www.globalcement.com

Contents Subscribe Ad Index

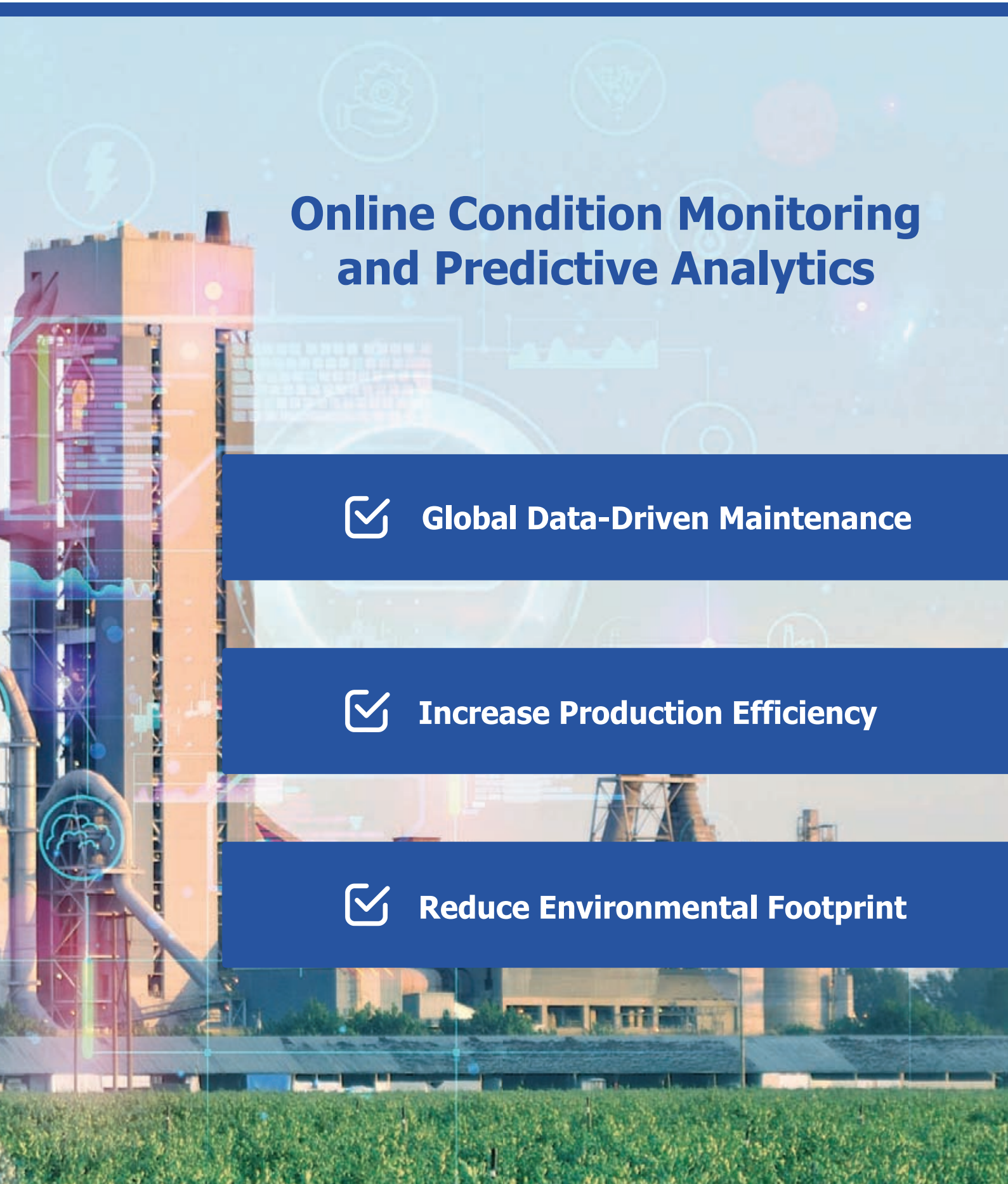
MARCH 2021

global cement™ MAGAZINE

DALOG®

For more information contact:
Christoph Muschaweck
E-mail: christoph.muschaweck@dalog.net
Phone: +49 821 74777 - 115

www.dalog.net



Online Condition Monitoring and Predictive Analytics

- Global Data-Driven Maintenance
- Increase Production Efficiency
- Reduce Environmental Footprint

global cement MAGAZINE

www.globalcement.com

Exclusive Official Magazine for

Global Cement Conferences: Global CemFuels, Global Ash, Global Slag, Global CemProducer, FutureCem, Global CemBoards, Global WellCem, Global CemProcess, Virtual Events

Editorial Director
Dr Robert McCaffrey
rob@propubs.com
(+44) (0) 1372 840 951

Editor
Dr Peter Edwards
peter.edwards@propubs.com
(+44) (0) 1372 840 967

Web Editor
David Perilli
david.perilli@propubs.com
(+44) (0) 1372 840 952

Editorial Assistant
Jacob Winskell
jacob.winskell@propubs.com
(+44) (0) 1372 840 953

Commercial Director
Paul Brown
paul.brown@propubs.com
Mobile: (+44) (0) 7767 475 998

Company manager
Sally Hope • sally.hope@propubs.com

Subscriptions
Amanda Crow • amanda.crow@propubs.com

Office administration
Jane Coley • jane.coley@propubs.com

ISSN: 1753-6812
Published by Pro Global Media Ltd
Ground Floor, Octagon House, 20 Hook Road,
Epsom, Surrey, UK KT19 8TR
Tel: +44 (0)1372 743837 / Fax: +44 (0)1372 743838

On the cover...

DALOG Diagnosesysteme GmbH provides online condition monitoring solutions for data-driven maintenance and process optimisation. Its solutions improve machine availability, lifetime and energy efficiency with the goal of increasing profitability while lowering the environmental footprint of industries worldwide.

The DALOG Diagnostic Center serves hundreds of customers around the globe, helping them minimise downtime and optimise the life cycle of their machines. The company can count on its in-house development team for sensor, data logger and software technologies.

Email: info@dalog.net **www:** www.dalog.net

Dear readers,

Welcome to the March 2021 issue of *Global Cement Magazine* - the world's most widely-read cement magazine. Prompted by the growing commitment among cement producers to increase sustainability, this issue looks at many of the cutting edge approaches being taken by global cement producers to reduce the CO_2 emissions of their cement and concrete products. Starting on Page 10, our special report covers the trend towards net-zero across four 'non-traditional' levers: ultra-low-CO_2 cement blends, the use of renewable power sources, the use of novel fuels and heating technologies, and CO_2 capture and utilisation / storage (CCUS). The list of references is already long, varied and impressive, with competition between and within different technological approaches. This will surely stand the sector in good stead in its now seemingly ubiquitous aim to become net-CO_2 neutral by 2050. *Global Cement* looks forward to revisiting and updating the content of the report in future years.

Also in this issue, we look at the cement markets of maritime South East Asia (Page 52), and hear what the future of the Chinese cement sector could look like from the World Cement Association's CEO Ian Riley (Page 48). Both articles tie in with the first ever *Virtual Asian Cement Conference* on 2 March 2021. The event is free to attend and will be held using the GoToWebinar platform. Head to *www.AsianCement.com* for more information. Elsewhere, this issue's technical features include a look at refractory replacement (Page 22), lime kiln efficiency (Page 29), chains (Page 26) and the remote commissioning of a full cement packaging system. There is also an interview with one of the founders of the 3D concrete printer manufacturer COBOD (Page 34). By cutting out waste, increasing the speed of building and increasing the resilience of the built environment, 3D printing offers yet more ways to make our sector more sustainable.

Enjoy the issue!

PKEdwards

Peter Edwards
Editor

Cement Industry Suppliers' Forum

Printed on Programme for the Endorsement of Forest Certification (PEFC®) certified papers by Pensord, a company with ISO 14001:2004 environmental certification.

Maerz lime kilns are extremely efficient in every environment. They also operate unmanned. Is it a bit lonely where you are? No problem: maerz.com

maerz

Features

Technical

Europe

Americas

Asia

Middle East & Africa

Regulars & Comment

Contents
Subscribe
Ad Index

Virtual Asian Cement Conference
2 March 2021
FREE Virtual Event
www.AsianCement.com

Virtual Future Cement Seminar
16 March 2021
FREE Virtual Event
www.FutureCem.com

Virtual Global CemTrans 2
13 April 2021
FREE Virtual Event
www.Cem-Trans.com

Hanover Fair
HM Digital Edition (Virtual Event)
12-16 April 2021
www.hannovermesse.de

DIGITALCEM
Türk Çimento (Virtual Event)
20-21 April 2021
digitalcem@turkcimento.org.tr

Virtual American Cement
27 April 2021
FREE Virtual Event
www.AmericanCement.com

3rd Virtual CemProcess Conference
11 May 2021
FREE Virtual Event
www.CemProcess.com

Virtual CemEnergy 2
18 May 2021
FREE Virtual Event
www.CementEnergy.com

3rd Virtual Global Slag Conference
15 June 2021
FREE Virtual Event
www.GlobalSlag.com

SOLIDS Dortmund
16-17 June 2021, Dortmund, Germany
www.solids-dortmund.de

Hillhead Quarrying & Recycling Show 2021
Buxton, UK
22-24 June 2021
www.hillhead.com

Virtual Middle Eastern Cement 2
6 July 2021
FREE Virtual Event
www.MiddleEasternCement.com

Virtual African Cement
7 September 2021
FREE Virtual Event
www.AfricanCement.com

2nd Virtual Global Concrete Seminar: Future Concrete
14 September 2021
FREE Virtual Event
www.Global-Concrete.com

15th Global CemFuels Conference
22-23 September 2021
Lisbon, Portugal
www.CemFuels.com

Virtual CemQC 2
5 October 2021
FREE Virtual Event
www.CementQC.com

Virtual CemProducer 4
9 November 2021
FREE Virtual Event
www.CemProducer.com

Virtual CemPower Seminar
23 November 2021
FREE Virtual Event
www.CemPower.com

Virtual European Cement
7 December 2021
FREE Virtual Event
www.EuropeanCement.com

ADVANCED PROCESS CONTROL
INNOVATIVE MEASUREMENTS

KIMA PROCESS CONTROL

KILN SHELL COOLING ON THE SPOT

WITH KILNCOOLER

INFRARED CONTROLLED WATER COOLING OF KILN SHELL

- expansion of kiln‘s operation time
- reduced mechanical tension
- fast, but carefully cooling down
- energy savings

THAT‘S WHAT WE CALL THE KIMA PROCESS.

WWW.KIMA-PROCESS.DE

SINCE 1996 INNOVATIONS MADE IN GERMANY

Peter Edwards, Global Cement Magazine

Towards net-zero: Low CO_2 cement production

With commitments to net-zero CO_2 cement production being made by producers across the board, *Global Cement* looks at the current status of low-CO_2 cement blends, novel production technology and CO_2 capture and storage.

While 2020 will forever be remembered for the Covid-19 pandemic, it also continued the 21st Century's run of warming climate trends. Indeed, 2020 was the hottest year on record not to feature an El Niño climate event, which would likely have boosted temperatures even higher. The mean temperature in 2020 was 13.9°C, around 1.2°C above the 20th Century average of 12.7°C. This was recorded despite a 7% year-on-year fall in CO_2 emissions due to pandemic-related lock-downs, which did not prevent CO_2 concentrations hitting 417ppm in January 2021. Atmospheric CO_2 concentrations are now 50% higher than the pre-industrial 278ppm of the late 1700s and around 20% higher than in the early 1990s (~350ppm).

Ultra-low CO_2 blends

Turn to Page 12

Right: As the world became obsessed with human temperatures in 2020, the planet's health took a back seat.

Build back better

As we emerge from the metaphorical rubble of the pandemic, construction activities, particularly cement and concrete, are increasingly under the spotlight of environmental campaigners, the wider public and national governments. There is good reason: Cement and concrete are responsible for ~7% of overall global CO_2 emissions. This is related to not only the use of fuel-derived CO_2 to heat the raw materials to 1400-1500°C, but also to the de-carbonisation of calcium carbonate, the essential first step in the formation of clinker.

While the most forward-thinking producers can now point to a 30 year plus record of alternative fuels, clinker substitution, waste heat recovery and other efficiency gains, it is clear that the sector's 'traditional levers' will be insufficient to reduce CO_2 to the low levels required by the UN Paris Climate Agreement. Indeed, in April 2018 a report by CDP (formerly the Carbon Disclosure Project) looking at some of the largest cement producers concluded that producers needed to *double* their emissions' reductions in order to meet the 2°C global warming target outlined in the Paris Agreement. The report, entitled 'Building Pressure,' analysed 13 large cement companies including LafargeHolcim, HeidelbergCement and Cemex.

Renewable energy

Turn to Page 15

Beyond traditional levers

As national and international governments ramp up their own CO_2 abatement targets with a view to meeting their obligations under the UN Paris Climate Agreement, cement producers have now set far bolder targets, both separately and

jointly under the auspices of the sector's two new international associations - the Global Cement & Concrete Association (GCCA) and the World Cement Association (WCA). Both of these were established in the late 2010s and each has a strong sustainability ethos.

Indeed, GCCA members, which represent 40% of the industry, have jointly committed to a low-carbon transition and the production of CO_2-neutral concrete by 2050. The association's 2050 Climate Ambition document was launched in September 2020, with a full Roadmap to be published by the close of 2021. Speaking with *Global Cement*, the GCCA's CEO Dinah McLeod said "It represents the first time that the industry has come together to jointly state such a bold and wide-ranging set of sustainability targets."

The WCA meanwhile, also supports a sustainable cement industry and encourages technical development and other steps to achieve full decarbonisation with the aim of keeping global temperature rises to less than 2°C and as close as possible to 1.5°C. It is extremely active through the dissemination of best sustainability practices across its membership network and professional committees, including with those outside of the sector.

Regionally, CEMBUREAU, the European Cement Association, has set out its Roadmap to achieve net-zero CO_2 emissions along the cement and concrete value chain by 2050. Germany's VDZ has done the same, its CEO Dr Martin Schneider noting that the potential for further gains from traditional sustainability measures is close to its limit, requiring a "Completely new approach to the production of cement and its use in concrete." In North America, the Portland Cement Association has announced that it too will publish a Roadmap to carbon neutrality by 2050 by the end of 2021.

Spain's Oficemen recently announced that it would target a 43% emissions drop by 2030 across its entire value chain compared to 1990 levels. Finally, UK Concrete and the Mineral Products Association (MPA) have launched a roadmap for the concrete and cement industry in the UK to become net CO_2 *negative* by 2050.

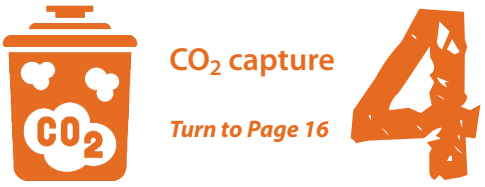
Above: The world of 2050 will likely need even more cement and concrete than today, making efforts to reduce the sectors' emissions even more vital.

Cement producers' targets

In 2020 cement producers introduced their boldest ever sustainability targets. Those of the largest firms, plus other notable cases, are outlined below.

China's cement producers, many of which are ultimately controlled by the state, were committed *en masse* by President Xi's commitment in September 2020 to reach a net zero CO_2 economy by 2060. Data from the Centre for International Climate and Environmental Research (CICERO) shows that the Chinese cement industry emitted an estimated 782Mt CO_2 in 2018 compared to 37.1Gt CO_2 from all anthropogenic sources globally. This means that Chinese cement plants were responsible for a staggering 2% of all CO_2 emissions in that year. If realised, this target would represent one of the larger pieces of the global zero-CO_2 puzzle.

LafargeHolcim signed the Science-Based Targets initiative (SBTi) Business Ambition for 1.5°C pledge in September 2020. This commits it to net-zero CO_2 emissions by 2050. It also committed to a 20% reduction in its CO_2 intensity by 2030 against a 2018 baseline. This interim target, to hit 475kg of CO_2 per tonne of cementitious material, will be partly backed up by a Euro850m sustainability-linked bond with a coupon of 0.5% that matures in 2031. Investors will be entitled to a higher coupon should the company not meet its emissions target.



Above: Ecocem's Dunkirk plant in northern France produces a range of products based on ground granulated blast furnace slag (GGBS).

HeidelbergCement has brought forward its former CO_2 emissions target for 2030 of 525kg of CO_2 per tonne of cement to 2025 as part of its Beyond 2020 programme. If achieved, this would represent a 30% decrease from 752kg of CO_2 per tonne in 1990. Its new goal for 2030 is 'below 500kg'. Its targets to 2030 have been successfully assessed against the Science Based Targets initiative's (SBTi) criteria.

HeidelbergCement has also strengthened its climate neutrality commitments by joining the Stiftung 2° support group, a network of private companies lobbying for climate goals. The group says that it wants to 'Develop cross-sector approaches and concepts for Germany and Europe in order to make climate protection a sustainable and successful business model.'

Cemex announced in October 2020 that Carbon Trust had validated its roadmap to decarbonise global operations in line with the Sectoral Decarbonisation Approach 2°C scenario developed by the International Energy Agency (IEA). It also aims to reduce its net CO_2 emissions by 30% by 2030.

Dalmia Cement commited in 2019 to below zero CO_2 emissions by 2040. In 2020 it joined five leading companies of other sectors in signing the Near-Zero pledge, an industry charter targeting near-zero CO_2 emissions by 2050.

Sumitomo Osaka Cement has formulated a set of medium-term goals and long-term policies in order to enable it to achieve carbon neutrality by 2050, in line with the Japanese government's target. These include a 30% reduction in energy-derived CO_2 emissions intensity between 2005 and 2030 and efforts toward carbon neutrality in energy and process-derived emissions by 2050.

Cementir Holding has set a CO_2 emissions reduction target less than 500kg per of CO_2 per tonne of cement by 2030.

Buzzi Unicem aims to reach a target of 662kg of CO_2 per tonne of cement in 2022.

Taiheiyo Cement will reduce specific CO_2 emissions by 80% between 2000 and 2050.

Vicem, the largest cement producer in Vietnam, and Danish cement sector supplier FLSmidth have announced a cooperation agreement with the aim of radically reducing the greenhouse gas emissions from Vicem's activities, including an aim to use 100% alternative fuels.

Grupo Cementos de Chihuahua (GCC) has committed to setting scientifically-verified greenhouse gas reduction targets by joining the SBTi.

How can we do this?

The commitments above will be met using a combination of approaches. These include, but are not limited to, the increased use of biomass alternative fuels, waste heat recovery, process efficiency gains, automation, lower clinker cements, renewable power generation, novel fuels / heating systems, re-carbonisation of concrete and CCU/S. Many of the above have been covered previously, so this article will focus on four main areas:

1. Ultra-low CO_2 mixtures;
2. Renewable power, including storage;
3. Novel fuels and heating technologies;
4. CO_2 capture and utilisation / storage.

The content relates predominantly to the production of binder systems based on calcium carbonate. Note that the limited space available means that it will not be possible to include all examples and case-studies.

Ultra-low CO_2 cement blends

The inclusion of supplementary cementitious materials, clinker extenders and other additives to substitute for a portion of the clinker in a cement blend is an extremely well-established practice. However, many traditional blends remain far from the 60% clinker factor required by the Cement Sustainability Initiative's (CSI) 2DS. This has led to the development of ultra-low CO_2 cement blends, including ternary blends and those that do away with clinker altogether.

Low-CO_2 producers

Several companies have been established specifically as low-CO_2 cement producers:

Ecocem's products are based on ground granulated blast furnace slag (GGBS), with the Irish firm claiming specific CO_2 emissions as low as 12kg/t for its non-clinker-containing 'Ecocem' product. It also produces CEM III / A, which contains >50% GGBS, and Ecocem Superfine, an additive with a specific surface area of 7000-8000cm^2/g. The company makes these products in Ireland, France and the Netherlands.

Hofmann Green Cement, based in France, makes a range of low-CO_2 products from a variety of materials. H-P2A is a geopolymer binder made by mixing flash-calcined clay and silicates that are combined with Hofmann's proprietary activators. H-EVA is an alkali-activated ettringite technology that combines flash-calcined clay, byproduct gypsum and Hofmann's activators. H-UKR is a GGBS-based blend, which Hofmann claims has a CO_2 footprint 80% lower than traditional concrete.

The company is in the process of building a new 0.25Mt/yr plant at the site of its existing Bornezeau 50,000t/yr plant in France's Vendée region and a second 0.25Mt/yr plant in the region surrounding Paris, which will come online in 2024.

DB Group markets CemFree in the UK, an ultra-low CO_2 cement alternative that reduces emissions by up to 80% compared to conventional mixes. CemFree is a proprietary alkali-activated cementitious material that activates pozzolanic materials such as GGBS and pulverised fly ash (PFA). The company launched Wolfenden Concrete, which has CO_2 emissions 62% lower than traditional concrete, with its partner Wolfenden Concrete in February 2021.

Celitement, now 100%-owned by Schwenk Zement, makes its eponymous product by heating calcium carbonate and silica-bearing minerals in a steam-saturated autoclave at a relatively cool 150-300°C. This produces a stable C-S-H rich 'raw meal' that can be activated by grinding. Celitement's lower CO_2 footprint is achieved predominantly through its lower process temperature.

BIGBOSS Cement, based in the Philippines, uses volcanic lahar material as a raw material, enabling it to produce cementitious binders that have a CO_2 footprint around 50% of that of OPC.

Concrene is a UK-based nanotechnology firm that has developed the use of graphene (thin sheets of carbon atoms) in concrete products. The properties of graphene lead to a faster cure, 15-20% higher flexural and compressive strength, reduced cracking and very high hydrophobicity. The lower CO_2 emissions of Concrene are derived from using less clinker to achieve the same strength.

