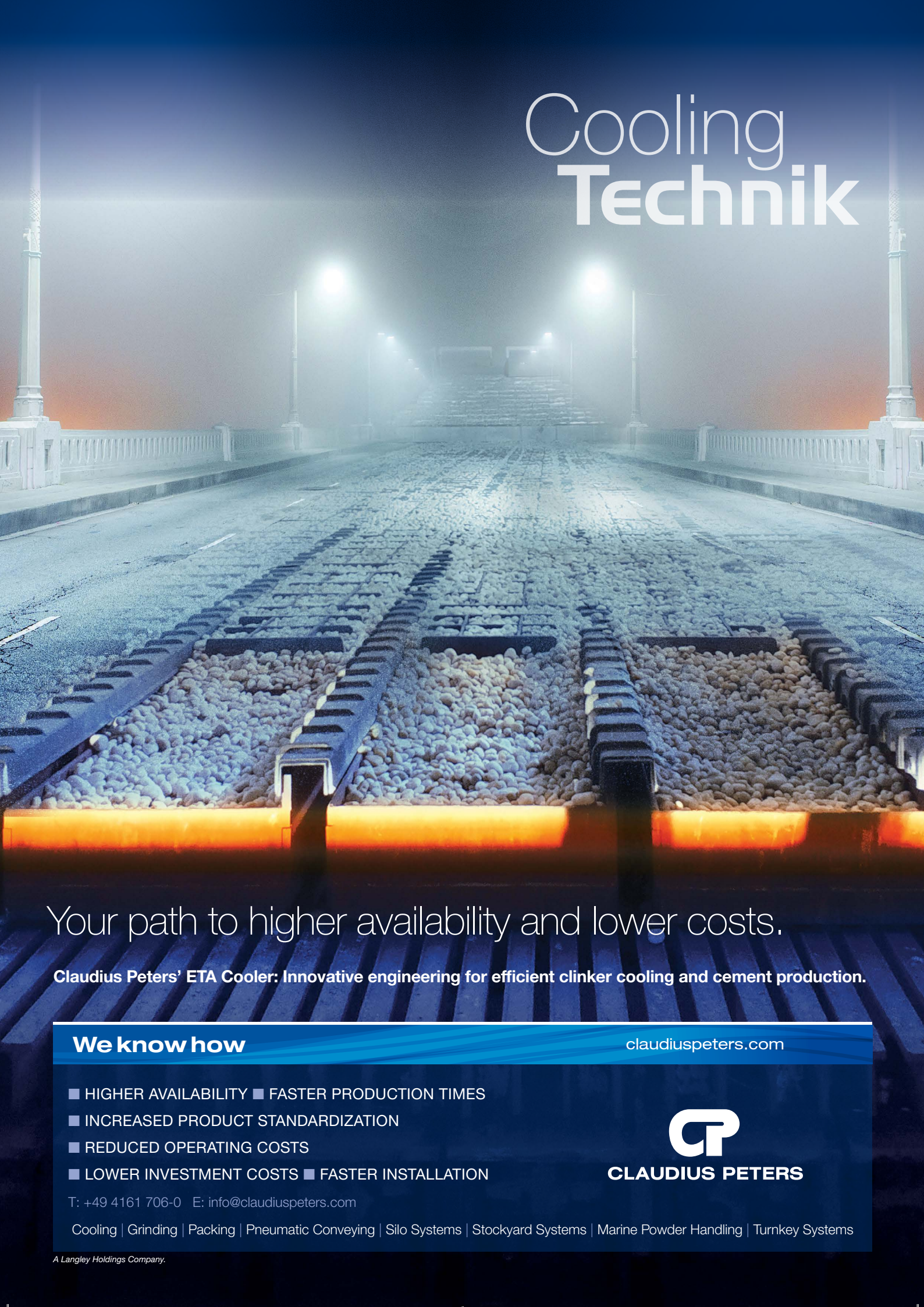
Claudius Peters

Ever since Claudius Peters demonstrated how to utilize cooler's potential based on references all over the world including the biggest cement players e.g., Holcim, Anhui Conch and HeidelbergMaterials. Especially the Claudius Peters ETA cooler is the leading technology in clinker cooling. What makes this type of cooler so attractive for the cement producer? What are its experiences in terms of the cooler process and maintenance?

Figure 1: ETA cooler at start-up

For decades Claudius Peters has been a reliable partner for the cement industry. Making processes reliable and minimizing operating costs are its core competences. This particularly applies to coolers. Saying so, the component with the highest potential for savings (this applies to CO_2 as well as to OPEX) within the clinker production process is the clinker cooler. By adopting an optimal approach to clinker cooler operation, both thermal performance and CO_2 emissions can be greatly enhanced.

With the development of the ETA cooler Claudius Peters offers cement producers an important means to reach the target values. It is the leading fifth-generation clinker cooler that has been developed to handle production rates of up to 13,000tpd.


Cooling
Technik
Your path to higher availability and lower costs.
Claudius Peters' ETA Cooler: Innovative engineering for efficient clinker cooling and cement production.
We know how
claudiuspeters.com
■ HIGHER AVAILABILITY ■ FASTER PRODUCTION TIMES
■ INCREASED PRODUCT STANDARDIZATION
■ REDUCED OPERATING COSTS
■ LOWER INVESTMENT COSTS ■ FASTER INSTALLATION
CLAUDIUS PETERS
T: +49 4161 706-0 E: info@claudiuspeters.com
Cooling | Grinding | Packing | Pneumatic Conveying | Silo Systems | Stockyard Systems | Marine Powder Handling | Turnkey Systems
A Langley Holdings Company.

The following factors are responsible for the superb process qualities of the ETA cooler:

High Efficiency Module

The ETA cooler receives the hot clinker on its High Efficiency Module (HEM), which is a static grate inclined by 15˚ and made up of several rows. Here, during the cooling process, one of the most important decisions regarding the clinker quality is made. The aim is to maintain stable C3S, which forms in the sinter zone and gives clinker its strength. This is ensured by rapidly cooling the clinker to temperatures below 1200˚C with a reliable aeration system consisting of mulden and nozzle grate plates. The size, quantity and arrangement of the plates, as well as the controlled air supply to several small aeration fields, are decisive factors for fast cooling. This will ensure the freezing of the liquid phase on the static inlet.

Bed height

The ETA cooler operates with a clinker bed height between 950 and 1100 mm. The cooling air is between 0.4 to 1.5 seconds in contact with the clinker depending on which area of the cooler is considered. In this short period of time the heat exchange must take place. For older coolers operating with a clinker bed height of 600 mm or lower this time is almost cut in half. Or in other words: a 70% longer retention time of the clinker in the recuperation area due to the higher clinker bed; min. 950 mm instead of 600 mm, clearly gives a superb cooler efficiency and a more uniform temperature over time.

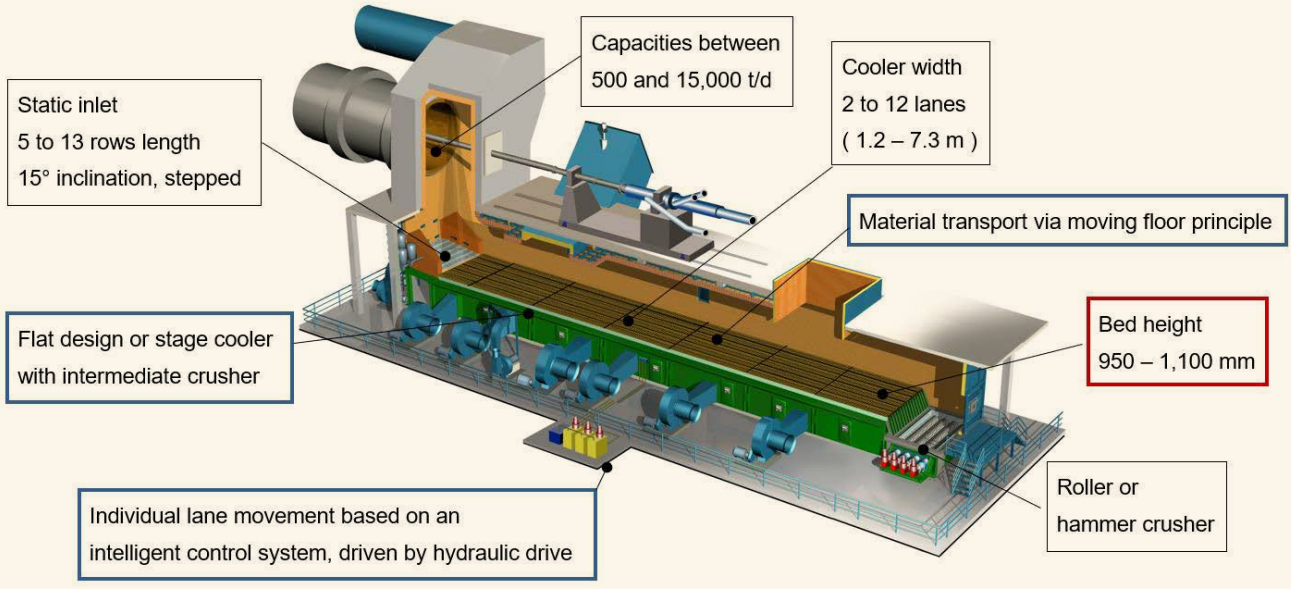


Figure 2: KPIs of the ETA cooler

The cooler efficiency of the ETA cooler is clearly better than that of a similar conventional grate cooler and still the highest in the market.

How can the ETA cooler be operated with a high clinker bed?

Individual Lane Control

The individual lane control allows the operation of each lane with a different stroke length and speed. This offers the great advantage of discharging the clinker from the static inlet in a controlled way. The normal setup is a stroke length of approx. 150 mm on the outer lanes, and 180 mm on the center lanes. This means for a clinker bed height of 950 mm that the retention time of the clinker in lateral areas is approx. 45.5 min (!) and in the middle approx. 38 min. This causes a thermal homogenization of the clinker over the width of the cooler. Problems, such as red river, are therefore clearly something of the past.

Aeration scheme

The aeration schemes of the latest generations of the ETA cooler can be adjusted to the needs. Behind the fine aeration fields of the static inlet (HE-module), chambers can have 1.2m, 1.4m, 2.2m, 3.3m and finally 4.4 meters in length.

The size of the chambers follows the clinker cooling curve with the small chambers at the high temperature side and the bigger chambers at low temperature side. This simple system has been proven successfully ensuring the highest cooler efficiency in the market. Due to this intelligent aeration system, the ETA cooler does not require any self-adjusted regulation flaps. And thus gives an advantage that the pressure loss of these regulation flaps is avoided. The HE-module length has been designed so that the clinker leaves the HE-module below 1200 °C.

