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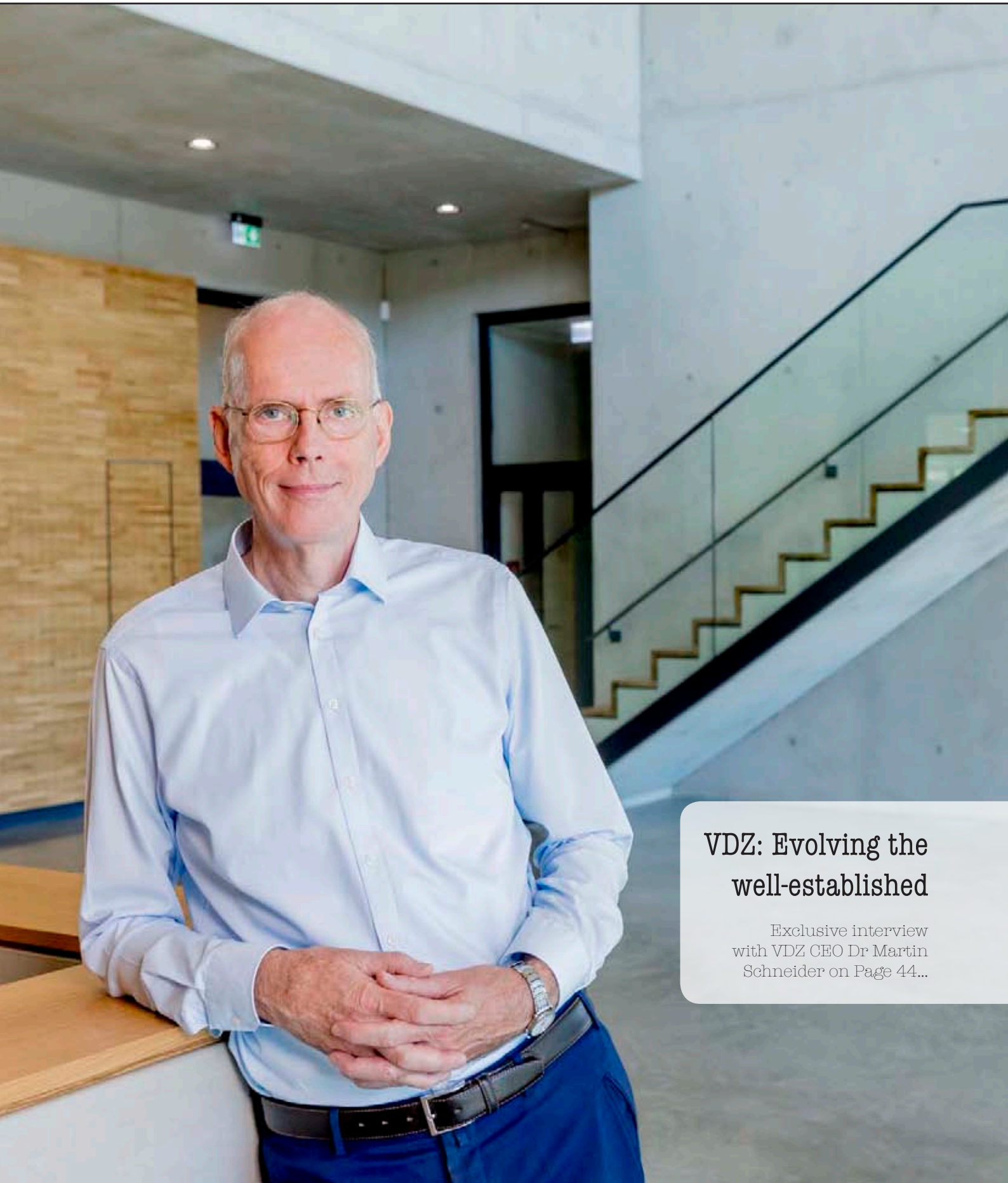

VDZ: Evolving the well-established

Exclusive interview with VDZ CEO Dr Martin Schneider on Page 44...

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VDZ: Since its founding in 1877, VDZ has sought to advance the cement sector, initially via the development of the first cement standards. Since the turn of the 21st Century VDZ has provided comprehensive scientific, consulting and technical services for the cement and building materials industry and now offers a wide range of services related to cement, concrete and environmental protection to customers all over the world. In September 2020 VDZ will move to new premises in Düsseldorf as part of its continued mission 'Evolving the well-established.' Turn to Page 44 to read *Global Cement's* exclusive interview with VDZ CEO Dr Martin Schneider. Image by Julia Vogel.

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Dear readers,

Welcome to the September 2020 issue of *Global Cement Magazine* - the world's most widely-read cement magazine - which is something of an innovation special. First up on Page 10 comes a wide-ranging discussion regarding innovation with Michele Di Marino of the cement producer Cementir. Moderately-sized within the grey cement sector, the Italian group is actually the largest white cement producer in the world. It is highly innovative, with a number of ingeneous and sustainable products already on the market. On the supplier side, KHD's new Chief Technical Officer Matthias Mersmann discusses how the company can help producers to meet their Paris Agreement targets for CO_2, as well as its approach to innovation and markets (See Page 14). Also looking to the future is Xavier d'Hubert, who argues the case for using renewably-generated hydrogen in the cement sector (Page 18). Splitting water to form hydrogen and oxygen is a well-established process but connecting to renewables could provide a plentiful supply of emission-free fuel for a wide range of processes, including cement. Last, but by no means least, we speak with VDZ CEO Dr Martin Schneider. In line with its mission 'Evolving the well-established,' VDZ will shortly move into a new purpose-built building. As well as this exciting move, which will unlock greater operational efficiencies for VDZ, Dr Schneider states that the German cement sector has now 'fully understood the climate issue.' "Never before in my 29 years in this sector," he says, "have I seen the cement sector so invested in a single goal."

A number of common themes emerge from the issue. Firstly, in its quest for enhanced sustainability, the cement sector must now look to even closer relationships with other sectors to unlock further material and energy flow synergies across a range of industrial processes. As part of this, it appears that CO_2 capture is now part of a suite of established technologies (Pages 24, 26 & 35) that should be used in cement production, rather than something from the distant future. Closely linked to this is the use of renewably-generated hydrogen (Pages 18 & 36), which could provide the missing link for greater industrial synergies across the board. Finally, and most importantly, there is a sense that sustainability is, to paraphrase Dr Schneider, no longer something we must do, but something we CAN do.

Enjoy the issue!

PKEdwards

Peter Edwards
Editor

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Interview by Peter Edwards, Global Cement Magazine

In discussion: Innovation at Cementir

Cementir is regarded as a medium sized player in global cement capacity rankings, but is the leader in white cement, with a strong innovation culture. *Global Cement* recently spoke with Michele Di Marino from the Group to discuss Cementir's operations, its response to the coronavirus outbreak and how its focus on new concepts places it well for the future...

Above: Michele Di Marino has worked for Cementir Holding for more than 10 years, the first seven in Copenhagen, Denmark, as Commercial & Business Development Director in the Nordic & Baltic Region. In January 2017 he returned to his native Italy as Chief Sales, Marketing & Commercial Development Officer, leading the global commercial strategy for the whole range of products and driving the Group innovation platform.

***Global Cement (GC):* Please could you introduce Cementir to readers who may be less familiar?**

Michele Di Marino (MDM): Cementir was founded as a cement producer in Italy in 1955. Since 1992 it has been owned by the Caltagirone Group, which has been prominent in Italian construction since the 1950s and is now diversified across several sectors. In 2004, Cementir acquired the Aalborg Portland Cement group from FLSmidth, bringing assets in Scandinavia, China, Malaysia, Egypt and the US. The group has since upgraded its production base and added a 1.1Mt/yr white cement plant in Egypt, the largest white cement plant in the world.

Cementir also added grey cement assets in Turkey via the acquisition of Çimentaş from 2001 onwards and Compagnie des Ciments Belges SA (CCB) in Belgium in 2016. In 2018 it took the bold step to sell its Italian assets due to the prolonged weakness in its home market, while further expanding abroad by acquiring the majority stake of Lehigh White Cement. These completed its tranformation from a producer of special cements exclusively in Italy into an international Group. It has invested Euro1.7bn in its growth without any capital increase.

Today Cementir has a white cement capacity of ~3.3Mt/yr and a grey capacity of up to 10Mt/yr. Its white plants and terminals are spread across five continents, making it a global leader in this arena. It also has more than 100 ready-mix concrete plants and 31 terminals across 18 countries in total.

Below: The Aalborg Portland Cement plant in Denmark, part of Cementir since 2003.

Relatively small but highly dynamic and innovative...

***GC:* What drives innovation at Cementir?**

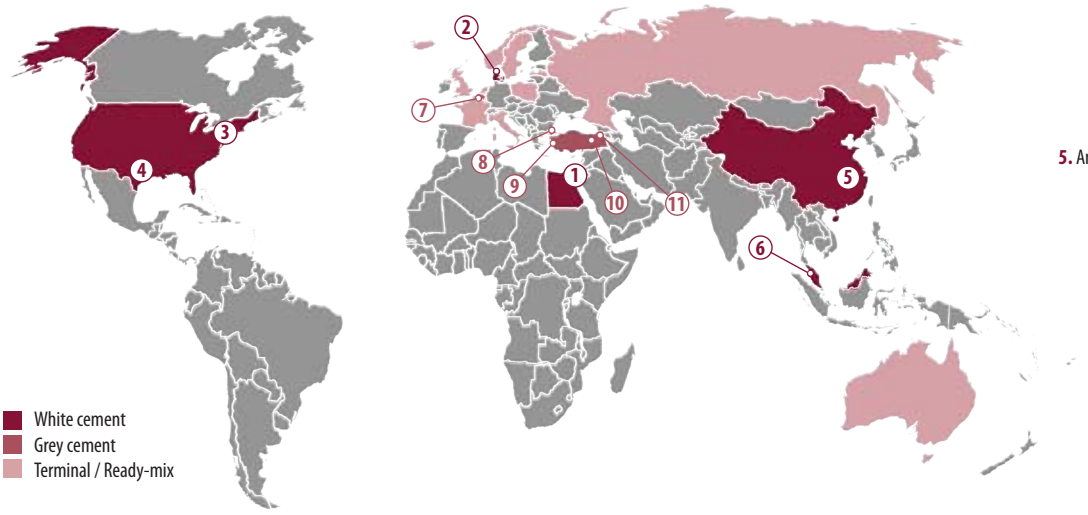
MDM: Cementir innovates in order to differentiate itself within a very crowded cement market. Indeed, 'innovation' without differentiation is just imitation. We innovate not only to develop better versions of our existing products, but to develop entirely new solutions and even new markets, always looking at the final applications.

We also want to develop niche markets to replicate the leading position that we have in the white cement sector. When successful, this approach provides first mover advantage, greater profitability and higher brand recognition. Via both approaches, we seek to build new mutually-beneficial long-term relationships with satisfied and loyal customers. Our ambition is to continuously facilitate and inspire the entire value chain, from architects, engineers and producers to the end users, by offering customer-oriented sustainable innovation.

I must also mention that sustainability is a key ingredient in our innovation mix. It is a constant target to lower the environmental impact of our products, some of which I will introduce later, and sustainability increasingly drives our customers too.

***GC:* Who generally suggests new ideas: Cementir or its customers?**

MDM: We have a mixture of Cementir- and customer-led projects and we are lucky to have a number of international customers that are highly innovative. They bring a lot of insights and suggestions. In turn, we observe how our products are used within the market by our clients, both large and small, which inspires us to try new mixes, approaches and projects.



WHITE CEMENT • 3.28Mt/yr

1. El Arish, Egypt, 1.1Mt/yr.
2. Aalborg, Denmark, 0.85Mt/yr.
3. York, Pennsylvania US, 0.13Mt/yr.
4. Waco, Texas, US, 0.13Mt/yr.
5. Anqing, Anhui Province, China, 0.72Mt/yr.
6. Ipoh. Perak, Malaysia, 0.35Mt/yr.

GREY CEMENT • 9.8Mt/yr

2. Aalborg, Denmark, 2.1Mt/yr.
7. Tournai, Belgium, 2.3Mt/yr.
8. Trakya, Turkey, 0.7Mt/yr.
9. İzmir, Turkey, 3.2Mt/yr.
10. Elaziğ, Turkey, 1.1Mt/yr.
11. Kars, Turkey, 0.4Mt/yr.

Above: Cementir's global presence, with white and grey cement plants shown. Countries with terminals and / or ready-mix concrete plants are also indicated.

***GC:* What developments can you tell us about?**

MDM: The biggest recent development has been our FUTURECEM™ technology, which has actually been developed over the past 20 years. It relies on the synergies between clinker, calcined clay and limestone. This allows for more than 40% clinker subtitution while keeping the performance of a pure Portland cement and a 30% reduction in CO_2 emissions. FUTURECEM™ has now been tested at full-scale in infrastructure projects as well as in indoor floors and walls. The technology can be implemented in standard concrete applications and offers high resistance in the most aggressive environmental exposure classes, which is fundamental for concrete durability. Lifecycle analyses show a ~20% CO_2 reduction compared to conventional concrete and an estimated 6% CO_2 emission reduction for a standard building. This chain of CO_2 emission reduction is aligned with CEMBUREAU's 5C approach, covering cement, concrete and construction.

In the past couple of years we have developed the InWhite® Solutions innovation platform, with the purpose of generating the most sustainable, cost-effective solutions in construction and building materials. InWhite™ brought in a number of ultra-high performance concrete premixes, both for aesthetic appearance and for more structural applications (Aalborg Extreme™ and Aalborg Excel™) based on FUTURECEM™ technology. We are looking at a 3D printing application (Aalborg Explore™), which takes advantage of the strength, durability and aesthetics of white cement. We are also researching a range of binders that our customers can build on to make new products, with 'InWhite® inside.'

Another very interesting project is with a German start-up that is looking into contactless charging for electric vehicles. Our role is to develop the cement mix and magnetic concrete for the charging points. The vehicle is then parked over the charging point to be charged. The project is currently looking at static charging, but dynamic, 'Scalextric-style' propulsion is a serious consideration. This is an example of how Cementir and its partners could disrupt other markets that are not related directly to building materials. Some car, scooter and forklift manufacturers are already taking an interest. It is a high-risk but potentially high-reward project.

***GC:* What about innovation in the production of cement?**

MDM: We looking at how our FUTURECEM™ technology can be used to produce white cement products and special premixers and binders, in addition to grey cement. Also on the white side, we are constantly on the hunt for alternative fuels that don't affect the colour of white cement. All this comes together with process-related innovations, some related to making the process leaner and more efficient, some linked to sustainability.

***GC:* Is innovation at Cementir led from the 'top-down' or does it rise from the 'bottom up?'**

MDM: I think we have a good combination of both at Cementir. In recent years maybe the 'top' has sparked the flame of innovation. It then spread fairly fast to all levels of the organisation and now the 'middle' and 'bottom' are fully and proactively involved. For instance InWhite™ is a good example on how we wanted to pursue an innovation mindset, embedded and institutionalised in the organisation and in the business process. We have been building good internal communication and bringing in people from different disciplines to cross-fertilise. This is leading to a collaborative culture that can quickly identify and develop relevant concepts.

Indeed, the Group has developed an approach to innovation that includes, among others, rapid prototyping, 'ideas factories' and business model design. This allows us to tailor our innovations to the market needs, to the customer's 'jobs to be done.' Also, it is important when an idea is developed to bring in

functions usually out of the innovation process, like the legal and finance departments. Depending on the business model, if there's an agreement with a third party in the pipeline or new business proposal from within the Group, we need to include these departments in the project from the start.

At the same time, we invest in people, which helps to develop the sense of engagement in the projects we are running. I think this important pillar is often overlooked.

***GC:* How does digitisation fit in with Cementir's innovation plans?**

MDM: We are part way through a major digitisation drive: Cementir 4.0. Over the next three years, this Euro20-25m digital drive will look at digital optimisation in three areas: production, maintenance and the supply chain.

The production element will look at digitisation in terms of automation of the cement production process and enhanced quality control. The smart maintenance element will develop and optimise our approach to predictive / preventative maintenance and diagnostics. The supply chain element will optimise material sourcing and ordering, tracking products and deliveries and ensuring best use of our fleets. Which in the end means improved value delivered to our customers.

***GC:* Which of these three elements will be the easiest and most difficult to implement?**

MDM: I feel that digitisation within the plants will be the least difficult of the three. There are now many suppliers of monitoring diagnostics equipment and artificial intelligence (AI) systems. Without being too crude, we can increase the use of them at our sites.

Most difficult will be digitally optimising our complex supply chain. For instance, our white cement plants supply material over tremendous distances to a large number of destinations. The Aalborg plant supplies more than 70 countries directly and indirectly, all under Cementir's direction. It is not a case of just loading the customer's ship and taking the cash.

Below: M Bridge in South Korea by Nanjing Beilida was made using Cementir's white cement.

***GC:* How *can* white cement production be made more sustainable?**

MDM: Digitisation aside, enhanced sustainability in white cement production is more difficult than for grey cement due to the higher quality requirements regarding its colour. Most problematically, this restricts for instance the types of alternative fuels. They must have zero effect on the colour, because the colour is one of the attributes you are selling with white cement.

However, the colour is only one of the differences between grey cement and white cement from Cementir. Due to the higher quality requirements placed on the process, the surface area is very high, leading to high strength and durability. This brings sustainability to infrastructure projects because it is possible to use less cement in the concrete mix.