Marta Abreu University in Cuba began the production of LC3 cement consisting of clinker, calcined clay, limestone and gypsum at a 1460t/yr pilot cement plant in Las Villas in October 2020.

Low-CO_2 products

Many established cement producers have now brought low- or net-zero-CO_2 cement and / or concrete products to market:

LafargeHolcim has introduced its EcoLabel to highlight products with at least 30% lower than average CO_2 emissions or more than 20% recycled content. It has also launched ECOPact green concrete products in Canada, Colombia, Ecuador, France, Germany, Mexico, Switzerland, the UK and the US. These allow CO_2 emissions reductions of 30-100% compared to using CEM I. For the range 70-100% the company uses offsetting schemes to compensate for the still unavoidable CO_2 released during clinker production. The company has also launched its Susteno cement product in Europe, which it claims is the only cement product that contains fine mixed granulate from demolished buildings as an additive.

Cementir Holding has developed its FutureCem™ technology, which uses clinker, calcined clay and limestone. This allows it to remove more than 40% of clinker from the blend and reduce CO_2 emissions by 30%. It has been used at full-scale in infrastructure projects in Europe.

Cemex is currently rolling out its net-zero CO_2 Vertua® concrete product worldwide following its release in Europe. The product, which has already found use in infrastructure projects in Europe, uses a geopolymer binder solution created by Cemex's Research and Development Center in Switzerland.

Below: Demonstration pour of Cemex's Vertua net-zero CO_2 concrete, now being launched across the world. **Source:** Cemex.

This solution has a reduced CO_2 footprint of up to 70%. The compensation of the remaining CO_2 is achieved by participating in reforestation projects, among other initiatives.

HeidelbergCement has developed i.tech 3D, a low-CO_2 concrete blend developed specifically for the 3D printing of buildings. This is currently being used to construct Europe's largest ever 3D printed structure in Bavaria, Germany. Its Hanson subsidiary markets GGBS-based binders in the UK under its Regen brand. In February 2021 its Lehigh Hanson subsidiary launched EcoCem Plus, which is made at its Edmonton cement plant in Alberta, Canada. The product is a blended Portland Limestone Cement (PLC) that comprises clinker, fly ash, limestone and gypsum, with CO_2 emissions 22% lower than for standard cement.

Cementos Argos announced the completion of work on a new 0.45Mt/yr calcined clay production line at its Rio Claro plant in Colombia in February 2020. It will enable Cementos Argos to produce ternary cement blends with CO_2 emissions 38% lower than for OPC. Energy consumption is also cut by 30%, which provides secondary benefits in terms of reduced off-site CO_2 emissions.

Cimpor Global Holdings is in the process of building a clay calcination plant at its new integrated Kribi cement plant in the Port of Kribi in South Cameroon. The system, supplied by thyssenkrupp Industrial Solutions, will calcine clay at 800°C. This is then substituted for a third of the clinker in CEM I, lowering the finished cement's clinker factor by up to 40%.

Renewable energy

Due to the high demand for thermal energy and the nature of the clinker production process, emissions from electricity usage at cement plants can often be sidelined. However, the CO_2 emissions associated with power generation still account for around 10-15% of the total. Minimising this is thus essential for producers in the quest for net-zero CO_2 emissions.

In many markets, electricity from wind and solar power is now cheaper than that made using fossil fuels, nuclear energy and geothermal plants in terms of cost per MWh. This has recently tipped the balance in favour of investment for numerous cement plants. Solar panels or turbines can be installed in former quarries, on roofs or elsewhere. Alternatively, producers can agree renewable energy supply agreements with utility suppliers. Projects and contracts dating from January 2020 to February 2021 are shown in Table 1 (left).

Despite their advantages in cost and sustainability, wind- and solar-generated electricity supplies are considerably less predictable than conventional sources. This leads to mismatches between demand and supply at the plant, forcing it to buy and sell power at different times.

This is a practical solution but one that will become unsatisfactory as the proportion of renewable energy increases. To provide more independence while ensuring that the CO_2 benefits of renewable

Below - Table 1: Summary of solar (top) and wind power (bottom) projects / contracts announced by cement producers from January 2020 to February 2021.
Source: *Global Cement* website news.

LH = LafargeHolcim.

HC = HeidelbergCement.

GCC = Grupo Cementos Chihuahua.

U/C = Under construction.

Cont. = Contract.

* = Floating.

** = Total size of supplier's solar farm.

*** = Split between wind and solar installations.

Country	Producer	Plant	Type	Size (MW)	Status
Germany	HeidelbergCement	Dettelbach Quarry	On-site	0.44*	Completed 2020
US	Holcim US (LH)	Hagerstown	On-site	10.0	Completed 2020
Honduras	Cementos Argos	Piedras Azules	On-site	10.6	Completed 2020
Cyprus	Vassiliko Cement	Amalas Quarry	On-site	8.0	Completed 2020
Mexico	GCC	Juarez & HQ	15yr Cont.	Unknown	Started 1 Jan 2021
Poland	Górażdże (HC)	Gorazdze	10yr Cont.	64.6**	Starting mid 2021
Mexico	Cem. Moctezuma	San Luis Potosí	On-site	10.0	U/C
Spain	Cementos Cosmos	Toral de los Vados	On-site	6.2	U/C
Zimbabwe	PPC	Coleen Bawn	On-site	16.0	U/C
US	Alamo Cement	Plant 1604	On-site	10.0	U/C

US	GCC	Rapid City	Cont.	50% of power	To begin spring 2021
Germany	Holcim D'land (LH)	Lägerdorf & Höver	Cont.	30,000MWh	Yet to begin
India	UltraTech Cement	Various	Unknown	255MW***	Announced

energy stay with the cement plant, there has been significant research in the field of intermediate energy storage, especially over multi-day timeframes. Potential solutions include: **Batteries** of various sizes and chemistries; **Gravity storage:** A heavy object is lifted using electrical power and later undergoes a controlled descent, regenerating electricity; **Thermal batteries:** Heat is transferred to high-capacity concrete blocks, ceramic blocks, pebbles or aluminium ingots; **Kinetic storage**, including flywheels; **Electrolysis** of water using renewable electricity to produce hydrogen and oxygen. These are stored and later combusted to provide heat.

The combination of such storage systems, industrial users and captive power generation facilities, is known as a microgrid. In the cement sector they remain a concept, with storage the final piece of the puzzle. In the period to 2050, such systems could become widespread, expanding to provide power for electric site vehicles and quarry machinery, as well as delivery fleets.

Novel fuels and heating methods

The benefits of using materials that would otherwise go to waste as cement plant fuels include the avoidance of landfill, lower production costs and, for biomass-derived fuels, lower CO_2 emissions. These advantages have led alternative fuels to take hold in many European countries and to a lesser extent in North and South America and are gaining a foothold in most parts of Asia, the Middle East and Africa.

However, the proportion of fossil fuels used by the 21% of cement producers that submitted data to the GCCA's Getting the Numbers Right (GNR) database in 2018 remained stubbornly high at 81.5%. Between them, petcoke and coal contributed 69.4% of the thermal energy used. Alternative fossil-based materials, for example waste plastics and oils, accounted for 12.1%, with biomass fuels contributing just 6.4% of the necessary thermal energy. There clearly remains a lot to be achieved using this particular traditional lever.

Very alternative fuels

Even when a plant does reach an alternative fuel substitution rate of 100%, it may still have a lot of work to do to lower its CO_2 emissions. Therefore, several approaches are being developed to optimise the combustion process or replace it with another process, while retaining clinker as the product. Some aim to eliminate fuel-based CO_2 emissions entirely, while others clean up the gas flow to enable cheaper and easier CCS (more on this on Pages 18-19). Prominent examples include:

With fuels

Catch4Climate is a project comprising four cement producers: Buzzi Unicem subsidiary Dyckerhoff, HeidelbergCement, Schwenk Zement and Vicat. The consortium intends to build and operate its own oxyfuel demonstration plant on a semi-industrial scale. Oxyfuel combustion uses an enhanced O_2 atmosphere, rather than ambient air, to increase combustion efficiency and simplify CO_2 capture. In the future, the captured CO_2 will be

Above: A 250kW solar receiver developed by Synhelion has recently achieved gas temperatures in excess of 1550°C, opening up the prospect of cement production with an 'invisible flame.'

used to produce so-called 'reFuels', climate-neutral synthetic fuels such as kerosene for air traffic, with the help of renewable electrical energy. The project is now planning a pilot plant at Schwenk Zement's Mergelstetten cement plant.

The European Cement Research Academy (ECRA) has selected HeidelbergCement's Colleferro plant in Italy and LafargeHolcim's Retznei plant in Austria as demonstration plants for two oxyfuel combustion projects. The costs of the test phase will be around Euro80m.

Hanson Cement's Ribblesdale plant in North Yorkshire, UK, is the subject of a study in the use of biomass and hydrogen fuels coordinated by the Mineral Products Association (MPA), with the aim of achieving 100% fossil-fuel-free operation. The Euro7m project, due to be completed by the end of March 2021, is being funded by the UK Department for Business, Energy and Industrial Strategy (BEIS) and has been awarded through the MPA. It follows a BEIS-funded feasibility study in 2019, which found that a combination of 70% biomass, 20% hydrogen and 10% plasma energy could be used to eliminate fossil fuel CO_2 emissions from cement manufacturing entirely.

AC^{2}OCem, a project coordinated by the University of Stuttgart, will conduct pilot-scale experiments and analytical studies to advance key components of oxyfuel cement plants with the aim of reducing the time to market of the oxyfuel technology in the cement sector. Its current funding period runs from November 2019 to the autumn of 2022.

The **Westküste100** green hydrogen project intends to produce green hydrogen, transport it in the gas network, use it in industrial processes and to interlink different material cycles within the existing infrastructure in Germany. The consortium brings together 10 partners: Holcim Deutschland, EDF Deutschland, OGE, Ørsted Deutschland, Raffinerie Heide, Heide's municipal utility, Thüga and ThyssenKrupp Industrial Solutions, along with the Region Heide development agency and the Westküste University of Applied Sciences.

"An electrolysis plant with a capacity of 700MW. This is our vision and the next milestone in implementing the development targets laid down in the national hydrogen strategy by 2030," said Jürgen Wollschläger, managing director of Raffinerie Heide and coordinator of the Westküste100 project.

Without fuels

Cemex announced the signing of a collaboration agreement with Switzerland-based alternative fuel specialist **Synhelion** in October 2020. The pair aim to develop the use of solar power as an alternative heat source to fuel in clinker production. In Synhelion's process, a classic solar tower configuration focuses radiation on a single point from a large number of reflectors, where it heats a mixture of CO_2 and H_2O gases trapped in a chamber, heating the mixture to 1550°C. In the project with Cemex, this hot gas mixture will be fed to the calciner, where it will heat the raw meal in the same way as a flame, just in the absence of any fuel. Pilot testing of Synhelion's technology at an as-yet unannounced Cemex plant is slated for late 2022.

Heliogen, based in California, US, has developed concentrated solar-thermal plants (CSPs) with the ability to focus sunlight to generate temperatures over 1000°C by micro-adjusting mirrors using computer technology. It has now engaged Parsons Corporation to build arrays of its CSPs for installation in cement precalciners. Requiring temperatures of 900°C, these represent the largest part of the industry's CO_2 output.

Heliogen CEO Bill Gross says that the installations will make CCS of the remaining CO_2 emissions from the conversion of limestone to lime easier by removing other pollutants. Heliogen is now targeting 1500°C from its CSPs, which would enable them to supersede cement fuels in kilns.

Cementa, HeidelbergCement Swedish subsidiary, and utility provider Vattenfall reported on the pilot stage results of their CemZero project in February 2019. These showed that the technical prerequisites exist for electrified cement production via the generation of high-temperature plasma. The study gives the green light to investigating how a pilot plant can be built.

CO_2 capture

All of the roadmaps discussed in the introduction make no secret of the fact that 'novel technologies' will be required to achieve a net-zero CO_2 cement sector. While some have been discussed in previous sections, the bulk of this task is likely to fall on CO_2

WE MOVE INDUSTRIES

HEKO offers the whole range of chains, rollers, sprockets and scrapers for reclaimers. HEKO products are proven in thousands of bucket elevators and conveyors, worldwide.

Our components for the cement industry:
central chains, link chains, reclaimer chains, sprockets, bucket elevators and clinker conveyors.

WWW.HEKO.COM

MORE THAN 100 YEARS

HEKO GROUP
CONVEYOR SOLUTIONS

capture and utilisation / storage (CCU/S). Such technology is currently very expensive, but competition and scale-up should this with time.

CO_2 capture and utilisation (CCU)

CCU is where captured CO_2 emissions are used to form products that can be used by the cement plant or sold to another user. Examples include:

Buzzi Unicem's Vernasca cement plant saw the inauguration of the pilot plant for the Cleanker project in October 2020. The plant uses calcium looping technology that captures CO_2 using raw meal as a sorbent.

Carmeuse has signed a joint development agreement with France-based energy transition specialist ENGIE and US company John Cockerill for a CCU project in Belgium. It will concentrate CO_2 from a novel lime kiln and combine it with renewably-generated hydrogen to produce 'e-methane,' which can be used by industry or as a transport fuel. Construction is due to begin in 2022, with commissioning to follow in 2025.

CarbonCure is a prominent Canadian company that sells technology to inject recycled CO_2 into fresh concrete, permanently mineralising it while adding strength. It sources some of its CO_2 from the Cementos Argos Roberta plant in Georgia, US.

Carbicrete, based in Canada, directly injects CO_2 into a wet GGBS-based concrete mixture, a process called carbonation activation. CO_2 is permanently sequestered.

Cemex is involved in a working group looking to implement FastCarb aggregates into concrete production. Administrated by the US-based International Research and Exchanges Board, FastCarb is developing a process to make aggregates from recycled concrete containing waste CO_2.

Below - Figure 1: EU ETS credit price, April 2008 - February 2021. One credit permits the owner to emit 1t of CO_2 to the atmosphere.

The EU's Emissions Trading Scheme (ETS) an example of one type of regulatory approach to CO_2 reduction, indeed one that has seen its impact on the sector increase over the past three years. In early 2018 it cost around Euro5 to emit 1t of CO_2. In early 2021 it is around Euro35. The EU ETS hit an all-time high of Euro39.97 on 12 February 2021.

On 1 February 2021 China began its national ETS, covering 26Bnt/yr of emissions. Emissions trading schemes are also applied in California, South Africa, New Zealand, South Korea and across Canada.

A contrasting method is the US' 45Q tax incentive, which provides US$20 per tonne of CO_2 that is geologically stored and US$10 per tonne of CO_2 used in enhanced oil recovery.

Data source: Ember carbon price viewer.

Vicat started using a CO_2ntainer system supplied by UK-based Carbon8 Systems at its Montalieu-Vercieu cement plant in November 2020. It uses captured CO_2 from the unit's flue gas emissions to carbonate cement-plant dust, producing aggregates.

Cemex is working with Canada-based Carbon Upcycling Technologies to improve the cementitious properties of residues such as fly ash and steel slag by physically processing them into more active nanomaterials using captured CO_2.

Solidia is a patented technology that combines a reduction in reaction temperature and the use of CO_2 to cure the concrete.

Mitsubishi Group is researching the injection of CO_2 into concrete in a project alongside Kajima Corporation and Chugoku Electric Power. They aim to develop an existing approach towards the production of cast-in-place concrete sections.

Sumitomo Osaka Cement is working on a CO_2 mineralisation research project with Yamaguchi University, Kyushu University and the New Energy and Industrial Technology Development Organisation. The partners are developing a process that captures CO_2 exhaust from cement and power plants and then mineralises it with calcium-containing waste materials, with the aim of commercial use by 2030.

Lafarge Zementwerke, OMV, Verbund and Borealis have signed a memorandum of understanding for the joint planning and construction of a full-scale plant to capture CO_2 and process it into synthetic fuels, plastics or other chemicals by 2030. As part of the 'Carbon2ProductAustria' (C2PAT) project, the companies intend to build the unit at the integrated Mannersdorf cement plant and capture all of the 0.7Mt/yr of CO_2 emitted. The project aims to use hydrogen produced by Verbund to allow OMV to transform the captured CO_2 into a range of olefins, fuels and plastics.

Schwenk Zement announced plans for the production of sustainable aviation fuel from the waste CO_2 from its Allmendingen plant in Baden-Württemberg in 2020.

Dalmia Cement will install large-scale CCU at its Ariyalur plant in Tamil Nadu, India in 2022 at the latest. An agreement was signed with UK-based Carbon Clean Solutions Limited to use its technology for a 0.5Mt/yr facility in 2019. The partnership has explored how CO_2 from the plant can be used, including direct sales to other industries and using the CO_2 as a precursor in manufacturing chemicals.

Evolving the well-established

Training Programme 2021

Online Courses

Process Technology of Cement Production
20 - 29 April 2021

Firing Alternative Fuels: Opportunities, impacts on process, optimisation and limitations
17 - 20 May 2021 and 25 - 28 October 2021

Crash Course for Young Engineers
14 - 18 June 2021

In-class Training

Plant Maintenance and Refractories
6 - 10 September 2021

Basic Course Process Control
8 - 11 November 2021

Process Technology of Cement Production
29 November - 10 December 2021

E-Learning

Learn up-to-date content at your own speed. Anytime. Anywhere.

More information and registration:
www.vdz-online.de/en/training
training@vdz-online.de

Follow us on LinkedIn

VDZ
Toulouser Allee 71
40476 Duesseldorf
Germany

Above: The Norcem Brevik plant will see a major CCS project come to fruition in 2024. **Source:** HeidelbergCement.

CO_2 capture and storage (CCS)

CCS is where large volumes of CO_2 are permanently stored underground. Examples include:

HeidelbergCement's Brevik plant in Norway is home to arguably the best-known CCS project in the cement sector. Now 10 years in development, the 1.2Mt/yr plant will be fitted with Aker Solutions' amine-based CCS technology to sequester ~0.4Mt/yr of CO_2 under the seabed as part of the country's Longship demonstration project and the Northern Lights project for permanent storage. It is expected to be in operation by 2024.

LafargeHolcim and CO_2 capture technology firm Svante are developing a full-scale CCS solution at the Holcim Portland plant in Florence, Colorado, US, as part of the CO_2MENT project. Svante has developed an extremely high surface area metal-organic framework (MOF), which traps CO_2 directly from industrial exhaust streams. It is expected that the project will be commissioned in 2024-2025. The partners are also developing the technology at the Lafarge Canada plant in Richmond, British Columbia, Canada.

HeidelbergCement's Lixhe plant in Belgium has been a key part of the Low Emissions Intensity Lime And Cement (LEILAC) consortium as a test-bed for Calix's Direct Separation Reactor (DSR) since 2018. The DSR separates fuel and process gas streams during the cement production process. This simplifies the process of condensing and storing the process CO_2. Following strong results from Lixhe, a second demonstration plant, LEILAC 2, will be installed at HeidelbergCement's Hanover plant in Germany. This will capture 20% of the cement plant's capacity, corresponding to around 100,000t/yr of CO_2. Including design, construction, commissioning and extensive testing, the overall project is expected to be completed by 2025. Cemex is also a participant in the consortium.

Lehigh Cement (HeidelbergCement) and the International CCS Knowledge Centre are conducting a CCS feasibility study at its Edmonton, Alberta, cement plant to find out whether capturing 90-95% of the plant's CO_2 is viable. Completion of the study is scheduled for the autumn of 2021.

Cemex subsidiary Cemex Ventures is working with US-based CCS specialist Carbon Clean toward the development of a CCS solution for under US$30 per tonne of CO_2 captured. Cemex is also working with Membrane Technology & Research's membrane CCS product at its Balcones plant in Texas, US.

Oficemen, the Spanish cement association has announced that it is working with the Spanish Technological Platform for CO_2 ($PTECO_2$) to identify potential locations for storing CO_2 captured from cement plants.

C-Capture, from the UK, has developed a non-amine solvent for use in CCS. The mechanism by which it absorbs and releases CO_2 means it breaks down less easily than amines. C-Capture's says that its technology uses 40% less energy than other available technologies.

Concluding remarks

The development of a net-zero-CO_2 cement and concrete sector is a daunting task, one that will continue to fill issues of this publication for decades to come. The many products, projects, case-studies and opportunities discussed above highlight the vast array of innovative solutions that the cement sector and its partners are bringing to the fight against climate change... and they are just the start.

No single country, company or technology will provide 'the answer,' alone. In their quest towards net-zero-CO_2, companies must coordinate their efforts and draw on each others' experience, a strategy that goes against decades of traditional business practice. In this regard the sector's associations - GCCA, WCA, Cembureau, PCA and others - will play an increasingly important role in coordinating collaboration on sustainability issues, while keeping their members free to compete in the business of selling cement.

International associations also have an important role to communicate the cement sector's needs to policy makers, and coordinate sustainability efforts with those outside of the sector. As the examples above show, assistance from waste processors, iron and steel manufacturers, gas handling experts, renewable energy, battery manufacturers and many others besides will inform and shape the cement industry of the future.


PlastRetard®
The Multifunctional Additive
Your Natural FUTURE
made in Italy
www.plastretard.com

Mike Martin, Brokk Inc & Keith Armishaw, Aquajet

Dry versus wet: Two approaches towards more efficient refractory removal

Refractory removal needn't be dangerous or time consuming.

Manual methods of removing refractories can mean shutting down for days or weeks and require large crews wielding heavy handheld equipment. However, some facilities are updating their processes with the help of robotic equipment. These machines keep workers out of the most dangerous situations and significantly speed up the refractory removal process.