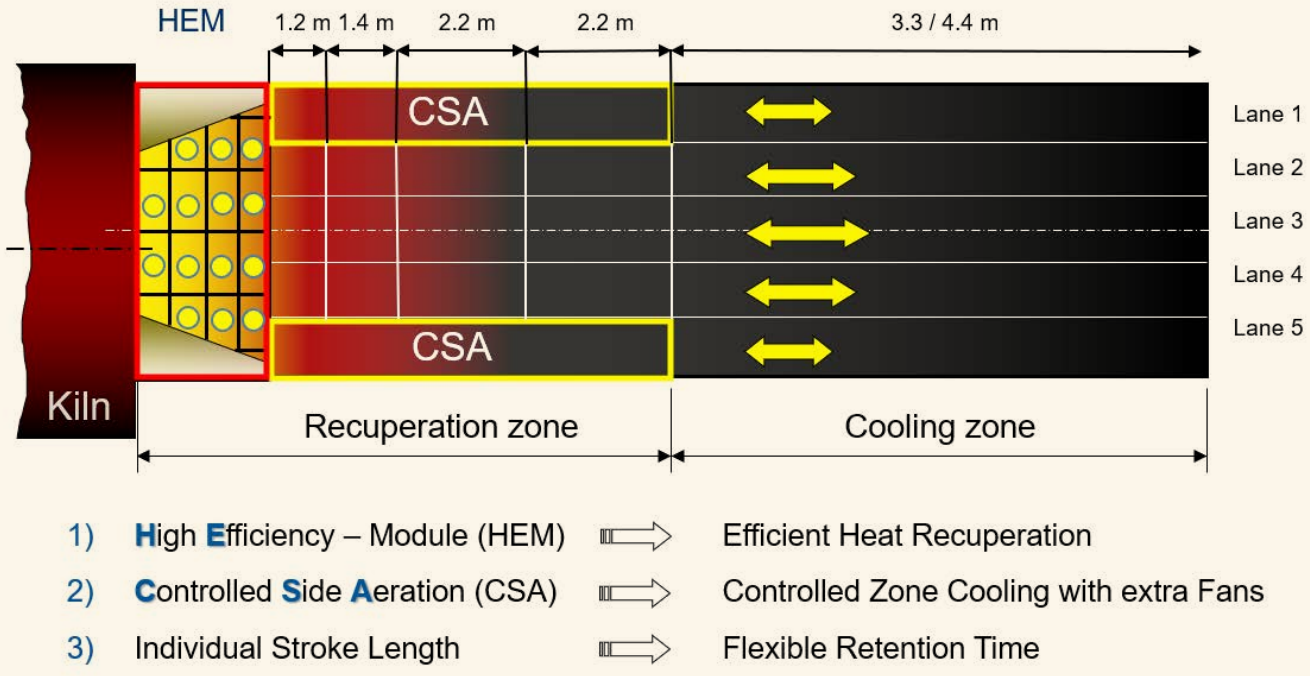


Figure 3: Process optimized Aeration

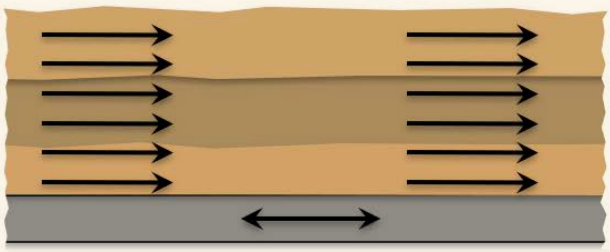
Temperature gradient

Another advantage of the ETA cooler is that the temperature gradient over the bed height is not disturbed. Colder clinker on the bottom of the bed and hotter clinker on the top do not mix but remain at their level. The air can heat up steadily as it works its way through the bed. In other types of coolers, the clinker bed gets mixed which disturbs the temperature gradient over the bed height; this reduces the heat that the air can absorb and therefore the cooler efficiency. Meaning that a mixing of the clinker layer should be avoided in the movable part of the cooler in any case.

In addition, the cold clinker temperature on the bottom will extend the lifetime of the grate compared to other systems.

ETA Lanes

The lane design has been further improved compared to its very first design. As an example, the air inlet “mushroom” has been optimized using Finite Element to reduce the pressure loss. This leads to a slightly lower total pressure loss over the lane including the layer of gravel compared to the equivalent figure over a traditional grate plate. Whereas the higher clinker bed causes some additional power consumption of cooling air fans. This is more than compensated for by the higher cooler efficiency due to the higher clinker bed. In addition to that the ETA cooler uses less air due to the higher clinker bed which results in less exhaust air and a reduction in the power consumption of the exhaust air fan. Usually, ETA coolers operate with around 1.5 Nm³/kg of cooling air. Over the total pyro-process the power consumption is less than that of a kiln line with a traditional grate cooler.



Plug – Flow Transport:

- No vertical mixing
- Undisturbed temperature gradient
- Steady heating of air, due to homogeneous layers

Slight compression in backward stroke:

- Improved heat transfer due to low void volume

Figure 4: Clinker movement in the ETA cooler

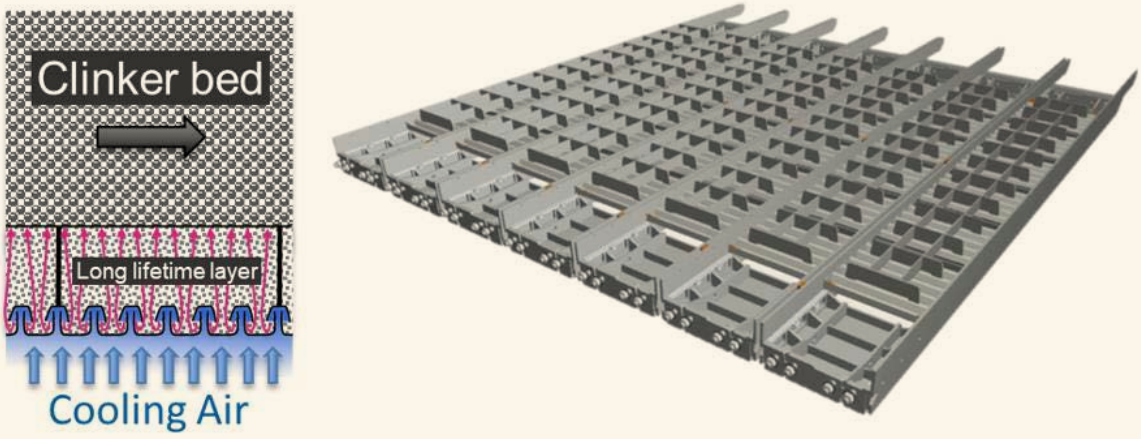


Figure 5: Self protecting lane design of the ETA cooler

Wear

The ETA cooler is exceptionally sturdy; first coolers e.g., like at Holcim Siggenthal have been in operation since 2004 and until now, no lane has been replaced due to wear. The gravel / pebble layer, contained in the lanes, protects the air inlet mushroom against heat and wear. An additional advantage is that the air flows into the clinker in a fine pattern which is highly beneficial for the heat exchange from the clinker to the air.

Lanes at start up with pebbles | Lanes after 9 years | Lanes after 19 years

Figure 6: Wear on the ETA cooler lanes over several years

The ETA-lanes have a lifetime well over decades, and they are still in good condition, this is a step change compared to a conventional cooler.

Therefore, Claudius Peters gives a lifetime guarantee of 5 years on the ETA lanes. On the critical transition between the static inlet and the lanes, a concrete beam protects the last plates of the HE-module. The beam has been specially designed in close cooperation with a refractory company. The lifetime guarantee of the HE-module plates is also 5 years.

Alternative fuels

The high clinker bed, or in other words, the large volume of clinker available for heat recuperation has a damping effect on the kiln discharge fluctuations and ensures a high and stable secondary air temperature. This gives ideal conditions for the firing of alternative fuels.

Furthermore, AFR often contains foreign particles such as metal parts. Due to its self-protecting pebble layer the CP ETA cooler is insensitive against these particles. Any damage to the lanes or lengthwise sealing system will be avoided.

Conclusion

The ETA cooler is extremely sturdy, with a guaranteed time of 5 years on the aerated lanes, roller supports and HE-module plates, a carefree cooler service-life is purchased. The performance figures are the best in the market. What Claudius Peters guarantees will be achieved and already described in a heat balance calculation during the project phase. The ETA cooler is very tolerant towards AFR usage. Its stable operations ensure the highest recuperation air figures due to the high clinker bed.

The Greek symbol ETA always stood for efficiency and that is what the CP cooler is about: Boosting Efficiency. Cutting CO_2.