Coronavirus effects

***GC:* How has the coronavirus outbreak affected Cementir's global operations?**

MDM: After a strong 2019, we lost about four weeks of production at our Chinese white cement plant due to the government-mandated shutdown. The Malaysian plant was also closed for a short time, again due to government restrictions. However, both plants were able to supply clients from their inventories and our bottom line was not affected too much.

In the second quarter a lack of demand forced the closure of one kiln at our Belgian grey cement plant. Production continued in Denmark, Turkey, Egypt and the US without too much disruption, other than adapting to social distancing, split teams and enhanced hygiene and cleaning measures. Our Turkish operations saw a reduction in demand at home but were able to continue to raise exports substantially.

The construction sector generally held up well over the first half, with white cement demand particularly resilient. The fact that we sell white cement to so many markets has smoothed out the worst of the geographical effects of the lockdown for Cementir.

***GC:* Has the outbreak had an impact on the group's capital expenditure projects?**

MDM: There have been a few delays and postponements, but we have carefully prioritised the projects. Nothing has been cancelled, just put on hold. The capital expenditure planned for 2020 will take place either later in 2020 or in 2021. According to the Industrial Plan 2020-2022, the Group is still committed to invest Euro100m in sustainability on top of the already budgeted capital expenditure for these years.

***GC:* How were office workers affected?**

MDM: Everyone that could work from home did so and many remain at home, with a switch to remote working. Some staff in Belgium and France were placed on government-supported job retention schemes. In the main, the transition to remote working has been successful. For example, my global team has an annual workshop on Innovation and commercial development but this year we experimented the virtual way. We actually found that engagement in the various workshops was higher online than in 'real life.' Our post event survey showed that people enjoyed it more and were more effective. Of course, it is still great to see everyone 'in the flesh' but we have learned that we don't need to fly to a physical location to still collaborate effectively.

We have even been able to undertake some complex activities, including the development of new products with customers. Senior management has begun to travel regionally once more. It is good to see customers again!

***GC:* How will the virus affect Cementir's working practices going forward?**

MDM: Of course home working isn't for everyone, but I think that the future for Cementir's office staff could be more flexible, if needed. A few colleagues benefitted from not having their commute and actually have more energy and focus for the task at hand.

Looking to the future

***GC:* How will demand develop through the rest of 2020 and the start of 2021?**

MDM: The coronavirus downturn, certainly for the cement sector, is very anomalous in that the economy has essentially been 'paused.' There will be some bad consequences in many sectors, particularly the hospitality and leisure sector, but construction is particularly well placed to both benefit from and contribute to the rebound. We already see steady improvement.

Of course there are risks. Aside from a potential second virus wave, there is the risk that stimulus packages may not yet be ready by 2021, which may hamper the recovery. National governments may also wind down their job retention schemes, which may contribute to unemployment and weaken confidence.

***GC:* What other threats are out there for cement producers in the post-coronavirus world?**

MDM: A major threat is the uncertainty regarding sustainability regulations, most pertinently for us the EU Emissions Trading Scheme (ETS). We need to know how it will develop but are currently in a kind of limbo-land where we can't confidently invest. Also a threat to many producers is continued consolidation. We must also look out for new players innovating into and disrupting our market.

Above: A FUTURECEM™ road bridge in Lolland, Denmark. **Source:** Torben Eskerod.

***GC:* What opportunities are there in the post-coronavirus world?**

MM: For both Cementir and the wider industry, I think there are massive opportunities to look beyond the immediate horizon. If we are serious about making sustainable buildings, we must look at the entire package. This includes bringing in glaziers, HVAC contractors, architects, energy companies and many others in an ideal ecosystem. Those that look beyond just cement and concrete will detect and benefit from wider trends.

***GC:* How will the cement sector of 2021 differ from that of 2019?**

MDM: At the risk of contradicting my previous answer, I think that many players will be much more focused on their core business of making cement over the next 12 months. They will have to restructure and divest non-core assets, with opportunities for well-placed smaller players.

There will also be a much bigger push towards digitalisation in 2021 than in 2019. The virus has really focused minds in this regard and shows us what is possible. Of course, digitalisation leads to greater process efficiency, which leads to lower emissions and greater sustainability. Everything is connected. Our job is to keep innovating to ensure that Cementir remains at the forefront of the changes that the rest of the 2020s will bring.

Financially the group is on a strong footing. Our net debt relative to EBITDA is one of the lowest among our competitors. By 2022 we anticipate that we will have a net positive financial position, which should provide a lot of freedom if others are looking to divest. The decision to sell our Italian assets speaks to the decisiveness of Cementir. It was not 'romantic,' but it was the right call. The owners have transformed the group before and will continue to review our position at this challenging yet exciting time.

***GC:* Thank you for your very interesting insights.**

MDM: It has been a pleasure to speak with you.

Interview by Peter Edwards, Global Cement Magazine

In discussion: Matthias Mersmann, KHD Humboldt Wedag

Global Cement recently spoke with Matthias Mersmann, the new Chief Technical Officer (CTO) at the German cement equipment manufacturer KHD Humboldt Wedag, about the company's approach to innovation, optimisation and wider trends for the future of the cement sector...

Above: Matthias Mersmann joined KHD in 1994. Over the next 15 years he led every major department, gaining a wide experience in process, design, engineering, automation, research and development and intellectual property. Mersmann left KHD in 2008 to found aixergee GmbH, a consultancy that specialises in digital modelling and optimisation solutions for the cement sector. He rejoined KHD as Chief Technical Officer on 1 February 2020.

***Global Cement (GC):* Please could you briefly introduce KHD?**

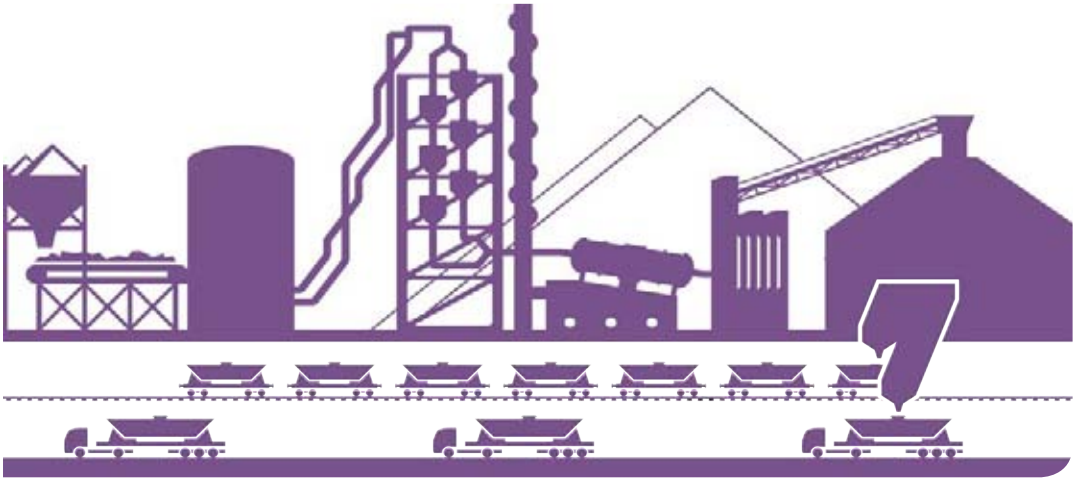
Matthias Mersmann (MM): KHD Humboldt Wedag was founded as early as 1856. At first it was a diverse local plant and machine manufacturer during the booming industrialisation of Germany during that time. After being part of the famous DEUTZ group, the inventors and pioneers of combustion engines in Germany, KHD became increasingly focused on industrial plants, particularly for the cement industry. It ramped up its international activities in the 1950s - 1980s, and gained its reputation by introducing a number of key innovations to the industry. These included cyclone preheaters, short dry kilns and the roller press, as well as innovative burners and many other components. KHD has several thousand crushing and grinding references, close to 1000 rotary kiln installations, 500 preheaters and more than 350 roller presses. Along with its main shareholder, China's AVIC, KHD can supply complete production lines, alongside specialised manufacturers of conveyors, bagging plants, silos and so on.

On top of this, KHD offers a wide range of equipment for individual plant modernisation or upgrades in areas such as emission reduction, alternative fuel processing as well as complex production automation and simulation.

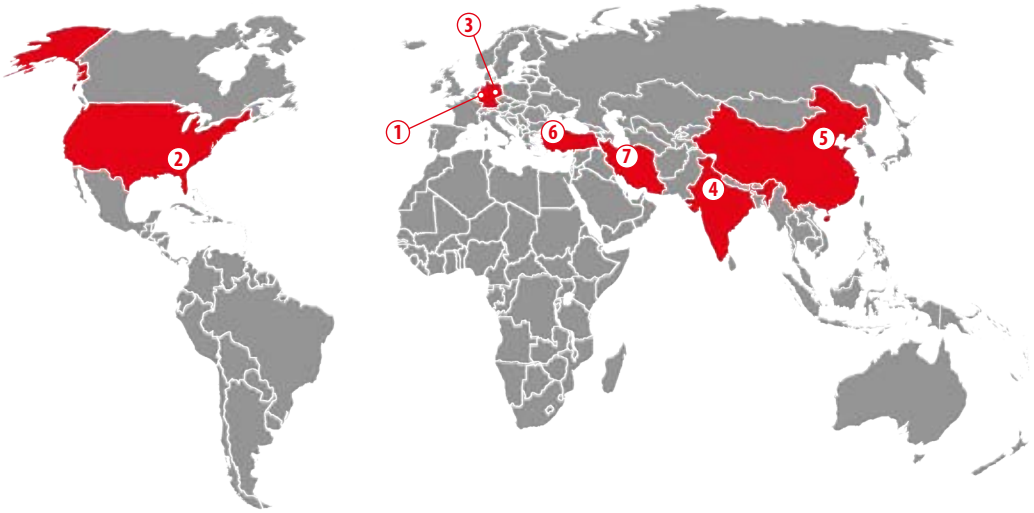
***GC:* What is your background within KHD?**

MM: I joined KHD in 1994. Over the next 15 years I was fortunate enough to lead several different technical departments, which gave me a great insight into the several technical fields of cement production equipment. In 2008 I left to found aixergee GmbH, an independant consulting company, and I then also had the opportunity to head the technology department for Loesche for eight years.

In 2019 KHD had revised its strategic outline, putting much more emphasis on future technologies and sustainability. They were looking for a CTO who could help KHD to transition into a low carbon digitised future. I was impressed by the determination and capability of the company. As we see it, there are two transformations that the cement industry will undergo rapidly in the coming years: low-CO_2 processes and digitisation. With a strong track record in innovative solutions, KHD is well placed to develop solutions to help in these areas.



Right: Cement producers will have to rethink decades of cement making technology over the coming 5-10 years.



Below: KHD Humboldt Wedag's international presence. The company employs around 700 people, predominantly in Germany and India.

1. HQ and Centre of Excellence, Cologne, Germany (Also Customer Service Centre for Europe, Africa, Middle East and Asia (not India / China)).

Other Customer Service Centres (Regions Served)

2. Atlanta, Georgia, US (The Americas).
3. Dessau, Germany (Russia & CIS).
4. Delhi, India (India / South Asia).
5. Beijing, China (Mainland China).
6. Istanbul (Turkey).
7. Tehran (Iran).

***GC:* What ethos drives innovation at KHD?**

MM: Our ethos is, and always has been, that technologically-advanced solutions are the best available option when considering cost, sustainability and actual performance. They may require a higher initial investment, but they will recoup that many times over in terms of operational cost, while also being more sustainable than a less advanced technology.

***GC:* The phrase 'technologically-advanced' conjours up images of fairly complex solutions. Is simplicity not sometimes the better option?**

MM: Technological advancement needs to still satisfy existing requirements - and the cement industry needs, first and foremost, robust solutions! Often it is more challenging to simplify the product than to add extra complexity. Our machines and plants should be as functional as possible while still being robust and simple. Our novel PYROREDOX® technology for instance reduces NO_x emissions to levels previously only possible using complex catalyst technology.

***GC:* What are KHD's latest technical responses to meet the needs of its cement sector customers, particularly with regard to CO_2 emissions?**

MM: There are a number of low-CO_2 roadmaps that have been published regarding the cement sector and more generally, for example from the World Business Council for Sustainable Development, International Energy Agency and CEMBUREAU. From these, KHD has identified five Action Points, which it has ranked depending on their technological readiness level and their potential to reduce CO_2 emissions.

The first Action Point is greater use of alternative fuels, which benefits plants both in terms of lower emissions and costs. KHD is in a strong position to help with state-of-the-art solutions such as its PYROROTOR®, a drum reactor that processes any kind of almost unprepared alternative fuels of up to 300mm 3D particle size. There are now three in operation, one in Austria and two in South Korea.

The second Action Point is greater use of supplementary cementitious materials (SCMs) in cement production. This is another strong area for KHD, given that it offers a range of very electrically-efficient and flexible grinding and crushing solutions based on roller press and separator technology.

The third Action Point, given that we expect SCM volumes to decrease in line with lower steel production and lower coal power use, is the use of calcined clays. We offer a calcined clay solution, KHD's Flash Calciner, although there are no references in operation as of yet. We feel that the industry is ready to accept this now, with a recent installation in Colombia and a forthcoming project in Cameroon coming from other suppliers.

Covid-19 effects

Mersmann reports that KHD was able to switch easily and quickly to remote working upon the onset of the coronavirus outbreak. At present its staff in Germany are working around 30% in the office, with a plan to increase this to around 50% in the autumn. As the virus recedes, Mersmann expects that there will be a greater proportion of office working but that it will not return to 100%. "We realise that home working doesn't create much of a problem for most staff, certainly not in the short-term. Indeed some people are more productive. However, we do need to keep tabs on the psychological effects of long-term working in the same environment that you are supposed to relax and sleep in."

Many ongoing projects have been paused, but Mersmann reports a collaborative and productive relationship between KHD and its clients regarding the resumption of projects at a later date. "We will undoubtedly suffer slightly from the delay, but are confident that all of the projects will resume."

A small number of the company's staff were placed on Germany's Kurzarbeit job retention scheme. However, the company has since decided to redeploy some of its project engineering staff to research and development tasks until the projects resume in full.

When asked if Covid-19 will lead to reluctance for cement producers to invest in capital expenditure projects, Mersmann says that cement and concrete are essential for society and will continue to be so in the future. He says that Covid-19 has paused developments as a 'small intermediate phenomenon.'

The fourth Action Point deals with using spent concrete as a sink for CO_2. There are technologies and logistical concepts being developed presently to re-carbonate spent concrete with CO_2 emitted from clinker production. In this approach a novel SCM (supplementary cementitious material) is being produced that can then be utilised for the production of new cement and concrete.

The fifth Action Point is the development of novel plants for producing clinker with novel, low-CO_2 technologies. This includes carbon capture and storage / utilisation (CCS/U), the use of oxygen in the kiln, the introduction of hydrogen from electrolysis and even running kilns completely as oxy-fuel kilns, i.e. without air as the oxidiser.

There has not been any real step change in innovation like this since the development of precalciners around 60 years ago. However, the next five years will see major changes due to low CO_2 emission requirements. These will challenge all cement producers and all equipment suppliers.

Indeed, cement plants as we know them could even become part of larger industrial complexes to unlock unrealised synergies in material and energy flows between different processes. This could include the use of renewable power from solar or wind to produce hydrogen and oxygen from the electrolysis of water. The oxygen would be used in the kiln to produce a high (90-95%) CO_2 exhaust stream that would be captured and then undergo the Sabatier Process (methanation) to produce methane (CH_4) and water. The methane could be converted to methanol and fed back into the kiln or used as a synthetic fuel for transportation.

The key to the fifth Action Point is bringing together previously distinct industries. The cement sector must open the discussion to include these kinds of technologies and more, not just rely on old approaches. This combination will result in different solutions at different sites, the configuration of which will depend on many factors - the proximity of CO_2 storage locations, the proportion of renewable energy, local industries and settlements that could make use of the methane - and so on.

Right: Schematic of the KHD Pyroredox® calciner for reduction of NO_x.

GC: **Is some form of CO_2 and / or H_2 infrastructure between sites a realistic prospect for the future?**

MM: It is possible, but building pipelines is expensive. I think there would have to be some very strong and reliable commercial drivers in place to see a widespread CO_2 or H_2 network, even in Europe.

GC: **You mentioned that the Action Points are ranked in terms of not only technical feasibility but also in terms of potential CO_2 savings. What are the relative gains of each?**

MM: Between the first two, which are both technically possible right now, we could reasonably expect to achieve 20-25% of the necessary savings to meet the UN Paris Agreement 2°C warming scenario by 2050 for the cement sector. Concrete recorbonisation, in my estimation, could contribute 30-50% of the saving budget to my estimation, with the remaining 30-50% contributed from novel clinker production approaches.

This will result in some cement plants that make traditional clinker with zero CO_2 emissions. I don't think all plants will be able to do this, but we will probably be able to take advantage of co-locating different industrial processes on the same site to greatly reduce emissions from the current level.

GC: **Do you think that, in some cases, the 'best' retrofit solution may be a padlock on the front gate?**

MM: In Europe some plants have already switched from integrated to grinding due to market conditions and the pressure from CO_2 costs. In the longer term, the potential for widescale closures is hard to predict. I think, right now, no one has enough information to clearly predict what the future will hold for the less-sustainable cement plants in operation around the world.