Both hydrodemolition and remote-controlled demolition robots increase safety and productivity over manual refractory removal methods. However, choosing the process that offers optimal results depends on several factors. These include the size of the vessel and the environment. Here are some points of consideration to help make the right choice.

Dry

For kiln maintenance or other applications where waiting for cool-down eats up valuable time, remote-controlled demolition machines allow facilities to begin tear-out while equipment is still warm.

Using a compact demolition robot, operators can remove coating or debrick at speeds of up to 10m/hr. Electric machines from industry-leading OEMs feature cutting edge technology that improves performance and uptime even in the harsh conditions encountered when removing refractory. With an operating distance of up to 300m, operators remain safe from falling debris and harmful silica dust.

Robots with a three-part arm and 360° of continuous rotation provide extended reach and a wide range of movement to further improve refractory removal efficiency. Additionally, a variety of attachments, including breakers, buckets and drum cutters, allow operators to use demolition robots for cleanup tasks, increasing versatility.

Below: Using a compact demolition robot, operators can remove coating or debrick at speeds of up to 10m/hr.

Wet

With hydrodemolition, elements need to be completely cooled before water can be introduced, limiting applications in some industries. However, hydrodemolition does offer one significant advantage for refractory removal: the high-pressure water jets don't damage the mounting surface. At 18,000psi, hydrodemolition equipment can provide 100 times the productivity of hand-held equipment, removing 0.27m^3/hr of refractory compared to just 0.003m^3/hr with a 6.8kg pneumatic hammer. The use of water also reduces airborne silica dust.

Several robotic options are available from innovative original equipment manufacturers (OEMs) to make refractory removal productive and safe. Compact hydrodemolition robots that feature an innovative mast system provide the versatility to work in tight spaces with extended reach in horizontal,

Above: Lightweight hydrodemolition systems are available that operate on a scaffolding system and provide four times the power of a hand lance.

vertical and overhead applications. Additionally, some advanced units can be broken down to a third of their original size by disconnecting the wheeled power control module from the tracked portion for an even more compact robot capable of accessing tight, inhospitable environments.

Lightweight systems are also available that provide four times the power of a hand lance in a compact footprint. These modular systems feature a power head with a variable number of water jets attached to a control unit. The power head is used with a scaffolding setup, allowing operation across a large area in any position – horizontal, vertical or overhead. It limits the need for workers in the most confined spaces, making it an excellent choice for automated refractory removal in kilns or other vessels.

Making the right choice

Wet or dry, there's no denying the productivity and safety benefits that robotic machines provide for refractory removal. Working with reliable OEMs for tailored robotic solutions means facilities can optimise their use of scheduled downtime and ensure that production is back on track quickly.

BEUMER Group

A digital look over the shoulder

Thanks to digitalisation, it is no longer unusual to parametise and commission single components remotely. BEUMER Group thinks ahead and, for the first time, commissions a complete packaging line including palletiser – from a distance of over 4000km.

Helping customers in the event of faults or shutdowns of existing systems is no problem for Beumer Group, even from a distance. The system provider was confronted with a completely new situation when a planned commissioning, which involves the dispatch of service personnel to the site, could not be carried out due to travel restrictions caused by the Covid-19 pandemic. Beumer Group was flexible and set the course for 'remote commissioning,' commissioning from a distance.

"The trigger was clearly the pandemic," explains Peter Teichrib, a department manager in Engineering at Beumer Group. However, this is not the only scenario that requires Beumer's new remote commissioning service. Anything that makes personal access to systems and users difficult or impossible requires new solutions.

As an example, Teichrib explains the packaging line of the cement manufacturer Norm LLC in Azerbaijan, which was almost completely erected on site. This line consists of two bag transport systems, the Beumer paletpac 5000 layer palletiser and a Beumer stretch hood A packaging line. "All components were already completely installed. Only some electrical installations and commissioning still had to be carried out when our experts had to leave the country due to the pandemic," explains Teichrib. This was a delicate situation for the customer, which had already included the capacity of the new packaging line in its future calculations. If the line couldn't be started up, the customer faced issues with delivery bottlenecks and a potential loss of market share.

Test run required

Beumer Group decided to launch remote commissioning as a pilot project. "The conditions were exceptionally good, which certainly cannot be taken for granted," emphasises Teichrib. In general, a number of conditions must be met before the 'remote commissioning' project can even be considered. The system must be tested in-house in

Below: The user is guided through the commissioning process from the back office.

Above Left: On site: Beumer Smart Glasses, smartphone and laptop provide an audiovisual connection to Beumer Group.

Above Centre: 20% of the electrical installation was carried out by the customer itself – the Beumer Customer Support checked and directed all steps from a distance using the Beumer Smart Glasses.

Above Right: Never change a running system: Beumer Group recommends to supply the Beumer stretch hood A with the previously tested film to ensure a smooth start of the remote commissioning.

advance. "With this system, we had indeed carried out an extended in-house commissioning, as the Beumer paletpac 5000 was running with the new PLC S7-1500 for the first time," he explains. "We wanted to make sure that everything would work perfectly later. It was this circumstance that made remote commissioning possible in the first place." Beumer Group also recommends that the Beumer stretch hood is tested with the appropriate film in advance. This way, possible differences in film quality can be excluded as a source of problems during commissioning.

Know how meets technology

In general the customer needs qualified maintenance and operating personnel, preferably ones familiar with Beumer systems. This is another prerequisite for successful remote commissioning. On the hardware side, several IP cameras provide the necessary overview of the complete system, while Beumer Smart Glasses, specially developed data glasses, connect the Beumer experts audiovisually to the user on site. "A broadband internet connection is, of course, required," says Teichrib. The data glasses allow a detailed view. This allows the Beumer customer support representative to see the same thing as the wearer on site and can directly specify the correct actions to be taken. In this way, the user is guided step by step through the commissioning process.

The cameras and Beumer Smart Glasses are part of the plug-and-play set for remote commissioning. This also includes a WLAN router for the Beumer Smart Glasses and a VPN client installed on an mGuard router. The IP cameras must be connected via LAN cable to ensure sufficient image quality and stable transmission.

"First, we installed the hardware and software components in our factory and tested the configuration. The complete package was then shipped to Norm LLC," says Teichrib. This procedure has proven itself and is also planned for future remote commissioning projects.

Keeping the overview

Beumer Group set up a separate back office for this project at short notice: Using four monitors and a laptop, the service staff always had an overview of the images from the IP cameras, the field of view of the BEUMER Smart Glasses and the data of the system sent via the VPN client.

"Broadband access, technology and know-how – at Norm LLC we encountered ideal conditions, which we made the best possible use of," explains the department manager. "Within a very short time we were able to develop a concept that will guide us safely and reliably through future remote commissioning projects. Standardised processes enable us to eliminate sources of error and offer our customers a reliable service, quickly and flexibly."

Regardless of external circumstances: If Beumer Group digitally takes the users by the hand via 'remote commissioning,' the understanding and know-how of its systems can grow. This motivates the customer's personnel on site, a fact from which the user benefits as much as Beumer Group – a better understanding of the system will significantly simplify future remote maintenance and services.

The remote commissioning of the packaging line at Norm LLC has shown that with adequate framework conditions, such as well-trained maintenance personnel and technically high-quality IT equipment, new ground can be broken. Beumer Group's technology and competence have impressively confirmed this.

Interview by Peter Edwards, Global Cement Magazine

In discussion: Dominik Stracke, KÖBO Group

Global Cement recently caught up with Dominik Stracke, CEO of KOBO USA, the North American arm of Germany's KÖBO Group.

Above: Dominik Stracke founded KOBO USA in 2014 as part of KÖBO Group's international expansion drive. He is responsible for markets in North, Central and South America across all industries. With two locations in the US and partners and representatives in Canada, Central and South America, KOBO USA supports cement plants in their needs of chains, sprockets and attachments.

***Global Cement (GC):* Please could you outline the founding and development of KÖBO Group?**

Dominik Stracke (DS): The KÖBO Group was founded 125 years ago in Germany and has manufactured chains and sprockets ever since. Today it is a global chain manufacturer, with facilities around the globe. We are deeply involved in many industries, including cement, mining, automotive, food, escalators and many more.

The group has manufacturing facilities in Germany and Poland, light manufacturing in the US and sales offices in the UK, France, South Africa and Thailand. Representatives around the globe support our customers locally and are the connection between the plant and our engineers. Globally we have roughly 500 employees.

***GC:* How did KÖBO first come into contact with the cement sector and why?**

DS: A lot of equipment for cement plants had traditionally originated within Europe, with many companies based in Germany. As an industrial chain manufacturer based in the same country, it was only a matter of time before we became involved in this sector. We moved into the cement sector in the 1960s and now cooperate with German and European OEMs to develop chains to withstand the toughest conditions. At the same time we retain contact with end-users, which helps us to understand their needs in order to develop our products.

***GC:* Which of its products are most commonly used within the cement sector?**

DS: In a cement plant our chains and sprockets are mostly used in bucket elevators, pan conveyors and reclaiming systems, although we will also supply drive chains. All chains are made to order and customised for each individual application. Lubricated or lube-free, case or induction hardened, with or without attachments, our cement chains extend the lifetime and reduce downtime at the plant. As we also fabricate buckets, pans and pan conveyor rollers, cement sector clients can obtain entire assemblies from one source.

We are engaged in many different industries, but the cement sector is one of the key industries for us. We believe in a consultative approach to help the customer by understanding the problems with their conveyors. Cement plants are increasingly looking into that kind of support right now.

***GC:* Please take us through the production process of a cement sector chain.**

DS: Every project starts with a customer requirement, be that a wear issue or a chain reaching the end of the lifetime in the plant. We consult with the client and may introduce new materials, processes or design changes to improve the life of the next chain.

With the purchase order we provide drawings and finalise the design together with the plant engineers hand in hand. This typically consists of link plates, pins, bushes and rollers. All parts are manufactured in-house, including heat treatment, for 100% process control.

After finishing the parts, they are assembled to chain strands, measured, checked for quality

Below: The KÖBO Group headquarters in Wuppertal, North Rhine-Westphalia, Germany.

and packaged for overseas shipping. After arrival at the plant, KÖBO consultants can provide support during the installation of the new chains. Overall it takes approximately 8-14 weeks to manufacture and install a cement sector chain.

***GC:* How do materials change with time?**

DS: Our developments are a mix of certain treatments such as case versus induction hardening, tolerances we have developed over time and the use of high quality materials. There are still better materials coming up every now and then, but there is no "Wow, you have to use this!" material anymore. It is more about the manufacturing process to make a good cement chain.

What is changing is our consultative approach with end users. It is useful for us to speak with them, find out what the real problems are and find solutions. For this reason we split our strategy to include a mixture of strategic OEM partners and end users. This is how we improve our chains across the sector. This approach also helps us to transfer knowledge from one sector to another. For example, the iron and steel sector and cement sector share a number of overlaps in terms of the size of chain and weights carried, as well as the temperatures that the metal reaches during operation.

***GC:* How did the Covid-19 pandemic affect KÖBO?**

DS: Thanks to swift action taken by the group and the installation of protective solutions and protocols, we have been able to continue our operations throughout the pandemic with only limited effects on operations. Simple measures that everyone will be familiar with include reducing visitor contact, social distancing in the workshop area, as well as the extensive use of video calls and online meetings for office staff.

Field support is difficult at this time and travelling is almost impossible. Many plants have a strict policy for visitors, so we are working with online tools to stay in touch with customers.

Overall the world hasn't come to a stop. It is good to see that business life goes on and we all find ways to work differently. For sure it has an impact on our overall performance, but we are all working to keep the effects as limited as possible.

With regards to the number and kinds of requests, they have not changed very much due to the pandemic. As long as there is cement demand, plants continue to make cement and we continue to provide replacement chains. So far the sector is relatively unaffected. This is surprising and welcome.

Above: KÖBO values its strong partnerships with OEMs but also works directly with cement producers. The photo above shows a retrofit solution implemented on a limestone reclaimer at American Cement's Sumterville plant in Florida, US.

***GC:* Is the group starting to work in different regions of the world or parts of the cement plant?**

DS: During the last decade KÖBO founded locations in the US, South Africa, Thailand and China to serve cement plants around the globe. Only through this close contact can we advance and develop the next generation of chains.

***GC:* What unique challenges does the cement industry give rise to that other sectors don't?**

DS: Chains and sprockets are a key component of every conveyor system. Since they are constantly moving, wear and tear is part of our daily business. The key to a good chain life is the predictability of wear and to avoid unexpected downtime. The

Below: Inside the company's chain production facility.

Above: Precision laser cutting of components.

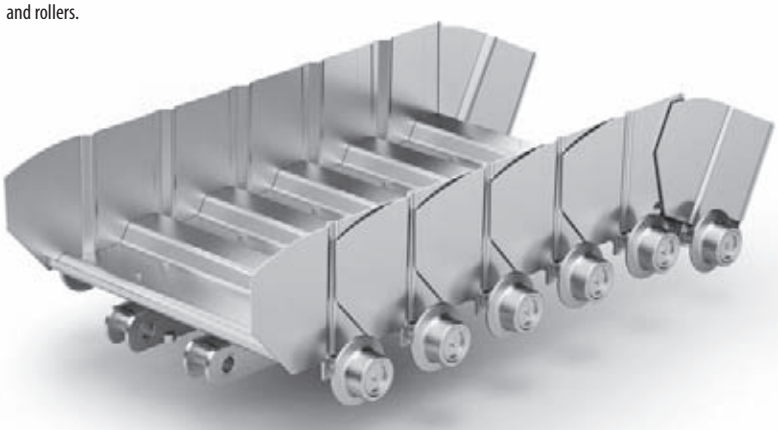
conditions in the cement industry are the toughest conditions for a chain across all industries. Mostly there is no lubrication, with dust, abrasive materials and heat, all factors that lead to increased wear and tear. Special materials and heat treatment are required to achieve good chain lifespans.

***GC:* What is the most difficult kind of chain to manufacture?**

DS: It is hard to identify a most 'technically difficult' chain. All applications such as bucket elevators, pan conveyors or reclaimers have different requirements. Speed, load and temperature are different in every application. Fast applications require more ability to withstand fatigue, slower chain applications such as reclaimers require more wear resistance due to higher loads. From a manufacturing standpoint every chain requires 100% attention to guarantee the highest quality.

Chain replacement sometimes becomes an emergency, even when the plant can accurately forecast a failure. It is a constant uphill struggle to convince cement plant operators that chains need to be ordered in a timely manner. I always compare it to tyres on a car. Anyone can drive a car on worn tyres and say, 'Hey look at me, I'm saving money!' However, you might have a blow-out or run out of grip on a bend, with catastrophic consequences... and you still have to buy a new tyre at some point, even if you don't crash.

Below: KÖBO pan conveyor chain assembly, with pans and rollers.



Chains are the same. It is metal on metal and there will be wear. It is best to deal with it before it causes damage to the sprocket, conveyor, attachments and so on, all of which can lead to higher maintenance and replacement costs. There is also the risk of catastrophic failure and loss of production, as chains are almost always used between vital pieces of the plant. And remember... both the tyre and the chain will be more expensive tomorrow than today.

***GC:* How do these multi-billion dollar companies manage to get themselves tied up with chains?**

DS: In a perfect world, there is always enough time between order placement and the installation. We all know that this is not the case. We see a rising percentage of our projects being extremely urgent caused by low inventory levels at the plant, emergencies or late order placement. In our private lives, especially during the pandemic, we have become used to clicking on something today and getting it tomorrow, or even later today. Unfortunately, this attitude is creeping into the industrial environment too, but with the drawback that it simply isn't realistic for a made to order product. We try to consult the producer to start the dialogue about chain replacement earlier so we can be prepared. Also, by keeping inventory in our warehouses for a certain time frame on custom chains it is possible to avoid these stressful situations for all parties.

***GC:* What lessons has the group learned during the pandemic?**

DS: In a nutshell we can be happy to have a broad existing customer base that trusts and relies on us. This really helps us to stay in touch with our customer base and partners remotely, even if it is not possible to visit in person.

***GC:* What 'pandemic-world' practices will it retain after the pandemic has passed?**

DS: I personally believe in direct customer contact and personal relationships. We have learned in this pandemic that sometimes we have to find other ways such as video calls and online conferences. To my surprise it is working well and customers seem to be more open to that kind of consulting than ever before. I think that some of this will remain after the pandemic and we will see a combination of on-site consulting and video-type meetings.

***GC:* Thank you for your time today.**

DS: You are very welcome indeed.

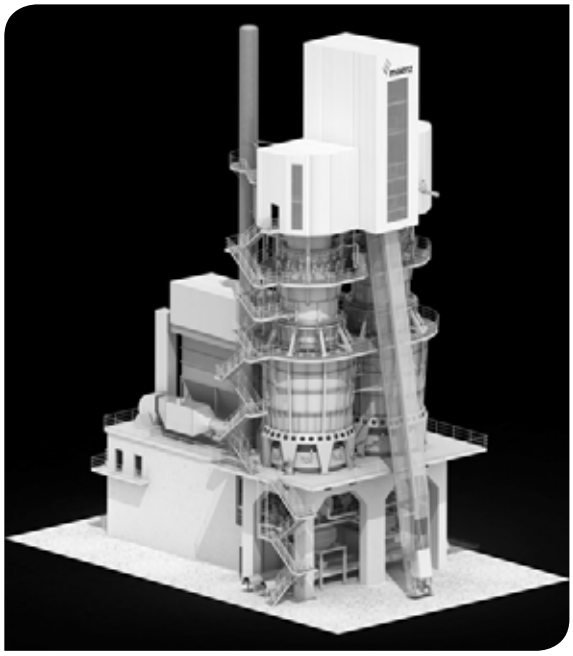
Hannes Piringer, Technical Director, Maerz Ofenbau AG

High-pressure fans save 25% of electric power consumption in PFR lime kilns

Maerz has dramatically improved the electrical efficiency of its PFR kilns.

The most efficient and ecological way to calcine limestone and dolomite is to use modern shaft kilns. The PFR lime kiln has proven its worth due to its ability to produce highly-reactive lime with the highest thermal efficiency of all lime kiln types available. Indeed, it is now almost impossible to further reduce the thermal energy consumption of such kilns.

PFR lime kilns work at positive pressures of up to 45kPa. They use roots blowers to compress combustion and lime cooling air with an efficiency of only 60%. High-pressure radial fans (Figure 4) provide pressures of up to 50kPa with efficiencies of 80%. Using these fans instead of roots blowers reduces the electrical power consumption by 25%.



Left - Figure 1: A typical PFR lime shaft kiln for production rates up to 800t/day.

Technical considerations

The turndown ratio of PFR lime kilns is usually 50% without a significant impact on thermal efficiency. Combustion and cooling air flow are almost proportional to the production rate. The gas flow through the packed material bed causes the main pressure drop.

The Ergun equation (Figure 2) provides a method to calculate the pressure drop in packed bed reactors. The first term in the equation shows a linear and the second term a quadratic dependency of the gas velocity. The PFR kilns work with relatively high gas velocity compared with other shaft kiln types and the second term dominates.

Figure 3 shows typical performance curves of a high-pressure radial fan with resistance curves of a typical PFR lime kiln. Radial fans provide an almost constant efficiency relating to speed control, as long as the system resistance curve conforms to the square law. The diagram also shows the operating range (yellow area), with the best efficiency. The fan should not operate in the 'unstable operating range' i.e.: the grey area on the left side of the diagram. In this area an aerodynamic stall at the rotor blades causes vibrations. An inlet vane control reduces this behaviour significantly.

High-pressure radial fans operate with velocities at the blade tips of up to 260m/s. The mechanical stress in the rotor is therefore high. This stress must be maintained constantly, as too much variation could adversely affect the fatigue strength, as well as service life.

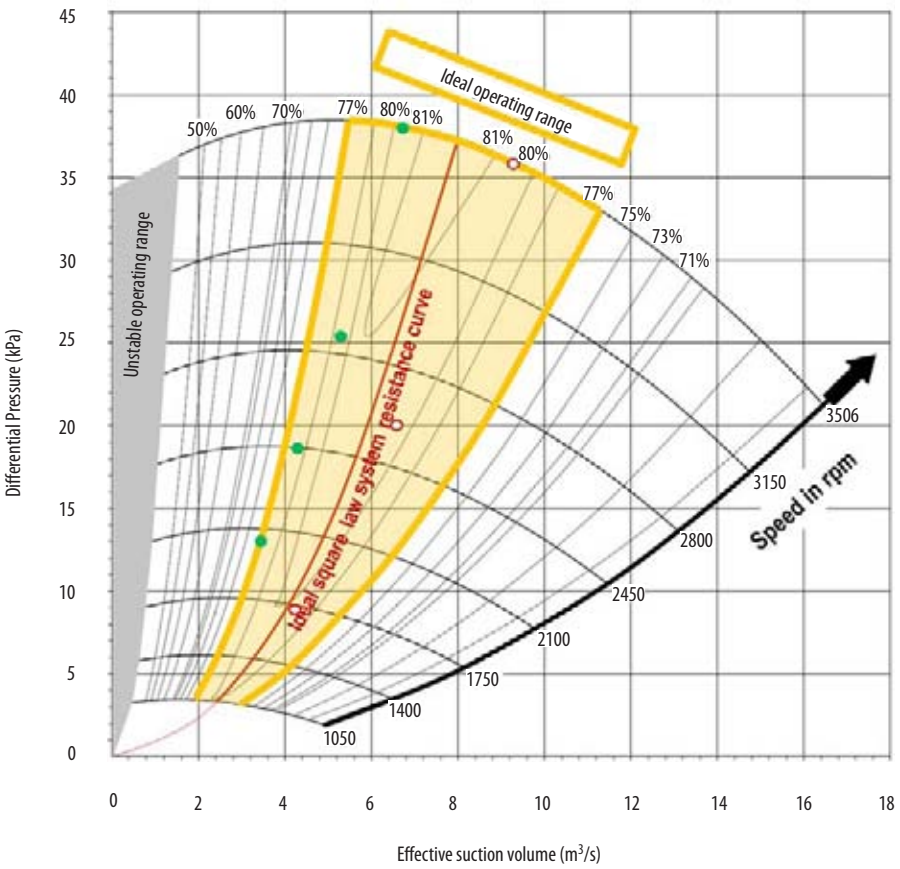
PFR lime kilns operate cyclically with typically 100 burning cycles per day. Between these burning cycles, there is a reversal time to direct the combustion air from one shaft to the other shaft. It is essential to interrupt the air supply to the lime kiln during such periods.