Cooler comparison

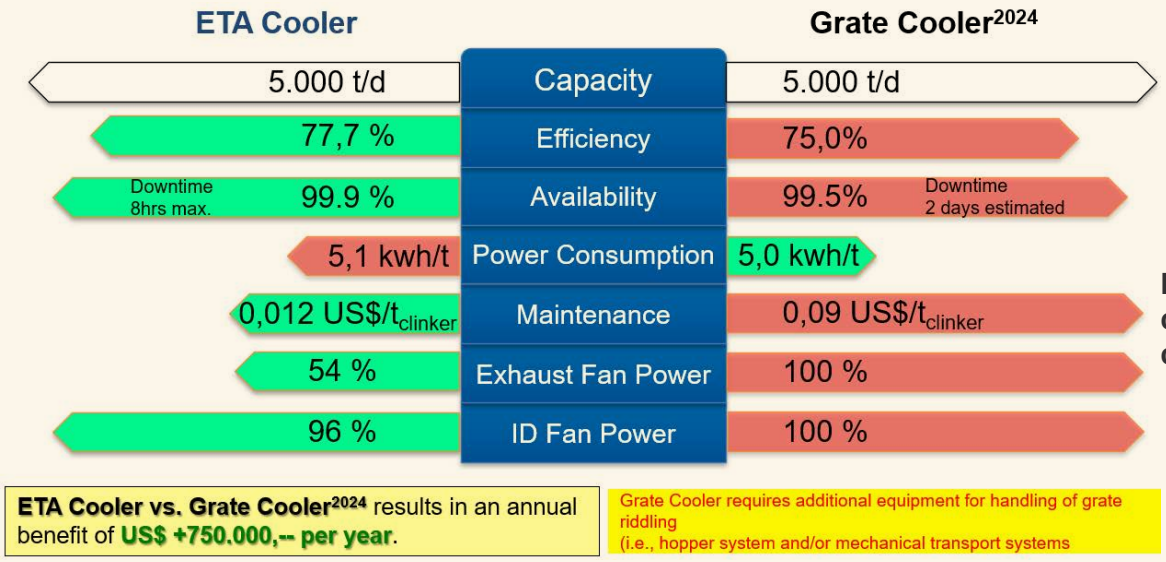


Figure 7: ETA cooler comparison to other coolers

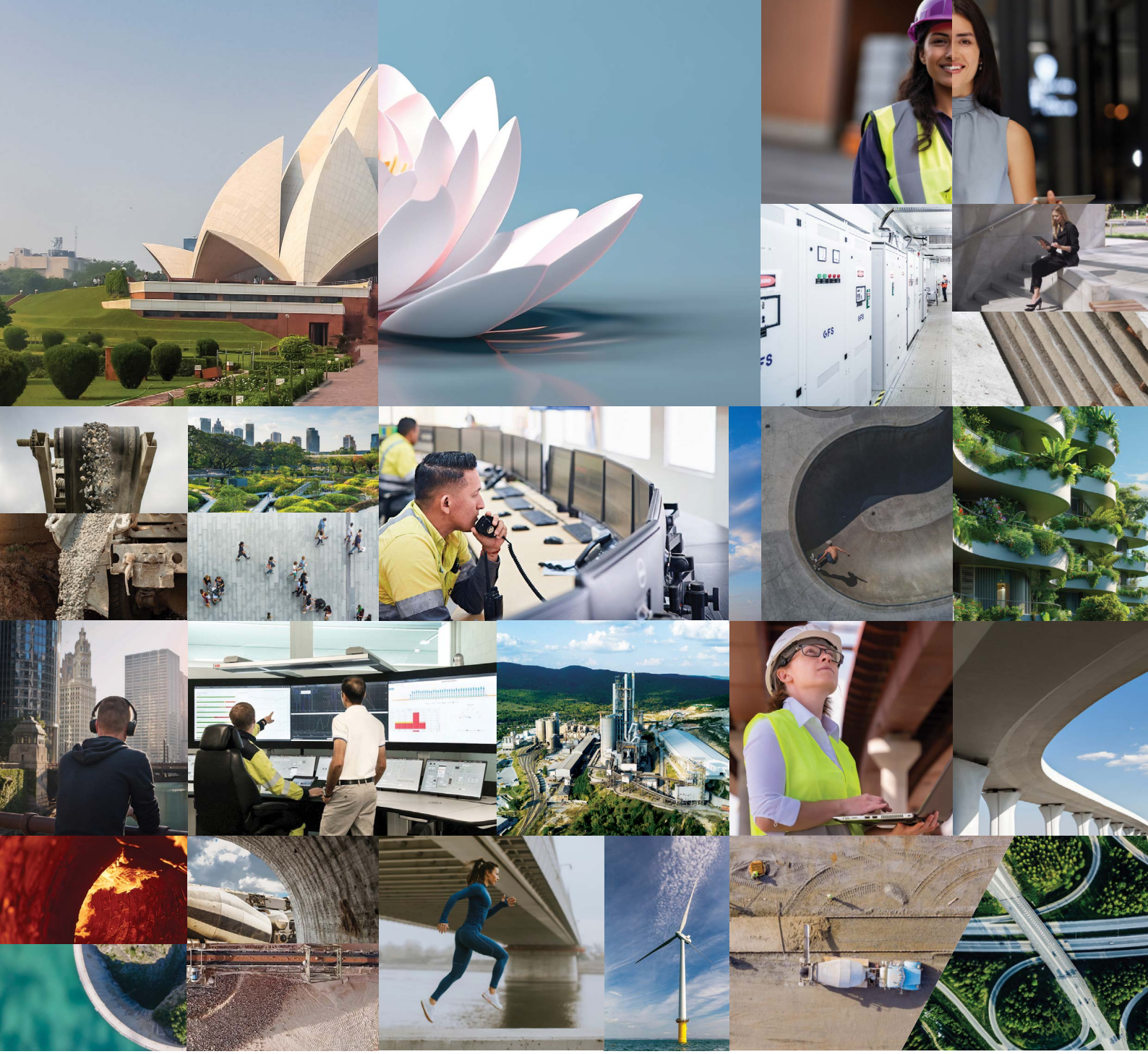
Smart Cement Operations

Putting cement in the mix with sustainable manufacturing

Bodil Recke, Global Cement Business Unit Manager,
ABB's Process Industries division

It's clear that the cement industry faces an uphill battle to convince consumers and the wider world that it is sustainable; it does have a long way to go as it stands today. But, because of this fact, it also has potential to leapfrog other industries in its development and become a flagbearer for decarbonization and modernization. Aided by digitalization and artificial intelligence (AI), this industry will rise to environmental and varied legislative demands around the world. With populations continuing to grow and becoming more and more urban, the challenges will only get bigger.

One region finding itself both pushing and pulling in this transformation is Middle East and North Africa (MENA), where infrastructure megaprojects and sustainability mandates are reshaping industrial priorities. In this article, ABB will share how it is active in this area and helping cement producers turn data into decisions, and those decisions into impacts.



Real Progress
is innovating technology to decarbonize the entire cement value chain.

Lowering the emissions of new concrete infrastructure enables society to sustainably advance. From quarry to dispatch, we're working with cement producers to digitally connect their processes, cutting carbon emissions and costs. By implementing these efficiencies and integrating the advances made by ABB and its collaborators in automation and electrification, our customers are building a more resilient future. **solutions.abb/realprogress**

Be part of Real Progress.

ABB

Mega MENA looks to the future

International market reports show that cement is set to grow to more than $16 billion this year[1], partly driven by Saudi Arabia's Vision 2030, further expansion through United Arab Emirates' (UAE) smart city initiatives and other construction projects, including in Iraq and around the Red Sea. Egypt has doubled its cement exports between 2022 and 2024[2], supplying markets across Africa and Asia. This pull is matched by a push for sustainability, with governments introducing Environmental, Social, and Governance (ESG) criteria for public tenders and tightening carbon disclosure regulations.

To help meet these challenges, cement producers are investing in low-carbon products, alternative fuels and digital technologies. There is a boom in cement exports, with added momentum from competitive energy prices. Both Saudi Arabia and the UAE are positioning themselves as low-carbon cement exporters, leveraging digitalization and sustainable electricity and fuels to meet international standards. Elsewhere on the Arabian peninsula Oman has always made positive industrial movements.

ABB's aims to continue to demonstrate its capabilities to deliver automation, electrification and digital solutions that align with regional goals for efficiency and sustainability. One project where ABB has made impacts is with Oman Cement Company (OCC). In the capital of Muscat, ABB modernized OCC's plant by integrating three process lines into a single digital platform using ABB Ability™ System 800xA®. This upgrade improved operational efficiency, reduced downtime and laid the foundation for future digital applications.

Similarly in the UAE, ABB has partnered with Star Cement to enhance operational efficiency and sustainability through the deployment of its ABB Ability™ Expert Optimizer. This advanced process control (APC) system integrates Star Cement's production lines across multiple sites, optimizing critical stages such as kiln operation, fuel management, grinding circuits and raw material blending. Expert Optimizer uses model predictive control, fuzzy logic and neural networks to stabilize processes and drive performance to optimal levels. By continuously adjusting setpoints and responding to real-time deviations, the system ensures consistent product quality, reduces energy consumption and minimizes emissions. The integration has enabled Star Cement to achieve up to 5% increases in production and energy savings, while also improving operational discipline and environmental compliance.

In Türkiye, Adana Cement Industry Inc. operates four separate clinker production lines, two coal mills and five cement mills at its Adana plant. Here, Expert Optimizer also enables the operating rules of the best operator to be applied accurately, tirelessly and consistently. The principle concept is that it mimics the actions of the operator and implements them in the manner of an autopilot. The potential benefit expected from the product is that performance will improve from that of an 'average operator' to that of the 'best operator' for 24 hours a day, 365 days a year. The customer reported 20% decrease in standard deviation, 10% longer refractory life, 2% energy saving and 2% production increase.

Such solutions from ABB help producers align with global procurement thresholds, which increasingly require ESG readiness and operational transparency. By digitizing operations and integrating sustainability, firms gain a competitive edge in both domestic and export markets.

Defining digital solutions in cement

AI should not just be a buzzword, but it has in recent times particularly because of generative AI. In industrial applications like cement, it does not just mean one thing. It's part of a suite of technologies that analyze vast process data, learn from it and optimize operations. ABB defines AI as a fusion of computational power, connected devices and advanced algorithms such as machine learning, deep learning and reinforcement learning.

[1] Middle East Cement Industry Report 2025 | Regional

[2] Beware Egypt's smokestack onshoring as cement exports surge | Reuters

These tools are already being used to optimize raw material mix design, predict equipment failures, monitor quality in real time to enable reduction of CO_2 emissions. Traditionally, cement plants relied on reactive or time-based maintenance. But these approaches often led to unnecessary shutdowns or missed hidden faults. ABB's digital solutions are changing that by analyzing signals like vibration, temperature and power consumption. This allows AI models to detect early signs of wear or misalignment, enabling predictive maintenance and teams to intervene before failures occur.

AI is also helping cement producers design lower-carbon blended cements. By predicting mechanical properties like compressive strength and flowability, AI accelerates recipe development and optimizes the use of supplementary cementitious materials (SCMs) such as slag and fly ash.

When it comes to real-time monitoring, AI can correlate data across systems. For example, a moderate temperature spike might seem unimportant on its own but when paired with increased vibration and motor current, it could signal a failing bearing. ABB's systems contextualize these signals, enabling smarter responses. Cloud platforms and edge computing allow fast local reactions and long-term trend analysis. This dual approach supports continuous improvement and empowers operators with actionable insights.

In MENA, where energy subsidies are being reduced and carbon regulations are tightening, these innovations are critical. ABB's tools enable plants to switch to alternative fuels and optimize combustion conditions, reducing emissions without compromising stability.

Engineered to Outrun, safe, leaner, cleaner

Cement production is a balancing act—kilns must run hot enough for quality but not so hot that fuel is wasted. Mills must grind finely without sacrificing throughput. ABB's APC systems help operators navigate these trade-offs. Such systems now incorporate historical data, predictive models and real-time inputs to adjust parameters dynamically. This leads to reduced overburning, improved energy efficiency and more consistent product quality.

This aligns with ABB's Engineered to Outrun approach, which focuses on designing systems that not only meet today's performance needs but also anticipate tomorrow's challenges. By embedding intelligence into control layers, ABB enables cement plants to operate safely, leaner, and cleaner—delivering long-term reliability and sustainability. We can also say that in partnership with Carbon Re, ABB's Expert Optimizer APC technology has achieved up to 5% energy savings and 2–5% reductions in fuel-derived CO_2 emissions, along with consistent quality with lower variability.

Despite the rise of automation, ABB emphasizes that digital tools on top of this automation layer are designed to support human expertise rather than replace it. Operators remain central to decision-making and explainability is key. ABB's systems are built to be transparent, helping users understand why a recommendation is made.

In line with this, service models are evolving too. Remote diagnostics, software updates and digital coaching are becoming part of day-to-day support. When combined with training and collaboration, these tools accelerate adoption and deliver consistent results.

Building industrial resilience through intelligence

The work ongoing in cement in MENA illustrates how digitalization and AI can drive efficiency, reliability, and sustainability, all while empowering people. As the region continues to invest in infrastructure and climate goals, intelligent automation will be essential.