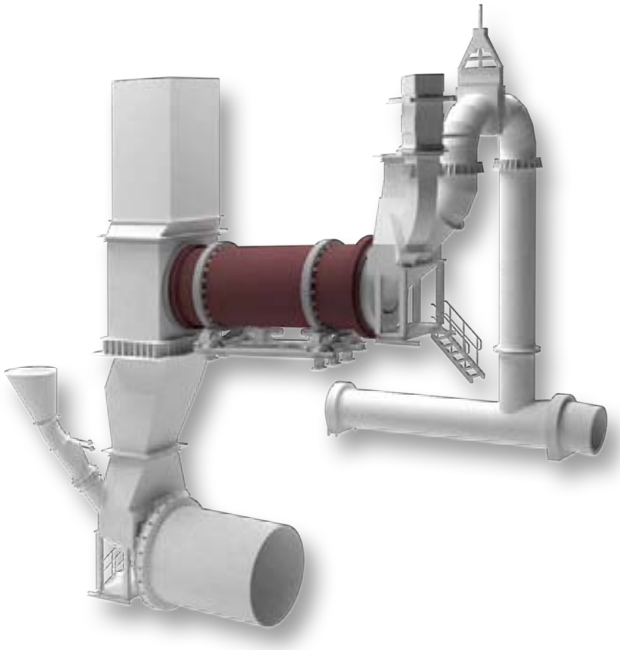
What I would say is that there is no future for construction without cement and concrete. By 2050 structures will probably be a little less concrete intensive, but there are simply no realistic alternatives that will mean a significant reduction in cement volumes. We will continue to use cement at a similar order of magnitude as at present, but its production will need to emit far less CO_2.

GC: **How have the digital optimisation solutions used at KHD changed over the years?**

Left: Many industrial processes may, in future, start with the hydrolysis of water via renewable energy sources.

MM: Before around 2000, KHD trialled a number of approaches, including numerical engineering tools, computational flow dynamics (CFD), 3D modelling and so on. However, simple CFD, for example, was not useful to our sector at that point because it lacked sufficient detail for the cement production process. So, while there was always a lot of interest, the modelling often did not yield good enough results.

Over the past 10-20 years, this has broadly changed. Such systems are now detailed enough to be used by cement engineering companies to design solutions that work. Undoubtedly, these simulation tools will be indispensible in the future and we will further integrate these technologies alongside artificial intelligence into expert systems for continuous online optimisation of the cement production.



Left: Schematic of the KHD Pyrorotor®.

Aside from CFD and machine learning, other approaches that have come since 2000 include 3D modelling from scanning the existing structures in order to build upgrades within the available space. These are increasingly used in response to the rising complexity of our projects. We work with more parties than in the past and in tighter time constraints. This kind of approach will help with ongoing improvements to plant engineering and project management.

GC: **How do you think remote process control will develop in the coming years?**

MM: There is certainly a desire for this approach, but the more we look at the problem of remote cement plant control, the more difficult the problem becomes. There is a clear analogy with driverless cars, where researchers found that their estimates of how much data is needed were gross underestimates. I'm not sure what the Greek letter suffix is for such volumes of data! That said, innovation is exponential. I think that we could see some 'driverless cement plants' in five years, but they would still have to be maintained!

GC: **Which markets will be important to KHD over the next 1-5 years?**

MM: Besides our traditional markets like India, Europe and Southeast Asia, there is a large potential market for low-CO_2 technology retrofits and digital solutions in China. KHD is well positioned to access this market via its major shareholder AVIC.

I think that the West has been slow to realise just how strict the Chinese authorities are on polluting plants. The emissions limits for pollutants there are now lower than those in Germany, with very strict enforcement. As the hundreds of cement kilns which have been installed in the early 2000s are now challenged with strict environmental regulation, there is a strong emphasis to individually optimise China's many hundreds of cement kilns. This provides enormous future potential for KHD, along with a huge number of markets, particularly retrofits and modernisations of plants in Europe, India and the US, which are major markets for us.

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

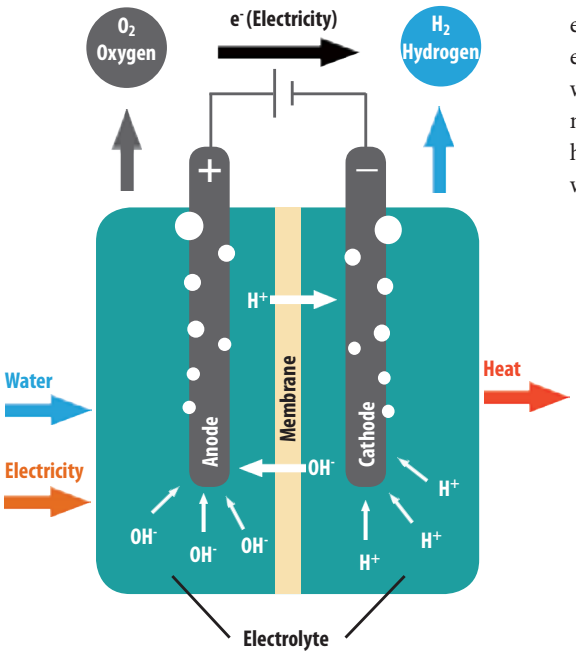
MM: You are very welcome indeed!

Xavier d'Hubert, Consultant

The multiple benefits of green hydrogen for the decarbonisation of cement production

The energy transition in the cement sector is accelerating under general public pressure to fight climate change. Technological advancements such as alternative fuels, waste heat recovery, lower clinker factor, the reduction in the cost of renewable energy, advances in electrical storage systems, and the approaches to carbon capture and storage / usage (CCS/U) in the cement industry will continue to present opportunities for improvement. Could green hydrogen also provide answers...?

The rising proportion of renewable energy being used in a number of markets is to be welcomed in the context of our collective efforts to mitigate climate change. However, as the world transitions to a low-CO_2 (i.e. a higher renewables) future, there remain issues regarding storage of the energy generated by such methods. At present the peaks and troughs associated with renewable energy, most notably solar energy and wind power, are compensated for by feeding back to national power grids in which renewables are only part of the mix. Current energy storage solutions can handle the fluctuations from renewables, but greater capacities will be needed as the proportion of renewables increases. Storage times, i.e. the discharge capacity of the system, will have to increase from the current 2-4 hours to days, weeks or months. Discharge times, currently around 10 hours for large battery solutions, will also need to be lengthened to fully harness the potential of renewable sources.



Right - Figure 1: Conventional electrolysis of water to produce hydrogen and oxygen.

Significant research therefore continues into effective storage solutions, which will be crucial in the effort to decarbonise our economy and, hence, the cement sector. To date answers to the intermediate storage problem have included:

- **Batteries** of various sizes and chemistries;
- **Gravity storage:** A heavy object (or water) is winched (/ pumped) upwards using electrical power and then lowered in a controlled fashion to regenerate power when required;
- **Thermal batteries:** Heat is transferred to high-capacity concrete blocks, ceramic blocks, pebbles or aluminium ingots;
- **Kinetic storage**, including flywheels.

Hydrogen as a storage solution

Hydrogen (H_2) is the simplest and lightest chemical element. Due to its high reactivity, it is not found on earth in its molecular form, but as its simplest oxide, water (H_2O) or as methane (CH_4), plus a myriad of more complex chemicals. Molecular hydrogen can, however, be generated from water via electrolysis, with molecular oxygen (O_2) also produced:

$$2\ H_2O\ (+\ \text{electrical energy}) \longrightarrow 2\ H_2 + O_2$$

Both hydrogen and oxygen are extremely reactive and can potentially be used as fuels / oxidants in rockets, fuel cells and other applications:

$$2\ H_2 + O_2 \longrightarrow 2\ H_2O\ (+\ \text{heat energy})$$

However, electrolysis of water is very energy intensive. This means that electrolysis using fossil-derived electricity is unsustainable. In contrast, hydrogen generated from renewable electricity would, despite being used as a thermal fuel but

Above - Figure 2: Could renewable energy sources (left) and alkaline electrolysis (right) work together to decarbonise the cement sector? Right image, courtesy of John Cockerill, shows a single 7.5MW stack.

without CO_2 emissions, represent a sustainable way to store and move energy. This is termed 'green hydrogen.' Indeed, 2019 saw a big push in this area, as well as with hydrogen generated from existing industrial processes. Some nascent technologies include thermal splitting of water using solar concentrators or nuclear energy.

As well as the ability to be stored for prolonged periods, the biggest advantage of hydrogen is that it has an existing infrastructure. 10Mt of hydrogen was produced in the US in 2019, mostly from fossil fuel fired steam / methane reformers (which produce carbon monoxide (CO) and hydrogen). This produces large amounts of CO_2. The alkaline electrolysis process mentioned above and shown in more detail in Figure 1 is also used.

Even with proven technology available, research continues with one option being to replace the water with steam. This would open up the possible use of waste heat from industrial processes, including cement plants, in order to increase the current conversion efficiency of 70%. If we assume that the conversion efficiency of a fuel cell is about 70%, then the 'round-trip' efficiency of the electrolyser/fuel cell pair is around 50%. The overall efficiency of an electrolyser / combustion process depends on the exact parameters of the combustion equipment used and the proportion of hydrogen in the fuel mix.

Firing cement kilns with hydrogen

The use of green hydrogen in the cement industry is soon to be a reality, with a multinational trialling its use at a plant in Europe as part of its target to achieve 100% fossil fuels substitution (See Box on Page 20). Hydrogen as a fuel to displace all or part of the fossil fuels used could soon be a reality. This approach is gaining most traction in Europe where natural gas is fairly expensive and there are costs associated with emitting CO_2. Mixing green hydrogen with natural gas is seen as a way to decarbonise electricity and heat production. Already large OEMs are offering gas turbines that can fire a mix of hydrogen and natural gas and are working toward 100% hydrogen combustors. As with oxygen, hydrogen can be mixed with natural gas at up to 10%, with very little impact on the combustion equipment.

Managing hydrogen

Of course precautions should be taken when handling hydrogen. It is very flammable and also very buoyant. This means that it escapes easily and quickly. Material for pipes and valves has to be specially selected to resist hydrogen-induced embrittlement. Major burner OEMs already have some experience firing pure hydrogen or mixtures. At any concentration it is a fairly easy-to-handle fuel, as long as the high flame propagation speed is considered and temperature peak issues are properly understood and dealt with. For rotary kilns this can lead to damage to the refractories and often higher NO_x levels, depending on the location of the hydrogen injection and the local oxygen concentration.

In fact, when gas was produced from coal in the 19th Century, the resultant 'town gas' contained about 40% hydrogen. Today, coke oven gas and

Hydrogen economy data

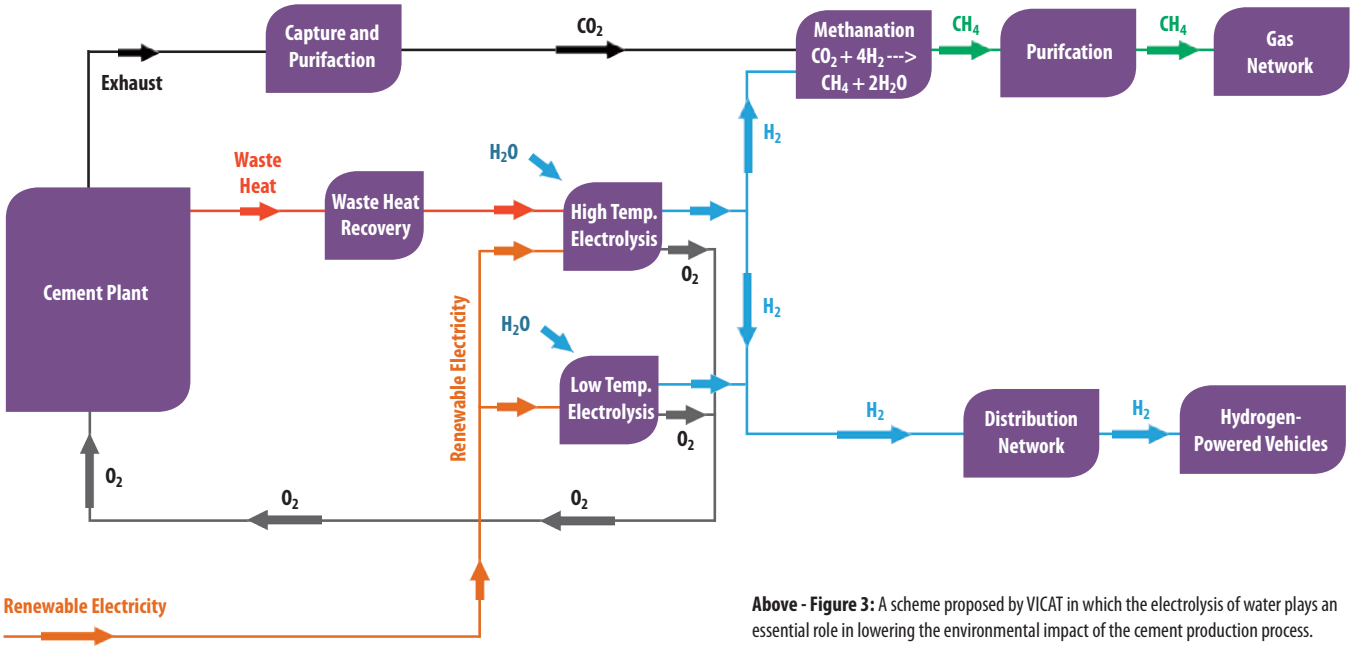
Density:		1kg H_2 = 11Nm^3
Mass energy density:		1kg H_2 = 3.2kg of petrol
Volumetric energy density:		1Nm^3 H_2 = 0.25L of petrol
1MW electrolyser produces:		
	H_2:	200Nm^3/hr / 18kg/hr / 0.43t/day
	O_2:	100Nm^3/hr / 144kg/hr / 2.45t/day
Conversion efficiency:		~70%
Water use:		Production of 1kg of H_2 requires at least 10L of demineralised water.

Use of hydrogen in the cement sector

1. VICAT is studying the possibility of recovering the CO_2 emitted through the use of hydrogen to convert it into a usable bio-fuel or chemical intermediate. It sees this as part of a wider scheme to decarbonise not only its clinker production process but also a fleet of trucks, which it has already ordered (See Figure 3). Waste heat from cement production can be used to increase the yield of hydrogen. Finally, the plant will use the oxygen generated to boost efficiency in its kiln. The use of hydrogen directly as a fuel in kiln and/or calciner will also be investigated, with the aim of zero fossil fuel use in the future.

2. The Hanson (HeidelbergCement) Ribblesdale plant in the UK announced in February 2020 that it would trial the use of hydrogen in its kiln, along with biomass. The results will be shared across the cement sector.

3. Lafarge Zementwerke, OMV, Verbund and Borealis signed a memorandum of understanding in June 2020 to plan and build a full-scale unit at a cement plant in Austria to capture CO_2 and process it with hydrogen into synthetic fuels, plastics or other chemicals.



Above - Figure 3: A scheme proposed by VICAT in which the electrolysis of water plays an essential role in lowering the environmental impact of the cement production process.

non-condensible gas (50-60% H_2) are routinely fired through the main burners of rotary kilns used to process lime mud in pulp and paper plants and in the lime kilns used at steel plants.

Don't forget the oxygen

While in electrolysers the focus is on hydrogen production, one important advantage of co-locating such electrolysers within cement or lime plants is the 'free' oxygen that would be available (See Figure 3). Indeed, some cement manufacturers currently pay a premium to receive oxygen in tanks from third parties due to the myriad benefits it brings to the process: A shorter and more stable flame; higher quality clinker; greater use of alternative fuels (including the use of lower quality alternative fuels); increases in production rate (or lower electrical use by the ID fan at the same rate, and, finally; reduction in CO_2 emissions. When oxygen is currently vented at some electrolysers for lack of an immediate practical use, this is a clear opporunity.

Concluding remarks

While great strides have been taken with regard to reducing the clinker factor, increasing the use of alternative fuels, raising process efficiency and improving other parameters in the production process, the path to fully decarbonising the cement industry continues to be long and incremental. However, it is clear that there is a way forward that uses existing mature technologies and green hydrogen generated from renewable sources. This can offer opportunities to both store and regenerate electrical power and also to directly fire the cement making process.

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Scott Grumski, Forney LP

Building a future-proof construction materials testing technology ecosystem

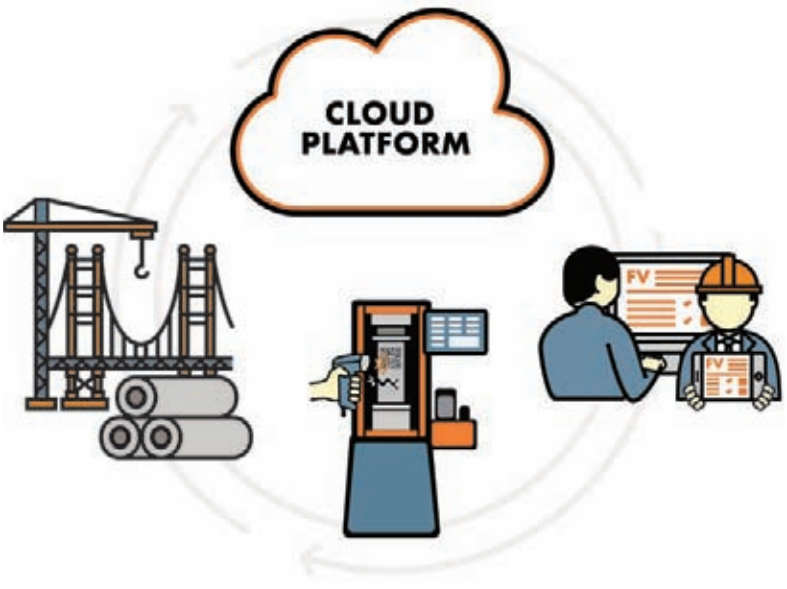
Increasing demands for better productivity, accuracy and transparency, especially during this new age of remote work and social distancing, have led cement and concrete firms to explore ways to modernise their testing workflows.