Maerz Ofenbau AG has developed a new PFR lime kiln process (patent pending), considering the above-mentioned conditions. This process comprises a new reversal sequence to avoid vibrations and to avoid affecting the service time of the high-pressure fan's rotor.

$$\frac{\Delta p}{\Delta z} = \rho_g \cdot \left(150 \cdot \eta \cdot \frac{(1-\varepsilon)^2}{\rho_g \cdot \varepsilon^3 \cdot d_k^2} \cdot u_B + 1.75 \cdot \frac{1-\varepsilon}{\varepsilon^3 \cdot d_k} \cdot u_B^2 \right)$$

Left - Figure 2: Ergun equation.

Δp = Pressure drop (Pa).
Δz = Height of layer (m).
ρ_g = Gas density (kg/m^3).
η = Dynamic viscosity of gas (kg/ms).
ε = Void space of bulk.
d_K = Representative diameter of ball (m).
u_b = Velocity in direction of the axis of the zone (m/s).



Above - Figure 3: Performance curves of typical high-pressure fan with resistance curves of a typical PFR lime kiln.

Real system resistance with natural gas firing.

Real system resistance with petcoke firing.

An additional advantage over the existing technology with roots blowers is that radial fans provide a gapless operating range for the lime kiln of 35-100% of the production rate. To date, most of the PFR lime kilns are equipped with a number of fixed-speed roots blowers and only one variable speed blower. A gapless operating range was not available with this system.

Commercial considerations

Previously, a typical air supply system for a large PFR lime kiln comprised 4-5 roots blowers for combustion air and 3-4 roots blowers for cooling air. Today the same kiln only needs one high-pressure radial fan for combustion air and another for cooling air. Less space and a smaller blower house is required. The overall investment costs with high-pressure radial fans are lower.

The savings in electric power consumption are in the range of US$160,000-200,000/yr for a 600t/day PFR lime kiln, based on an energy price of US$0.1/kWh. Replacing roots blowers on existing PFR lime kilns is commercially interesting, particularly when the roots blowers are at the end of their lifespan.

Below - Figure 4: A typical high-pressure fan made by Germany's Pollrich.

A contribution against climate change

A typical PFR lime kiln consumes around 40kWh for the production of one tonne of quicklime. High-pressure fans reduce the electric power consumption by 10kWh/t of lime. Considering a global lime production of 350Mt/yr, the magnitude of the savings' potential is around 3.5TWh/yr. CO_2 emissions from lime production could be reduced by 1.75Mt/yr.

Summary

For more than 60 years, PFR lime kilns have proven their worth in the lime, steel and mining industries, as they provide the highest thermal efficiency of all lime kiln types available. A large number of PFR lime kilns are in operation worldwide. All of them work with positive pressure of up to 45kPa. In all of these PFR kilns roots blowers compress the process air, which is mainly combustion and cooling air. Until today, nobody questioned whether it was possible to make adjustments in order to save electric energy. With roots blowers the specific electric power consumption averages at about 40kWh/t of lime.

Maerz Ofenbau AG has recently developed a new PFR kiln process, which uses high-pressure radial fans. In comparison to roots blowers, which have an efficiency of only 60%, the high-pressure radial fans provide an efficiency of 80%. In combination with the new PFR lime kiln process, high-pressure radial fans are perfectly suitable for both new PFR kiln models, as well as for revamping existing PFR lime kiln plants. The result is 25% lower electrical power consumption, which provides not only a contribution to limiting global warming, but also reduces plant operating costs.

Contents
Subscribe
Ad Index

India: KHD Humboldt Wedag to supply UltraTech

UltraTech Cement has awarded Germany-based KHD Humboldt Wedag a contract relating to three new kiln lines, one new raw meal grinding plant with two KHD roller presses, and the upgrade of five existing clinker grinding plants with KHD roller presses. KHD said that the engineering and supply of equipment as well as supervisory services related to erection and commissioning, comprised a potential order volume of more than Euro30m. It added that UltraTech Cement and Humboldt Wedag India are currently negotiating, with the aim of concluding a corresponding Engineering and Procurement (EP) contract package.

Mexico: Holcim Supra range launched

Holcim Mexico has launched its Holcim Supra range of cements. The company says that products contain a unique three-in-one technology for water repellence, construction optimisation and protection against environmental agents. It says that the use of Holcim Supra cements gives buildings greater sustainability compared to ordinary Portland cement (OPC).

Colombia: Holcim launches Eco range

LafargeHolcim subsidiary Holcim Colombia has launched Eco, a cement bag label detailing a product's CO_2 emissions reduction by comparison to Ordinary Portland Cement (OPC), on its Boyacá Súper Fuerte and Holcim Maestro cements. The La República newspaper has reported that the labels signal the company's commitment to the Business Ambition for 1.5°C anti-climate change initiative.

Philippines: CBMI Construction lifts Solid's new kiln into place

Cemex Philippines' Solid Cement plant in Antipolo has lifted a new rotary kiln into position as part of a US$235m installation of a new production line at the site. Once complete the new line will add 1.5Mt/yr to the unit's production capacity, increasing the total to 3.4Mt/yr. The new production line will use waste hot gases to dry raw materials and high efficiency bag filters to improve emissions control. Cemex is also using its proprietary Low Temperature Clinker technology to reduce carbon dioxide emissions.

"This milestone demonstrates our full commitment to the development of the country and brings us closer to further strengthening our position in providing the infrastructure and building needs for economic development," said Ignacio Mijares, the chief executive officer and president of Cemex Holdings Philippines.

China-based CBMI Construction has been contracted to build the new line. It lifted the new kiln in two days. Tong Laigou, chairman and general manager of CBMI Construction, said that the CBMI and Cemex Philippines' teams worked under strict protocols to secure the safety of the site.

Brazil: Votorantim's bags dissolve

Votorantim Cimentos is testing the use of dissolvable cement bags in a pilot project with paper and bag manufacturer Klabin. Following development, the new bag type will be tested in a pilot project in the south of the country based around the Rio Branco do Sul cement plant in Paraná state. The bags can be dissolved directly in a mixer when making concrete to speed up the process.

France: Fives refurbishes kaolin plant

Fives has refurbished a rotary kiln at SOKA's (Société Kaolinière Armoricaine) kaolin plant at Quessoy. Work on the project included: implementing a new nose-ring fitted with a downstream seal, to reduce false air flow and improve brick-lining lifetime; machining the tyres, replacing of the rollers and installing a new lubrication system, to improve the kiln scanning and enable an homogeneous wear of the contact areas; and installing a grease spraying system fitted with a new girth gear housing to prevent advanced wear initiated by grease contamination.

India: Hasle castable for Asian Cement

Denmark-based Hasle has supplied a Hasle D59A coating-resistant castable to Asian Cement for use on the inlet chamber and riser duct at its cement plant. The supplier supervised installation. It said that the castable will reduce the required lining materials of the equipment, resulting in savings.

Spain: Cemex supplies cement and concrete to Teruel Airport Platform

Mexico-based Cemex has supplied 30,000t of cement and 100,000m^3 of concrete for an expansion of Teruel Airport Platform (PLATA) maintenance, repair and operations airport in Teruel, Aragon. The company said that the expansion consists of a 3km runway, terminals, an expanded parking platform and two new hangars, in addition to an industrial zone and other facilities. The airport's current expansion phase requires a further 40,000m^3 of concrete.

Europe, Middle East, Africa, and Asia regional president Sergio Menéndez said "Since the beginning of the Teruel Airport project more than a decade ago, Cemex has been present in its construction and continuous expansion. We are proud to have contributed to this infrastructure, becoming an engine of economic recovery."

UK: Cemex supplies concrete for Thames Tideway sewer project

Cemex will supply 40,000t of lining-sprayed concrete for the construction of the 13km central section of the Thames Tideway sewer project in Greater London. Engineering partners Ferrovial Construction and Laing O'Rourke will use the concrete for shafts and launch tunnels. The company produced the concrete at its Buxton, Derbyshire concrete plant. It says that it offers ultra-high strength, consistency and two-hour workability in line with the stringent requirements of the job. It also needs to be pumpable with a pipeline length of up to 400m. The producer will deliver up to 3000t/month of the concrete to Central London over 'a few months.'

Europe, Middle East, Africa and Asia president Sergio Menendez said "The Thames Tideway Tunnel project is one of incredible scale which will solve serious capacity issues with London's sewer system and have considerable benefits for the area's wildlife and population, while also preventing pollution, creating jobs, a rejuvenated river economy and new areas of public space." He added "This is a remarkable piece of engineering and we're proud to be working with world-class contractors to build this key infrastructure in the most sustainable and cost-effective way possible for one of the world's greatest cities."

UK: Yorkshire Water trials concrete surface application

Yorkshire Water is trialling a new concrete surface application designed to prolong the lifespan of concrete. It says that the alumina and zirconia silicate ceramic surface treatment protects concrete from wet/dry and freeze/thaw cycles, peeling, flaking, chalking and delaminating. This reduces the need for replacement of concrete structures, reducing CO_2 intensity by 43% compared to bare concrete, according to the company. Advanced materials producer Haydale supplied the product.

Senior project manager Jonathan LeMoine said "In early 2021 we will be using one of our capital partners to apply the material to a number of our chemical bunds. The results will be immediately apparent and will pave the way for a larger programme of works protecting our assets." He added "We often invest in trialling new technologies and techniques to pave the way for lower emissions in our capital expenditure and operating expenditure solutions. We're excited to see the results from this trial, and hope that it will provide a low carbon alternative to demolishing and rebuilding."

Spain: Cementos Molins increases Escofet stake

Cementos Molins has increased its stake in concrete design specialist Escofet to 76% from 37%. The company says that it hopes to retain the public architecture producer's management team. It said that it will integrate the subsidiary under its prefabricated concrete division to combine industrial expertise with design excellence.

Chief executive officer Julio Rodríguez said that the company's 2020 – 2022 strategy prioritises "both organic and inorganic growth," seeking new acquisitions while "maintaining financial discipline and selecting projects where the return on investment is clear."

Switzerland: Holcim Switzerland buys electric mixer trucks

Holcim Switzerland has started using three full electric concrete mixer trucks. The subsidiary of LafargeHolcim is working with Designwerk, a Switzerland-based company specialising in the electric mobility sector. Designwerk has equipped a motorless basic chassis of a Volvo vehicle with electric motors for both locomotion and the mixing drum. This is intended to be sustainable and offer quiet driving, mixing and unloading. The three vehicles are expected to save around 90t/yr of CO_2.

The trucks are labelled with the Futuricum brand and are active in the St Gallen, Zurich and Basel regions. The building materials company says that electric vehicles suit concrete logistics because they cover relatively short transport routes and have a fixed starting point with a battery charging station in the Holcim concrete works. Holcim says it obtains the electricity it needs exclusively from renewable energy sources.

Interview by Peter Edwards, Global Cement Magazine

COBOD: 3D Printing with concrete

Global Cement recently spoke with Henrik Lund-Nielsen, the founder of the Danish 3D concrete printing equipment manufacturer COBOD, about the company and its vision for the construction sector of the future.

Above: Henrik Lund-Nielsen founded COBOD in 2017. He has previously been involved in a number of other businesses in the building materials sector since 2006, having spent 15 years in senior positions at blue chip companies. In 2021 COBOD employs 40 people at its site in Copenhagen Harbour in Denmark.

***Global Cement (GC):* What led you to establish COBOD and develop 3D concrete printing?**

Henrik Lund-Nielsen (HLN): I founded The 3D Group in 2014 along with a team of others that knew the 3D printing sector. I was one of five older guys who had seen the disruption brought about by the advent of desktop computing and the switch from fixed phone lines to mobiles. We thought that 3D printing would be another moment where technology is going to disrupt a lot of businesses.

We wanted to develop 3D printing technology to be ahead of the curve. At first, we didn't know which area the company was going to target with any technology that we developed, but it became apparent fairly early on that construction could be a major market. I saw that a significant number of construction firms were considering it, so we decided to team up with some other people to look at the possibilities. We hired people with 10-20 years' of 3D printing know-how.

As we developed our approach, we investigated the cutting edge in 3D printed buildings using a grant from the Danish government. We visited dozens of projects and held two conferences in 2017. During our internal discussions after the first event in February 2017, we realised that not one of the project teams had said 'We will build the first 3D printed building in Europe.' So I said to the team, 'Let's do it!' That's when we founded COBOD. I thought something would have stopped us by now, but that hasn't happened so far.

***GC:* So what did you do?**

HLN: We developed the BOD 1 printer, which was a state-of-the-art design, during six months in 2017. By September 2017, we were ready to start printing the first BOD Building, a 50m^2/yr port-side structure in Copenhagen Harbour. It is just around the corner from where we are based today.

We started printing on 11 September 2017 and it took around two months. We have since taken construction times down considerably. After the BOD Building was made, a lot of parties asked if we could print buildings for them. At that point we took the decision to step back and say, 'We are a technology company, not a builder.'

The response to this from the market was that they would like to buy a printer, but we felt the technology was not ready to be 'unleashed.' This is why we developed the BOD 2 printer during 2018. We began selling it in early 2019.

Right: Demonstration of the BOD 2 Printer in Copenhagen.

During this process Germany's Peri Group, which operates within formworks and scaffolding equipment, became an important minority shareholder. This was important because it is a traditional concrete building equipment supplier entering the world of 3D printing. It gave us an important dose of credibility.

Above: Peri constructed the world's first three-storey 3D printed building in Germany using a BOD 2 Printer.

***GC:* What 'firsts' has COBOD been involved with?**

HLN: After the original BOD building, which was the first 3D printed structure in Europe, the BOD 2 printer was used to build the first 3D printed two-storey building in Europe in Belgium. Then came the first three-storey building in the world, in Germany, printed by Peri. Our technology has also been used by a LafargeHolcim subsidiary to print the first 3D printed building in Africa and L&T Construction constructed the first two-storey 3D printed building in India. COBOD has also 3D printed wind turbine towers for GE using LafargeHolcim concrete. It has been an exciting ride so far.

***GC:* What is the financial model for COBOD at the moment?**

HLN: At present we sell the BOD 2 printer, with double digit references. Of course, we support the customer extensively after they have purchased the equipment to ensure that they can get the most out of it and are successful. In the longer term leasing would be a viable approach, but we need a certain maturity in the market that isn't there yet. A 3D concrete printer is not a very common piece of equipment. Of course we would like it to become one in the future. At the moment, we are ahead of the game and have a unique market position. We are the only company selling gantry type 3D printers to the constrution sector.

***GC:* Are all BOD 2 printers the same, or are there small differences?**

HLN: The BOD 2 printer is modular, so they are scaled for the kinds of building that the customer wants to print. The biggest we have supplied so far is 27m long. For length, we can go as long as you like, it's like building a track. There are currently limits of 15m on width and 10m on height. We are on a mission to change that.

***GC:* What are the capabilities of the most developed printer?**

HLN: As the equipment supplier, COBOD defers to its clients regarding how long it takes to build a given structure. However, I can explain the improvements that COBOD has already made compared to the early days. The original 50m^2 BOD Building took two months to build. We didn't know how it would go, we made a lot of mistakes and we learned a lot. In 2019 we decided to use our experiences of the BOD 2 printer to print another copy of the building, exactly the same. It took 28hr. That's an improvement of over 20 times and it's not the end of the story. Even in that print run, we printed more building in the last 8hr than in the first 20hr. We learned on the job. I estimate that a third run would have taken the time down to 8-10hr, with an eventual target time in the range of 4-5hr.

Another example: We printed the first 3D printed wind turbine tower ever. It took three weeks. The client, GE, was very impressed but we knew we could do better. I told them that we had learned enough from the first run to complete it in three days. A second turbine, 75% larger than the first, was subsequently printed in 76hr. A seventh of the time. Again, this time is not even close to the optimum. I hope this shows the possibilities!

***GC:* What do you have to change within the concrete mix to make it suitable for 3D printing?**

HLN: There are two options. The first is dry-mix mortars with a maximum particle size of less than 4mm. These are typically made by cement manufacturers and we have helped several producers optimise these for 3D printing. Mortars are a relatively easy technology to optimise and use on site, but they are also incredibly expensive.

The much cheaper alternative is to mix the concrete on-site, although this is more difficult.

The printer can handle particles up to 10mm, so it can process a lot of different types of blends. The issue now is that we need it to cure faster because we are going faster and faster with the printer. This requires additives, the exact nature of which will depend on the situation.

***GC:* What was the most difficult part of developing the BOD 2 printer?**

HLN: The joins where different modules meet have to be extremely well aligned so there is no disturbance of the printer head as it travels from module to module. If there is the slightest difference there is the opportunity for errors. You need to use high precision steel.

***GC:* Do you ever get a 'printer jam?'**

HLN: On the whole, no. Almost every time that something doesn't work it's not the printer itself but some other part of the overall system, for example a concrete pump or mixer.

***GC:* Where are the printers manufactured?**

HLN: We assemble the printers in Copenhagen using high-precision parts manufactured by a number of suppliers.

***GC:* How does a 3D printed building compare to traditional methods?**

HLN: 3D printing is a lot quicker than traditional methods. In addition, we can prepare the building much better for other trades that come after us. For example, we can leave spaces for electrical sockets and plumbing, which makes subsequent installation quicker, cheaper and less wasteful. The cost-to-build benefits are significant.

Think of the staff costs. Running a printer takes two people: one to control / monitor it using a laptop and one to ensure there is enough concrete in the silo. There is no need for a swarm of people all over the building. Safety is also massively improved because the machine does everything for you.

***GC:* What are the CO_2 benefits of 3D printing?**

HLN: Of course using concrete as a material does not start us off in the best place regarding CO_2 emissions. As a 'green guy' this is not a comfortable position for me. However, we are on a constant quest to improve the sustainability credentials of the materials our printers can handle via the inclusion of supplementary materials and additives in collaboration with our cement sector partners. Even in the first BOD Building we used 20% recycled ceiling tiles.

However, 3D printing has a generic advantage in that you only use what you need. The level of waste is so much lower. There are no holes to drill, no precast pieces to cut in half, very little waste indeed.

***GC:* How does a 3D printed building compare in terms of strength and durability?**

HLN: This is a question that comes up very often, particularly in the early days, when we were asked what the expected lifetime of the building is. Our response is always the same: We expect them to go on and on and on. There is no acceptable lower limit as far as we are concerned. There is no technical reason why they shouldn't last hundreds of years. Once a client comes to see the BOD Building, they understand what we mean. There are no weak points, no joins. Not only are they made of strong material, they are monolithic and built to last.

Below: Printing buildings reduce manpower costs. Image taken in Malawi. **Credit:** 14 Trees / LafargeHolcim.

***GC:* Are the 'rough-and-ready' aesthetics a disadvantage for 3D printed buildings?**

HLN: I would have thought that clients would prefer smooth walls rather than the look of the 3D printed style. However, many people we deal with actually like the 3D printed look. One client in the Middle East even made it a selling point.

That said, the BOD 2 printer can print incredibly smooth surfaces. In the longer term, I think that smooth surfaces will continue to be the preference once the novelty of 3D printing wears off.

***GC:* Are there any types of building that are well suited to 3D printing?**

HLN: 3D printing has an advantage for any surface that is curved or walls with

overhang, i.e. is not completely vertical. Obviously there are physical limits - we can't print in thin air - but there are many possibilities for new and exciting architectures with 3D concrete printing. This is a competitive advantage. Regarding types of building it could be offices, retail, housing, light commercial, anything that fits in the 'print area.'

***GC:* Are there any world regions where this technology is particularly relevant?**

HLN: If you had asked me two years ago I would have said that 3D printing would be a low-labour technology for developed markets. However, in 2020 we sold in Africa, India and the Far East, indeed we sold as many units to these developing markets as we did to established ones. This was a surprise but the answer lies in the massive need for easy-to-build affordable housing in such markets. I cannot answer as to where the biggest market will be in the longer term. The US is also strong.

***GC:* What are your expectations for 2021?**

HLN: In 2021 we anticipate significant growth in terms of BOD 2 printer sales. We hope to sell as many in 2021 as we did in 2020 and 2019 combined.

***GC:* What do you want to see at COBOD over the next five years?**

HLN: I hope that in five years we can go to 6-7 storeys with wider and taller printers. These will use more than just concrete as we are expanding into multi-functional robotics. This will mean that, after we have printed the concrete structure, we will plaster, insulate and paint the building too. This requires relatively little additional technology on top of what we have already developed and for us it's a 'no brainer.'

We will have the first glimpse of this future at the end of 2021 with the launch of the BOD 3 printer. In 2022 we will use this in a new pilot project in Denmark where a lot of the construction and finishing will be taken care of by the one machine.

***GC:* What is the biggest barrier to the development of 3D printed structures?**

HLN: Conservatism in the construction sector is a major hurdle for us to overcome. Construction is such a conservative industry and, even though we are working with cutting-edge partners, there are many more not currently willing to take the plunge.