ABB is there on the journey, helping cement producers lay the digital foundations for a more resilient, low-carbon future. In doing so, it's not just optimizing processes, it's redefining what's possible in the industry.

Building The Future Together

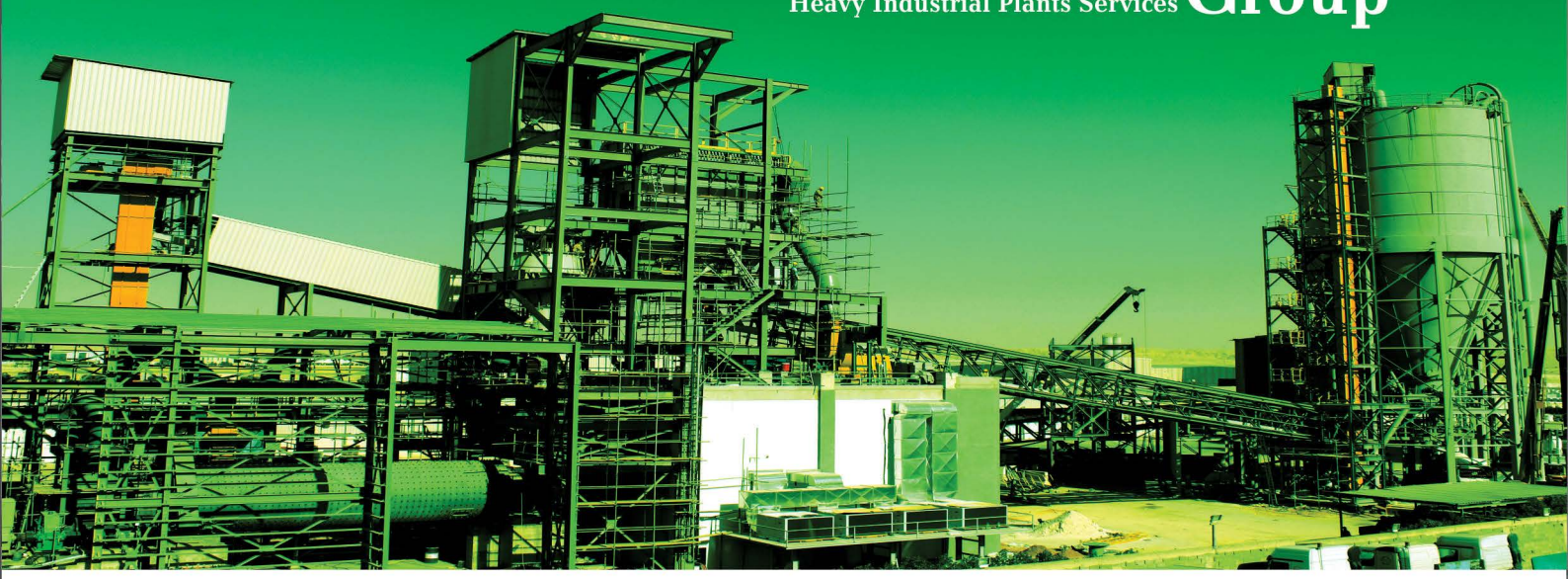
INTERMAINT Group

From Vision to Vanguard

Founded in 2003, INTERMAINT Group began as The International Company for Construction and Special Maintenance in Egypt—with a bold ambition: to become a regional leader in industrial construction and maintenance. Today, INTERMAINT is a dynamic group of companies operating across Egypt, Saudi Arabia, Libya, Tanzania, Austria and beyond, delivering precision-driven solutions for heavy industry

Our journey from a single entity to an international group reflects more than growth—it's a story of resilience, innovation, and strategic evolution. With each project, we've built more than industrial plant or infrastructure; we've built trust, empowered local talent, and contributed to the industrial transformation of the regions we serve.

INTERMAINT
Heavy Industrial Plants Services Group



Building The Future Together

Leading Industrial & infrastructure Solutions Since 2003

Our Core Services

Industrial Construction

Greenfield projects & plant expansions with state-of-the-art technology and sustainable practices.

Steel Fabrication

Precision manufacturing of steel structures and plate works with exceptional quality standards.

Installation Services

Steel structure, Equipment and Piping installation and commissioning by certified professionals.

Maintenance Services

Comprehensive asset care & shutdown services to maximize operational efficiency.

Infrastructure Construction

Construction of civil foundations and electrical facilities for industrial complexes.

Quality Assurance

Rigorous quality control processes ensuring excellence in every project we deliver.

Internationally Certified Excellence

ISO 9001 2015 ISO 14001 2015 ISO 45001 2018

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A Legacy of Industrial Excellence

INTERMAINT's reputation is forged in the field— where technical mastery meets operational discipline. For over two decades, we've delivered complex, multidisciplinary projects across oil & gas, petrochemicals, mining, cement, steel making and energy sectors. Our teams are known for their ability to execute under pressure, adapt to challenging environments, and uphold the highest standards of safety and quality. Whether constructing greenfield facilities, fabricating steel structures, or executing high-stakes shutdowns, our work reflects a commitment to precision, partnership, and performance.

Mission & Vision

Mission: To deliver turnkey industrial and infrastructure solutions of exceptional quality, safety, and value. We aim to be the contractor of choice by forging long-term partnerships and empowering our teams to achieve excellence every day.

Vision: To be the premier integrated industrial group recognized for innovation, reliability, and a profound commitment to advancing the industrial landscape of Africa and the Gulf.

Our Core Values

Safety First: Our Zero Harm philosophy protects our people, clients, and communities.

Quality Excellence: Every weld, bolt, and beam reflects our ISO 9001-certified commitment to precision.

Integrity & Partnership: We build transparent, trusted relationships that drive collaboration and success.

Innovation & Growth: We invest in cutting-edge technologies and facilities.

Certified to Deliver

INTERMAINT Group operates under globally recognized standards:

Certification	Focus Area
ISO 9001	Quality
ISO 14001	Environment
ISO 45001	Occupational Safety

These certifications are embedded in every project, ensuring consistent outcomes and safeguarding client assets.

Strategic Capabilities

Our integrated structure enables seamless, end-to-end delivery across the industrial lifecycle. We don't just build—we engineer solutions that last.

Our Core Services

1. Greenfield Project Construction

From concept to commissioning, we manage the full lifecycle of new industrial facilities—ensuring timely, budget-conscious delivery to exacting specifications.

2. Steel Structure & Plate Works Fabrication

Through INTERMAINT Fabrication, we produce highprecision steel structures and plate works in-house, ensuring superior control over quality, cost, and schedule.

3. Mechanical & Electrical Equipment Erection

Our certified teams install and align complex systems to manufacturer specifications, optimizing performance and longevity.

4. Tank Farm Construction

We engineer and build secure, efficient storage solutions for oil, gas, and chemical industries—integrating foundations, assembly, and loading systems.

5. Thermal Insulation

Our insulation services enhance energy efficiency, stabilize processes, and protect personnel across industrial environments.

6. Refractory Works

We install high-temperature linings for furnaces, boilers, and reactors—ensuring thermal efficiency and structural integrity under extreme conditions.

7. Electrical Works

From Medium - voltage distribution to plantwide instrumentation and lighting, we deliver safe, reliable electrical systems tailored to industrial needs.

8. Major Maintenance & Shutdown Services

We execute planned and emergency shutdowns with military precision—minimizing downtime and restoring operations swiftly and safely.

9. Civil Construction Works

Our civil division lays the foundation for industry, delivering earthworks, concrete structures, and industrial buildings with strength and precision.

Why INTERMAINT Group?

End-to-End Integration

We manage every phase in-house—from fabrication to commissioning—ensuring seamless coordination, consistent quality, and timely delivery.

Internationally Certified Excellence

Our ISO-certified systems guarantee performance, sustainability, and safety across all operations.

Local Fabrication, Global Standards

Our advanced workshop blends local manufacturing with world-class technology—accelerating timelines and boosting regional industrial growth.

Specialists in Heavy Industry

With deep expertise in Oil & gas, Cement, Steel making, Petrochemicals, and Mining, we deliver robust solutions tailored to the extreme demands of heavy industrial environments.

Regional Reach, Strategic Presence

With operations in Egypt, Saudi Arabia, Libya, Tanzania and Austria, we combine global best practices with local insight—serving clients across the Gulf and Africa with agility and precision.

Looking Ahead

As we move forward, INTERMAINT Group remains committed to shaping the future of industrial development. We continue to invest in talent, technology, and partnerships that drive sustainable growth and regional impact. Our alignment with national visions—such as Saudi Arabia's Vision 2030—reflects our dedication to building not just infrastructure, but opportunity.

With every project, we reaffirm our promise: to build with integrity, lead with innovation, and serve with purpose.

Are you Ready to start your next project? Contact us today to discuss how our expertise can support your industrial goals.

AUMUND launches the revolutionary electrified Linear Calcination Conveyor (eLCC)

Pioneering sustainable clay calcination for next-generation cement production

AUMUND Foerdertechnik, Germany

Innovative technology addresses growing demand for LC3 Cement while achieving carbon-neutral operations

Rheinberg/Germany, October 2025 – AUMUND Fördertechnik GmbH, a global leader in conveying technology with over 27,000 installations worldwide, announces its official market launch of the groundbreaking electrified Linear Calcination Conveyor (eLCC). This innovative, patented solution directly supports the cement industry's transition to sustainable production methods, specifically enabling efficient clay calcination for Limestone Calcined Clay Cement (LC3).

The cement industry faces unprecedented pressure to decarbonize, accounting for approximately 8% of global CO_2 emissions. LC3 (limestone calcined clay cement) presents a transformative opportunity to reduce emissions and unlock economic benefits within existing industry infrastructure. LC3 is a blend of clinker, calcined clay, limestone, and gypsum, which reduces carbon emissions in the cement production process by up to 40% compared to ordinary Portland cement.

LC3 technology represents a paradigm shift in cement composition, utilizing approximately 50% clinker (compared to 95% in ordinary Portland cement), 30% calcined clay, 15% limestone, and 5% gypsum. The synergy between calcined clay and limestone creates complex pozzolanic reactions, with calcined clay providing additional alumina that reacts with limestone to form carboaluminate phases, contributing significantly to strength and durability while maintaining comparable or superior performance characteristics to conventional cement.

AUMUND eLCC: A NEW SOLUTION FOR CALCINED CLAY

A SIGNIFICANT CONTRIBUTION TO THE DECARBONISATION OF CEMENT PRODUCTION

We congratulate AUCBM's Cement and Building Materials Review on the remarkable milestone of publishing its 100th issue. This achievement is a testament to the magazine's enduring commitment to excellence, knowledge-sharing, and service to the cement and building materials industry.

We are grateful for the valuable collaboration over the years and look forward to continuing this successful partnership in the future.