Historically, construction materials testing (CMT) has been a highly manual effort, with paper-based tools that lead to inefficiencies, errors and increased costs. Many firms persist with these legacy processes. However, today's challenges can't be solved with pencil and paper. Some firms have been willing to move on using automatic testing machines. Others have implemented homegrown databases or third-party software to keep track of test results, timelines, billing and other project data. However, interrupted workflows are inherent in these homespun methods and can ultimately undermine the initiative.

Many companies are overwhelmed by their options and unsure of where to begin. The extensive data silos in the construction industry don't help. Conflicting file formats, software packages that don't integrate and user errors scare off teams from trying to implement unfamiliar solutions. In an industry that relies on the continuity of standards and where so little change happens over prolonged periods, it can be difficult to imagine how transformative these new technologies can be.

Then Covid-19 burst into our lives and everyone who depended on CMT results, be they test labs, engineers, project owners, etc, has had to socially distance and access key project data from home. Compared to other industries, the cement, concrete and wider construction sectors are poorly equipped for effective remote working. On one hand, this has provided the impetus for construction firms to catch up. On the other hand, it has led many firms to search for quick solutions that only solve the short-term needs of social distancing and remote work.

To get through this - and come out on the other side in an even better position - the conversation needs to move to future-proof technology, which grounds CMT workflows in modern technology. Four major building blocks make up a future-proof CMT technology ecosystem, each of which is essential:



1. Cloud-based platform: The cloud definitely helps to jump-start the process. Any firm that is already comfortable with the cloud found it a relatively easy transition to work from home. It's also a major facet of scalable technology. This is because on-premise or stand-alone solutions age out within years, but cloud-based tech can continuously and remotely update without interruption.

It's important to note the difference between a cloud-based platform and cloud-based storage. The two terms are not synonymous. Cloud-based storage is defined as flat files shared on a server that are manually organised into a folder structure (e.g.: Google Drive). In contrast, an integrated cloud-based platform is defined by free-flowing data that can be integrated to work with other software programs.

An integrated cloud platform makes CMT workflows more productive, accurate and transparent. It provides structure to a lab's testing, analytics, data access and security needs and it eliminates the vulnerability of paper-based data management. Putting this at the centre of the workflow will help teams, processes and other associated technology work together better. Due to the nature of the cloud, these processes are very future-proof.

2. Open system: A cloud-based platform by itself

is not enough. To really pay off, the platform must be able to scale and integrate with other CMT components. Data must sync and move freely between the cloud database, testing machines, laboratory information management systems, accounting system and more. To accomplish these capabilities, the solution needs to play along well with other technologies. An open ecosystem, where individual applications work together, will make the job painless. In contrast, a closed, siloed system makes it challenging to collaborate between apps and it becomes impossible to add more functionality as the systems grow.

If the solution can't easily be integrated into the existing process and systems, it won't help. It is prudent to ask: If things change, will the software be able to adapt? An integrated, cloud-based platform should enable an easy pivot for the organisation.

3. Short learning curve: It can be difficult to get people to change the way they are used to working. This means any piece of technology that is introduced into a testing environment should transform the process without making it more difficult to get the work done. After all, technology is only as good as it is usable. Although learning curves are inevitable, they shouldn't be a roadblock in the adoption and training process. To identify any potential for conflict, it is important to ask:

- Can long-term employees easily integrate existing work-processes with this platform?
- Can new employees quickly pick up on the process?
- How easy is it for you to connect the platform to the tools you already have and want to continue using?
- Is the job easier and the results better?

A platform with a short learning curve allows users to configure systems in a way that they are comfortable using them, while still improving the processes.

4. Quick technical support: Regardless of the solution that is chosen, a provider with an experienced, dedicated team that knows the unique issues of construction materials testing and exactly how to tailor solutions to meet your needs is key. There should be a quick startup and turnaround for firms that need immediate support. Future-proof technology requires a support team that can keep the necessary systems working when they are needed.

Conclusion

Once Covid-19 subsides, the world will have moved beyond paper-based testing and data management protocols. For cement and concrete producers that lag behind this trend, it will be much more difficult to catch up. There is no better time than now to invest in a cloud-based platform that enables a fully-connected CMT ecosystem.

Carbon8 Solutions

Carbon8 Systems to deploy pioneering CO_2 capture and usage technology at Vicat plant

A UK-based carbon capture firm reports on the first commercial development of its CO_2ntainer carbon capture and usage solution at a cement plant...

Carbon8 Systems, which has invented and owns a process that combines industrial byproducts with captured CO_2 emissions to produce lightweight construction aggregates, has reported its first commercial contract. The agreement with Vicat saw the installation of Carbon8's CO_2ntainer technology at Vicat's Montalieu plant, near Lyon, France, in August 2020.

The CO_2ntainer system is a modular, containerised solution that has been successfully piloted at cement plants in the UK and Canada. It is directly integrated into the existing process, capturing CO_2 directly from the plant to convert cement bypass dust into lightweight aggregates.

The process uses Carbon8 Systems' patented Accelerated Carbonisation Technology (ACT) solution. ACT relies on a process of carbonation, which occurs naturally under atmospheric conditions. If left in the open, calcium and magnesium oxides, hydroxides and silicates react with and absorb atmospheric CO_2.

However, carbonation is extremely slow. Carbon8's technology accelerates this process in a controlled manner, which means it can control the physical characteristics of the end-product. The end-product has various applications, including as aggregates for construction, agricultural fertiliser and other high-value applications.

Below: The CO_2ntainer arrives at the Montalieu plant. It will enter full production by the end of 2020.

Working with Vicat

In its first phase of operation, Carbon8 Systems' CO_2ntainer will process and convert up to 12,000t of cement bypass dust into construction aggregates. Vicat can then repurpose the aggregates in various ways, for instance as lightweight concrete blocks.

Dr Paula Carey, co-founder and Technical Director of Carbon8 Systems, says, "Securing a commercial agreement with Vicat, which has a strong commitment to process innovation and sustainability, is a massive endorsement of our technology. We are delighted that Vicat has chosen Carbon8 Systems to help reduce its carbon emissions and, at the same time, create a potential new income stream for its business."

Dr Laury Barnes-Davin, Scientific Director of Vicat said, "As part of our commitment to limit our environmental impact, Vicat has looked at a number of innovative ideas to reduce its CO_2 emissions. We are attracted by Carbon8 Systems' two-part technology proposition and are excited by its potential for our operations elsewhere in France and around the world."

Further projects

Carbon8 Systems is now in advanced discussions with other cement producers around the world to deploy its CO_2ntainer solution. In addition, the company is pursuing opportunities in other sectors where waste residue disposal is increasingly expensive and CO_2 emissions need to be reduced as part of the transition to zero CO_2 emissions by 2050, for example energy from waste, steel and paper. By utilising the waste at source and onsite, companies using ACT will reduce the amount of waste going to landfill and so further reduce the environmental impact of their operations.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Dr Helen Atkinson, C-Capture

Towards large-scale CO_2 capture in the cement sector

Due to a highly competitive market, modern cement plants are very efficient, which limits the scope to further reduce CO_2 emissions via efficiency improvements. Therefore, the cement industry is taking an increased interest in carbon capture and storage (CCS) in order to significantly reduce CO_2 emissions from cement production.

Above: Dr Helen Atkinson, Business Development Manager at C-Capture.

The World Business Council for Sustainable Development estimates that 500Mt/yr of CO_2 must be captured from cement production using CCS by 2050 in order to stay within the 2°C scenario defined by the UN Paris Agreement. Significantly more will have to be captured to achieve net zero emissions from the sector.

There are, however, significant challenges that need to be addressed when assessing the feasibility of large-scale deployment of CCS at cement plants. Firstly, deployment of CCS technology requires substantial investment, and in a price sensitive industry these costs are not easily passed on to the consumer. Second is the question of what to do with the captured CO_2. In some countries, this question is now being answered. For example, the industrial clusters of the UK are making progress with roadmaps for CO_2 transport and storage infrastructure. However, these are only useful for cement plants located in or near a cluster. Thirdly, there are additional challenges due to the nature of the flue gas from cement plants, which have high levels of O_2, SO_x, NO_x and dust.

As the calls for a post-Covid economic recovery that prioritises climate goals grow louder, it has become clear that economic stimulus packages for industry must tie in with the goal of net zero CO_2 emissions by 2050. Now is an opportune time for companies to invest in technologies such as CCS. Regarding the fate of the captured CO_2, the cement industry is uniquely placed, with options directly relevant to the building sector. Many are developing technologies that turn CO_2 into building materials. These include the production of aggregates via the combination of CO_2 with waste ash, as well as mineralisation processes. CO_2 can also be used to accelerate the rate at which concrete cures.

A non-amine approach to CCS

The nature of the flue gas is where C-Capture is able to offer something unique to the cement industry. C-Capture's solvent is very resistant to oxidation and it has a different CO_2 capture mechanism compared to existing technologies based on amines. With amine systems, it is the fundamental reactivity of the nitrogen atom that absorbs CO_2. But this same nitrogen atom makes them susceptible to oxidation and hence degradation. C-Capture's solvent is different in that it is amine-, indeed nitrogen-free. The mechanism by which it absorbs and releases CO_2 means it breaks down far less easily. C-Capture's technology uses 40% less energy than current commercially available technologies. It has been specifically developed to minimise environmental impacts, is biodegradable and can be manufactured from biological sources.

The company feels that its solvent offers some real advantages to industrial applications, particularly those with less clean flue gases. These advantages will help the development of large scale deployment of CCS in the cement industry.

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Europe: Tallest wind turbines could be made with 3D printed concrete

France's GE Renewable Energy, Denmark's COBOD and Switzerland's LafargeHolcim have joined forces to develop record-tall wind turbine towers with 3D-printed concrete bases. While traditional turbines are limited to heights of around 100m, 3D printing the base with concrete directly on site, will enable the creation of larger bases and cost-effective taller hybrid towers, reaching up to 200m. This will enable the turbines to capture stronger winds, generating more power at a lower cost. The consortium, which makes use of COBOD's 3D printing technology and LafargeHolcim's concrete, successfully printed its first prototype, a 10m-high tower pedestal in October 2019 in Copenhagen. By exploring ways to economically develop taller towers that capture stronger winds, the three partners aim to generate more renewable energy per turbine.

"Concrete 3D printing is a very promising technology for us, as its incredible design flexibility expands the realm of construction possibilities," said Edelio Bermejo, Head of Research and Development at LafargeHolcim. "As both a user and promoter of clean energy, we are delighted to be putting our material and design expertise to work in this groundbreaking project, enabling cost efficient construction of tall wind turbine towers and accelerating access to renewable energy."

Henrik Lund-Nielsen, founder of COBOD International A/S added: "We are extremely proud to be working with world-class companies like GE Renewable Energy and LafargeHolcim. With our groundbreaking 3D printing technology combined with the competence and resources of our partners, we are convinced that this disruptive move within the wind turbines industry will help drive lower costs and faster execution times, to benefit customers and lower the CO_2 footprint."

US/Mexico/France: Cemex to turn old concrete into new aggregates

Cemex is involved in a working group 'focused on the application of FastCarb aggregates to concrete production' as part of its efforts towards net-zero CO_2 concrete production. FastCarb, administrated by the US-based International Research and Exchanges Board, is a project that aims to produce aggregates from recycled concrete containing trapped CO_2 from industrial exhaust streams.

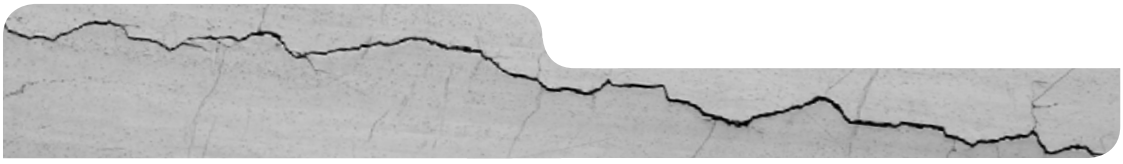
Cemex said, "After completing the first phase of the experimental approach at the laboratory level with promising preliminary results, the project is now entering the second phase, which seeks to tackle the industrial approach. In this industrial approach phase, Cemex was recently assigned to evaluate the physical and mechanical properties of the carbonated recycled concrete aggregates when used in ready-mix concrete in the laboratory facilities at the Cemex France National Technical Centre."

Germany: HeidelbergCement uses low-alkali concrete for Autobahn

HeidelbergCement has reported the successful resurfacing of a section of Federal Motorway 5 between Karlsruhe and Frankfurt using a concrete made from low-alkali cement produced at its 1.4Mt/yr-capacity Schelklingen, Baden-Württemberg integrated cement plant. The company used over 3600t of cement to produce the 12,000m^3 of concrete required for the 3.2km stretch of road.

Finland: New ready mix plant

Lujabetoni says it has begun work on a new 80 - 100m^3/hr ready-mix concrete plant in Kuopio, Northern Savonia to replace its existing plant in the town. The new unit, which will serve construction projects throughout the region, will have an improved raw material heating system. The plant is scheduled for completion in late 2020 or early 2021.



Dr Paul Flachskampf & Dirk Schlemper, INFORM GmbH

Machine learning in logistics: Make every minute count

Logistics in the cement, ready-mix concrete and aggregates industry is facing a major overhaul as traditional tools and processes are enhanced or even replaced with machine learning (ML). When it comes to automated decision-making in transport planning, ML algorithms can move predictions one step closer to reality.

We have all heard a lot of hype and excitement around machine learning (ML). However, there's a lot of confusion about what the term ML really means and what it can do today. So, before we take a look at how it can improve the logistics performance in our industry, let's break down five of the common myths around ML.

Myth 1: ML can do anything with data. For many, ML simply means shovelling piles of data into one side of a computer and collecting 'answers' on the other side. What if the answers are wrong? Well, just stir the pile until the answers start looking right. Right?

No, it isn't that easy. ML is a sophisticated set of technologies that allows you to use the data generated by your business. Before you can expect answers, however, you have to understand the problem that you are trying to solve.

Myth 2: ML and data mining is 'easy.' Early experiences in ML often resulted in disappointing results because analysts grabbed data sources without vetting them first. Before taking any action, data has to be clean and accurate. To benefit from big 'data lakes,' it is important to truly understand their sources. Where does it come from? Who has manipulated it? Are they reliable? At the same time, make sure that you have enough data to discover the patterns and anomalies within that data. ML cannot turn missing, incomplete, or wrong data into valuable insights.

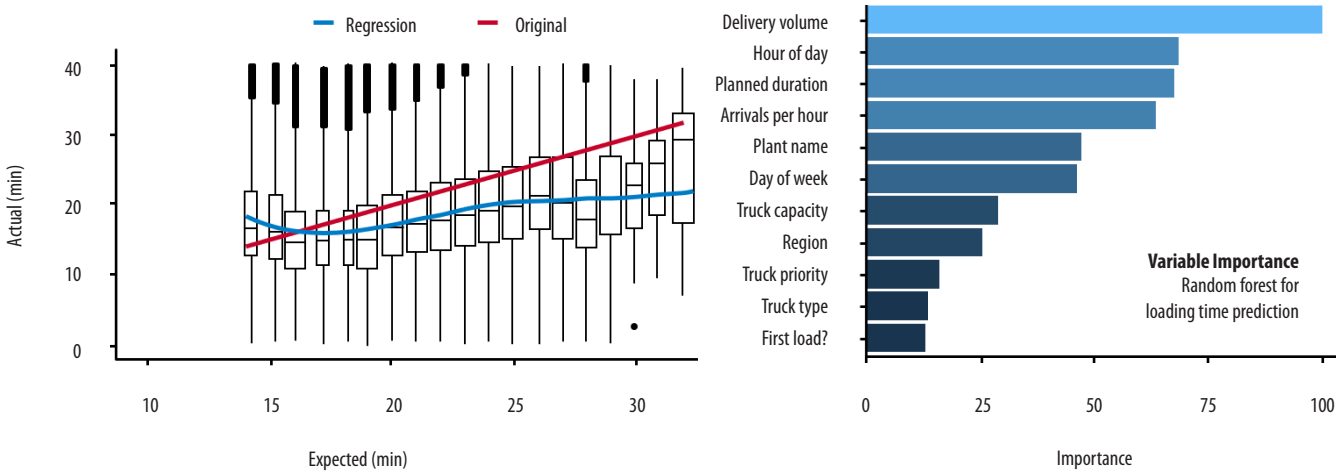
Myth 3: ML is about predicting the future. This is true... and false. Keep in mind that ML will always be trained on historical data, so it will struggle to predict the future in situations where the future is expected to diverge from the past, e.g.: predicting the next pandemic crisis. Instead, you should use ML for its full range of use cases: to generate business insights and to add new application features, in addition to predicting outcomes and forecasting.

Myth 4: In ML data we trust. The per capita consumption of mozzarella cheese in the US correlates with the number of civil engineering doctorates awarded over the same period. Is there really a correlation between cheese and civil engineers? No! This is one of the many spurious correlations that Tyler Vigen, a Norwegian student, has published on his website *(www.tylervigen.com)*. Just because two trends seem to fluctuate in tandem, that doesn't prove that they are meaningfully related to each other. This example is not meant to create a distrust for ML, rather it illustrates the pitfalls of our data-rich age. If you torture data long enough, it will confess anything. So when you use ML, doublecheck the outcome with your human experts. Don't trust blindly.