Another limitation is permitting. There are many cases out there where the present rules do not take new approaches like 3D printing into account. Right now, we have to adapt to the building codes, which are written for older technologies. We are being forced to construct, in many markets, structures that don't fully take advantage of the technology we have at our disposal.

Above: The BOD 2 Printer can print smooth surfaces rapidly.

***GC:* What are the biggest opportunities for COBOD over the next five years?**

HLN: If you had told me in 2018 that I would be working alongside Peri, LafargeHolcim, GE and L&T as partners, I would have told you you were dreaming. We are extremely fortunate to work with these parties and others, and have been able to develop our technology rapidly alongside them. These partnerships, combined with COBOD's internal know-how, should lead to many more opportunities in the coming years.

We are always open to partnerships with any interested party. We need a range of actors to join hands to develop this technology to its full potential. 3D printing could quite literally reshape the sector as we know it.

GC: Henrik Lund Nielsen, thank you for your time.

HLN: You are very welcome Peter!

Below: 3D Printing opens up the possibilities of freeform building architectures.

Sabine Maier, Axians-IAS

Improved logistics for HeidelbergCement

Looking at the installation of an Axians-IAS logistics portal for HeidelbergCement.

Various plants in the global cement, aggregates and concrete business areas are currently being equipped with the VAS® integrated logistics solution from Axians Industrial Applications & Services GmbH. The company was selected by HeidelbergCement as a suitable partner and preferred supplier due to its international experience as a hardware-independent IT specialist in an industrial environment and its flexibility in connecting to SAP.

An initial logistics portal that had been created specifically for HeidelbergCement's cement operations went live back in 2015. The project team at that time had created an unprecedented online tool that revolutionised the entire ordering process in the bulk materials industry. This was not only a relief for HeidelbergCement, it also offered several advantages for the customers.

The portal was upgraded in 2020 to additionally accommodate HeidelbergCement's sand and gravel operations, with attention paid to three areas in particular:

1. Optimisation of automation processes, especially for sand and gravel for shorter gate-to-gate times;

2. Development and implementation of a special 'All IN ONE' mask for faster manual handling of trucks;

3. Development and implementation of a wheel loader application for the online and off-line operations.

A top priority of the project was to integrate the three above challenges into the software solution in the best possible way. Above this, the project also sought successful synchronisation and the development of synergies between the two divisions, cement and aggregates. This was achieved by means of a VAS® template. Due to highly-restricted working practices surrounding the Covid-19 pandemic, the project team also had to deal with the following challenge: How to bring all of the sand and gravel plants online without being on site?

As part of the further consistent digitisation and optimisation of HeidelbergCement, an integrated material flow management system will also be introduced to achieve significant savings in logistics costs throughout the group. Based on this ongoing development process, HeidelbergCement has already been able to provide very effective remote access, which enabled a smooth 'go live' of all plants.

"This was an exceptionally good cooperation and an outstandingly good result," said Alexander Müller, the IAS team member responsible for leading the project. He led the Axians-IAS team throughout the project, working closely with senior HeidelbergCement staff and its wider workforce.

Project outcomes

With the installation of the new Logistics Portal, HeidelbergCement can today not only offer its customers a portal to cover the cement distribution process, but it also has a dedicated solution for its entire sand and gravel plant network.

Left: Axians-IAS has upgraded and expanded HeidelbergCement's logistics portal, bringing benefits to the company and its clients.

Italy: Buzzi Unicem holds steady in 2020

Buzzi Unicem's net sales remained stable at Euro3.22bn in 2020. Cement sales volumes grew slightly to 29.3Mt and ready-mixed concrete sales fell by 3.1% year-on-year to 11.7Mm^3 from 12.1Mm^3. The group attributed this to growth in the US and stable markets in Russia and Germany, compensating for weaker trends in Eastern Europe and Italy.

Italy: Cementir Holding's full-year sales and volumes increase

Cementir Holding recorded revenues from sales and services of Euro1.22bn in 2020, up by 1% year-on-year from Euro1.21bn in 2019. Cement and clinker volumes rose by 13% to 10.7Mt from 9.49Mt. Volumes increased most rapidly, by 39%, in Turkey Ready-mixed concrete (RMX) volumes grew by 7.8% to 4.4Mm^3 from 4.1Mm^3. The company maintained its 2019 earnings before interest, taxation, depreciation and amortisation (EBITDA) levels of Euro264m. It said that an improvement in performance in Turkey, Denmark, Egypt, China and Sweden balanced out negative effects on earnings in Belgium, US and Malaysia.

Chair and chief executive officer Francesco Caltagirone said "In 2020, despite the serious pandemic, the group showed significant resilience with a 13% increase in cement volumes sold and revenue reaching the historical record. On a recurring basis, EBITDA increased by 2%, EBIT was up by 4% and yearly cash generation was Euro119m."

Under its 2021 – 2023 Industrial Plan, the company says that it envisages sales growth of 20% to Euro1.47bn and EBITDA growth of 29% to Euro340bn in 2023 compared to 2020 figures. It said that digitalisation investments begun in 2019 will contribute an expected Euro15m to EBITDA in 2023.

The group is planning to invest around Euro107m from 2021 to 2023 on sustainability and digitalisation. This includes the construction of a new calcination plant in Denmark for the production of its Futurecem product and the installation of wind turbines with an installed capacity of 8.4MW. It is also planning to increase the alternative fuels substitution rate at its integrated Gaurain plant in Belgium to 80% from 40% and invest in the use of natural gas and biogas in some of its plants.

France: Lafarge France to convert Contes cement plant into terminal

LafargeHolcim subsidiary Lafarge France plans to stop cement production at its integrated Contes cement plant in Alpes-Maritimes department and convert the site into a terminal instead. France Bleu radio has reported that the company has announced the loss of 65 jobs. The company promised to take measures to avoid forced redundancies, including offering positions at other Lafarge France sites and help with retraining. The union representing workers at the plant says that the total number of jobs at risk is 300. The producer said that its Bouc-Bel-Air (La Malle) integrated cement plant in Bouches-du-Rhône department near Marseille will provide jobs for truck drivers and subcontractors. It said "This will require additional industrial maintenance and increase logistics needs. These jobs are not threatened, they should even develop."

Six workers will stay on at the Contes facility after the end of cement production.

Source: Shutterstock

Latvia: Schwenk Latvija plans Euro34m Broceni plant upgrade

Schwenk Building Materials Group subsidiary Schwenk Latvija plans to invest Euro34m in installing a new 170t/day grinding mill and 12,500t silo at its Broceni cement plant. The Baltic Business Daily newspaper has reported that the company aims to reduce energy consumption with the new mill.

The group acquired the plant from Cemex in February 2019 as part of a Euro340m expansion into the Baltic and Nordic markets. The company's 2019 profit was Euro36.4m.

Italy: Italcementi's Bergamo research centre to stay in Italy

An agreement between Italcementi and its unions has confirmed that its Bergamo research centre will stay in Italy. The agreement with the FenealUil, Filca-Cisl, Fillea-Cgil and Italcementi RSU unions is intended to preserve jobs at the company, maintain at least 15,000 hours/yr of research at the site and dedicate at least 1% of the company's profits towards research and innovation. Parent company HeidelbergCement was reportedly considering a relocation of the centre to Heidelberg in Baden Württemberg, Germany in late 2020.

UK: SigmaRoc launches cement-free concrete block

SigmaRoc has launched Greenbloc, a cement-free concrete block. The product reduces emissions by 77% compared to concrete blocks produced with ordinary Portland cement (OPC), corresponding to a reduction of 1.1kg/block.

Chief executive officer Max Vermorken said "Our Greenbloc range and brand is the brainchild of our innovation and technical teams. It addresses a key challenge in the building products industry - the embodied CO_2 in one of the most widely used building materials: the concrete block. Greenbloc is only the start of a range of sustainable alternatives to our product offering as we invest, improve, integrate and innovate."

GLOBAL CEMENT NEWS: *EUROPE*

Belgium: Cembureau calls for free allocation to be retained during EU's Carbon Border Adjustment Mechanisms roll-out

The European cement association Cembureau has called for the European Union (EU) to continue to permit the free allocation of carbon credits under the EU Emissions Trading System (ETS) until it completes the roll-out of Carbon Border Adjustment Mechanisms (CBAM) in 2030 at the earliest. It said that this would provide indirect cost compensation and mitigate the risk of the relocation of industries. It would additionally incentivise emissions reduction by EU suppliers, ensure a smooth implementation of CBAM in the event of challenges to CBAM by the World Trade Organisation (WTO) and mitigate distortions on the EU internal market, according to the association. It gave the example of cement producers competing with other building materials producers as a way in which an overlap period can limit the disruptive impact of CBAM on European value chains.

Chief executive officer Koen Coppenholle said "A pragmatic approach is needed regarding the interaction of CBAM with the existing carbon leakage measures. A full co-existence of CBAM and free allocation is essential to minimise risks for the industry, avoid distortions on the internal market, safeguard the competitiveness of exports and provide certainty for investors. Such full co-existence, which can be done without any risk of 'double protection,' should last at least until the end of Phase IV of the EU ETS in 2030, following which the CBAM will hopefully be mature and expanded to cover most sectors of the economy." He added "CBAM is a useful tool to address the imports of products not subject to similar carbon constraints in the EU and therewith mitigates the carbon leakage risk allowing the European cement industry to deliver low-carbon investments."

US: PCA welcomes US Paris re-entry

The Portland Cement Association (PCA) has welcomed the new administration's plan to re-enter the Paris Agreement to reduce global greenhouse gas emissions. President and chief executive officer Michael Ireland said "Climate change is one of the greatest challenges of our time. The cement and concrete industry have an important role to play in decarbonising the manufacturing sector while providing the building materials necessary for a safe, resilient, and sustainable economy."

PCA government affairs senior vice president Sean O'Neill said "Federal policymakers will have a particularly important role to play. Some of the technologies needed to tackle industrial decarbonisation are still in the research and development phase. Governmental support is needed to accelerate both development and deployment. We also need to make sure that federal policies support industrial decarbonisation without undermining the competitiveness of US manufacturers." He added, "Climate change is a global issue, and it will require global co-operation. The US cannot solve this problem alone."

Canada: Lehigh Cement begins CCS feasibility study at Edmonton cement plant

Lehigh Cement and the International CCS Knowledge Centre are conducting a feasibility study looking at carbon capture and storage (CCS) at the Edmonton cement plant in Alberta. The project aims to find out whether capturing 90 – 95% of the CO_2 from the plant's flue gas is viable. Completion of the study is scheduled for the autumn of 2021.

The Lehigh CCS Feasibility Study will consider an engineering design using carbon capture technology owned by Japan-based Mitsubishi Heavy Industries Engineering (MHIENG), part of MHI Group. The KM CDR process, which is being deployed at 13 commercial plants globally, will be examined for integration with Lehigh's plant and output specifications, such as a flue gas pre-treatment system and the carbon capture and compression process.

The aims of the study are: to deliver a Class 4 cost estimate; to work with a capture technology provider (MHI Group) to perform engineering design tailored to the Lehigh plant; to manage the process and engage third parties, as necessary; to complete a detailed business case; and to develop the budget for Front End Engineering Study (FEED). The project has received US$1.4m in funding from Emissions Reduction Alberta (ERA) through its Partnership Intake Program.

US: LafargeHolcim and Massachusetts Institute of Technology launch MIT Climate and Sustainability Consortium

Switzerland-based LafargeHolcim has become a founder member of the MIT Climate and Sustainability Consortium with the Massachusetts Institute of Technology (MIT). The group says that the consortium aims to accelerate climate action through innovation. It says that it will represent the building materials industry in working with MIT's research team to develop 'scalable solutions' to tackle climate change. It joins 12 other companies, including Apple, Boeing and IBM.

Chief executive officer Jan Jenisch said "I am committed to building a net zero future, driving innovative and sustainable building solutions that work for people and the planet. With the urgency of today's climate crisis, no single organisation can tackle it alone. That's why I am proud to be joining MIT's alliance of like-minded industry leaders and academic partners."

Mexico/US: Cemex fires up kiln at CPN cement plant to supply southwest US

Cemex has invested US$15m in recommissioning a 1Mt/yr cement kiln at its CPN cement plant in Hermosilla, Sonora. The decision is intended to reduce cement shortages in the western US and bolster its supply chain in Arizona, California and Nevada. The project at the CPN plant is scheduled for completion in the second quarter of 2021 and will create 130 jobs.

Cemex USA cement commercial executive vice president Joel Galassini said "Many cement customers in California, Arizona and Nevada have been impacted by supply constraints this past year. The decision to recommission this kiln was made with our customers top-of-mind, to give them reliable access through a local supply chain to help meet their growing needs. Our network of production facilities in this region allows us to make these types of investments that will have a meaningful impact on meeting our customers' needs."

California regional president Francisco Rivera said "We are excited to build greater synergies with our Mexican operations to strengthen our US cement supply chain and help our customers avoid or mitigate any potential delays to their projects in 2021."

Peru: UNACEM's 2020 sales fall

Unión Andina de Cementos' (UNACEM) income fell by 14% year-on-year to US$467m in 2020 from US$546m in 2019. Cement despatches dropped by 16% to 4.46Mt from 5.32Mt. Its profit decreased to US$8.3m from US$96m. The cement producer attributed the reduction in sales and profits to the country's coronavirus-related lockdown from March to May 2020. In December 2020 it agreed to buy Chile-based Cementos La Unión Chile for US$23m. The deal includes the 0.3Mt/yr San Antonio grinding plant and a concrete plant.

US: Eagle Materials reports rise in nine-month sales to US$1.28bn

Eagle Materials' sales in the nine months up to 31 December 2020 rose by 16% year-on-year to US$1.28bn from US$1.10bn. Its net earnings were US$273m, compared to a loss of US$1.54m in the first nine months of its 2020 financial year. Volumes rose by 28% to 6.1Mt from 4.8Mt, and cement sales revenue rose by 35% to US$676m from US$502m.

President and chief executive officer Michael Haack praised the performance in the quarter which ended on 31 December 2020, saying "Our cement shipments were up by 28% year-on-year, reflecting the strong performance of the recently acquired Kosmos Cement business and the strength of our core markets. We continued to generate strong operating cash flow, which significantly improved our balance sheet and liquidity position providing us with increased financial flexibility." He added "As we continue to navigate the Covid-19 environment, I want to thank our team for their exceptional work under extraordinary circumstances, delivering strong results, remaining focused on the integration of Kosmos and keeping our strategic projects on schedule. We continue to closely monitor the disruptions caused by the Covid-19 pandemic and their possible impact on our business in current and future periods. We also continue to enforce strict health and safety protocols to protect our employees, customers and business partners, and we will continue to manage our cash flow prudently and protect our balance sheet."

Canada: CO_2MENT Phase 2 completed at Lafarge Canada's Richmond cement plant

LafargeHolcim subsidiary Lafarge Canada, Svante and France-based Total have completed Phase 2 of the CO_2MENT carbon capture and storage (CCS) project at Lafarge Canada's Richmond cement plant. The completed phase consisted of construction and installation of the CO_2MENT technology to capture and filter the flue gas. Lafarge Canada said that Phase 3, scheduled for construction over the next three years, will include the installation of a liquefaction unit, the development of an expansion project to further reduce emissions and a business case review for further expansion across the Lafarge network.

Western Canada president and chief executive officer Brad Kohl said "This has been a turbulent year for business and people due to the Covid-19 pandemic with many large-scale projects being put on hold, but the perseverance that the people working at the Richmond cement plant continue to show is evident in this success. To continue leading change in the building materials industry means we are always looking to partner with like-minded thought leaders such as Svante and Total. This partnership is showcasing our drive towards a net-zero future. We are seeing this vision become a reality with the completion of this phase."

Brazil: CSN embarks as independent company

Companhia Siderurgica Nacional (CSN) subsidiary CSN Cimentos began operating as an independent company on 1 February 2021. The Valor Economico newspaper has reported that the move is a preliminary to a likely future initial public offering (IPO) in the near-term although no date has been set yet. Under the same strategy, sister company CSN Mineracao is due to launch its IPO of US$1bn on 18 February 2021.

The 4.7Mt/yr-cement capacity producer operates two integrated plants and it is planning an 8.6Mt/yr expansion consisting of an upgrade to its Arcos plant and three new cement plants at Pará, Paraná and Sergipe respectively.

Canada: Lehigh Cement launches blended Portland limestone cement

Lehigh Hanson has launched EcoCem Plus at its Edmonton cement plant in Alberta. The product is a blended Portland Limestone Cement (PLC) made by inter-grinding clinker, fly ash, limestone and gypsum. It is available in Alberta, Saskatchewan and Manitoba. The subsidiary of Germany-based HeidelbergCement says it provides strength and durability while reducing the carbon footprint of concrete.

"The motivation behind the EcoCem brand of products is to reduce the embodied carbon of cement and concrete," said Shawn McMillan, Vice President, Cement for Lehigh Hanson's Canada Region. "The introduction of EcoCem Plus to the Prairie market builds on our commitment to providing environmentally responsible types of cement that deliver excellent performance while dramatically reducing CO_2 emissions."

Canada: Svante raises US$75m

Svante has raised US$75m in an investment round. The financing was led by Temasek and includes strategic investors Chart Industries, Carbon Direct and Export Development Canada (EDC). Existing investors OGCI Climate Investments, BDC Cleantech Practice, Chevron Technology Ventures, The Roda Group and Chrysalix Venture Capital also participated.

The investment will allow the company to advance a number of initiatives over the next three years, including work to support several commercial scale carbon capture facilities to address hard-to-abate emissions from industrial operations such as cement manufacturing, blue hydrogen production and natural gas boilers. Svante has now attracted more than US$150m in funding since it was founded in 2007 to develop and commercialise its solid sorbent technology.

"Lowering the capital cost of the capture of the CO_2 emitted in industrial production is critical to the world's net-zero carbon goals required to stabilise the climate," said Claude Letourneau, president CEO of Svante. "Leaders from industry, financial sectors and government agree on the enormity of the challenge and the critical need to deploy carbon capture and carbon removal solutions at Gigatons scale. The carbon pulled from earth as fossil fuel needs to go back into the earth in safe CO_2 storage."

India: Star Cement completes Jalpaiguri grinding plant

Star Cement has announced the completion of its US$61m grinding plant project in Jalpaiguri, West Bengal. The Press Trust of India has reported that the 2Mt/yr grinding plant is set to enter production shortly. This will bring the company's installed capacity to 6.3Mt/yr. The company intends to source clinker from its integrated cement plant in Meghalaya. Fly ash will be procured from West Bengal or Bihar. Star Cement discontinued its lease of another grinding plant in Siliguri, West Bengal, at the end of January 2021.

Star Cement has also announced plans to increase the cement production capacity of its Guwahiti integrated cement plant in Assam by 2Mt/yr. It also plans to increase its clinker production capacity in Meghalaya by 2Mt/yr. The Free Press Journal newspaper has reported that the total cost of the planned investment is US$137m. Managing director Sajjan Bhajanka said that the company would complete the work by mid-2023.

India: Birla Corporation's nine-month profit rises

Birla Corporation recorded a net profit of US$52.2m in the nine-month period which ended on 31 December 2020, up by 23% year-on-year from US$42.6m in the corresponding period of 2019. Sales fell by 10% to US$650m from US$724m, while earnings before interest, taxation, depreciation and amortisation (EBITDA) fell by 2% to US$141m from US$144m.

China: Huaxin predicts 2020 profit drop

Huaxin Cement has forecast a 9-14% year-on-year fall in full-year net profit in 2020, of up to US$140m. It said that it recorded a net profit attributable to shareholders after deducting non-recurring gains and losses of around US$980m in 2019.

The company said "The main reason for 2020 performance decline is the hit of Covid-19 in the first half of the year and a vast flood disaster along Yangtze River in July 2020. The sales volume of main products were hugely affected and the price fell to some extent, leading to the reduction in the operating revenue."

India: UltraTech Cement records 47% nine-month profit growth

Aditya Birla subsidiary UltraTech Cement recorded a profit of US$506m in the nine-month period ending on 31 December 2020, up by 47% year-on-year from US$345m in the corresponding period of 2019. Sales fell by 4% to US$4.16bn from US$4.33bn. Third-quarter sales rose by 17% to US$1.68bn from US$1.43bn and third-quarter profit rose by 122% to US$217m from US$97m. The company said that it ended the period having reached 84% production at its newly acquired cement plants of 15Mt/yr total capacity. In the third quarter the board approved capital expenditure investments of US$747m aimed to increase cement production capacity by a further 13Mt/yr.

The company said "Recovery from the Covid-19-led disruption of the economy has been rapid. This has been fuelled by quicker demand stabilisation, supply side restoration and greater cost efficiencies." It added, "While UltraTech continues to closely monitor the impact of Covid-19 on its operations, its capital and financial resources remain entirely protected and its liquidity position is adequately covered. With strong rural growth, revival in manufacturing sentiment, buoyancy in the goods and services tax and tax collections, UltraTech expects demand to grow on the back of the government's push on infrastructure projects. Given its pan-India presence, UltraTech is well-positioned to support the rising demand for cement in the country. As always, UltraTech remains committed to all its business associates and stakeholders."

India: The India Cements records nine-month sales drops

The India Cement's consolidated nine-month net sales for the period which ended on 31 December 2020 were US$416m, down by 24% year-on-year from US$550m in the corresponding period of 2019. Its sales volumes of cement fell by 29% to 5.9Mt from 8.4Mt. However, its net profit more than doubled to US$21.5m from US$8.3m. The cement producer said that the construction industry started to recover from September 2020 following coronavirus-related lockdowns earlier in the year. Earnings and profits grew in the reporting period in part due to reduced production costs.