VISIT OUR EXPERTS AT THE AUCBM 2025 ON THE SWEIDAN STAND (E8-E13)

- **Completely enclosed conveyor system** for maximum thermal efficiency & energy savings
- **Heat Deflector Technology** creates distinct calcination zones
- **Quick startup and heatup** offering great operational flexibility
- **Modular design** enables uncomplicated capacity expansions

AUMUNDGROUP
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WE CONVEY
QUALITY

AUMUND

AUMUND's eLCC Technology:

Engineering excellence meets environmental responsibility

Building on more than two decades of expertise in conveying hot materials – including proven solutions like the KZB-S (up to 1,000°C), BZB-H-I (up to 850°C), and FPB-K (up to 850°C) – AUMUND has developed the eLCC specifically for efficient clay calcination. The development project, initiated nearly four years ago in collaboration with HOLCIM, culminated in the construction of a pilot demonstration unit at AUMUND's headquarters in Rheinberg, Germany, where initial calcination tests produced encouraging results.

The technology addresses the critical challenge of clay calcination, which requires precise temperature control at 750-800°C – significantly lower than traditional clinker production temperatures. This temperature reduction, combined with the eLCC's energy-efficient design, contributes substantially to the overall carbon footprint reduction achieved by LC3 cement.

Advanced Technical Features:

The eLCC incorporates the following advanced design elements and features:

- **Triple Heat Barrier System:** Advanced engineering limits chain and roller temperatures while maintaining optimal calcination conditions
- **Heat Deflector Technology:** Strategically positioned plates at discharge and return points minimize heat losses and create distinct calcination zones
- **Inert Gas Purging Capability:** Controls color variations from iron oxidation, ensuring consistent product quality
- **Complete Enclosure and Insulation:** Maximizes thermal efficiency and minimizes environmental heat loss

Superior Energy Efficiency and Proven Durability

The eLCC's specific energy requirement is significantly lower compared to alternative solutions due to its completely enclosed and insulated design. The compact heating chamber volume reduces heat losses substantially and enables rapid system startup, providing unprecedented operational flexibility for plant operators. This design philosophy aligns with the cement industry's need for responsive, efficient production systems.

Based on AUMUND's robust pan conveyor technology, the eLCC benefits from decades of field-proven reliability. The modular design architecture allows production capacities to be expanded seamlessly by adding additional modules, providing long-term scalability as market demand for LC3 cement grows.

Carbon-Neutral Operation Capability

While the eLCC can accommodate various heating systems including ceramic gas burners, its electric heating elements can be powered entirely by renewable energy sources such as wind or solar power. This capability enables completely carbon-neutral calcination processes with zero direct CO_2 emissions, thus representing a fully sustainable cement production technology approach.

Global market presence

With the support of HOLCIM, a global cement industry leader, in the development and testing process, the eLCC technology is now ready to be globally marketed. AUMUND's established presence in the cement sector, supported by decades of successful global partnerships and technological expertise, positions the company to drive the widespread adoption of the eLCC as a sustainable calcination technology.

The AUMUND Group, with its manufacturing companies AUMUND Fördertechnik GmbH, ESI Eurosilo B.V, SCHADE Lagertechnik GmbH, SAMSON Materials Handling Ltd and Tilemann GmbH, is a leading international specialist in conveying and storage technology. The eLCC represents the latest advancement in AUMUND's comprehensive portfolio of solutions designed for the evolving needs of sustainable industrial operations.

AUMUND continues to invest in research and development to enhance the eLCC's capabilities and explore additional applications for sustainable bulk material handling technologies across various industries.

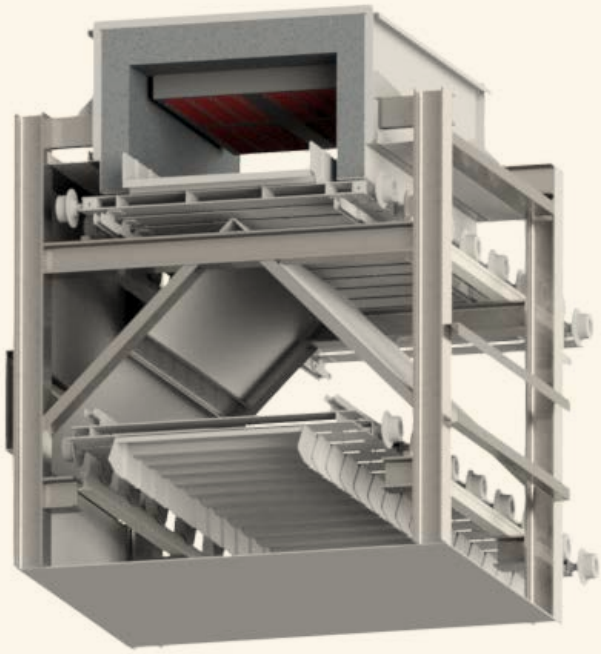
Picture 1 and 2: eLCC demonstration pilot unit at AUMUND Fördertechnik Headquarter in Rheinberg, Germany

Picture 2:

About the AUMUND Group:

Operating in over 150 countries worldwide, the AUMUND Group is a recognized expert in bulk material handling with more than 27,000 references. Its technically advanced, innovative solutions can be seamlessly integrated into virtually any customer or site-specific setup. AUMUND systems for the safe transport of hot, abrasive materials, optimized cooling processes, advanced storage and blending bed technology, as well as mobile loading and unloading systems, have made the Group a key player in demanding industries. At the same time, AUMUND companies are reliable partners for plant manufacturers and operators – whether for new builds, conversions, or modernization projects. Multiple production sites with engineering and R&D capabilities, strategically located warehouses, in-house spare parts production, international service companies, service centers, and numerous sales locations ensure maximum plant availability for customers worldwide – while supporting resource conservation.

Since 2023 the Aumund Foundation has been the new proprietor of the AUMUND Group with the aim of a long-term and sustainable company development.



Picture 3: Design of the AUMUND eLCC (electrified Linear Calcination Conveyor)

Alongside reliable plant availability, customers can also count on the sustainability of solutions from AUMUND. Each Group company and each service provider offers ecological solutions, which are environmentally sound, and follow the principle of the circular economy.

Contact

AUMUND Group | AUMUND Holding B.V.

Christopher Durst

Head of Marketing

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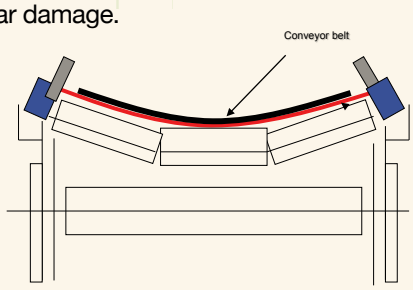
BULLDOG

CONVEYOR BELT ALIGNMENT & RIP DETECTION SWITCH

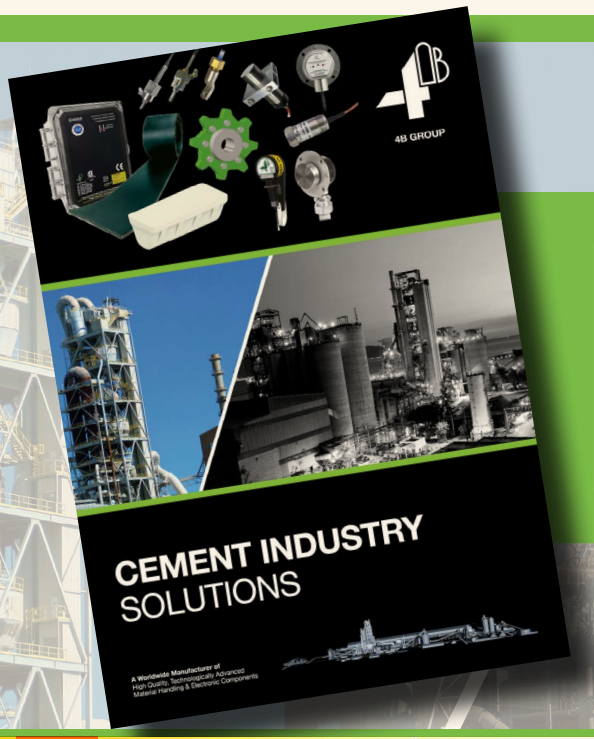
The Bulldog alignment and rip detection switch is an electro-mechanical system designed to detect dangerous misalignment of the conveyor and also detection of belt tear damage.



Features:

- Easy installation
- No calibration required
- Robust design
- 20° belt misalignment alarm
- 35° belt misalignment shutdown
- For open belt conveyors
- Worldwide hazardous location approvals

IP66



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Loss-in-weight feeders: PLC or dedicated control solutions?

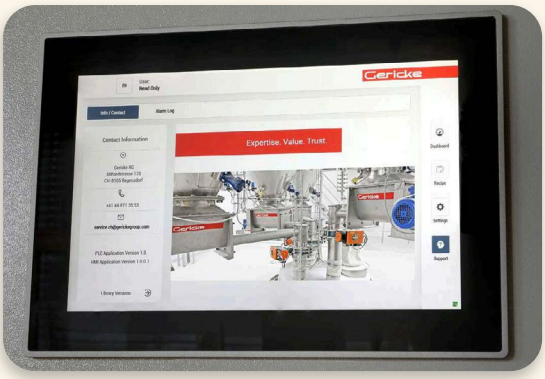
The Gericke Universal Controller GUC-F stands out compared to integrated PLC solutions and other separate weighing electronics.

In the realm of bulk handling applications, the choice of feeding and dosing technology is crucial for ensuring efficiency and accuracy. This write-up explores why the Gericke Universal Controller GUC-F stands out compared to integrated PLC solutions and other separate weighing electronics.

The Gericke GUC-F offers a comprehensive approach to feeding and dosing processes. Unlike PLC solutions, which require separate weighing electronics and programming, the GUC-F combines all necessary components into a single package. This integration simplifies the process setup and enhances overall performance.

When comparing GUC-F to other solutions, several key differences emerge. GUC-F provides extensive service and support for all types of bulk handling applications, whereas PLC solutions lack a dedicated service team for process, dosing, and feeding issues. Additionally, GUC-F excels in the mechanical integration of feeding, dosing, and weighing technology. Most feeders are not stand-alone, and seamless integration into the process is key. GUC-F also features an intuitive modern design for its Human-Machine Interface (HMI), reducing the time needed to read manuals. In contrast, PLC based HMI designs require more time for programming and manual reading.

The GUC-F can control multiple dosing and feeding processes with one controller, with parameters already configured and tested individually with the corresponding loss-in-weight feeders. GUC-F employs sophisticated algorithms to filter out environmental effects, ensuring the best accuracy even under harsh conditions. It supports both analogue and digital weighing cells and different weighing platforms depending on application and accuracy requirements. Furthermore, GUC-F integrates frequency inverters preconfigured, saving time and reducing the need for additional programming.



Another aspect of weighing companies is that they have limited experience with feeding and dosing processes. They do not manufacture or sell feeders and cannot test the complete configuration before shipping and installation. They also lack a dedicated service team for process, dosing, and feeding issues. Gericke, on the other hand, offers a complete package with extensive support for accessories and associated processes.