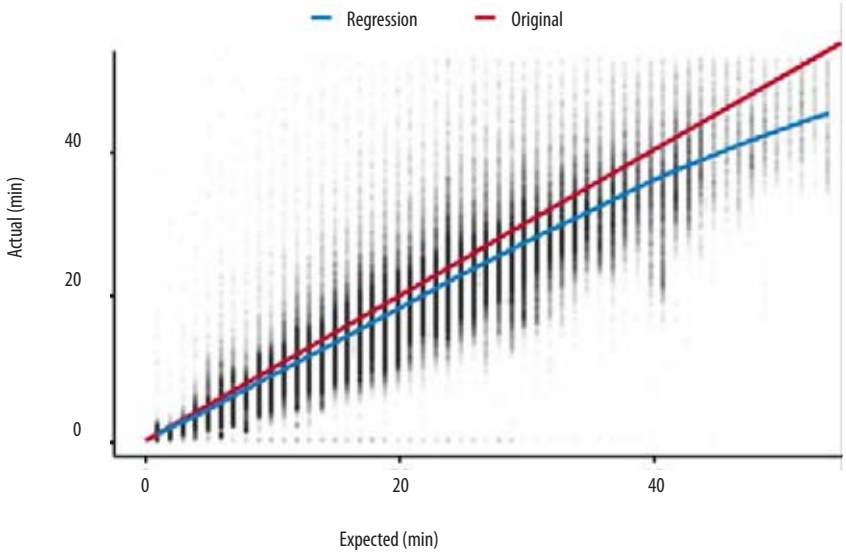
Myth 5: ML and AI are basically the same. ML is often referred to as Artificial Intelligence (AI). For most people, when they hear AI they think of General AI, or human-level AI, which can mimic

Below: Crossing the data lake in building materials logistics.

Below - Figure 2: Loading times. Data from 150,000 ready-mix concrete deliveries in 2018. Outliers removed.



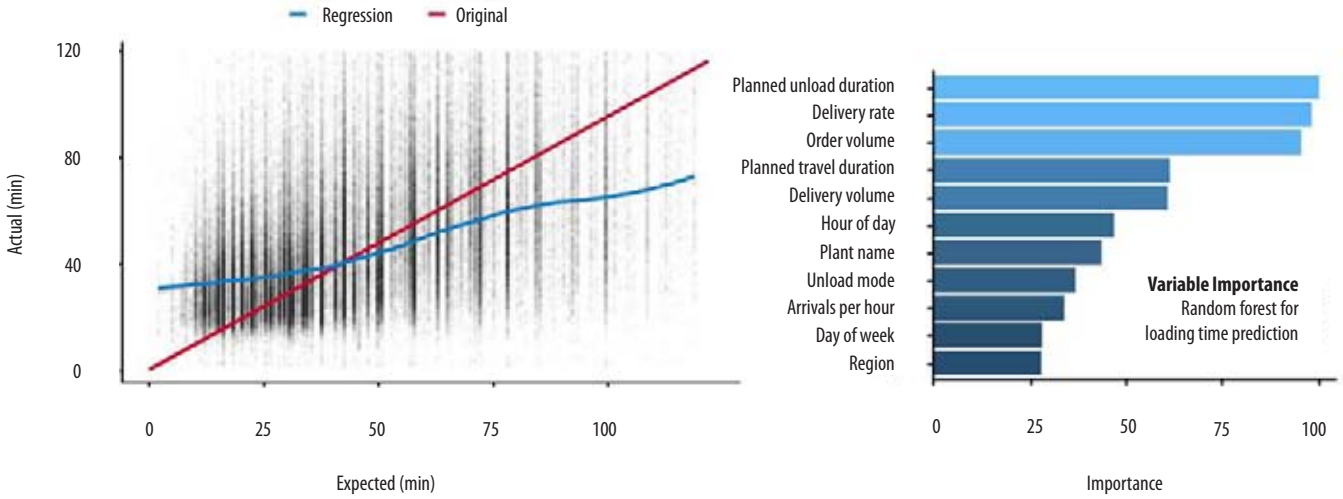
Below - Figure 3: Travel times. Data from 136,000 ready-mix concrete deliveries in 2018. Outliers removed.



all aspects of human intelligence. However, a digital 'jack of all trades' that can replace human beings is not yet available. The truth is, it still has a very long way to go. In contrast, ML tools use algorithms to learn from and adapt to data, enabling computers to find hidden insights without being instructed where to look. A simple example of this is email spam filters. Smart spam filters continuously learn from a variety of signals and tailor themselves to the email needs of the individual user.

A hidden champion of AI is Operations Research (OR). It uses analytical methods to analyse data in order to optimise the planning and real-time control of business processes. Much of this technology has its roots in supply chain optimisation. It entered our industry in the mid-1990s, sparked by massive improvements in low-

Below - Figure 4: Unloading times. Data from 138,000 ready-mix concrete deliveries in 2018. Outliers removed.



cost computer power. Redlands in France (now LafargeHolcim) was the first company in the aggregates and ready-mix industry to use the authors' OR planning tool to optimise its truck fleet operations. Six years later, Pioneer in Australia (now Hanson HeidelbergCement), followed.

Any OR-based planning tool is only as good as the quality of its input data. Bad inputs will result in bad outputs. As such, we undertook an assessment project looking at how ML could be used to improve the quality of input parameters that influence the optimisation calculations of our OR planning software. As a first step, we took a closer look at loading times.

Muddy waters

Before we dived headfirst into a data lake of 150,000 ready-mix deliveries, we had to clean the muddy waters by removing or modifying data that was incorrect, incomplete, or irrelevant (e. g. due to the lack of reliable GPS information). Once the hard work was done, the smart work began. We compared our expected loading times against the actual loading times (See Figure 2). In case the expected and the actual loading times coincide, you would end up on the red line. The box plots, however, show what reality looked like.

The next step was to look for the most relevant variables that will help you to achieve more accurate loading time predictions. A widely applied and proven ML approach to do this is the so-called 'random forest approach,' which ranks the importance of variables in a regression problem.

The most important variable in order to predict loading times, which comes as no surprise, is the actual volume of a delivery. Interestingly, the hour of the day, planned loading duration, truck arrivals per hour, and the plant itself proved to be highly relevant too. Based on these results, we build a prediction model for loading times, the blue line in Figure 2. This was already a lot closer to reality compared to the red line.

The same approach, data cleaning, looking for explanatory variables, and creating a prediction model, was repeated for travel times and unloading times. Much to our surprise, predicted travel times (red line) and actual travel times (blue line) in Figure 3 were very close to each other, i.e. any fine-tuning by ML will result in very small gains in prediction improvement.

However, once the trucks arrive at the customer site, things change completely. Predicted unloading times and actual unloading times do not have much in common (See Figure 4). In other words, in the planning phase you have no clue at all what will happen during execution, making it the ideal test bed for ML algorithms. The most important variables in order to better predict unloading times are also listed in Figure 4.

Back to reality

Having done all that cleaning, analysing and modelling, we resurfaced from the data lake and put the new model to a real-life test. This was our test ground: 40 ready-mix plants, five consecutive planning days, on average 275 trucks making 1060 deliveries a day to an average of 350 customer locations, supplying almost 10,000m³ of concrete.

Using the revised ML-generated prediction model for loading times, travel times and unloading times instead of the standard OR variables, we were keen to see the effect this would have on the planning accuracy over the five days. Table 1 shows the results. For all deliveries, loading a truck took on average 20:28 minutes. Travelling to the customer site took 59:42 minutes, while unloading needed 49:64 minutes. Again, all on average.

	Loading	Travel	Unloading	Total
Actual	20:28	59:42	**49:64**	129:34
ML	01:23	00:06	**08:45**	10:14

Left - Table 1: Effect of ML prediction on planning accuracy (average times).

By applying our ML based prediction model we managed to estimate the average loading time by 1:23 minutes more accurately. For travel times, the average result was six seconds more accurate. Remember, they were already pretty close to our standard OR planning. The biggest gains in accuracy were, as expected, in unloading times: 8:45 minutes. So for a delivery that takes 2 hours and 10 minutes in total, we were able to get our planning calculations almost 10 minutes closer to reality.

Understanding your customer

These numbers highlight an interesting truth: The highest value and the biggest impact is always in understanding your customer, as opposed to internal processes (e.g. loading) or external factors (e.g. live travel information). However, understanding your customer is probably the greatest challenge of all. Unloading time is a great starting point. To gain a better picture of the full customer journey, our next ML assessment project will look at order volume predictions and customer buying patterns. The goal will be to approach a point where dispatchers and planners can predict follow-up orders with higher accuracy. We will report on this approach in a future issue of *Global Cement Magazine*.

Contents
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Philippines: Petra ready2grind

Germany-based Gebr. Pfeiffer says a ready2grind system it supplied to Petra Cement started in early December 2019. The clinker grinding mill is operational at a grinding plant on the Zamboanga Peninsula in Mindanao. No value for the order has been disclosed. Petra Cement's sister company, Big Boss Cement, has also ordered a modular mill system from Gebr. Pfeiffer.

Image: A ready2grind plant in Costa Rica.

Brazil: Low CO_2 cement made from bauxite residues

Norway-based Norsk Hydro and the Federal University of Pará (UFPA) have announced their collaboration on the development of a low-carbon cement from bauxite residue from Norsk Hydro subsidiary Alunorte's bauxite mining and alumina refining operations in the state of Pará. Electronic News has reported that the research partnership hopes to develop a new cement for commercial production and sale by 2030. This will use an estimated 500,000t/yr of waste bauxite residue.

Myanmar: New plant mooted

Young Investment Group Industry Company Limited (YIGICL) has entered into a joint venture with China-based China Gezhouba Group Cement (CGGC) and China Gezhouba Group Overseas Investment (CGGOI) with the aim of establishing an integrated cement plant in Mandalay, Mandalay region. The joint venture, which is held 30:70 by YIGICIL and the Chinese partners respectively, will also set up a limestone mine.

France: CHRYSO fully activates cement with new technology

CHRYSO has launched, CHRYSO®ICARE, which it describes as a 'disruptive patent-pending technology' to provide extra activation to cement, to allow cement blends to reach their full activation potential. This boosts the reactivity of cement, creating a synergy effect between chemical and mechanical activation to further increase cement strengths at all ages, while optimising the clinker factor. CHRYSO®ICARE additives provide additional levers for cement manufacturers to reduce energy and production costs, as well as the CO_2 footprint of cement.

North Africa: DAL supplies mill

Turkey-based DAL Engineering Group has announced that it has acted upon a contract to design and manufacture a ball mill for a grinding plant project. It shipped a 3.0m x 10.0m mill to a grinding plant in North Africa in June 2020.

Spain: LafargeHolcim launches mortars for 3D printing

LafargeHolcim España has announced the launch of a range of mortars specially suited to use in 3D printing. The range, called Tector 3D build, includes cement and natural hydraulic lime mortars. The company says that the products can sustain pressures of up to 90MPa with high-speed application. It is collaborating with construction companies to apply the products to 3D printing in large residential and energy infrastructure projects.

Singapore: Siwertell sells three unloaders

Jurong Port has ordered three new ST 490-M screw-type rail-travelling unloaders from Bruks Siwertell to handle cement imports. The port's cement terminal already has three Siwertell ship unloaders that have been used for over 20 years, two of which will be replaced.

The new unloaders will each discharge cement, fly ash and cement slag from vessels up to 50,000dwt at a continuous rated capacity of 800t/hr. Two of the new unloaders are scheduled for delivery in May 2022 and the third by the end of 2022.

Egypt: Mondi bags new plants

Austria-based Mondi Group subsidiary Mondi Paper Bags has announced its acquisition of two cement bag plants; the Helwan Cement bag plant and the InterCement bag plant, which supplies Amreyah Cement. The two facilities share a capacity of 60-80m bags/yr. As a result, Mondi Paper Bags will now meet the bagging needs of both cement producers.

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GROWING INTO PERFORMANCE

France: LafargeHolcim back to 2019 level

LafargeHolcim says that net sales in each of its five regions 'returned to prior-year levels by the end of June 2020' following the easing of coronavirus-related lockdowns. Its net sales fell by 10.8% year-on-year to Euro9.95bn in the first half of 2020 on a like-for-like basis due to the 'severe' impact of the lockdowns on construction sites in several of its main operating countries. It also blamed negative currency effects for an additional fall in sales. Its recurring earnings before interest and taxation (EBIT) dropped by 22% to Euro1.11bn. Its net debt decreased by 15.8% to Euro9.91bn from Euro11.8bn. Cement sales volumes fell by 13.1% to 87.2Mt.

By region the group noted the most severe coronavirus-related disruption in Asia-Pacific, despite China delivering a full recovery and growing sales volumes by the end of the second quarter. In Europe lockdowns in the UK and France had a particular impact. Significant impacts were noted in Ecuador, Colombia and El Salvador. Sales volumes declined in Algeria, Egypt, Iraq and South Africa, but Nigeria delivered a 'resilient' performance. North America was the group's best performing region, with slight dips in cement and aggregate sales volumes but a rise in ready-mix concrete and rising recurring EBIT.

Germany: HeidelbergCement revenue falls 10%

HeidelbergCement's revenue fell by 10% year-on-year to Euro8.25bn in the first half of 2020 from Euro9.21bn in the same period in 2019. Its result from current operations before depreciation and amortisation (RCOBD) decreased by 2% to Euro1.40bn from Euro1.44bn. Sales volumes of cement dropped by 8% to 56.3Mt. Its net debt decreased by 1.4% to Euro8.99bn.

By region the group noted major falls in sales volumes, revenues and RCOBD in Western and Southern Europe and Asia-Pacific. It added that the construction industry in Germany had 'hardly been affected by the corona crisis,' despite significant negative effects elsewhere in Europe.

France: India affects Vicat

Falls in sales in India, France and Italy since the end of the first quarter of 2020 have negatively affected Vicat's half year results. However, it noted a rebound at the end of the period, particularly in France, and reported earnings growth in the US and Brazil. Its consolidated sales fell by 2.7% year-on-year to Euro1.30bn in the first half of 2020 from Euro1.34bn in the same period in 2019. Its earnings before interest, taxation, depreciation and amortisation (EBITDA) decreased by 6.7% to Euro213m.

UK: Tarmac to electrify car and van fleet

Tarmac says that it is the first cement company to have signed up to xEV100, a scheme that targets net-zero carbon emissions in transportation. Under the initiative, Tarmac will replace its fleet of 2000 corporate cars and vans with electric models by 2030.

Italy: Strong US helps Buzzi

Good performance in the US has helped Buzzi Unicem hold sales steady in the first half of 2020 despite falling sales volumes of cement, particularly in Italy and Eastern Europe, as the coronavirus pandemic spread. The group's net sales remained stable at Euro1.52bn. Its cement sales volumes fell by 3.4% year-on-year to 13.4Mt from 13.9Mt in the same period in 2019. Buzzi's earnings before interest, taxation, depreciation and amortisation (EBITDA) rose by 8.8% to Euro314m from Euro289m.

Greece: Titan grows earnings

Titan says that cost savings, lower prices for solid fuels and price 'resilience' all helped to grow its earnings in the first half of 2020. Its earnings before interest, taxation, depreciation and amortisation (EBTIDA) rose by 12% year-on-year to Euro137m from Euro122m in the same period in 2019. Its revenue remained stable at Euro786m in the first half of 2020. Cement sales volumes fell by 2% to 7.9Mt. Although coronavirus-related lockdowns were mostly blamed for falling cement sales volumes, they were also affected by lower exports from Greece and the lack of fly ash supply in the US. Its US and Eastern Mediterranean regions contributed the most to its performance, with strong starts to the year in Egypt and Turkey before the pandemic began.

Norway: Norcem and Aker sign CCS agreement

Norcem, a subsidiary of HeidelbergCement, has signed an agreement with Aker Solutions to order a CO_2 capture, liquification and intermediate storage plant at its integrated Brevik cement plant. The final decision for the project depends on funding from the Norwegian government, which is expected to approve the unit in its national budget for 2021.

The project will use Aker Solutions' Advanced Carbon Capture (ACC) technology and its S26 amine solvent. Once complete the unit will capture 0.4Mt/yr of CO_2. This will be transported to the Northern Lights project for permanent storage offshore beneath the North Sea.

Germany: Westküste 100 hydrogen project receives Federal funding

The Westküste 100 green hydrogen project has received funding approval from the Federal Ministry of Economic Affairs. The initiative 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. The consortium brings together 10 partners, including Holcim Deutschland.

The funding approval enables work to begin on the first phase of the project, which is set to run for five years. A newly formed joint venture, H2 Westküste, will build a 30MW electrolyser to produce hydrogen via electrolysis from offshore wind energy. In a later stage of the project hydrogen from both electrolysis and CO_2 from the Holcim Deutschland Lägerdorf cement plant in Schleswig-Holstein will be used in the process. During the initial phase of the Westküste 100 project preparations will be made to convert the Lägerdorf cement plant to an oxyfuel combustion process.

Thorsten Hahn, CEO and chairman of Holcim Deutschland said, "For us, as a manufacturer of building materials, the funding approval is a key milestone on the way to decarbonising cement production. Now all of us involved in Westküste 100 must move forward quickly, decisively and dynamically in order to achieve our ultimate goal of cross-sectoral coupling on a large industrial scale in the coming years."