India: Shree sales fall

Shree Cement has recorded consolidated net sales of US$1.27bn in the first nine months of its 2021 financial year (1 April 2020 – 31 March 2021), down by 2% year-on-year from US$1.29bn in the corresponding period of its 2019 financial year. The group's net profit increased by 52% to US$204m from US$138m.

Thailand: SCG's cement division's sales fall

SCG's revenue from its cement division fell by 7% year-on-year to US$5.7bn in 2020. However, its earnings before interest, taxation, deprecation and amortisation (EBITDA) rose by 3% to US$719m. It blamed falling sales on the coronavirus pandemic and a 'challenging' economy, but said that it managed to raise earnings and profits through efficiency improvements and lower production costs. In the fourth quarter of 2020 the business faced resurgent coronavirus outbreaks and flooding in Thailand, Vietnam and Cambodia. Overall, the group's revenue fell by 9% to US$13.3bn with declines in most divisions apart from packaging.

SCG forecast total earnings growth of 5 - 10% in 2021 from US$13.3bn in 2020. The Bangkok Post newspaper has reported that the group believes that its businesses are likely to be driven by product development and the circular economy, with an emphasis on diversification outside of cement.

President and chief executive officer Roongrote Rangsiyopash said "We have a positive outlook for our businesses because we have strong strategies. The company is focused on high value-added products and global trends to support our businesses during the outbreak."

Pakistan: Lucky Cement to upgrade Pezu cement plant

Lucky Cement plans to increase the production capacity of its Pezu plant by 3.2Mt/yr. Following negotiations with potential suppliers, work is expected to start in 2021 and will be completed in 2023.

Indonesia: Taiheiyo updates on Semen Indonesia deal

Taiheiyo Cement says that its board has approved and concluded its deal with Semen Indonesia to buy a 15% stake in its subsidiary Solusi Bangun Indonesia (SBI) for around US$220m. As part of the agreement, SBI's Tuban plant will increase its export capacity by building a new jetty and silos. It will then export 0.5Mt/yr of cement to Taiheiyo Cement's subsidiary in the US. The Japanese cement producer said that it is focusing on markets in South-East Asia as part of its sustainable business development strategy in response to projected long term declining cement demand in Japan.

China: New projects boost for Sinoma

Sinoma (CNBM) International Engineering's value of new projects grew by 9% year-on-year to US$5.3bn in 2020. Most of these projects came from growth in its construction business segment. However, new project value from its equipment manufacturing business fell by 5% to US$629m. Chinese domestic new project value decreased by 3% to US$2.1bn but overseas new project value rose by 19% to US$3.2bn. The engineering company and member of CNBM group also reported that its US$480m project to build a 5000t/day clinker production line in Zambia for Central African Cement remains in the financing stage. The project was originally announced in late 2018.

Interview by Peter Edwards, Global Cement Magazine

In discussion: Cement in China, Ian Riley, WCA

Global Cement takes a look at China with Ian Riley, CEO of the World Cement Association and a long-standing participant in the Chinese cement industry.

China has the world's largest cement sector by a considerable margin and produces more cement than the rest of the world combined every year. From making 'just' 500Mt/yr in 1995 production rose to 1Bnt/yr by 2005. By 2014, production had skyrocketed to 2.45Bnt. Cement production in 2019 was approximately 2.35Bnt, more than seven times that of India, the second-largest cement producer.

Efforts to improve the industry's production efficiency and sustainability have been made in earnest in recent years. In 2013, China's State Council issued its 'Guideline to tackle serious production overcapacity,' including in the cement sector. At the same time, the Chinese Cement Association (CCA) drafted plans to promote mergers and acquisitions in the sector. A complete ban on new capacity was announced by the Ministry of Industry and Information Technology (MIIT) in February 2018. State-mandated plant shutdowns of up to 100 days per year have been carred out since 2017 in order to reduce capacity. There has also been consolidation, most notably the merger of CNBM and Sinoma to produce the world's largest cement producer, with more than 500Mt/yr of capacity, in 2018. The aim of these measures is to reach clinker and cement capacity utilisation rates of 80% and 70% respectively, while improving the profitability and sustainability of the sector.

Above: Ian Riley is the CEO of the World Cement Association (WCA). He has many years of experience in the cement sector, most recently as country manager for LafargeHolcim in China between 2008 and 2019.

In discussion: Ian Riley, WCA

***GC:* Can you provide a summary of the Chinese cement sector in 2020?**

Ian Riley (IR): The story of cement in China in 2020, like everywhere else, was one dominated by the Covid-19 pandemic. Having originated in Wuhan, Hebei Province in late 2019, the outbreak led to the first lockdowns seen anywhere in the world in China during the first quarter. Across the country, cement production fell by 29% year-on-year to 150Mt in January and February 2020 combined, already the quietest months of the year due to Chinese New Year. Output then picked up to 149Mt in March 2020, still 17% lower than in March 2019. Across China, producers felt the full brunt of the coronavirus outbreak in their first quarter results.

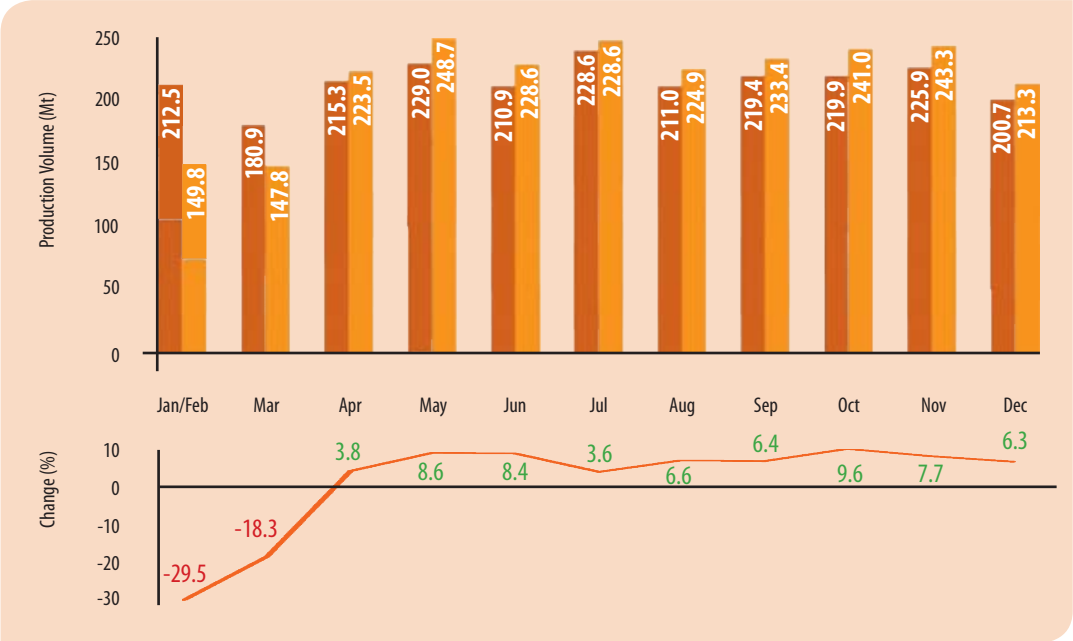
However, the Chinese cement sector bounced back strongly in the second quarter, as demand was displaced from the first quarter. Subsequently, the second half of 2020 panned out much as it would have done in the absence of the Covid-19 outbreak. The information I am party to indicates that producers will be happy with their financial results for the year as a whole.

***GC:* What about volumes in 2020?**

IR: Overall volumes. as reported by the National Statistics Bureau of China, were slightly higher in 2020 than in 2019, around 2.4Bnt compared to 2.35Bnt. The reports I have seen show very minimal changes year-on-year. Rather than reducing demand, Covid-19 displaced demand from the first quarter to other quarters, rather than knocking it on to 2021. Indeed it may have even contributed to higher demand overall.

***GC:* What other sub-plots were lurking in the background of the Chinese cement sector in 2020?**

IR: From the outside it is tempting to say that China has completed its major building and infrastructure drive. This may be almost true of Beijing and Shanghai, but it is not the case elsewhere. Infrastructure is still a key development pillar for China. The central government has major plans for more than 60 of its major cities with more than 5 million inhabitants. There are huge outstanding metro projects, for example. There are entire rail and road networks that the government wants to build and they will demand vast quantities of cement.



Left - Figure 1: Monthly cement production in China, January 2019 - December 2020 January and February figures are reported together. **Source:** National Statistics Bureau of China.

2019

2020

Left - Figure2: Year-on-year percentage changes in monthly cement production volumes in China, January - December 2020 January and February figures are reported together. **Source:** National Statistics Bureau of China.

***GC:* How will the sector develop from here?**

IR: The Chinese cement industry continues to defy gravity and in the short term, the rest of 2021, we could even see production rise relative to 2020. This is because a lot of the infrastructure projects have been brought forward into 2021 and 2022 from further on in the government's new Five Year Plan (2021-2026), to mitigate some of the worst economic effects of the pandemic. The plateau above 2Bnt/yr that the industry currently finds itself on will likely continue for the next 3-4 years, which probably wouldn't have been the case if the pandemic hadn't happened.

After 2025 demand will tail off. This is because major projects will have been brought forward to 2023-2026 from the second half of the 2020s. I think the rate of decline will be fairly noticable. By 2030 a substantial decline will be clear to see and, in the following decade, demand will likely settle at around 1Bny/yr - half of the current level. Of course, this is still astronomically high compared to anywhere else in the world.

***GC:* How have tighter environmental standards affected the sector's ability to produce cement?**

IR: The two main pollutants that have been tightened significantly in recent years are dust and NO_x. This has led to older plants replacing electrostatic precipitators with baghouses for example. There have been dozens of new SNCR systems, with subsequent pyroprocess modifications, increases in the quantities of biomass fuels and SCR in some cases. These projects don't affect the ability to produce cement and there haven't been closures due to them.

Below: Skyline of Shanghai, the most populous city in China.

The Chinese industry is now world leading in terms of NO_x emissions control. This is because the limits for cement plants were borrowed from the power sector. From 800mg/Nm^3 a decade ago, we are now talking of limits of 100mg/Nm^3 in the most stringent jurisdictions, for example around Beijing. The best performing plants have NO_x emissions of below 25mg/Nm^3.

Even if these had affected capacity, there would still be plenty of extra capacity to go round, as manufacturers are constrained by government requirements to seasonally shutter capacity. This differs by Province, but each plant is required to shut down for 80-100 days per year on environmental grounds, thus removing a significant chunk of capacity.

***GC:* What is the situation with imports / exports?**

IR: I don't have good export data, but imports have risen recently. This is due to the low prices in South East Asia, mainly from Vietnam. China has allowed these in because the volumes are a drop in the ocean and it would be too costly to compete on price.

***GC:* What do you make of Chinese cement producers expanding to outside of China? How far can this replace lower domestic production in the future?**

GC: There was a spate of announcements regarding Chinese investment in overseas cement plants in 2017 and 2018 but this has slowed. It is important to note that only a handful of serious cement producers: Huaxin, Red Lion, Conch and West China, have expanded overseas. Sinoma has too, but that is a special case due to its engineering division. The remainder of Chinese cement plants outside of China are actually private investors with limited experience of operating within the cement industry. There will likely be further projects, but not on the scale of China itself.

***GC:* What proportion of the Chinese cement industry is ultimately controlled by the government?**

IR: I don't have a percentage figure but I would say over half is ultimately controlled by either the central government or a regional government. Some of the larger players, CNBM, Jidong BBMG and China Resources Cement, are all government controlled. Anhui Conch is controlled by the Anhui Provincial government, which is not quite the same. There are many smaller ones that are state-controlled too.

This doesn't stop the industry being competitive, far from it. Producers compete like crazy. Indeed, the government has to sometimes step in and call on them to maintain some kind of market order. This is the opposite of what might be seen in the west, where competing entities have in the past clubbed together in a cartel.

What the government has been able to do, however, via imposing seasonal shutdowns, is demonstrate to producers that they can make more money from less cement. This has calmed things down a bit. All the time, the central government has to balance the interests of the cement sector against those of the construction sector, its major customer. Higher profits may be great for cement companies, but they shouldn't get too big because that will mean that the construction sector is overpaying.

In terms of environmental limits, China's cement industry is controlled in a different way to those in the rest of the world. Not only will it set a limit for a given pollutant, but it will also prescribe the technological solution that cement producers should use. This was seen very clearly with waste heat recovery (WHR) in the 2010s. There were pilots that proved the technology, the economics were reasonable and the government said, 'you must do this.'

I suspect that the approach to CO_2 emissions will be similar to WHR. If the government decides that LC3 cements, for example, are a good cement for China, then we can expect Chinese cement plants to start making them shortly afterwards. If a certain type of CO_2-derived product or a particular storage method is approved, expect Chinese equipment suppliers to rapidly meet that new need.

***GC:* Thank you for your insights today Ian.**

IR: A pleasure as always.

Below: Informal waste recycling in Guilin, Guangxi Autonomous Region. "Alternative fuel use is very low in China," says Riley. "Even the leading firms can only use low single digit percentages. There's no problem from the technology standpoint but there are huge issues with securing the waste stream on the supply side."
Credit: eXpose / Shutterstock.com.

2 MARCH 2021 • 14:00 - 18:00 SINGAPORE TIME **ON YOUR DESKTOP**

asian cement
CONFERENCE • EXHIBITION

asiancement.com

#asiancement

FREE REGISTRATION

The Virtual Asian Cement Conference - from *Global Cement Magazine* - will cover the latest developments in the region's cement markets, as well as looking at the latest technology and case studies from around Asia. Delegates from more than 60 countries will attend!

Asian Cement Enquiries

Exhibition and sponsorship:
paul.brown@propubs.com

Programme and speakers:
robert.mccaffrey@propubs.com

Organised by:
global cement MAGAZINE

Peter Edwards, Global Cement Magazine

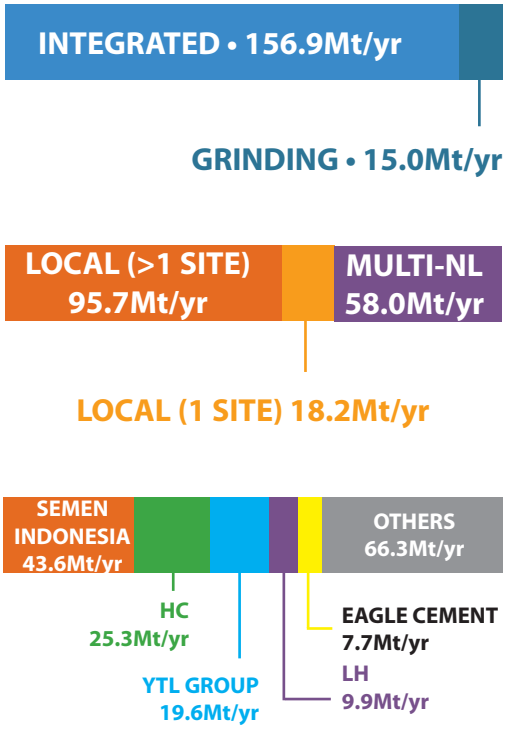
Cement in South East Asia

Global Cement turns its regional gaze to six countries in maritime South East Asia: Brunei-Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Timor-Leste.

The six south east Asian nations covered in this article share a total of 171.9Mt/yr of cement production capacity across 71 plants. 156.9Mt/yr of the capacity is integrated (53 plants) and 15.0Mt/yr is from clinker grinding (18 plants) - See Page 54.

Cement producers among the six countries are many and varied. Locally-owned producers control the lion's share of cement production across the region. They control 24 integrated plants (85.5Mt/yr) and 12 grinding plants (10.2Mt/yr) to control a total of 95.7Mt/yr. Local producers with only one production site are also a major force in the market, with 11 integrated (15.6Mt/yr) and three grinding plants (2.6Mt/yr) that share a combined 18.2Mt/yr of capacity. Multinationals, including Cementir, CRH, Cemex, LafargeHolcim, HeidelbergCement and Anhui Conch, control 18 integrated plants and three grinding plants, holding a total of 58.0Mt/yr of cement production capacity between them.

The largest producer is Semen Indonesia, which operates 43.6Mt/yr of capacity across 10 integrated plants (42.9Mt/yr) and one grinding plant (0.7Mt/yr). Second is HeidelbergCement (25.3Mt/yr) via a 51% stake in Indocement's three integrated plants (24.7Mt/yr) and a grinding plant in Brunei (0.6Mt/yr). Third is Malaysia's YTL Group, which operates 19.6Mt/yr of capacity across five integrated plants (17.1Mt/yr) and two grinding sites (2.5Mt/yr).



Right - Figure 1: Split of integrated / grinding capacity in Brunei-Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Timor-Leste. **Source:** *Global Cement Directory 2021.*

Right - Figure 2: Types of cement producer in Brunei-Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Timor-Leste. **Source:** *Global Cement Directory 2021.*

Right - Figure 3: Largest cement producers in Brunei-Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Timor-Leste. HC = HeidelbergCement. LH = LafargeHolcim. **Source:** *Global Cement Directory 2021.*

Below: Aerial view of Sungai Kebun Bridge in Bandar Seri Begawan, Brunei-Darussalam.

Brunei-Darussalam

Brunei-Darussalam is an absolute monarchy located on the island of Borneo. It comprises two small sections that are separated by and surrounded by Malaysia. Historically oil-rich, it has one of the highest GDP/capita rates in the world, although its standing has slipped somewhat in recent years due to fluctuating oil prices. From US$19.1bn in 2012, its GDP fell to US$11.4bn in 2016, subsequently recovered to US$13.5bn in 2019.

Brunei has one 0.6Mt/yr capacity grinding plant, the Butra HeidelbergCement grinding plant in Muara. The company is a joint venture between HeidelbergCement (70%) and Brunei's PJ Corp Sdn Bhd (30%). It produces specialty cement from imported clinker and gypsum, including sulphate-resistant cement, mainly for oil wells. The company claims to have a 73% market share in the country. The remainder is imported from around the region.

Indonesia

Indonesia is the largest and most populous of the nations covered in these pages, with more than 260m people spread over 1.9m km^2 of land. It gained independence from the Netherlands in 1949 and has developed the largest economy in the region, with a GDP of US$1.2tn in 2019. Its GDP /capita was US$12,345 in the same year.

The largest producer of cement in the country, indeed in this entire review, is Semen Indonesia. It controls 43.6Mt/yr of capacity across 10 integrated plants (42.9Mt/yr) and one grinding plant (0.7Mt/yr). It traces its history to 1957 when it was established as NV Semen Gresik. In 1991, PT Semen Gresik was the first state-owned company to go public on the Indonesia Stock Exchange. It grew significantly in 2019 when it acquired the assets of the former LafargeHolcim subsidiary Holcim Indonesia, including 14.7Mt/yr of capacity at integrated cement plants at Narogong (West Java), Cilacap (Central Java), Tuban (East Java) and Lhoknga (Aceh). Taiheiyo Cement later purchased shares in Semen Indonesia's new Solusi Bangun Indonesia subsidiary.

The second-largest producer in Indonesia is HeidelbergCement's 51% subsidiary Indocement, which operates the incredible 18.0Mt/yr integrated Citeureup plant in Java, along with two others. The plant was the first to be operated by the company and was established in 1975. In 1985 the plant, along with those managed by five similar state-run firms, became part of PT Indocement Tunggal Prakasa. The company went public in 1989, with HeidelbergCement becoming the major shareholder in 2001.

Left: Skyscrapers in Jakarta, the capital of Indonesia.

The third-largest cement producer in Indonesia is PT Conch Indonesia, a subsidiary of the giant Chinese cement producer Anhui Conch. It operates 5.5Mt/yr of capacity from two integrated sites.

In October 2020, Semen Indonesia said that it expected a 14% year-on-year decline in Indonesian cement demand to 50Mt in 2020 from 58Mt in 2019, with the Covid-19 pandemic being the primary cause of a 7.7% first-half decline in cement consumption to 27Mt from 29Mt. This suggests a capacity utilisation rate of just 49%.

Malaysia • 31.2Mt/yr

INTEGRATED - 27.0Mt/yr

1. Malayan Cement (YTL), Langkawi, Darul Aman, Kedah, 5.4Mt/yr.
2. YTL Cement, Bukit Sagu, Pahang, 1.5Mt/yr.
3. Perak-Hanjoong Simen (YTL), Perak, 3.5Mt/yr.
4. Malayan Cement (YTL), Kanthan, Darul Ridzuan, Perak, 4.2Mt/yr.
5. Malayan Cement (YTL), Tetouan, Darul Aman, Kedah , 2.5Mt/yr.
6. Tasek Cement, Tasek, Perak, 2.3Mt/yr.
7. Aalborg Portland Malaysia (Cementir), Ridzuan, Perak, 1.9Mt/yr.
8. Hume Cement, Gopeng, Darul Ridzual, Perak, 1.7Mt/yr.
9. Negeri Sembilan Cement, Jalan Tampin, Bahau, 1.3Mt/yr.
10. Negeri Sembilan Cement, Perlis, Kangar, 1.7Mt/yr.
11. CMS Cement, Kuching, Sarawak, 1.0Mt/yr (Exp'n to 2.8Mt/yr).

GRINDING -4.2Mt/yr

12. Malayan Cement (YTL), Pasir Gudang, 1.2Mt/yr.
13. Malayan Cement (YTL), Johor Darum Takzim, 0.8Mt/yr.
14. YTL Cement, Port Klang, 0.5Mt/yr.
15. Cement Industries (SABAH), Kota Kinabalu, Sabah, 0.9Mt/yr.
16. CMS Cement, Bintulu, Sarawak, 0.8Mt/yr.