Cost Comparison: GUC-F vs. PLC Solutions

When it comes to cost, GUC-F offers a more economical solution. The integration of all necessary components into a single package reduces the overall cost of installation and maintenance. Furthermore, preconfigured frequency inverters and support for various technologies minimize the need for additional investments in equipment and training. The extensive service and support provided by the Gericke group also contribute to cost savings by reducing downtime and ensuring optimal performance. With PLC solutions, the need for separate weighing electronics and additional programming increases the total cost.

Fit for Every Application

In conclusion, GUC-F stands out as a superior choice for feeding and dosing technology due to its complete and integrated package, advanced features, and extensive support. Its ability to control multiple processes, sophisticated algorithms, and support for various weighing technologies make it a reliable and efficient solution for bulk handling applications. Additionally, the cost benefits of GUC-F position it an economical and sustainable alternative compared to PLC solutions.

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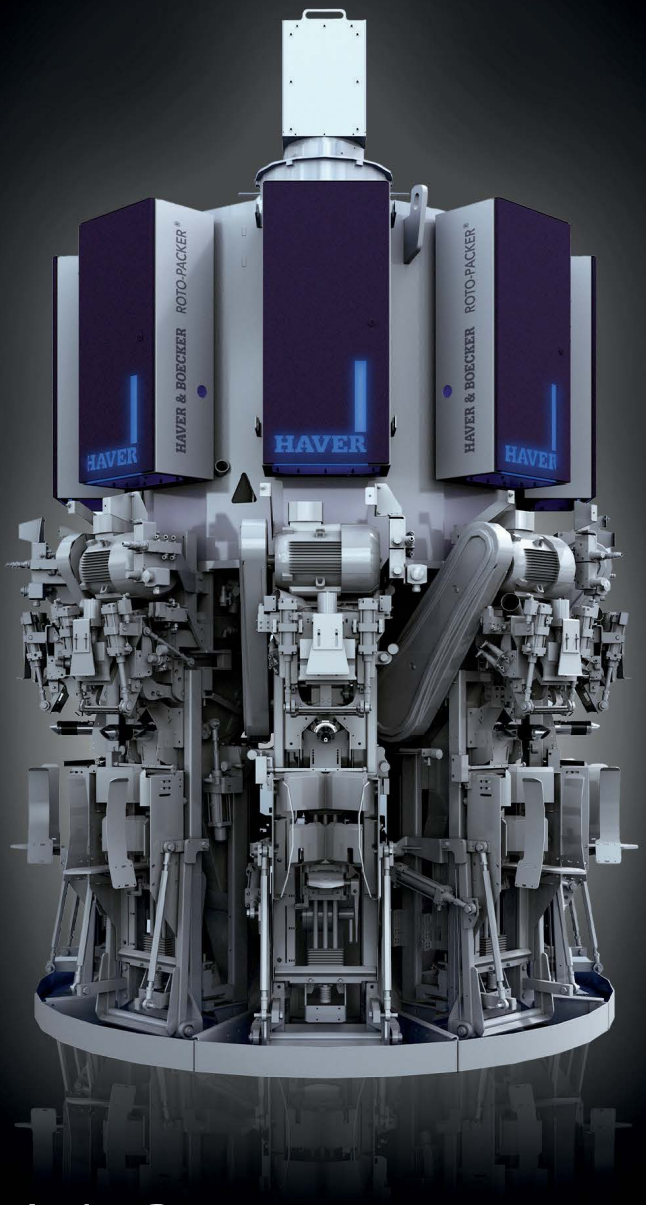
SOLUTIONS



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The new DUPLOCON discharge cone from WAM

With the DUPLOCON™, WAM has developed a patented system for discharging cement from silos in concrete mixing plants, dry mortar and precast plants that does not require compressed air.

One of the major challenges with compacting bulk materials such as cement or dry construction materials is keeping them free-flowing during processing. In order to prevent bridging or shaft building in the silo, these materials are usually fluidised at problematic points using air nozzles, air loosening pads or other techniques for adding air. For plant operators, this means not only high costs due to the consumption and storage of compressed air, but also high maintenance costs for the compressed air system.

With the DUPLOCON™, WAM has developed a patented system for discharging cement from silos in concrete mixing plants, dry mortar and precast plants that does not require compressed air. Instead, the discharge cone is equipped with vibration motors that loosen the material and keep it flowing. Thanks to its internal design, the DUPLOCON™ ensures a constant discharge rate regardless of the fill level in the silo. The efficiency of the downstream dosing screw is improved, which reduces the feeding time of the concrete mixer. There is no segregation of the material during discharge. Operating costs can be significantly reduced by avoiding compressed air and regular maintenance work.

The DUPLOCON™ also allows the use of silo cones with shallower angles, which frees up space underneath the silo. This creates more flexibility for the plant manufacturer, especially when using downstream equipment, as the plant height can be reduced accordingly.

As with all WAM products and components, global technical support and availability are guaranteed for the DUPLOCON™.


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The Russian-language periodical professional publication devoted to the production of cement and other binders, concretes, dry mixes and their applications, as to research and design.

A conspicuous place in the journal materials is given to the problems of plant development, capital movement, economic problems facing the cement industries of Russia and other countries.

The journal comes out once in two months and includes news, analytical materials and detailed abstracts of all the articles in English.

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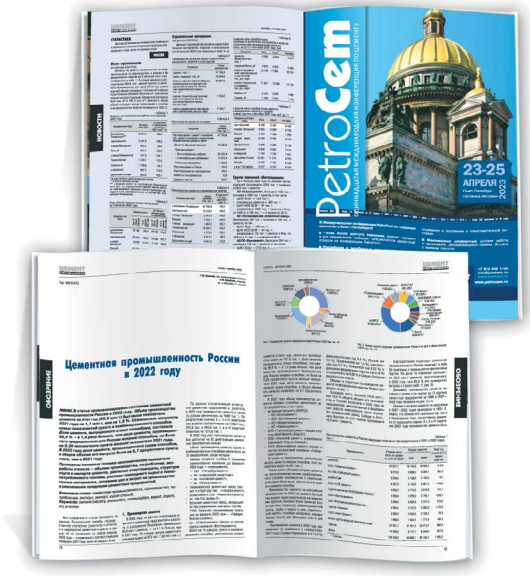

The new Penko checkweigher: Precise, durable, flexible

Meet Penko's all-new engineered checkweigher: built for precision, durability, and total production flexibility.

At Penko, accurate and fast weighing has always been our standard. So it's no surprise we were often asked if we also offered checkweighers.

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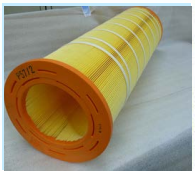
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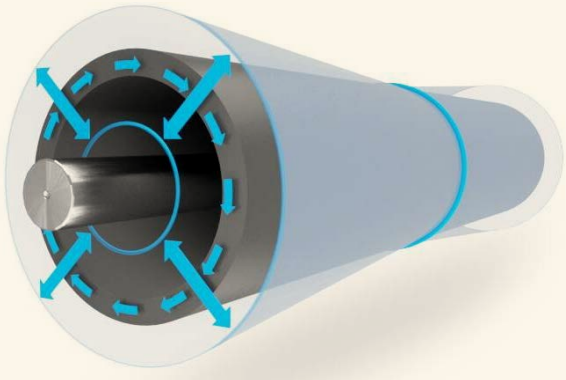
The PrimeTracker – no more belt misalignment

The PrimeTracker is an innovative system for belt tracking on conveyor systems, particularly used in industries with high demands on belt precision and operational availability.



Functionality and Technical Features

Conventional belt tracking systems usually intervene only after a significant deviation or misalignment of the conveyor belt has already occurred. This causes friction and increases wear, leading to considerable costs for maintenance and spare parts. The PrimeTracker adopts a different approach:

- Early Correction: The system reacts as soon as the belt slightly strays from the center. Thanks to an innovative mechanism, the PrimeTracker immediately applies gentle corrective forces with minimal friction.
- 360-Degree Freedom of Movement: The PrimeTracker features a flexible central bearing, allowing free movement in all 360°. This ensures extremely fast response times and reliably guides the belt back to the central position—without significant friction between belt and roller.
- Self-Regulating Functionality: In normal operation, the PrimeTracker acts like a conventional conveyor roller and does not actively influence the belt. The self-regulating steering only kicks in upon deviation.

E-PrimeTracker and Industry 4.0

The E-PrimeTracker is an enhanced version of the system, combining the original benefits with digital sensor technology

- Condition Monitoring and Predictive Maintenance: Sensors monitor belt position, speed, and condition of the connection, wirelessly transmitting data to maintenance systems.
- Visual Status Display: A light unit indicates the tracking status, enabling operating personnel to intervene promptly and helping to prevent downtime or damage.

Applications and Benefits

- Economic Advantages: - Reduced wear and longer belt lifespan; - Decreased downtime and maintenance costs; - Increased operational safety through early detection of critical conditions
- Industry-Specific Applications: The system is particularly relevant in all kind of bulk handling industries, where belt tracking substantially affects efficiency and product quality.
- Future Outlook: Integration of sensors and connection to digital monitoring systems make the PrimeTracker ready for **Industry 4.0**, securing a significant innovation lead in conveyor technology.

Conclusion

The PrimeTracker represents a revolution in conveyor belt technology. The combination of intelligent early detection, minimally invasive corrections, and advanced sensor technology delivers measurable added value for maintenance and operation of modern conveyor systems. Companies benefit long-term through cost savings, increased operational safety, and improved plant availability.

Tip: For those technically interested and for maintenance professionals, a practical test or integration of the system with condition monitoring infrastructure is recommended in order to unlock its full potential.

Future-proof your plant with polytrack® eco from thyssenkrupp Polysius

As cement producers face increasing pressure to reduce energy consumption and improve process efficiency, the polytrack® eco sets a new benchmark in clinker cooling. Engineered for maximum thermal performance and long-term reliability, this next-generation cooler delivers up to 76% cooling efficiency and less than 4 kWh/t power consumption — all while maintaining a clinker outlet temperature just 65°C above ambient.