Turn to Page 18 for more on green hydrogen.

Image: The Cemex South Ferriby plant.

UK: South Ferriby mothballed

Cemex confirmed its decision to mothball its 0.8Mt/yr integrated South Ferriby, Lincolnshire cement plant on 14 July 2020. The announcement followed a consultation period with employee and union representatives and the majority of the plant's 110 workers have since been made redundant.

It said, "Cemex customers will be supplied from the company's existing cement network. Cemex's supply chain plan and commercial management will ensure that customer service will be maintained at all times. Cemex remains committed to the UK and will continue to have a strong national presence."

Belarus: Cement sales rise

Belarusian Cement Company (BCC) sold 1.85Mt of cement over the first five months of 2020, up by 12% year-on-year from 1.65Mt in the corresponding period of 2019. The Belarusian Architecture and Construction Ministry has reported that, of BCC's three subsidiaries, Krichevtsementnoshifer recorded the largest sales growth in the period, of 9.6% to 465,000t. Belarusian Cement Mill sold 657,000t, up by 3.6%, including 249,000t to Russia, and Krasnoselskstroymaterialy sold 568,000t, up by 0.2%

UK: Lockdown knocks Breedon down

Breedon Group's sales fell by a quarter in the first half of 2020 due to coronavirus-related lockdown measures. Its revenue fell by 25% to Euro371m in the first half of 2020 from Euro495m in the same period in 2019. Its underlying earnings before interest and taxation (EBIT) dropped to Euro0.7m from Euro54.8m. Cement sales volumes deceased by 20% to 0.8Mt.

Spain: Consumption down by a sixth

Total domestic cement consumption was 6.19Mt in the first half of 2020, down by 17% year-on-year from 7.41Mt in the first half of 2019. Interempresas News has reported that the coronavirus lockdown caused consumption in the period to decrease. June consumption rose by 5.2% to 1.34Mt from 670,000t in June 2019.

Russia: Eurocement exports rise

Eurocement Group's exports rose by 67% year-on-year to 0.33Mt in the first seven months of 2020 from 0.20Mt in the same period in 2019. Deliveries to Belarus, Finland, Latvia, Estonia and Kazakhstan have grown significantly. The group says it managed this despite coronavirus-related lockdowns with construction project suspensions in many markets.

France: Eqiom lowers transport emissions

CRH subsidiary Eqiom has announced a 9000t/yr reduction in its transport-related CO_2 emissions, down by 5% to 171,000t/yr for the past three years from 180,000t in 2017. It achieved the reduction through its commitment to the FRET21 initiative, a sustainable development strategy of the Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME) and Association des Utilisateurs de Transport de Fret (AFAT).

Peter Edwards & Jacob Winskell, Global Cement Magazine

Update on Germany

Global Cement turns its attention back to Germany, a diverse and resilient cement market.

Germany's 33 integrated cement plants share a total capacity of 33.2Mt/yr. Plants are generally on the smaller side, with median and mean sizes of almost exactly 1.0Mt/yr. Facilities range from 0.2Mt/yr (Ref. 27 & 33 in Figure 2) to 2.4Mt/yr (Ref. 9 in Figure 2). All except for LafargeHolcim's 1.5Mt/yr Lägerdorf plant (Ref. 15 in Figure 2) are dry process facilities. As well as the integrated plants, Germany has 18 grinding plants.

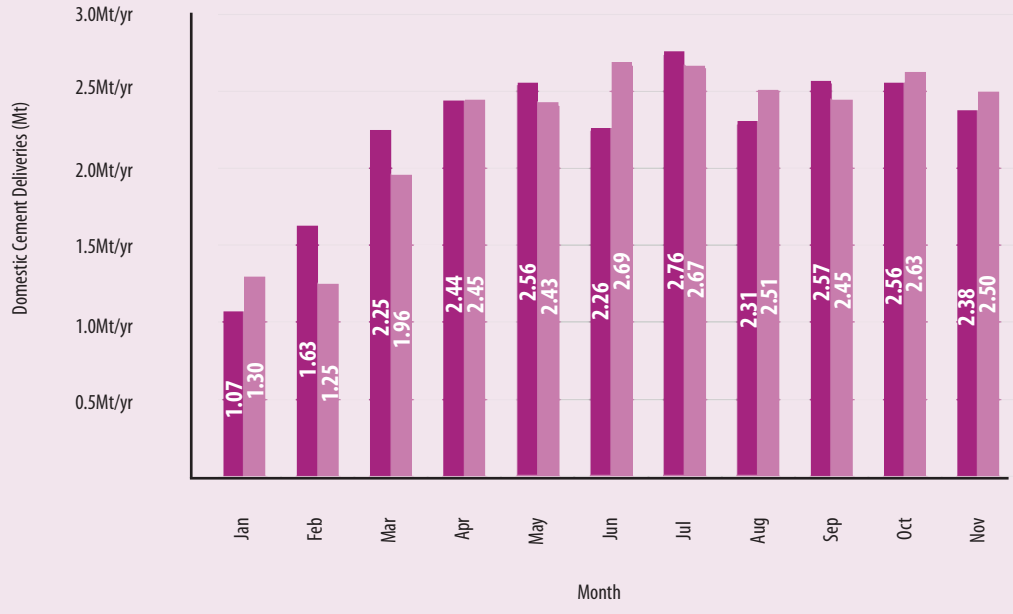
While the country's cement plants are generally on the older side, with many in excess of 50 years' service, its home-grown expertise and equipment suppliers have enabled it to become a global leader in terms of cement process efficiency. The sector also ranks very favourably in terms of alternative fuel use, with an overall thermal substitution rate of 68% in 2018.[1] This represents 3.6Mt of AF, comprising 1.98Mt (55%) commercial and industrial waste, 0.63Mt (18%) sewage sludge, 0.28Mt (7.8%) unsorted municipal waste, 0.20Mt (5.4%) tyres and 0.16Mt (4.6%) animal matter, in addition to other materials such as oil sludge and organic residues.

Germany also has an increasing focus on alternative raw materials. In 2018 power plants provided the German cement sector with 0.26Mt of flue gas desulphurisation (FGD) gypsum, while iron and steel production yielded 7.70Mt of granulated blast furnace slag (GBFS) in addition to contaminated ore, ferric dusts and fly ash.[1]

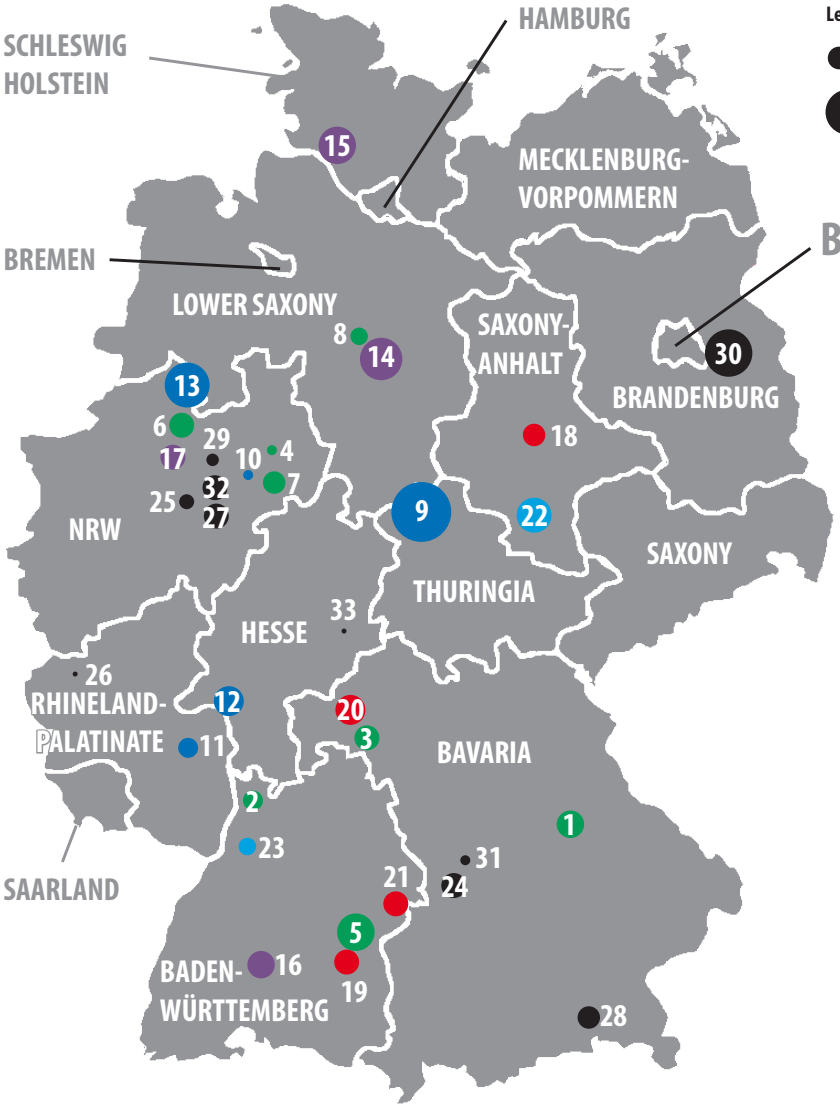
Production

21st Century trends

Changes to German cement deliveries have been relatively minimal from 2002 to 2015 at around 24-25Mt. The lowest recent figure, 23.0Mt, was in 2010. The overall drop since 2002 has been due to a lower backlog of demand from the former East German states than in the 1990s, unfavourable demographic and tax frameworks for residential construction work and restricted government infrastructure spending. However, an increased emphasis on infrastructure has since seen deliveries increase. After deliveries fell to 24.8Mt in 2015 from 25.3Mt in 2014 they rose again in 2016 to 25.6Mt due to increased construction activity, particularly from the public sector. A further 1Mt was delivered in 2017, taking the figure to 26.6Mt. 29Mt was delivered in 2018.



Right - Figure 1: German monthly cement deliveries for January - November 2018 and 2019. **Source:** VDZ.



Left - Figure 2: German cement plants map. (NRW = North Rhine-Westphalia).

= 1Mt/yr

= 2Mt/yr

HEIDELBERGCEMENT • 7.4Mt/yr
1. Burglengenfeld, Bavaria, 1.1Mt/yr.
2. Leimen, Baden-Württemberg, 0.8Mt/yr.
3. Lengfurt, Bavaria, 1.0Mt/yr.
4. Paderborn, NRW, 0.4Mt/yr.
5. Schelklingen, Baden-Württemberg, 1.5Mt/yr.
6. Ennigerloh, NRW, 1.0Mt/yr.
7. Geseke, NRW, 0.9Mt/yr.
8. Hannover, Lower Saxony, 0.7Mt/yr.

BUZZI UNICEM • 6.6Mt/yr
9. Deuna Zement, Deuna, Thuringia, 2.4Mt/yr.
10. Dyckerhoff, Geseke, NRW, 0.4Mt/yr.
11. Dyckerhoff, Göllheim, Rhineland-Palatinate 0.8Mt/yr.
12. Dyckerhoff, Wiesbaden, Hesse, 1.2Mt/yr.
13. Dyckerhoff, Lengerich, NRW, 1.8Mt/yr.

HOLCIM (LAFARGEHOLCIM) • 5.3Mt/yr
14. Holcim (LafargeHolcim), Höver, Lower Saxony, 1.7Mt/yr.
15. Holcim (LafargeHolcim), Lägerdorf, Schleswig-Hostein, 1.5Mt/yr.
16. Holcim (LafargeHolcim), Dotternhausen, Baden-Württemberg, 1.1Mt/yr.
17. Holcim (LafargeHolcim), Beckum, NRW, 1.0Mt/yr.

Schwenk ZEMENT • 4.1Mt/yr
18. Bernburg, Saxony-Anhalt, 0.9Mt/yr.
19. Allmendingen, Baden-Württemberg, 1.0Mt/yr.
20. Karlstadt, Bavaria, 1.2Mt/yr.
21. Mergelstetten, Baden-Württemberg, 1.0Mt/yr.

OPTERRA (CRH) • 2.1Mt/yr
22. Opterra Zement (CRH), Karsdorf, Saxony-Anhalt, 1.4Mt/yr.
23. Opterra Wössingen (CRH), Wössingen, Baden-Württemberg, 0.7Mt/yr.

OTHERS • 5.8Mt/yr
24. Märker Zement, Harburg, Bavaria, 1.0Mt/yr.
25. Thomas Zement, Erwitte, NRW, 0.6Mt/yr.
26. Portlandzementwerk Wotan H Schneider, Üxheim, Rhineland-Palatinate, 0.2Mt/yr.
27. Portlandzement Wittekind Hugo Miebach Söhne, Erwitte, NRW, 1.0Mt/yr.
28. Südbayerisches Portland-Zementwerk Gebr. Wiesböck (Rohrdorfer), Rohrdorf, Bavaria, 0.9Mt/yr.
29. Phoenix Zementwerke, Beckum, NRW, 0.5Mt/yr.
30. Cemex, Rüdersdorf, Brandenburg, 1.9Mt/yr.
31. Solnhofer Portland-Zementwerke, Solnhofen, Bavaria, 0.4Mt/yr.
32. Spenner Zement, Erwitte, NRW, 1.0Mt/yr.
33. Zement und Kalkwerke Otterbein, Großenlüder-Müs, Hesse, 0.2Mt/yr.

Figure 1 shows the seasonal trend over the first 11 months of 2018 and 2019, as December 2019 data was unfortunately not available at the time of going to press. Following a slower start in January 2019 compared to January 2018, deliveries rebounded over the first quarter of 2019 to 4.95Mt, compared to 4.51Mt in the first quarter of 2018. This represented a 9.7% year-on-year rise. The second quarter of 2019 was slightly slower than the second quarter of 2018, with 7.20Mt of cement delivered compared to 7.57Mt in the second quarter of 2018. The third quarter of 2019 was almost identical to that of 2018 (7.64Mt / 7.63Mt), while deliveries lagged slightly in October and November 2019 compared to a year earlier. After 11 months, the two years were neck and neck in terms of cement deliveries: 24.79Mt (2019) to 24.84Mt (2018).

Capacity by State

Table 1 shows the integrated cement capacities of German Federal States. Three, North Rhine-Westphalia (8.6Mt/yr), Baden-Württemberg (6.1Mt/yr) and Bavaria (5.6Mt/yr) dominate by this metric, and jointly hold 20.3Mt/yr. This represents 61% of the national capacity total for some 41.6 million people, around 50.1% of Germany's 83 million inhabitants. Seven further Federal States have cement capacities of 1.0-2.4Mt/yr. The three city-states of Berlin and the Free Hanseatic Cities of Bremen and Hamburg have no integrated cement plants, although Holcim (Deutschland) produces cement from clinker at its slag plant in Bremen and Zementwerk Berlin, a subsidiary of Spenner Zement, operates in the capital.

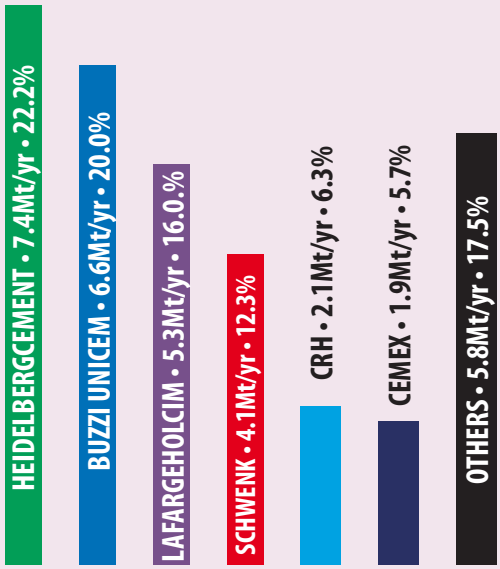
Right - Table 1: Integrated cement production capacities of German Federal States.
Source: *Global Cement Directory 2020.*

Federal State	Capacity (Mt/yr)
North Rhine-Westphalia	8.6
Baden-Württemberg	6.1
Bavaria	5.6
Lower Saxony	2.4
Thuringia	2.4
Saxony-Anhalt	2.3
Brandenburg	1.9
Schleswig-Holstein	1.5
Hesse	1.4
Rhineland-Palatinate	1.0
TOTAL	**33.2**

Capacity by Producer

There are many familiar multinational names among the top cement producers in Germany, including HeidelbergCement, Buzzi Unicem, LafargeHolcim, CRH and Cemex. However, Germany is unusual in Europe in terms of its large number of smaller groups and independent cement producers, which hold a sixth of integrated capacity. Combined, German-held companies, including HeidelbergCement and Schwenk Zement, account for 17.3Mt/yr (52%) of domestic capacity. The top producers are profiled below.

Eight independent companies each operate a single integrated cement plant in Germany. Of these, Märker Zement, Spenner Zement and Thomas Gruppe Zement also each operate a grinding plant. A further five independent players each operate a standalone grinding plant.

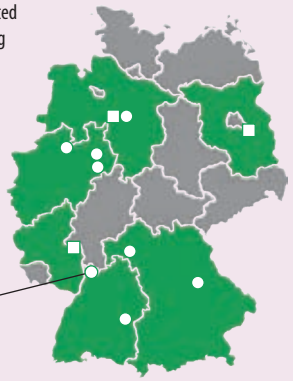


Right - Figure 3: Cement producers in Germany ranked by installed integrated cement capacity. **Source:** *Global Cement Directory 2020.*

1. HEIDELBERGCEMENT

Operating in 48 countries worldwide, HeidelbergCement operates 7.4Mt/yr of integrated cement capacity in Germany across eight sites. Its global operations netted it Euro18.8bn in sales in 2019, of which Germany represented a small portion. It recently completed a major upgrade at its Burglengenfeld plant in Bavaria (shown below right).