Singapore • 0.3Mt/yr

GRINDING - 0.3Mt/yr

1. G & W Industries, 0.3Mt/yr.

Brunei • 0.6Mt/yr

GRINDING - 0.6Mt/yr

1. Butra HeidelbergCement (70% HC), Muara, 0.6Mt/yr.

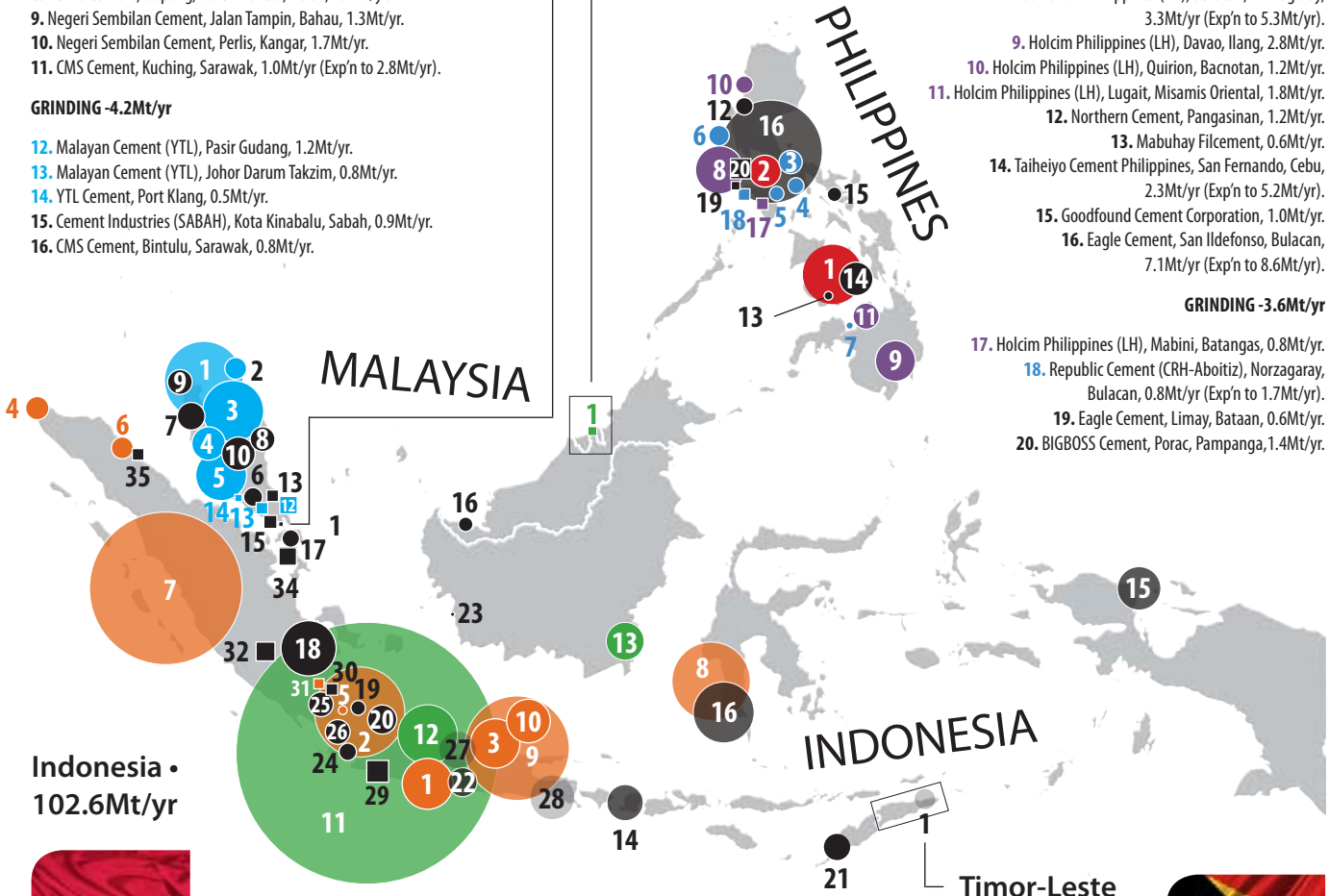
Philippines • 37.2Mt/yr

INTEGRATED - 33.6Mt/yr

1. APO Cement (Cemex), Barangay, Cebu, 4.0Mt/yr.
2. Cemex Philippines, Solid, Antipolo, Rizal, 2.2Mt/yr.
3. Republic Cement (CRH-Aboitiz), Norzagaray, 1.6Mt/yr.
4. Republic Cement (CRH-Aboitiz), Teresa, Rizal, 1.1Mt/yr.
5. Republic Cement (CRH-Aboitiz), Batangas, 1.0Mt/yr.
6. Republic Cement (CRH-Aboitiz), Bulacan, C Luzon, 1.9Mt/yr.
7. Republic Cement (CRH-Aboitiz), Iligan, Mindanao, 0.5Mt/yr.
8. Holcim Philippines (LH), Bulacan, Norzagaray, 3.3Mt/yr (Exp'n to 5.3Mt/yr).
9. Holcim Philippines (LH), Davao, Ilang, 2.8Mt/yr.
10. Holcim Philippines (LH), Quirion, Bacnotan, 1.2Mt/yr.
11. Holcim Philippines (LH), Lugait, Misamis Oriental, 1.8Mt/yr.
12. Northern Cement, Pangasinan, 1.2Mt/yr.
13. Mabuhay Filcement, 0.6Mt/yr.
14. Taiheiyo Cement Philippines, San Fernando, Cebu, 2.3Mt/yr (Exp'n to 5.2Mt/yr).
15. Goodfound Cement Corporation, 1.0Mt/yr.
16. Eagle Cement, San Ildefonso, Bulacan, 7.1Mt/yr (Exp'n to 8.6Mt/yr).

GRINDING -3.6Mt/yr

17. Holcim Philippines (LH), Mabini, Batangas, 0.8Mt/yr.
18. Republic Cement (CRH-Aboitiz), Norzagaray, Bulacan, 0.8Mt/yr (Exp'n to 1.7Mt/yr).
19. Eagle Cement, Limay, Bataan, 0.6Mt/yr.
20. BIGBOSS Cement, Porac, Pampanga,1.4Mt/yr.



Indonesia • 102.6Mt/yr

INTEGRATED - 96.3Mt/yr (Active)

1. Semen Indonesia, Cilacap, Central Java, 3.5Mt/yr.
2. Semen Indonesia, Narogong, West Java, 6.2Mt/yr.
3. Semen Indonesia, Tuban, East Java, 3.4Mt/yr.
4. Semen Indonesia, Lhokngа, Aceh, 1.6Mt/yr (Exp'n to 2.1Mt/yr).
5. Semen Indonesia, Polino Perkasa, Banten, 0.6Mt/yr.
6. Semen Indonesia, Langkat, North Sumatra, 1.5Mt/yr.
7. Semen Indonesia, Padang, West Sumatra, 10.5Mt/yr.
8. Semen Indonesia, Pangkep, South Sulawesi, 5.4Mt/yr.
9. Semen Indonesia, Tuban, East Java, 7.2Mt/yr.
10. Semen Indonesia, Rembang, Central Java, 3.0Mt/yr.
11. Indocement (51% HC), Citeureup, Bogor, West Java, 18.0Mt/yr.
12. Indocement (51% HC), Paliman, West Java, 4.1Mt/yr.
13. Indocement (51% HC), Kotabaru, South Kalimantan, 2.6Mt/yr.
14. Semen Anhui Conch, Tanjung, South Kalimantan, 2.5Mt/yr.
15. Semen Anhui Conch, Manokwari, West Papua, 3.0Mt/yr.
16. Semen Bosowa, Ujung Pandang, South Sulawesi, 4.2Mt/yr.
17. Semen Bosowa, Batam Riau Islands, 1.2Mt/yr.
18. Semen Baturaja, Palembang, South Sumatra, 3.8Mt/yr.
19. Semen Jakarta, Jakarta, 1.0Mt/yr.
20. Semen Jui Shin, Karawang, West Java, 2.0Mt/yr.
21. Semen Kupang, Kupang, East Nusa Tenggara, 1.8Mt/yr.
22. Semen Pan Asia, Ajibarang, Central Java, 2.0Mt/yr.
23. Semen Puger, Ketapang, East Java, 0.3Mt/yr.
24. Semen Serang, Kertasana, Banten, 1.2Mt/yr.
25. Cemindo Gemilang, Lebak, West Java, 4.0Mt/yr.
26. Cement Hippo (PT Sun Fook), Serang Banten, 1.7Mt/yr.
27. PT Semen Grobogan, Grobogan, Central Java, 2.5Mt/yr (Coming mid 2021).
28. PT Semen Imasco Asiatic, Puger Wetan, East Java, 3.0Mt/yr (u/c).

Timor-Leste

GRINDING (PLAN)

1. TL Cement, Baucau, 1.4Mt/yr (Announced 2016).

GRINDING - 6.3Mt/yr

29. PT Conch Indonesia, Semarak, Java, 1.5Mt/yr.
30. Cemindo Gemilang, Ciwandan, Banten, 0.8Mt/yr.
31. Semen Indonesia, Ciwandan, Banten, 0.7Mt/yr.
32. Semen Baturaja (Persero), Ogan Komering Ulu, South Sumatra, 1.3Mt/yr.
33. Semen Baturaja, Panjang, Bandar Lampung.
34. Semen Bosowa, Kampung Baru, Riau Is., 1.2Mt/yr.
35. Cemindo, Medan, North Sumatra, 0.8Mt/yr.

Opposite- Figure 4: Locations of cement plants in Brunei, Indonesia, Malaysia, Singapore, the Philippines, Singapore and Timor-Leste.
Source: *Global Cement Directory 2021.*

= 1Mt/yr Grinding
= 2Mt/yr Grinding

= 1Mt/yr Integrated
= 2Mt/yr Integrated

u/c = Under construction.
LH = LafargeHolcim.
HC = HeidelbergCement.

New line for BIGBOSS

Philippines-based BIGBOSS Cement, which makes low-CO_2 cement based on activated volcanic residues, commissioned a new ready2grind XL modular grinding mill from Germany's Gebr. Pfeiffer in January 2021. The mill has increased the plant's capacity by around 1680t/day, taking it to around 1.4Mt/yr.

Above: Construction of the ready2grind mill at the BIGBOSS Cement plant in Porac, Philippines in mid November 2020.

WHR project for Cemex APO

In February 2021 Cemex announced that it would install a 4.5MW waste heat recovery (WHR) plant at its APO cement plant in Barangay, Cebu, the Philippines.

Upgrade for Cemindo Gemilang

China-based Sinoma International Engineering has completed the installation of a 10,000t/day integrated cement production line complete with raw material processing and clinker storage capacity at Gama Group subsidiary PT Cemindo Gemilang's integrated Bayah II plant. Sinoma International completed the commissioning process ahead of its scheduled date in May 2020, despite Covid-19 restrictions.

Above: The Petronas Towers in central Kuala Lumpur, the capital of Malaysia.

Malaysia

A former British colony, Malaysia gained independence on 31 August 1957. Split between the Malay Peninsula and the island of Borneo, the country is a melting pot of Malay, Chinese and Indian cultures. Its economy, aided by significant oil reserves, is varied and resilient, the sixth-largest in South East Asia and the 39th-largest in the world.

There are 11 integrated (27.0Mt/yr) and five cement grinding plants (4.2Mt/yr) in Malaysia, giving a total of 31.2Mt/yr. By far the largest cement producer is YTL Group, which operates 19.6Mt/yr of capacity across five integrated (17.1Mt/yr) and two grinding plants (2.5Mt/yr). This is sufficient to give it 63% of national capacity. Established in 1955, the company has interests in infrastructure development, construction and cement production. It grew substantially in 2019 when it acquired the assets of LafargeHolcim's former subsidiary Lafarge Malaysia, which included 14.2Mt/yr of cement production capacity across three integrated (12.2Mt/yr) and two grinding sites (2.0Mt/yr).

The remainder of the Malaysian cement sector comprises smaller producers, none of which controls more than two plants. The largest of these is CIMA's Negeri Sembilan Cement Industries, which runs two integrated plants that share 3.0Mt/yr of capacity. It is a home-grown cement producer that has been active in the market since 1975. A further five companies operate six cement plants between them, as shown on Page 54.

Cement production in Malaysia is currently well below its production capacity. Production had been as high as 24.7Mt in 2015 but this fell to 20.0Mt in 2016, 18.8Mt in 2017, 17.6Mt in 2018 and as little as 16.1Mt in 2019. This indicated a capacity utilisation rate of around 61%. 2020 is unlikely to have fared much better, despite the government's resolve to restart major infrastruture works. Cement plants initially closed during the early stages of the Covid-19 pandemic, although they were reopened at the end of April 2020. Cementir, which operates in the country via its Aalborg Portland Cement subsidiary, noted poor performance in the country in its recent annual results.

Philippines

The Republic of the Philippines is a large archipelagic nation. Unusually for the region, the country is predominantly Christian, a characteristic it traces back to its 377 years as a Spanish colony and 44 years as a US protectorate. Fully independent since 1946, the country is today classified as 'newly industrialised,' with the sixth-largest economy in Asia, with a GDP of US$360bn in 2020. It is in the midst of a construction boom, with the government pledging US$165bn of infrastructure spending between 2017 and 2022 as part of its 'Build Build Build' programme.

There are 16 active integrated cement plants in the Philippines that share a combined capacity of 33.6Mt/yr, according the *Global Cement Directory 2021*. The country is also home to three active grinding plants

Tasek changes hands

Singapore-based Hong Leong Asia subsidiary HL Cement Malaysia acquired an 88% stake in Tasek Corporation in May 2020. Another Hong Leong Asia subsidiary, Ridge Star, acquired the remaining 12% minority stake. The combined deals were worth a reported US$19.4m.

with a total capacity of 2.2Mt/yr. Taken together, these 19 plants have a headline cement capacity of 35.8Mt/yr.

The largest cement producer in the Philippines is the Swiss-French giant LafargeHolcim, which operates 9.9Mt/yr of capacity across four integrated plants (9.1Mt/yr) and one grinding plant (0.8Mt/yr). LafargeHolcim had been due to sell its 86% stake in Holcim Philippines to San Miguel Corporation for US$2.5bn in the first half of 2020 but the deal fell through in May 2020 after the Philippines Competition Authority (PCC) failed to approve the deal within 12 months of its conclusion. The agreement, dated 10 May 2020, would have completed LafargeHolcim's withdrawal from the South-East Asia market.

Eagle Cement (7.7Mt/yr) is the second-largest cement producer in the Philippines. It is locally-owned and has been making cement since 2010. In 2021 it operates a three line 7.1Mt/yr integrated plant and 0.6Mt/yr grinding plant. It is also building a 2.0Mt/yr plant in Cebu.

The third largest producer by installed capacity in the Philippines is CRH-Aboitiz, via the subsidiary Republic Cement (6.9Mt/yr). It runs five integrated cement plants (6.1Mt/yr) and one grinding plant (0.8Mt/yr). CRH had been rumoured to be considering selling its Filipino assets in late 2019, but this has not since transpired.

Below: Construction of a new expressway in Cebu, the Philippines. Many such projects are currently underway as part of the government's 'Build Build Build' initiative. **Credit:** Michael D Edwards / Shutterstock.com

Above: View over Singapore's Marina Bay.

Singapore

The Republic of Singapore is a city-state located just to the south of the Malay Peninsula. It was established in its current form as a trading post of the British Empire in 1819. Occupied by Japan during the Second World War, it was briefly part of Malaysia from 1963 to 1965. Today it is the most densly populated country on Earth, with 5.7 million inhabitants bunched into just 728km^2. It has a vibrant and diverse service-based market economy, which has the greatest ease of doing business in the world.

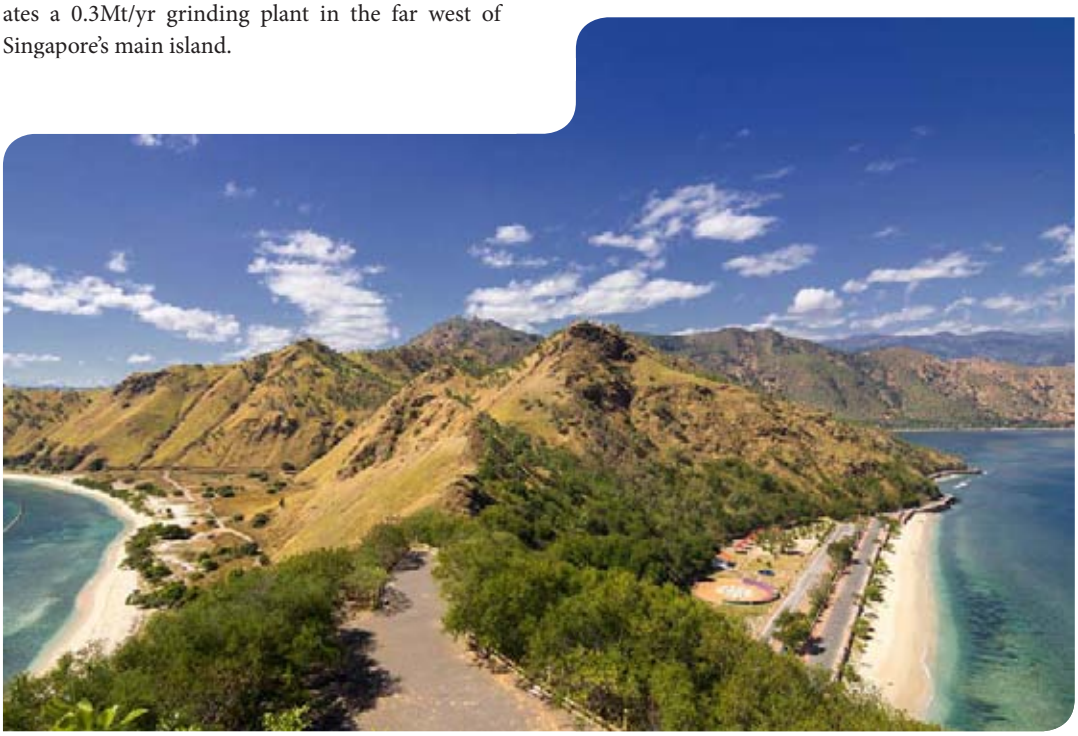
There is a single cement producer in Singapore, the locally-owned G&W Industries, which operates a 0.3Mt/yr grinding plant in the far west of Singapore's main island.

Timor-Leste

The Democratic Republic of Timor-Leste is a former Portuguese colony in the extreme south east of the Malay Archipeligo. It declared independence in 1975 but was subsequently invaded by neighbouring Indonesia. The following 24 years saw widespread abuse by the Indonesian government as it sought to gain control of the populace. However, a UN-led referendum in 1999 saw 78.5% support for independence. Three further years passed before the country gained full independence, on 20 May 2002. Today, it is one of the world's poorest countries, with a GDP/capita of US$1560 in 2019.

Timor-Leste imports cement, although the national government announced plans for a plant in Baucau, a 1.4Mt/yr integrated facility to be built by thyssenkrupp / Polysius, in late 2016. The national government signed a 'non binding letter of intent' signaling that it would take an equity stake in the project in the future. However, the plant has not yet been built, with the TL Cement company website noting that it will be 'back online soon.'

In December 2013 Australian press announced that Posco E&C Australia would build a US$360m integrated plant in Baucau, which appears to indicate a trend for this project.

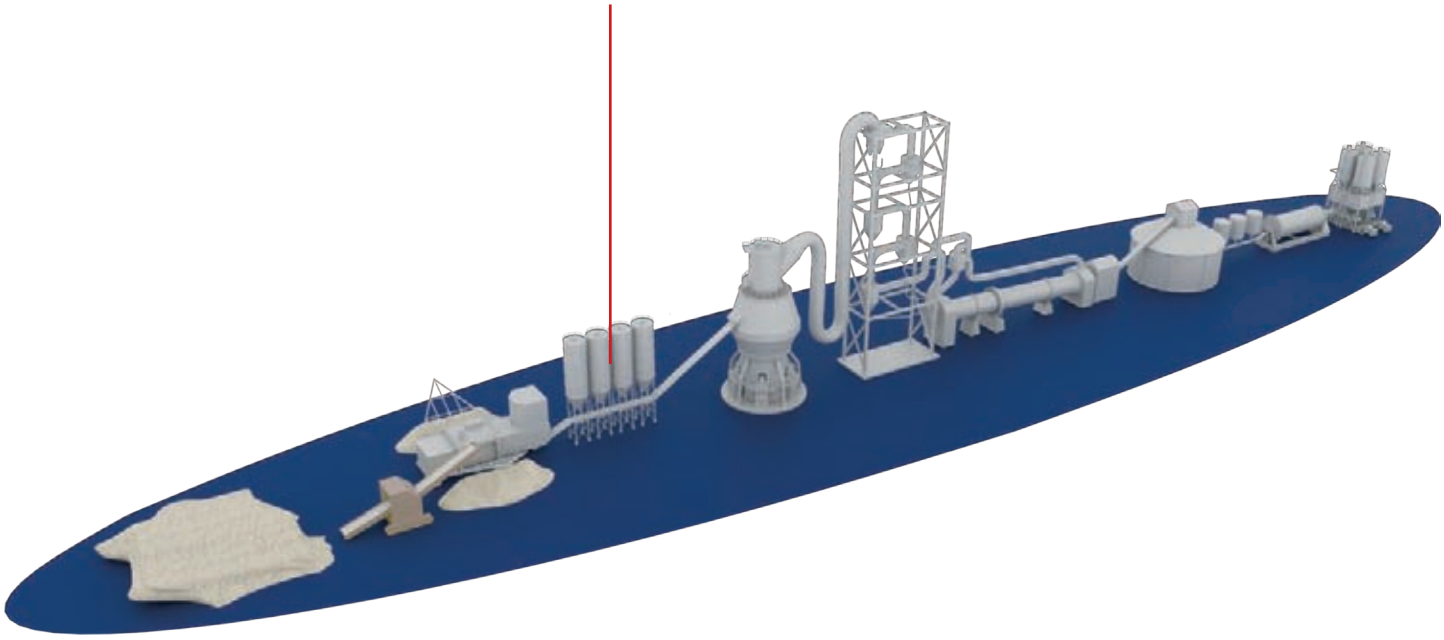


Right: View from the Monte Cristo Rei of Dili, Timor-Leste.