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Asia Environmental and Waste Management Expo (Asia EnwastExpo)

"Empowering Asia's Green Future"

Hall 5-6, IMPACT Exhibition & Convention Center, Bangkok, Thailand

Time: 09.00 a.m - 6.00 p.m

For more information, please contact:
The Federation of Thai Industries (FTI)
Ms. Thitiporn (Kat) Mobile: +66 (0) 84-166-9229
Ms. Pavinee (May) Mobile: +66 (0) 63-223-4014

27th February – 1st March 2026

9th Edition of Sri Lanka Buildcon 2026

BMICH, Colombo

For more information, please contact:
Mr. Moiz S. J, Exhibitors Consultant, Bright Exhibitions
WhatsApp: +971 50 8721510

18-19 24-27 March 2026

Solids, Recycling-Technik

Dortmund, Germany

Analytica 2026

World's Leading Trade Fair for laboratory technology, analysis, biotechnology and analytica conference

ICM - International Congress Center Munich, Germany

22-24 April 2026

Analytica Vietnam 2026

ASEAN's Leading International Trade Fair for Laboratory Technology, Analysis and Biotechnology

International Exhibition Center (ICE) | Hanoi, Vietnam

04-08 May 2026

IFAT Munich 2026

World's Leading Trade Fair for Water, Sewage, Waste and Raw Materials Management

Munich, Germany

14 May 2026

3rd Egypt Drymix Mortar Meeting and University Symposium (MEDMA)

New Administrative Capital, Egypt

14-17 May 2026

16th Iraq International Building, Construction and Machinery Exhibition

Erbil Build Expo, Iraq

For more information, please contact:
PYRAMIDS GROUP FAIRS
Tel.: +90 216 5752828

17 September 2026

9th Central and South European Drymix Mortar Conference

Istanbul, Türkiye

28th September - 1st October 2026

Bauma CONEXPO INDIA (bCI) 2026

8th edition of the International Trade Fair for Construction Machinery, Building Material Machines, Mining Machines, and Construction Vehicles

India Expo Centre (IEML), Greater Noida – Delhi NCR, Uttar Pradesh, India

For more information, please contact:
Messe Muenchen India Pvt. Ltd.

16-18 November 2026

19th Annual MEDMA Conference

Jeddah, Saudi Arabia

Analytica China 2026

The International trade fair for laboratory technology, analysis and biotechnology in China

Shanghai New International Expo Centre (SNIEC)

24-27 November 2026

Shanghai New International Expo Centre, China

Bauma China 2026

31 March – 2 April 2027

Analytica Vietnam 2027

International Trade Fair for Laboratory Technology, Analysis, Biotechnology and Diagnostics

Hanoi, Vietnam

مجلة الإسمنت ومواد البناء

جدول موضوعات المجلة 2025

العدد	الموضوعات	المراسلات
ديسمبر/كانون الأول 2025 (العدد رقم 102)	* المبردات * المراوح * ضاغط الهواء * الصحة والسلامة المهنية * تكنولوجيا الطحن * المطاحن العمودية * زيادة إنتاج طاحونة الإسمنت * التكسير * مساعدات الطحن والطحن * استعادة الحرارة المفقودة * التصوير الحراري * إعادة التدوير الحراري * طرق معالجة استخدام غبار الممر الجانبي * الحماية من الانفجار في صوامع تخزين الوقود البديل * أنظمة مناولة الوقود البديل * إنتاج واستخدام الوقود الصلب المستعاد	

آخر موعد لاستلام المقالات أو النصوص الصحفية أو الإعلانات لعدد ديسمبر / كانون الأول : 8 ديسمبر / كانون الأول 2025

الإعلانات

(بالدولار الأمريكي)

	الإعلان في عدد واحد	الإعلان في عددين	الإعلان في ثلاثة أعداد	الإعلان في أربعة أعداد
غلاف خارجي ملون	1,250	*	*	*
صفحة داخلية ملونة (A4)	750	950	1,250	1,350
نصف صفحة داخلية ملونة (A5)	450	550	650	750
ربع صفحة داخلية ملونة (210*75 مم)	300	350	400	450

أبعاد الإعلان على الغلاف الخارجي: ارتفاع 20 سم وعرض 20 سم
الدقة : 300dpi
نوع الملف: PSD أو EPS أو PDF

إعلان في موقع الاتحاد www.aucbm.net

- عرض 200 بيكسل وارتفاع 75 بيكسل ، بقيمة 150 دولاراً أمريكياً في الشهر الواحد
- يرجى إرسال الصور مع اللينك المطلوب ربطه بها بدقة 300 dpi (dot per inch)

الجزائر

إسمنت المنطقة الشمالية توقع عقد بناء محطة طاقة شمسية بقيمة 32.6 مليون ريال

وقعت شركة إسمنت المنطقة الشمالية عقد بناء محطة طاقة شمسية في محافظة طريف بقدرة 20 ميغاواط، مع شركة سينوما أوفرسيز للتطوير المحدودة، وهي شركة صينية تعمل في صناعة الإسمنت وتقديم الخدمات الهندسية المتكاملة، بقيمة بلغت 32.6 مليون ريال (8.7 مليون دولار).

ويقوم العقد وفق نظام عقود الهندسة، التوريد والبناء (EPC) مع الشركة الصينية، وستقوم الشركة الصينية بصفتها المقاول بتنفيذ أعمال الهندسة والتوريد والتسليم بشكل الكامل خلال مدة العقد بالإضافة إلى أعمال التركيب والإنشاءات المدنية والتشغيل التجريبي للمشروع وجاهزيته للعمل.

وتشمل الأعمال جميع المباني والمكاتب والبنية التحتية والأسوار والبوابات داخل موقع المشروع والتصميم الهندسي للمشروع وفقاً لشروط وأحكام العقد.

مصنعين جديدين لإسمنت الخضر بالجلفة وغليزان

تم إطلاق مشروع لإنجاز مصنعين جديدين للإسمنت الأخضر "إسمنت منخفض الانبعاثات الكربونية وصديق للبيئة" بولايتي الجلفة وغليزان، بالإضافة كذلك إلى تدعيم مصنع أدرار القائم بخط جديد لإنتاج هذا النوع من الإسمنت.

وستبلغ الطاقة الإنتاجية الأولية لمصنع الجلفة 1.5 مليون طن، في حين ستبلغ الطاقة الأولية لمصنع غليزان 2 مليون طن. أما مصنع أدرار القائم، فسيتم تدعيمه بخط إنتاج ثان مخصص لإنتاج الإسمنت الأخضر بطاقة إضافية تقدر بـ 1.5 مليون طن.

وتشهد السوق الوطنية فائضاً في إنتاج الإسمنت، بكل أنواعه. حيث تبلغ القدرة الإنتاجية 42 مليون طن، مقابل إحتياجات وطنية تتراوح بين 29 و30 مليون طن، أي بفائض يقدر بحوالي 12 مليون طن.

المملكة العربية السعودية

إطلاق "الأكاديمية الوطنية للإسمنت"

تم إطلاق "الأكاديمية الوطنية للإسمنت" بالشراكة بين "الشركة العامة للتدريب التقني والمهني" و"شركة إسمنت ينبع" ودعم وزارة الصناعة والثروة المعدنية.

وتهدف هذه الأكاديمية إلى تأهيل الكوادر الوطنية للعمل في قطاع صناعة الإسمنت، من خلال برامج تدريبية متخصصة تغطي الجوانب الفنية والإنتاجية والإدارية، بما يسهم في دعم التوطين وتعزيز كفاءة رأس المال البشري.

توقيع عقد مع سينوما انترناشيونال انجينيرينغ لمشروع إنشاء خط إنتاج بمصنع الشركة بمدينة بريدة

أعلنت شركة إسمنت القصيم عن توقيع عقد مع شركة سينوما انترناشيونال انجينيرينغ لمشروع إنشاء خط انتاج رابع في مصنع الشركة في مدينة بريدة بطاقة انتاجية 10,000 طن يوم، وذلك في أغسطس / آب 2025. تم توقيع العقد مع شركة سينوما انترناشيونال انجينيرينغ على أساس عقد تصميم وتوريد وبناء وتسليم وتشغيل خط إنتاج إسمنت بطاقة 10,000 طن كلنكر في اليوم وذلك بنظام عقد تسليم المفتاح، في مصنع الشركة بمدينة بريدة وفقاً لأحدث التقنيات المتطورة في مجال صناعة الإسمنت وتبلغ مدة العقد 24 شهراً. ومن المتوقع أن يسهم هذا المشروع في تعزيز كفاءة استغلال الطاقة، الأمر الذي سينعكس إيجاباً على تكاليف الإنتاج وذلك اعتباراً من تاريخ التشغيل التجاري.

ويهدف المشروع إلى إحلال خط إنتاج جديد ومتطور محل بعض الخطوط القديمة ذات الكفاءة المنخفضة، مما يسهم في رفع كفاءة استغلال الطاقة وحماية البيئة. ويأتي المشروع لتعظيم الاستفادة من البنية التحتية للمصنع الحالي، ويُعتبر إضافة نوعية لاستراتيجية النمو المستدام التي تتبعها الشركة، بالإضافة إلى تلبية الطلب المحلي وتنويع المنتجات بما يتوافق مع رؤية المملكة 2030.

الجمهورية العربية السورية

افتتاح مصنع الفيحاء للإسمنت الأبيض في عدرا الصناعية – دمشق

تم افتتاح مشروع معمل "فيحاء" للإسمنت الأبيض، في مدينة عدرا الصناعية بريف دمشق، الذي يأتي بتوقيت بالغ الأهمية مع انطلاق مرحلة إعادة الإعمار التي تتطلب تعزيز الإنتاج المحلي من المواد الإنشائية، حيث سيسهم المعمل الجديد في تغطية جزء كبير من حاجة السوق المحلي والحد من الاستيراد.

وقد تم إنجاز المشروع نتيجة تنسيق مباشر بين الجهات الاقتصادية في سوريا والعربية السعودية، وهناك تنسيق جارٍ مع شركات سعودية أخرى للانتقال إلى مراحل تنفيذية جديدة بعدد من المشاريع الصناعية.

توقيع مذكرة تفاهم لتأهيل وتطوير معمل إسمنت حماة وإنشاء خط إنتاج جديد بطاقة 6 آلاف طن

وقّعت وزارة الاقتصاد والصناعة السورية مذكرة تفاهم مع مجموعة "فيرتكس" العراقية للاستثمارات، تتضمن إعادة تأهيل وتطوير وتشغيل معمل إسمنت حماة – الخط الثالث، ورفع طاقته الإنتاجية على مدى 13 شهراً من تاريخ توقيع العقد.

وتشمل المذكرة رفع الطاقة الإنتاجية للخط الثالث من 3300 طن يومياً إلى 5000 طن كلنكر يومياً، إضافةً إلى إنشاء خط إنتاج جديد بطاقة تصل إلى 6000 طن يومياً، بما يرفع إجمالي الطاقة الإنتاجية للمعمل إلى نحو 11 ألف طن يومياً خلال السنوات الخمس المقبلة.

ونصّت المذكرة على تدريب وتأهيل الكوادر العاملة وتطبيق أعلى معايير الجودة والالتزام بالمعايير الدولية الخاصة بالبيئة والسلامة المهنية والأمن الصناعي، بما يسهم في تعزيز تنافسية صناعة الإسمنت الوطنية.