Founded: 1874
HQ: Heidelberg, Baden-Württemberg, Germany
Integrated German Capacity: 7.4Mt/yr



2. Buzzi Unicem

Founded: 1864 (Dyckerhoff)

HQ: Casale Monferrato, Italy (Buzzi)

Integrated German Capacity: 6.6Mt/yr

Integrated
Grinding

Buzzi Unicem subsidiary Dyckerhoff was founded in 1864 in Amöneburg, where it retains its original plant, as well as its headquarters. It became, along with its own subsidiary Deuna Cement, a 100% subsidiary of Buzzi Unicem in 2008, seven years after Buzzi acquired an initial 34% stake in the firm.

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3. LafargeHolcim

LafargeHolcim operates three former Holcim subisidiaries in Germany. In 2015 the group sold Lafarge's German assets due to competition issues within the EU and acquired others from Cemex. In addition to the integrated plants shown in Figure 1, LafargeHolcim operates a clinker grinding plant in Duisburg-Schwelgern and a slag grinding plant in Duisburg.

Founded: 1833 (Lafarge) / 1912 (Holcim)
HQ: Holderbank, Switzerland
Integrated German Capacity: 5.3Mt/yr

4. Schwenk Zement

Schwenk Zement operates four plants in Germany. Its Mergelstetten plant is the subject of Europe's first 100% carbon capture and storage (CCS) project as part of a partnership with Buzzi Unicem-Dyckerhoff, HeidelbergCement and Vicat. Schwenk has interests in the Baltic and Scandinavia but exited the Namibian market in January 2020.

Integrated German Capacity: 4.1Mt/yr

HQ: Ulm, Germany
Founded: 1847

5. CRH

CRH's German cement interests primarily comprise former Lafarge facilities that were offloaded during the LafargeHolcim merger in 2015. Its subsidiary Opterra Zement makes clinker at two plants. The Karsdorf, Saxony-Anhalt, plant was due for sale to Schwenk Zement in March 2017 but was eventually retained. Opterra also operates a 0.3Mt/yr grinding plant at Sötenich, North Rhine-Westphalia.

Founded: 1970 (Merger of Cement Ltd & Roadstone Ltd)
HQ: Dublin, Ireland
Integrated German Capacity: 2.1Mt/yr

6. CEMEX

Cemex Zement GmbH's cement production centres on its 1.9/Mtyr Rüdersdorf plant in Brandenburg. Cemex can also rely on its nearby Eisenhüttenstadt grinding plant. In May 2019, Cemex Zement GmbH sold its North and North-West regional aggregates and ready-mix operations to GP Günter Papenburg for a reported Euro87m.

HQ: Monterrey, Mexico
Founded: 1931 (Merger of Cementos Hidalgo & Cementos Portland Monterrey)
Integrated German Capacity: 1.9Mt/yr

Coronavirus effects

While 2019 was a 'normal' year for German cement production, 2020 has been anything but. Coronavirus infection was first confirmed within Germany in Munich on 27 January 2020. A national lockdown, including curfews in some Federal States, was implemented on 22 March 2020. This was lifted cautiously from 20 April 2020 onwards, with gradual increases in permitted gathering size and the reopening of shops and workplaces. As at 9 August 2020 the country has recorded around 217,000 confirmed cases, with 9260 deaths. This represents a significantly lower proportion of deaths compared with many of its EU neighbours, possibly due to greater testing leading to the detection of more mild cases in the wider community.

Despite its competent handling of the pandemic, Germany officially entered a recession in the first quarter of 2020, with contraction of 2.2%. This was followed by a larger 10.1% contraction in the second quarter of 2020 compared to the first quarter of 2020. This will have negative consequences for German construction firms and cement producers. The HDB, Germany's construction association, expects that the construction sector's turnover will fall by 3.0% in 2020. This will be unevenly split between a 6.0% fall in commercial building projects and a 0.5% fall in revenues from residential construction works.

With respect to the second half of 2020, Germany is, barring a disastrous second coronavirus wave, one of the EU Member States best positioned to weather the economic damage wrought by the pandemic. Its strong and efficient cement sector and its many suppliers should continue to reap the benefits of a resilient economy and underlying construction demand.

1. VDZ, '*Zementindustrie Umweltdaten*' August 2019.

Interview by Peter Edwards, Global Cement Magazine

In discussion: Martin Schneider, VDZ

Global Cement catches up with VDZ CEO Martin Schneider ahead of VDZ's big move into its new building...

Above: VDZ CEO Dr Martin Schneider.
Credit: Julia Vogel.

***Global Cement (GC):* How has VDZ changed since we last spoke in September 2018?**

Martin Schneider (MS): The big story for VDZ right now is the move into our new building, following 65 years in our current one. VDZ grew massively over this time and the building has become a part of our identity. A lot of VDZ's development in the old building, to more than 200 staff, was organic. New laboratories, rooms and departments had to be placed where there was space rather than where they needed to be. This restricted our activities and led to inherent limitations that we could not circumnavigate - not to mention the buildings infrastructure, which needed to be renewed since it had begun to reach its limits.

Like a new dry process kiln line, the new building allows VDZ far more opportunities for efficiency. We have, for example, grouped all of the laboratories together, aligning the respective workflows, with much more logical layouts for other departments too. We have also designed for flexibility and innovation in the years ahead. For example, in order to allow the highest possible flexibility, the laboratories can in a long-term perspective be converted into offices and vice-versa.

Right: Exterior of the VDZ's impressive new purpose-built building in Düsseldorf.
Credit: Julia Vogel.

Above: The new building's impressive reception area.
Credit: Julia Vogel.

***GC:* Is the new building larger than the current one?**

MS: The overall amount of space is almost the same as in the former building, but the space efficiency is much higher and there is still room for growth. Our new location is closer to the airport in Düsseldorf, as well our University partners. The whole area is becoming a hub for science, engineering and technology, which are crucial for the cement sector in the years ahead. Being in that area will allow for cross-pollination of ideas and lead to innovations. It is a great area for VDZ to move to.

***GC:* Last time we spoke, you said that VDZ faced a challenge to make the public aware of the innovative side of cement and concrete. Will the new building help with this aim?**

MS: I would not say that the public perception of cement and concrete is particularly negative in Germany. However, the new building will certainly help to show that we represent a modern industry that has a lot to offer in terms of innovation, particularly with regard to the environmental challenges we face. Indeed, the building itself is a testament to the sustainable use of concrete in structures and for architectural designs.

Right: CO_2 Steuer = CO_2 Tax. "The most important thing for VDZ members about the EU ETS is that it is fundamentally like a stock exchange," says Dr Schneider. "There are some variations day-to-day and month-to-month, but the general trend is up, up, up."

To help with our public- and government-facing activities, VDZ will release a Germany-specific Climate Roadmap in September 2020. It will look at decarbonisation along the value chain, with a particular focus on reduced clinker content in cement and, in turn, reduced cement content in concrete. We must encourage efficiency in the value chain, from the selection of raw materials at the cement plant, all the way to encouraging the broader use of clinker-efficient cements in concrete. This can be through the use of more pre-cast elements on the construction site but also customised concretes for individual exposure classes.

Overall, our Roadmap will be broadly in line with the targets previously released by CEMBUREAU, with some added specificity regarding supplementary cementitious materials. For example, the coal power plant closures taking place in Germany mean that fly ash is rapidly becoming scarce. The transition to direct reduction with hydrogen in steel plants will result in different amounts and types of slag.

***GC:* Does the focus on cement efficiency open doors to VDZ members via diversification or threaten them due to lower clinker demand?**

MS: The real challenge to 2050 is to fully decarbonise the value chain - and producers will adjust to new market realities. Part of this is lower volumes of clinker. So the question becomes 'What is the cement of the future?' It is VDZ's opinion that the answer involves increasingly sophisticated cement blends that are tuned to different applications. There will be less one-size-fits-all concrete but more that is customised. Here lie opportunities for our members.

At present the standards for these novel cements are not harmonised across the EU. However, steps are being taken right now. We are very optimistic that this will lead to standards that will help to develop the market for low-CO_2 cements and enable greater clinker efficiency in construction.

***GC:* What other points has VDZ been able to bring to the attention of the Federal government?**

MS: I think that we have been successful in getting across the message that the fundamental process of clinker production cannot be easily electrified and hence decarbonised. It is a heavy process industry with its CO_2 process emissions that, to fully decarbonise, will also need carbon capture and storage / utilisation (CCS/U).

Right: Laboratories have all been grouped together in the basement of the new building, with other deparments distributed efficiently through the rest of the building. **Credit:** Julia Vogel.

"We provide our excellent services with pride: on-site, online or with online-support."

Martin Schneider, CEO VDZ

Our Services

Low carbon strategies

- Carbon capture concepts
- Clinker efficient cement and concretes
- Burning and characterisation concepts for calcined clay

Process optimisation

- Technical reviews
- Fuel concepts and improvement of burning conditions
- Process and environmental measurements

Maintenance

- Inspection and survey of rotary kilns and ball mills
- Kiln alignment and adjustment
- Tyre and roller grinding

Training and education

- Classroom training and customised courses
- Online courses
- Hands-on, practical training

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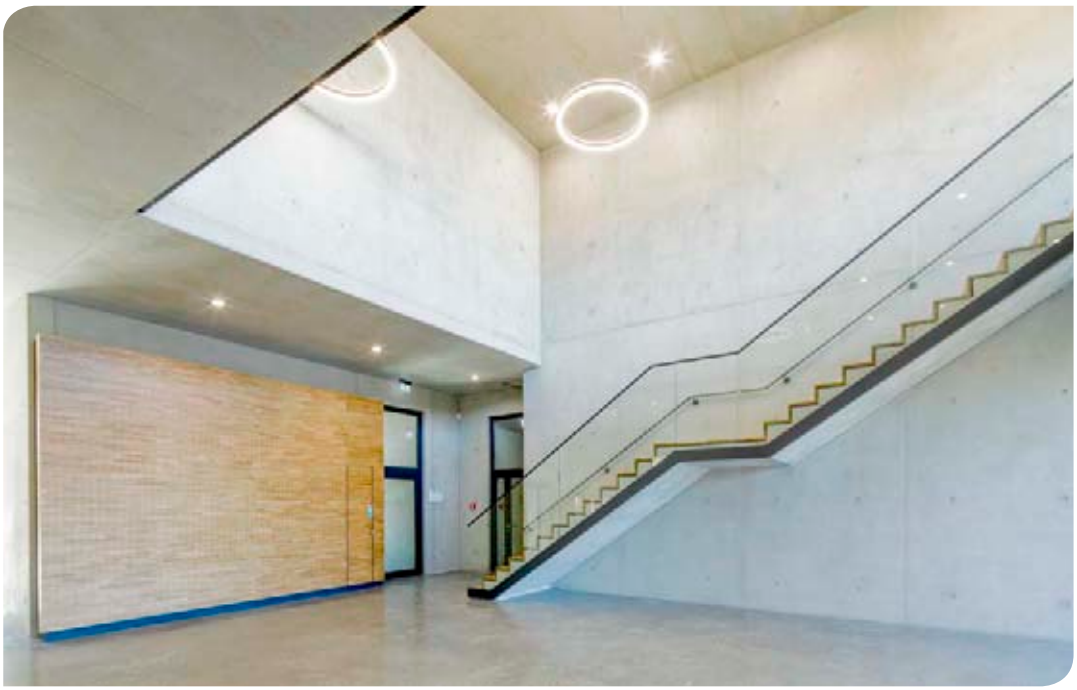

Right: Dr Schneider describes the new building as a 'testament to the sustainable use of concrete in structures.' **Credit:** Julia Vogel.

Our industry is now in a position to develop kilns that can capture a portion of their CO_2. Technical solutions exist. They are at the pilot stage at present, but scale-up is imminent. From our perspective, there are two big challenges for cement decarbonisation. Firstly, what do we do with the CO_2: Store it or use it? For both, we will need CO_2 infrastructure, like we have water, gas and electrical infrastructure. This will need to be developed. For the utilisation, we need to find a mass process to turn CO_2 into a useful material, a fuel, a plastic or something else. Again, there are many pilots but the path is far from clear.

Secondly, what do we do about cement coming from outside of the countries subject to the EU Emissions Trading Scheme (ETS)? There has been a lot of productive discussion regarding the Carbon Border Adjustments (CBA) recently. This has to be fair to both the producers inside and outside of the EU ETS regions and I think that recent discussions have been positive in this regard.

***GC:* The EU ETS price has risen from Euro15-20/t in mid 2018 to nearly Euro30/t in July 2020. It was also around Euro15-16/t in March 2020. How does this fluctuation affect your members and do you think that the CBA would dampen the variability?**

MS: The most important thing for VDZ members about the EU ETS is that it is fundamentally like a stock exchange. Yes, there are some variations day-to-day and month-to-month, but the general trend is up, up, up. Of course this is a feature of the EU ETS, not a bug. It is how the system works. It is due to the reduction in the number of allowances.

***GC:* Does VDZ have an internal price forecast for EU ETS allowances?**

MS: Not at present. We do, however, estimate that the cost of CCS/U technology applied to the stack will, in the long term, be around Euro 50-90/t. On the lower end, you can see that the EU ETS price is not that far away in terms of 'the cost,' at the stack. However, we still need to add on transport and storage/utilisation costs, which will inflate the stack price fairly significantly.

We are sure that our members are well placed to develop innovative solutions for all aspects of CCS/U. Many have been working on it for many years and VDZ, as a founding member of the European Cement Research Academy (ECRA), has been looking at the technology since 2007. Without ECRA's activities pushing towards innovation we would today not be able to apply carbon capture in our industry.

I would say at this point that the industry has now fully understood the climate issue. CO_2 abatement is at the top issue of every CEO's or plant manager's to-do list. This has become particularly apparent to me over the past 12-18 months. Never before in my 29 years in this sector have I seen the cement sector so invested in a single goal. It is fantastic to see and gives me great hope for the future of the sector. All of a sudden the feeling is there that, not only do we have to do something, but that we CAN do something. The sector is really taking responsibility, not just ticking boxes.

Coronavirus effects....

***GC:* How has the coronavirus affected the cement and wider construction market in Germany?**

MS: As a whole the first half of 2020 was very strong for the German construction sector, despite the outbreak. Public works continued, as did larger private projects and many smaller ones. Although there is a six month publishing delay for the cement production and consumption figures, I can say that this translated very well indeed through to cement sales over the first half of 2020.

However, these high activity levels seen in the first half of the year were based on permits granted before the pandemic began. There may now be a reduction in activity throughout the second half of 2020, possibly into 2021. If everything goes well, the year will even out and be roughly the same as 2019 in cement sales terms (28.6Mt). In 2021 we expect a 3-5% fall in cement demand. This is due to permit delays but also the state of the general economy, which is expected to contract by about 6% in 2020. In the future we can imagine that the commercial sector, for example shopping centres, hotels and restaurants, may fall out of favour with the public, dampening demand for this kind of construction project. On the other hand, there is a massive lack of homes in some areas of Germany, particularly multi-family buildings. This could boost demand nicely. Of course, we are being very careful with our forecasts for 2020 and 2021. Everything could be sideswiped by a second wave of the virus.

***GC:* How was VDZ affected day-to-day?**

MS: Everyone who could work from home was sent home, in line with government advice. Those with children were allowed to work within a 'family first' approach when the schools were closed. If you are

Below: Germany has been proactive in its handling of the coronavirus pandemic, with lower recorded death rate than its EU counterparts.

Right: The new VDZ building will allow for greater collaboration between departments.

not happy with your family life, your work life will suffer and, ultimately that is bad for the worker, their family and VDZ. The response from our staff that have families has been astonishing. It is fantastic to see how they have fitted their work around their home lives, often with increased productivity.

Inside the building, those that have to be in the office must follow the appropriate guidelines regarding distancing and hygiene. The laboratory staff have been split into two teams that never meet. They continued working throughout. Our field staff, for example those that analyse stack emissions from the plants, continued to work. Actually, the hardest part was finding hotels that were open close to the plants! We made our online courses even more online than before. Some international projects were delayed due to travel restrictions, some of which are now lifted. Overall, compared to many other employers we have been very lucky indeed.

***GC:* What has been your role regarding the management of the outbreak response?**

MS: I am lucky to work with an excellent team that has taken on these extra challenges very well and so I have been quite hands-off. I have a colleague who is responsible for VDZ's response to Covid-19 and we have been very clear with staff regarding what is expected of them. Indeed, I have produced a number of web-videos to properly explain why things have changed and how we can continue to work safely. It is only through careful explanation of the new rules that we will have proper acceptance and compliance. VDZ has had no infections to date and I would like to thank our staff for complying with the new restrictions at this challenging time.

***GC:* Were there any cement plant closures due to coronavirus?**

MS: There have been a few isolated cases of infections but there have been no plant closures within Germany. This is good news and is thanks to the swift action taken by our members. They enacted pre-existing pandemic plans that enabled them to continue production. They were extremely proactive.

This goes back to following the rules. Sometimes they can be a nuisance but coronavirus restrictions are not prohibitive for our sector. The annoyance of wearing a mask is nothing compared to the damaging effects of an outbreak in a cement plant or the closure of the whole of VDZ.