CEMENT
QUALITY

RMCS
Raw Mix
Control
System

$#&@%?!!



The last thing you need in the middle of your process is the wrong mix.

Keep it in line with

PSCL®

The world leader in quality control solutions for the cement industry

Work Smarter® · pscl.com

Contents
Subscribe
Ad Index

Nigeria: BUA Cement reports full-year results

BUA Cement recorded full-year net sales of US$550m in 2020, up by 20% year-on-year from US$460m in 2019. Profit after corporate taxes was US$185m, up by 16% from US$159m.

In December 2020, *Global Cement* reported that the company planned to bring three integrated cement plant projects with a total capacity of 9Mt/yr to fruition by the end of 2022. This would bring its installed capacity to 20Mt/yr.

Turkey: FLSmidth converts line at Çimko Çimento's Adiyaman cement plant to produce grey cement

Denmark-based FLSmidth has won a contract to provide a grey-to-white cement line conversion at Çimko Çimento's cement plant in Adiyaman. The company will supply equipment suited to the production of white cement including its DuoFlex burner, rotary cooler and OK raw mill. It said that it will begin work in 2021 and the producer will commission the renovated line in early 2022.

The supplier said "Once completed, the upgraded line will offer Çimko Çimento new opportunities to expand its product range and enter new markets. White cement is especially sought-after in countries with relatively hot climates, as it tends to keep buildings cooler with its reflective characteristics. In addition, as a high-quality, value-added product, white cement is often used in the construction of innovative buildings and important landmarks. FLSmidth brings significant experience and know-how to the project, having conducted several similar grey-to-white conversions in recent years, including projects with Turkey-based Adana Cement and Eskisehir Cement, as well as Al Safwa Cement Company and Riyadh Cement Company in Saudi Arabia."

Image: Concrete distribution in Nigeria.

Ghana: Lafarge Africa to sell 35% CBI Ghana stake

LafargeHolcim subsidiary Lafarge Africa plans to sell its 35% subsidiary Continental Blue Investment (CBI) Ghana. CBI Ghana runs the Supacem brand from the Tema Free Zone near Accra. It reportedly started building a cement grinding plant at the site in 2017 for a cost of US$55m.

Kuwait: Suez Cement sells Hilal Cement stake

HeidelbergCement subsidiary Suez Cement has sold its 51% majority stake in Hilal Cement. Decypha News has reported the new owner of the stake as Silver Share Real Estate. Boodai Group retains 44% of the remainder of shares.

HeidelbergCement chief executive officer Dominik von Achten said "We are pleased with the closing of the transaction in Kuwait." He continued, "The focus of our portfolio management is the simplification of country portfolios and a prioritisation of the strongest market positions."

Hilal Cement operates two cement terminals and four ready-mix plants.

Ivory Coast: Société Ciment Côte d'Ivoire inaugurates grinding plant

Société Ciment Côte d'Ivoire (SCCI) has inaugurated a 1.5Mt/yr grinding plant in the PK24 industrial zone of Akoupé-Zeudji near Abidjan. The subsidiary of Atlantic Financial Group spent US$110m on the project and it is expected to create 300 direct jobs, according to Koaci Media. Minister of Trade and Industry Souleymane Diarrassouba attended the event.

Oman: Raysut Cement's sales rise in 2020

Raysut Cement's revenue grew by 7% year-on-year to US$235m in 2020 from US$219m in 2019. Its profit after tax increased to US$36.5m from US$5.88m.

Oman: Raysut breaks ground on Salalah WHR unit

Raysut Cement has held a groundbreaking ceremony for a new 9MW waste heat recovery (WHR) unit at its Salalah cement plant. The Times of Oman newspaper has reported that China-based Sinoma Overseas Development will undertake the engineering, procurement and construction work on the project.

The producer said that the installation 'will contribute significantly to our ambitious targets such as reducing power consumption by 25 - 30%, reducing CO_2 emissions and reducing in our water consumption by more than 50%."

DRC: Imports from Uganda rise

The Democratic Republic of Congo has increased its imports of cement from Uganda by 30% to 90,000t in the two years since 1 February 2019 compared to the two prior years. The Daily Monitor newspaper has reported the reason for the increase as a Rwandan ban on Ugandan goods across the East African country's border. This contributed to a 3% fall in the value of Uganda's cement exports to US$59.9m in the 2020 financial year from US$61.5m in the 2019 financial year.

Burkina Faso: GCM Industries to build cement plant in Kossodo

GCM Industries plans to establish a 0.64Mt/yr integrated cement plant, expandable to 1.2Mt/yr, in Kossodo, Ouagadougou. RTB News has reported the cost of the plant as US$135m. In its export phase, the producer says that the plant will provide 700 jobs. The cement plant will be Burkina Faso's fifth. Commissioning is scheduled for early 2022.

Kenya: Court spares East African Portland Cement managers jail time

The Court of Appeal has stopped directors and accounting officers at East African Portland Cement Company (EAPCC) from being sent to jail due to the company's failure to pay contract workers about US$12m as agreed in a collective bargaining agreement. The judges noted that the cement producer had already paid US$0.8m as a gesture of goodwill, according to the Business Daily newspaper. Members of the Kenya Chemical & Allied Workers union brought the legal case against the EAPCC accusing it of paying them less than permanent staff.

Oman: ABB integrates three lines into single digital control system at Oman Cement Company's Muscat cement plant

Switzerland-based ABB has completed a digital systems overhaul at Oman Cement Company's (OCC) Muscat cement plant. The supplier says that by integrating the plant's three production lines with its ABB Ability System 800xA product it will optimise performance across the lines, boosting operational efficiency, increasing availability, lowering costs and driving sustainability. It says that it has also replaced older controllers in their final lifecycle phase with AC800M models. Teams from OCC and ABB collaborated to complete the engineering, supply, installation and commissioning of the ABB systems.

OCC head of instrumentation and control Bashar Al Farsi said "Cement production is a core industry for Oman, serving and enabling a self-sufficient construction industry. With the long-term support of ABB we have added to this strength and look forward to continued success, now with the latest digital control system across our three process lines. We have already identified time and cost savings, and will drive towards greater efficiencies and sustainability targets as we aim to be the number one cement manufacturing company in the Sultanate."

Image: Oman Cement's Muscat plant.

Uganda: Hima Cement sells cement on WhatsApp

Hima Cement has introduced Kafluu, a chatbot-led initiative that lets customers order products via WhatsApp. The subsidiary of Lafarge-Holcim says that customers can use the platform 24 hours a day, seven days a week to manage their orders and transactions. The automated chatbot software guides customers through the ordering process, gathering specifics like the product type, number of bags, delivery site and payment options. Payment is available via MTN MoMo Pay or bank transfer.

"We are always looking to improve the customer experience and Kafluu is able to respond quickly and effectively, enabling customers to place orders, make payments and input their delivery information with ease," said Israel Tinkasimiire, the Hima Cement Sales Director.

The initiative is being piloted in Mbarara first before rollout in the rest of the country.

Tunisia: Study tests cement's heavy metal content

Carthage University, Ciments de Bizerte, the Tunisian Ministry of Higher Education and Scientific Research and the University of Algarve faculty of science and technology have concluded a study into the heavy metal content of CEM-I and CEM-II cement. The study found that both types of cement contain traces of arsenic, barium, boron, cadmium, chromium, copper, manganese, nickel, lead, strontium and zinc in equal measure, according to the Journal of Engineering.

Carthage University said, "Heavy metals in cement can originate from a variety of processes in production, including their initial presence in raw materials and fuel, incorporation into kiln refractory brick, metal erosion from the raw material grinding process and in additives such as gypsum, as well as cement kiln dust."

These pages give *Global Cement Magazine*'s monthly review of global cement prices - in US$ for easy comparison. Some price information is only available to subscribers to *Global Cement Magazine*. Subscribe on Page 64. In this issue subscribers receive information from: Lebanon, Nigeria, Pakistan, DRC and India.

Prices are for metric tonnes unless otherwise stated. US$ conversions from local currencies are correct at the time of original publication.

Brunei: Butra HeidelbergCement, Brunei's sole cement producer, has launched an initiative to reduce the price of cement in the country, effective 9 February 2021.

"While Butra HeidelbergCement is highly affected by the Covid-19 pandemic and slowing economy, we took the move to reduce our cement price by US$3.76/t. We believe we must take this step to spur and support the construction industry and the nation as a whole," said Clement Lai, Commercial Manager at Butra HeidelbergCement.

Available at retailers across Brunei's four districts, the price reduction will be passed on to end-users, especially those who purchase 50kg bags. Butra HeidelbergCement now recommends that these are sold at US$5.26/bag in the Brunei-Muara District and at US$5.45/bag in Tutong, Belait and Temburong districts. The difference is due to transport costs. *See more on Brunei on Page 52.*

Egypt: Ordinary Portland Cement prices as at 16 February 2021: Arabian Cement Co (Al Mosalah) = US$51.41/t; Arabian Cement Co (Al Nasr) = US$48.66/t; Cemex (Al Nasr) = US$49.17/t; Cemex (Al Fahd) = US$48.02/t; Minya Portland Cement (Minya) = US$48.66/t; El Nahda Cement (Al Sakhrah) = US$47.25/t; Wadi El Nile Cement = US$48.66/t; Lafarge (Al Makhsous) = US$48.66/t; Arish Cement (Alaskary) = US$47.25/t; Sinai Cement (Sinai) = US$47.25/t; Suez Cement (Al Suez) = US$49.94/t; Helwan Cement (Helwan) = US$50.26/t; Misr Beni Suef = US$49.30/t; El Sewedy Cement = US$51.22/t; Misr Cement Qena (Al Masalah) = US$46.74/t; South Valley Cement (Ganoub Elwady) = US$47.38/t; Al Watania Company for Cement in Beni Suef = US$47.70/t.

White cement prices as at 16 February 2021: Sinai White Cement (Alabid Elnada) = US$160.05/t; Sinai White Cement (Super Sinai) = US$157.29/t; El Menya Cement (Super Royal) = US$155.37/t; El Menya Cement (Royal Elada) = US$154.48/t; Menya Helwan Cement (Alwaha Alabiad) = US$155.05/t.

Blended cement prices as at 16 February 2021: Cemex (A.one) = US$40.28/t; El Menya Cement (Al Omran) = US$41.11/t; Helwan Cement (Al Waha) = US$42.71/t; El Sewedy Cement (Sewedy Tashtibat) = US$43.03/t.

Sulphate-resistant cement prices as at 16 February 2021: Arabian Cement Company (Moqwem Mosalah) = US$52.11/t; Cemex (Al Mukawem) = US$50.71/t; Minya Portland Cement (Asec Sea Water) = US$49.24/t; Lafarge (Kaher Al Behar) = US$51.87/t; Suez Cement (Al Suez Sea Water) = US$51.23/t; El Sewedy Cement (El Sewedy Al Mukawem) = US$51.87/; Al Watania Company for Cement in Beni Suef = US$49.31/t.

EU ETS: The cost of CO_2 emissions permits reached another record high of Euro39.97/t on 12 February 2021, as Phase 4 of the EU Emissions Trading Scheme continues to bare its teeth. This represented a 4.8% week-on-week increase from Euro38.15/t on 5 February 2021, a 15.7% increase month-on-month compared to 12 January 2021 and a 67.7% increase year-on-year increase compared to 12 February 2020.

The price has not dipped below Euro30/t since 9 December 2020 and has remained above Euro35/t since 2 February 2021.

China: All-China 42.5 grade cement spot prices from sunsirs.com: 12-17 February 2021 = US$77.45/t. The slight reduction from prices earlier in February 2021 is due to the Chinese New Year holiday, running from 12-26 February 2021.

Do you have your finger on the cement price pulse where you are?
If so, *Global Cement Magazine* needs you!

Contact: Peter Edwards
peter.edwards@propubs.com

Regular contributors receive a free subscription to *Global Cement Magazine*!

Money money money...

Peter Edwards Editor, *Global Cement Magazine (peter.edwards@propubs.com)*

In its report *The Inequality Virus*,[1] the charity Oxfam highlighted one of the most startling figures of the Covid-19 pandemic so far: US$500bn. This is the amount by which the world's 10 richest men added to their wealth from April to December 2020. Read that again: *Added* to their wealth! In an effort to put a scale against this figure for us non-billionaires, Oxfam says this amount would be enough to vaccinate everyone on the planet against Covid-19 and to ensure that nobody ended up worse off due to the outbreak.

So where did this money come from? Well, you don't need to look beyond the cardboard box on your doorstep to see why Amazon's Jeff Bezos gained a tidy US$70bn in 2020. Elon Musk saw his wealth grow five-fold to US$170bn as shares in Tesla jumped 650% on hopes that the pandemic would speed up electric mobility. As online communication boomed, Facebook's Marc Zuckerberg saw his company grow by 30%, taking his wealth past US$100bn.

This is great for the stock markets, which following the immediate pandemic shock spent much of 2020 seemingly unaffected by the real economy outside. In the real econony, millions have lost their jobs and surviving businesses have lost orders. According to *The Inequality Virus,* it could take the world's poorest countries until 2035 to recoup their Covid-19-related losses. The IMF estimates that these require a combined US$2.5tn.[2] So far they have received around US$100bn, 1% of what has been spent by the world's richest economies.

The effects of the pandemic are uneven between economies, but also within them. In the US, the world's largest economy, 44 million people lost their jobs in the second quarter of 2020. In that country and elsewhere, research has repeatedly found that those in lower-paid professions, for example in retail and hospitality, have been more likely to be laid off due to outlet closures or, if fortunate, put on government job-retention schemes. Higher earners, often in computer-based professions have been able to continue working from home, with relatively limited disruption to their wellbeing. Like the billionaires, they were more likely to hold onto their jobs, incomes and their pre-existing savings than those in lower paid sectors.

The effects of Covid-19 on wealth inequality have reinforced pre-pandemic disparities in many countries. Women and ethnic minorities, over-represented in low-paid jobs, have borne the brunt.

The disconnect between the theoretical economy of the stock market and the economy 'as lived' was highlighted earlier in 2021. In January Wallstreetbets, a Reddit-based group of small-scale investors, noticed that shares in videogame retailer GameStop were being borrowed by large hedge funds, which were then selling them with a promise to buy back at a later date. This process, known as short selling, relies on the share price falling over the lending period and routinely turns a profit for well-placed hedge funds.

It would have worked if members of Wallstreetbets hadn't stepped in to 'defend' GameStop by buying up shares. This took the price from ~US$20 to ~US$350, flipping the hedge funds' expected profits into huge losses. While this provided profits for those that sold at the right time, many others lost out when the share price returned to its long-term value. Some claimed that this was a price worth paying to see the hedge funds suffer. GameStop didn't get anything out of the situation either, as it continues to close stores and shed jobs, the kind of jobs that lower paid workers rely on. The share-price rollercoaster was entirely unrelated to its fundamental prospects.

It is the hedge funds' losses that put the spotlight onto GameStop. Now illuminated, it brings wider attention to some of the methods by which wealthy entities can manipulate the economy to their advantage, sucking money out of GameStop, its employees and others like them. Oxfam, the World Economic Forum and others are now calling for progressive taxes, debt relief for developing economies and wide-ranging investment in the lives of the world's poorest to build an economic recovery from the pandemic that benefits as many as possible. This will cost a lot of money. Maybe we should ask Bezos, Musk, Zuckerberg, et al...?

1. https://www.oxfam.org/en/press-releases/mega-rich-recoup-covid-losses-record-time-yet-billions-will-live-poverty-least.

2. https://www.weforum.org/agenda/2020/10/covid-19-is-increasing-multiple-kinds-of-inequality-here-s-what-we-can-do-about-it

global cement MAGAZINE

Advertising enquiries: **Paul Brown:** +44 (0) 7767 475 998 / paul.brown@propubs.com

Editorial enquiries: **Peter Edwards:** +44 (0) 1372 840 967 / peter.edwards@propubs.com
Jacob Winskell: +44 (0) 1372 840 953 / jacob.winskell@propubs.com

Next issue: April 2021

Countries: Austria & Switzerland

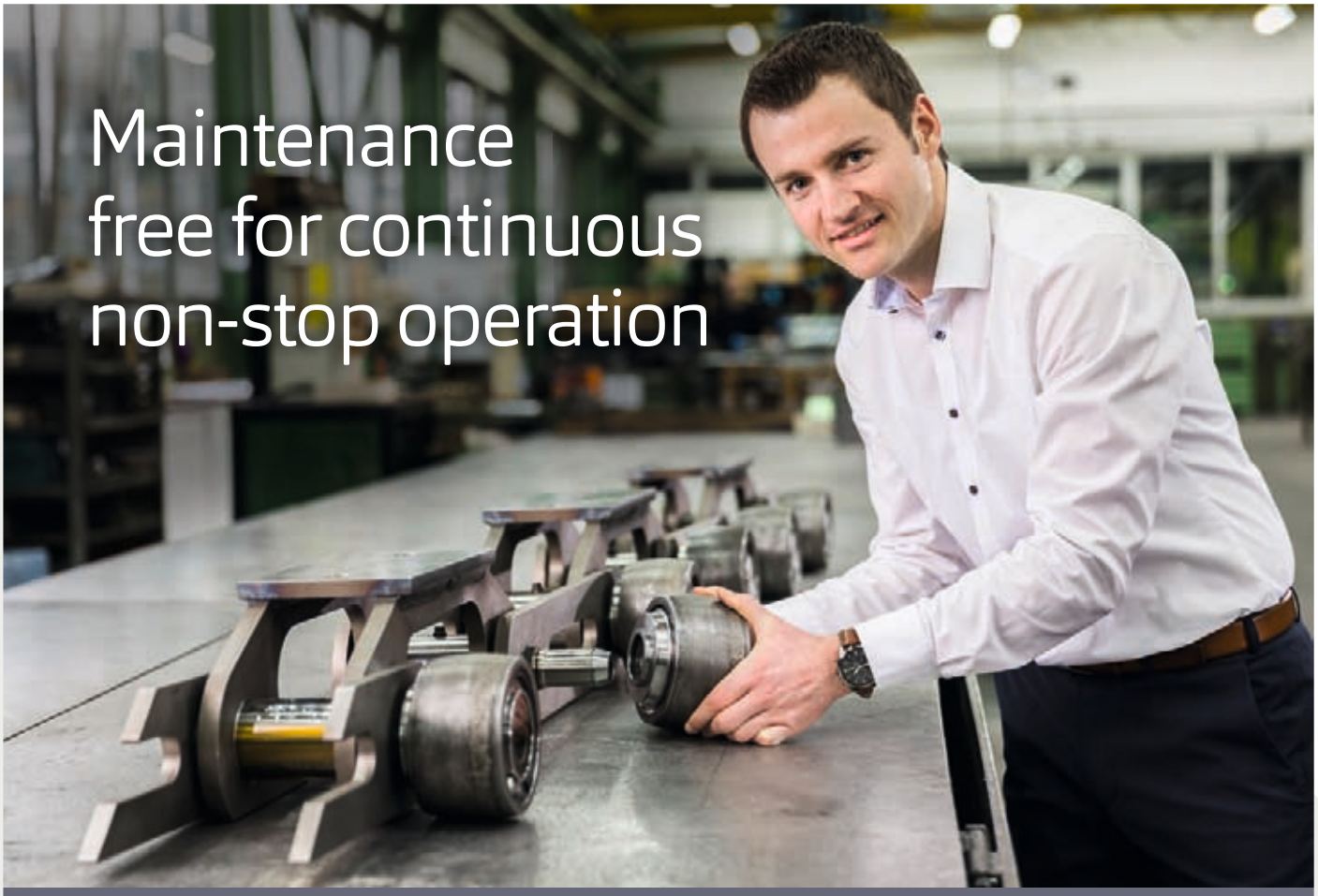
Distribution: Virtual CemTrans Conference
Virtual American Cement
Hanover Fair (Virtual Event)

Advertising deadline: 19 March 2021

Interview: PCA President and Chief Economist
Technical: Plant upgrades / Retrofits, Thermographic cameras, Waste heat recovery, Wear parts, Electrical issues, Laboratories / Analysis, Bulk Handling

EcoEvolution Technologies

KettenWulf



RECLAIMER CHAINS

WITH **SEALED CHAIN SYSTEM (TYP SCS PO)**

For over 90 years, KettenWulf, as an expanding global company, has stood for quality, reliability and flexibility. More than 1400 employees develop, manufacture and market customized solutions in the field of bulk material handling industry at ten locations across Europe, America, Australia and Asia.

» **SCS PO – Permanently Oiled**
The chain joint is equipped with our special SCS PO design. The one hundred percent oil-tight system allows continuous maintenance-free operation.
» Protects the sealed chain joint against contamination
» Field-tested under the toughest environmental conditions

Designed & manufactured by KettenWulf – www.kettenwulf.com

KettenWulf Betriebs GmbH
Zum Hohenstein 15
59889 Eslohe-Kückelheim
Germany

T + 49.(0)2973.801-0
F + 49.(0)2973.801-228
service@kettenwulf.com
www.kettenwulf.com

axians

2021

COMING SOON

VAS Suite

Let's get **forward together**

Digitalization and Automation are the key factors for your Business Optimization.

www.axians-ias.com

VINCI ENERGIES