جمهورية العراق

تنفيذ مصانع جديدة لإنتاج الإسمنت بطاقة إنتاجية 52 مليون طن سنوياً

أعلنت وزارة الصناعة والمعادن في العراق عن خطة لإنشاء مصانع إسمنت جديدة بطاقة إنتاجية تصل إلى 52 مليون طن سنوياً. ويبلغ الإنتاج الحالي لمصانع الإسمنت في العراق، سواءً التابعة لوزارة الصناعة والمعادن أو للقطاع الخاص، 32 مليون طن سنوياً. وقد أعدت الوزارة خطة لرفع الطاقة الإنتاجية للإسمنت بسبب زيادة الطلب والمشروعات العمرانية التي يشهدها العراق حالياً، وتلبية الاحتياجات الحالية والمستقبلية.

وتتضمن الخطة أيضاً فرصاً لإنشاء مصانع إسمنت متكاملة، بطاقة إنتاجية تبلغ 52 مليون طن سنوياً وفق الخطة التي وضعتها وزارة الصناعة والمعادن ، علماً بأن الوزارة كلفت المديرية العامة للتنمية الصناعية بمنح إجازات تحت التأسيس لإنشاء مشاريع إنتاج الإسمنت، وكذلك هيئات الاستثمار في المحافظات باعتبار أن وزارة الصناعة هي الجهة القطاعية المسؤولة.

قطر

شركة سيكا السويسرية للكيماويات تشتري مصنع الخليج للإضافات في قطر

أعلنت شركة سيكا السويسرية للكيماويات أنها اشترت مصنع الخليج للإضافات، وهو عبارة عن شركة متخصصة في كيماويات البناء، في دولة قطر.

وقالت الشركة إن المنشأة الحديثة الخاصة بمصنع الخليج سوف تمكن «سيكا» من التوسع في قطر والأسواق المحيطة، وإن إضافة المنتجات المصنعة محلياً مثل العزل الخارجي وأنظمة التشطيب تدعم الطلب المتنامي على المباني الموفرة للطاقة، مشيرة إلى أن الخطوة سوف تساعد أيضاً في خفض التكاليف عن طريق جلب العمليات تحت سقف واحد.

ومن المتوقع أن ينمو سوق البناء في قطر بمعدل سنوي مركب، بواقع أكثر من 4 % سنوياً حتى 2028، مدفوعاً بالاستثمارات الرئيسية في الطاقة والمرافق والنقل والرعاية الصحية والسياحة والتصنيع.

ليبيا

مؤسسة النفط تستأنف أعمال الصيانة: محطة الكوفة تؤكد استمرار التوجه نحو إدامة رفع الطاقة الإنتاجية

تمكنت الكوادر الفنية والهندسية في معمل سمنت الكوفة من إنجاز سلسلة هامة من أعمال الصيانة والتأهيل خلال فترة التوقف نتيجة انقطاع الغاز عن المعامل. وشملت الأعمال تبديل منطقة بناء داخل الفرن الأول بطول (62) متراً، إضافةً إلى تبديل قطعة أسفل التاير الثاني، وإجراء صيانة وقائية شاملة لأجزاء الفرن والمرسبة، كما تم إضافة زناجيل جديدة للفرن الثاني، وإجراء صيانة وقائية لكامل أجزاء الأفران بما يرفع الطاقة الإنتاجية ويعزز كفاءة العمل.

وفي السياق ذاته، أنجزت الكوادر الفنية تبديل قطعة في بدن الطاحونة الثانية، وتبديل طابوق البطانة المتضرر، وإضافة شحنة قياسية لغرض رفع الطاقة الإنتاجية للطاحونة، فضلاً عن إجراء أعمال الصيانة التي شملت قسم طواحين المواد الأولية، والناقل المطاطي، والساحبات.

ويأتي هذا الإنجاز لبرنامج الصيانة في إطار حرص إدارة الشركة العامة للسمنت العراقية على تعزيز كفاءة معاملها، ورفع الطاقة الإنتاجية، وضمان توفير مادة السمنت للأسواق المحلية وفق أعلى المواصفات الفنية.

مؤسسة النفط توقع مذكرة تفاهم مع شركة أفريقيا للاستثمار لإعادة تشغيل مصنع إسمنت مصراتة

أعلنت محفظة ليبيا أفريقيا للاستثمار مواصلة اللجنة الفنية الإعداد لانطلاق مشروع مصنع إسمنت مصراتة ضمن الجدول الزمني المستهدف. حيث ناقشت اللجنة الفنية لتنفيذ مشروع مصنع إسمنت مصراتة التواصل مع المؤسسة الوطنية للنفط بهدف المساهمة في توفير الغاز والزيت الثقيل، والتنسيق مع الشركة العامة للكهرباء لدراسة إمكانية توصيل الطاقة الكهربائية اللازمة لموقع المصنع، ومخاطبة وزارة المواصلات للمساهمة في تنفيذ طريق معبّد بطول 10 كيلومترات، والتحقق من توفر المواد الخام بالموقع، بما يضمن استدامة تشغيل المصنع لمدة خمسين عاماً.

كما شرعت اللجنة في تحليل وتقييم الإجراءات الفنية والمالية للعقد السابق المبرم مع شركة "سينوما – ووهان" الصينية، والتفاوض معها بشأن إعادة صياغة البنود الخاصة بالعقد الجديد.

وضع حجر الأساس لمصنع إسمنت نالوت بكلفة 600 مليون دولار

وضع مسؤولون في بلدية نالوت حجر الأساس لمصنع الإسمنت بتكلفة 600 مليون دولار بمنطقة أم الباقل بنالوت (أقصى غرب ليبيا)، ويستهدف إنتاج 12 ألف طن يومياً من خلال خطي إنتاج قدرة كل خط 6 آلاف طن، مع إمكانية رفع الطاقة الإنتاجية إلى 14 ألف طن يومياً

ويستهدف المصنع إنتاج الإسمنت البورتلاندي، والإسمنت المقاوم للكبريتات، وإسمنت عالي المقاومة للبناءات الخاصة.

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وزارة الصناعة تبحث مع شركة مجرية إنشاء مصنع لإنتاج الإسمنت في ليبيا

بحثت وزارة الصناعة والمعادن مع وفد من شركة «روتري» المجرية (Rotary International Ltd)، "مقترحاً أولياً قدمته الشركة لإنشاء مصنع لإنتاج الإسمنت في ليبيا". وتم استعراض فكرة المشروع والمقترح المبدئي لإنشاء مصنع حديث لإنتاج الإسمنت والذي يعتمد على التقنيات الصناعية الصديقة للبيئة، وبما يسهم في تلبية احتياجات السوق المحلي وتعزيز الإنتاج الوطني وتقليل الاستيراد.

شركة إسمنت المغرب تستحوذ على "إسمنت تمارة" و"غرابيمارو"

أعلنت شركة Ciments du Maroc، التابعة للمجموعة الألمانية "هايدلبرغ ماتيريالز"، عن إتمام عملية الاستحواذ على 62,62% من رأسمال شركة "إسمنت تمارة" و99,99% من رأسمال شركة "غرابيمارو"، المتخصصتين في إنتاج الإسمنت، الخرسانة الجاهزة والركام.

وتندرج هذه الصفقة في إطار تنفيذ الاتفاق الموقع بين "هايدلبرغ ماتيريالز هولدينغ" و"فوتورانتيم سمنتوس". وقد بلغت قيمة العملية 262,4 مليون دولار، قابلة للتعديل حسب الشروط التعاقدية.

بفضل هذا الاستحواذ، تعزز "شركة إسمنت المغرب" حضورها في السوق الوطنية من خلال إضافة مصنع إسمنت بطاقة إنتاجية تبلغ 1,4 مليون طن سنوياً، وثماني محطات خرسانة جاهزة بطاقة 510 متر مكعب في الساعة، بالإضافة إلى وحدتين لإنتاج الركام بطاقة سنوية تصل إلى 1,6 مليون طن.

كما ستمكن العملية الشركة من الحصول على حصة غير مباشرة في رأسمال شركة "SMBRM" المتخصصة في معالجة وتثمين النفايات الصناعية، بطاقة استقبال سنوية تقديرية تناهز 30.000 طن. وبعد إتمام الصفقة، تظل 37,01% من رأسمال "إسمنت تمارة" مملوكة لشركة "بروسيما"، التابعة بدورها لمجموعة "هايدلبرغ ماتيريالز"، فيما يحتفظ مساهمون آخرون بحصة تقارب 0.4%.

وتواصل "شركة إسمنت المغرب"، الرائدة وطنياً في مجال الخرسانة الجاهزة والركام، استراتيجيتها للنمو المستدام، معززة التزامها البيئي عبر توسيع استخدام الوقود البديل وتقليص البصمة الكربونية لأنشطتها. ويمتد الجهاز الصناعي للشركة ليشمل ثلاث مصانع للإسمنت (آيت باها، حد حرارة، ومزوضية)، وأربعة مراكز للطحن (إثنان في العيون، وواحد في الجرف الأصفر، وآخر في الناظور)، إلى جانب أربع مقالع للركام و24 محطة خرسانة موزعة على مختلف مدن المملكة.

أما مجموعة "هايدلبرغ ماتيريالز"، فهي من بين أكبر المصنعين العالميين لمواد البناء والحلول المرتبطة بها، وتتمتع بحضور قوي في أكثر من 50 بلداً، ويشتغل بها حوالي 51.000 موظف عبر 3.000 موقع إنتاج، مع التزام راسخ بحماية البيئة وتعزيز الاستدامة.

جمهورية مصر العربية

توقع إنتاج الإسمنت تجاوز 50 مليون طن بعد إعلان "حافز أكتوبر"

تتجه مصانع الإسمنت المصرية نحو توسيع الإنتاج ورفع معدلات التشغيل بعد "حافز أكتوبر" الذي أعلنه وزير التجارة والصناعة، مع توقعات باستقرار سوق الإسمنت المحلي.

أبرز التفاصيل:

مدفلتوسع: شركات الإسمنت تستهدف زيادة قدرتها الإنتاجية ورفع كفاءة استغلال الطاقة لتلبية احتياجات السوق المحلية والتصدير.

حافز أكتوبر: قرار الوزارة يهدف إلى دعم الصناعات المحلية وتشجيعها على التوسع والتصدير، خاصة وأن الإسمنت المصري يتمتع بجودة عالية.

استقرار الأسعار: من المتوقع أن يشهد سوق الإسمنت المحلي استقراراً في الأسعار، مع تحسين المنافسة.

تحديات سابقة: واجهت المصانع تحديات بسبب ارتفاع تكاليف الإنتاج، وتراجع الطلب خلال فترات سابقة.

دعم القطاع: الخبراء يؤكدون أن هذا الحافز سيسهم في إنعاش القطاع وتوفير فرص عمل جديدة، ويشجع الاستثمار.

المملكة المغربية

توسع في المغرب بافتتاح مصنع جديد للملاط والمواد المضافة بالقرب من أغادير

افتتحت شركة سيكا السويسرية، الرائدة في تصنيع وتوزيع المواد الكيميائية الخاصة بالبناء، مصنعاً جديداً للملاط والمواد المضافة بالقرب من مدينة أكادير في المغرب. يهدف هذا

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