***GC:* What government stimulus or new regulations have benefitted the cement and construction sector?**

MS: The most effective policy, not only across cement and construction but most areas of the economy, is the Kurzarbeit scheme, which translates as 'short working.' This means that the government pays 60% of the salary of those unable to work due to the coronavirus restrictions. This has saved a lot of companies from bankruptcy. In many areas the economy is now recovering and the staff have been retained. The government has been incredible, right from the Chancellor down, and I am sure we will miss her for many reasons when she steps down. Of course, everyone will always want more to be done but there have to be financial limits. What it shows is that the government cares and is taking steps to maintain public morale. This, in itself, breeds confidence, which goes a very long way across the economy, to the benefit of all activities. Regarding construction, there was already a large amount of money allocated to infrastructure. While this has been extended, we are conscious that we must retain the ability to pay for this over the long term and do not unnecessarily burden future generations.

With all these challenges - climate change, coronavirus, housing, the economy - VDZ is here to help its members and its partners in Germany, the EU and further afield. We continuously strive to improve the cement production process thanks to our mission to 'Evolve the well-established.' This means we aim to improve continuously and not rest on our laurels.

The staff are an integral part of this ethos and bring new approaches to current and future challenges. I have a great management team which works in a spirit of trust and friendship and I am extremely happy to lead it. I've spent 29 years in the sector and I don't regret a moment of it.

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

MS: You are very welcome indeed.

Left: Dr Martin Schneider has spent 29 years in the cement sector and 'doesn't regret a moment of it.' **Credit:** Julia Vogel.

Mexico: Cemex net income plummets

Cemex recorded a net income of US$5.61m in the first half of 2020, down by 97% year-on-year from US$218m in the first half of 2019. Net sales fell by 8% to US$6.00bn from US$6.49bn and consolidated cement volumes fell by 5% to 29.2Mt from 30.7Mt. The company increased its US sales by 7% to US$1.97bn from US$1.85bn and cement volumes by 6%, while prices increased by 1%.

Cemex CEO Fernando González said, "Despite the unprecedented conditions in which we are operating due to the pandemic, I am pleased with our second quarter performance and our quick reaction to implement cost containment measures across all geographies. In the second quarter of 2020 we saw a rapid V-shaped volume recovery in our core products from trough levels in April, reaching slightly below pre-Covid-19 outbreak volumes in June. Importantly, our health initiatives have helped protect our employees, customers, suppliers and communities, and allowed us and our customers to continue operating in most markets.

Mexico: Cemex launches carbon neutral concrete

Cemex has announced the launch of a range of carbon neutral concretes called Vertua. By offsetting, Cemex has eliminated Vertua's remaining carbon footprint following a 70% reduction in embodied emissions compared to Ordinary Portland Cement (OPC) through use of a geopolymer cement mixture. The concretes will become available in different markets globally in 2020 and 2021.

US: PCA welcomes INVESTment

The Portland Cement Association (PCA) has lauded the introduction of a bill to reauthorise infrastructure spending until 2025 in the legislative assembly. Called the INVEST in America Act, the Democratic bill proposes to increase investment and shift towards more sustainable infrastructure and transport.

PCA President and CEO Mike Ireland said the boosts to funding, 'are critically important as our nation deals with high unemployment and economic stagnation as a result of the Covid-19 pandemic.'

Uruguay: FANCAP privatisation rejected

The Federación Administación Nacional de Combustibles, Alcohol y Portland (FANCAP) and Construction Union (SUNCA) have rejected plans for the privatisation of the Administación Nacional de Combustibles, Alcohol y Portland's (ANCAP) 0.3Mt/yr integrated Paysandú cement plant in Paysandú Department.

ANCAP Coordinator of Trade Unions Gerardo Rodríguez said, "Any change in the cement industry must leave cement production in public hands and keep all three ANCAP cement plants open, as well as keeping all jobs. Management must provide the necessary levels of investment to complete upgrades to the Paysandú plant and the personnel necessary for its operation." He added, "In the face of adversity, we show more unity, solidarity and struggle and in the face of an attempt to close Paysandú we will respond with more organisation and more struggle." He said that an occupation of all workplaces would follow the closure of any plant.

Argentina: May sales slide by a third

Producers sold 649,000t of cement in May 2020, down by 33% year-on-year from 965,000t in May 2019. Data from the Asociación de Fabricantes de Cemento Portland (AFCP) shows that the sharpest decline, of 80%, was in Buenos Aires. Total sales nonetheless grew by 61% month-on-month from 404,000t in April 2020. Five-month sales to 31 May 2020 fell by 35% year-on-year.

Brazil: SNIC forecasts increase in cement sales in first half

The National Cement Industry Union (SNIC) has estimated a 3.7% year-on-year increase in total cement sales to 26.9Mt in the first half of 2020 from 25.9Mt in the corresponding six months of 2019. Export sales rose by 56% to 84,000t from 54,000t. Sales increased by 7.7% month-on-month in June 2020, however SNIC president Paulo Camillo Penna expressed worries about demand going forward into the second half of 2020.

"The cement industry is responsible for more than 70,000 jobs, generates an income US$4.94bn and an annual net collection of US$562m. We are very sensitive to the macroeconomic scenario and government stimuli. For this reason, the cement industry is anxiously awaiting the launch of the new government housing project, 'Casa Verde Amarela,' which is expected to leverage the real estate and renovation market more strongly, and restarting works on 100,000 housing units," said Penna.

Colombia: Argos coronavirus effects

Cementos Argos Colombia has reported on its situation and shared its business outlook as it returns to full operations post-coronavirus lockdown. The company says that 1700 people are currently active in operations, with 910 working from home and 660 on furlough. In May 2020 it served 5300 customers, down by 26% year-on-year from 7210 in May 2019. Cement volumes fell by 41% and concrete volumes fell by 43%. 44 of Cementos Argos Colombia's 58 concrete plants were operational, and 73 of its 92 work centres.

During the lockdown period the company completed over 100 new infrastructure project supply contracts. Cementos Argos Colombia regional vice president Tomás Restrepo said, "We are confident in a positive future, in our resilience, in the ability to face challenges and that we have extraordinary talent who are aware of the importance of self-care and who work every day on good ideas to continue to be the best allies of our clients."

Contents
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Peter Edwards, Global Cement Magazine

Cement in Central America and the Caribbean

Global Cement turns its attention to the cement industries of Central America and the Caribbean...

The 34 nations and territories of Central America and the Caribbean covered in this article share a total of 41.1Mt/yr of cement production capacity, 33.8Mt/yr integrated and 7.3Mt/yr grinding. The region's 43 cement plants are shown in Figure 2.

The region's producers comprise a mixture of 12 local (19.8Mt/yr) and three multinational players (21.3Mt/yr). The main cement producer by installed capacity is, by some distance, Mexico's Cemex. It operates 13.0Mt/yr of capacity across seven integrated plants (9.5Mt/yr) and six grinding plants (3.5Mt/yr), with around 30.5% of the region's capacity. It is present in Costa Rica, Guatemala, Nicaragua, Panama and Puerto Rico under the Cemex name, as well as by Trinidad Cement, in which it has a 69.8% stake, in Trinidad & Tobago, Barbados and Jamaica.

Two producers, LafargeHolcim and Cementos Progreso, are joint second-largest by installed capacity, with 5.5Mt/yr each (13.4% of regional capacity). LafargeHolcim operates its capacity across three integrated plants (4.4Mt/yr) and three grinding plants (1.1Mt/yr). Cementos Progreso operates three integrated plants in Guatemala (5.3Mt/yr) and the Cementos Interoceánico grinding plant (0.2Mt/yr) in Panama. A further 12 cement producers are active in Central America and the Caribbean. The majority of these are small operators based in local markets, with the exception of Colombia-based Cementos Argos (4.0Mt/yr), which also has extensive assets in South America and the US.

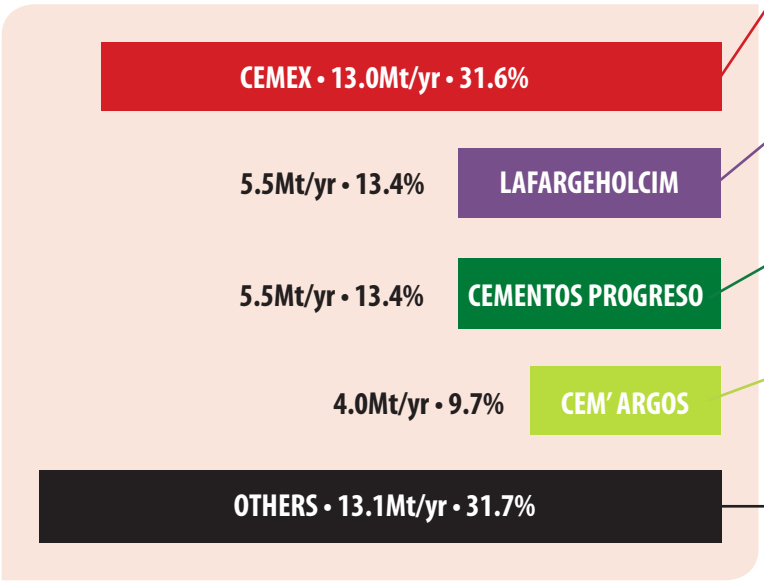
Barbados

Barbados has one 0.3Mt/yr integrated cement plant, run by Arawak Cement, part of Trinidad Cement, in turn majority-owned by Cemex. The plant is the only clinker production site between Trinidad & Tobago and Puerto Rico, 350km and 940km away respectively. It exports around 80% of its cement and is an important source of clinker for grinding plants up and down the eastern Caribbean.

The launch of the importer Rock Hard Cement in 2015 disrupted Arawak's business and caused local

Left: The preheater tower of the Cemex San Pedro de Macorís plant in the Dominican Republic.

Below - Figure 1: The largest cement producers in Central America and the Caribbean.



Left - Figure 2: Cement production facilities in Central American and the Caribbean.
Source: *Global Cement Directory 2020.*

I = Integrated.
G = Grinding.

CEMEX • 13.0Mt/yr (I = 9.5Mt/yr, G = 3.5Mt/yr)
1. San Pedro de Macorîs, Dominican Republic, 2.4Mt/yr (I).
2. Caribbean Cement (Trinidad Cement), Rockfort, Jamaica 2.0Mt/yr (I).
3. Larga, Panama, 2.1Mt/yr (I).
4. Trinidad Cement, Claxton Bay, Trinidad & Tobago, 1.2Mt/yr (I).
5. Arawak Cement (Trinidad Cement < Cemex), St Lucy, Barbados, 0.3Mt/yr (I).
6. Colorado, Costa Rica, 0.9Mt/yr (I).
7. San Rafael del Sur, Nicaragua, 0.6Mt/yr (I).
8. Ponce, Puerto Rico, 1.2Mt/yr (G).
9. Guatemala City, Guatemala, 0.5Mt/yr (G).
10. Arizona, Guatemala, 0.5Mt/yr (G).
11. Patarra, Costa Rica, 0.9Mt/yr (G).
12. Cuidad Sandino, Nicaragua, 0.4Mt/yr (G).

LAFARGEHOLCIM • 5.5Mt/yr (I = 4.4Mt/yr, G = 1.1Mt/yr)
13. Holcim El Salvador, El Ronco, El Salvador, 1.7Mt/yr (I).
14. Holcim El Salvador, Maya, El Salvador, 1.6Mt/yr (I) (Mothballed).
15. Holcim Costa Rica, Cartago, Costa Rica, 1.1Mt/yr (I).
16. Holcim Nicaragua, Naragote, Nicaragua, 0.3Mt/yr (G).
17. Lafarge Ciments Antilles, Guadeloupe, 0.4Mt/yr (G).
18. Lafarge Ciments Antilles, Martinique, 0.4Mt/yr (G).

CEMENTOS PROGRESO • 5.5Mt/yr (I = 5.3Mt/yr, G = 0.2Mt/yr)
19. San Gabriel, Guatemala, 2.2Mt/yr (I).
20. San Miguel, Guatemala, 2.9Mt/yr (I).
21. La Pedrera, Guatemala, 0.2Mt/yr (I).
22. Cemento Interoceanico, El Limon, Panama, 0.2Mt/yr (G).

CEMENTOS ARGOS • 4.0Mt/yr (I = 2.4Mt/yr, G = 1.6Mt/yr)
23. Piedras Azules, Honduras,1.0Mt/yr (I).
24. San Juan Dorado, Puerto Rico (US), 0.8Mt/yr (I).
25. CINA, Port au Prince, Haiti, 0.6Mt/yr (I).
26. San Lorenzo, Honduras, 0.3Mt/yr (G).
27. Cemento Panama, Quebracha, Panama, 0.8Mt/yr (G).
28. Cementos Colón en República Domincana, Dominican Rep., 0.5Mt/yr (G).

OTHERS • 13.1Mt/yr (I = 12.2Mt/yr, G = 0.9Mt/yr)
29. Cementos del Norte, Rio Baijo, Honduras, 2.0Mt/yr (I).
30. Cementos Curazao, Mariel, Cuba, 1.5Mt/yr (I).
31. Corporacion Cementos Cubanos, Artemisia, Cuba, 0.6Mt/yr (I).
32. Cementos Cienfuegos, Guabairo, Cuba, 1.7Mt/yr (I)
33. Corporacion Cementos Cubanos, Siguaney, Cuba, 0.7Mt/yr (I).
34. Corporacion Cementos Cubanos, Bufadero, Cuba, 0.6Mt/yr (I).
35. Corporacion Cementos Cubanos, Santiago de Cuba, Cuba, 0.6Mt/yr (I)
36. Cementos Cibao, Santiago, Dominican Republic, 2.0Mt/yr (I).
37. Cementos Andino Dominicanos, Pedernales, Dominican Republic, 0.5Mt/yr (I).
38. Domicem, Palenque, Dominican Republic, 1.0Mt/yr (I).
39. Cemento Panam, Santo Domingo, Dominican Republic, 1.0Mt/yr (I).
40. Cementos Santo Domingo, Hatillo, Dominican Republic, 0.4Mt/yr (G).
41. Cemento Regional, Acajutla, El Salvador, 0.1Mt/yr (G).
42. Cemento Regional, Escuintla, Guatemala, 0.1Mt/yr (G).
43. Plycem / Cementos Fortaleza, Salinas Esparza, Costa Rica, 0.3Mt/yr (G).

Territory	Integrated (Mt/yr)	Grinding (Mt/yr)	Total (Mt/yr)	Type / Location
Barbados	0.3		**0.3**	Independent / Caribbean
Costa Rica	2.0	1.2	**3.2**	Independent / Central America
Cuba	5.7		**5.7**	Independent / Caribbean
Dominican Republic	6.9	0.9	**7.8**	Independent / Caribbean
El Salvador	3.3	0.1	**3.4**	Independent / Central America
Guadeloupe		0.4	**0.4**	French Overseas Dépt / Caribbean
Guatemala	5.3	1.1	**6.4**	Independent / Central America
Haiti	0.6		**0.6**	Independent / Caribbean
Honduras	3.0	0.3	**3.3**	Independent / Central America
Jamaica	2.0		**2.0**	Independent / Caribbean
Martinique		0.4	**0.4**	French Overseas Dépt / Caribbean
Nicaragua	0.6	0.7	**1.3**	Independent / Central America
Panama	2.1	1.0	**3.1**	Independent / Central America
Puerto Rico	0.8	1.2	**2.0**	US Protectorate / Caribbean
Trinidad & Tobago	1.2		**1.2**	Independent / Caribbean
Totals	**33.8**	**7.3**	**41.1**	

Above - Table 1: Cement production facilities in Central American and the Caribbean.
Source: *Global Cement Directory 2020.*

cement prices to fall by 30%. Following a prolonged argument over product quality, Rock Hard has been able to continue to import cement as 'other hydraulic cement,' which attracts a 5% import duty, rather than the 60% import duty attracted by 'hydraulic cement.'

Belize

Belize has no cement production facilities. It imported US$13.2m worth of cement in 2018.

Costa Rica

Costa Rica has two integrated cement plants. The LafargeHolcim plant at Cartago was established as Industria Nacional de Cemento SA, (INCSA) in 1964. Holcim took a majority stake in the plant in 2003 before installing a 3000t/day dry process line from Fives FCB. The plant has been part of LafargeHolcim since 2015.

The other integrated plant in Costa Rica was commissioned by Edica Ltda in 1979 at Colorado de Abangares in 1979. It has a capacity of 0.9Mt/yr and was partly owned by Cemex during the 1990s. In 1999 Cemex took its stake to 95.3%. Cemex also operates a 0.9Mt/yr grinding plant in San José. The fourth, and most recently commissioned, plant in the market is the new 0.3Mt/yr Gebr. Pfeiffer Ready2Grind vertical grinding plant in Puntarenas, a joint venture between Mexico's Cementos Fortaleza and fibre cement producer Plycem.

Cuba

Socialist Cuba has six integrated cement plants that are predominantly controlled by the state. Four of the six are operated by the national producer Corporacion Cementos Cubanos. One relatively modern Cuban-run plant is operated by Cementos Cienfuegos, which is also state owned. The sixth, Cementos Curazao, is 50%-owned by Mexico's Cemex. Four of the six plants are older wet process facilities. Production is likely to be well below the country's headline 5.7Mt/yr capacity.

Dominican Republic

There are five integrated cement plants (6.9Mt/yr) and two grinding plants (0.9Mt/yr) in the Dominican Republic, with each facility operated by a different producer. The largest producer is Cemex Dominicana, which operates a 2.4Mt/yr integrated plant, the largest in the Caribbean. The Mexican giant entered the Dominican cement market in 1995 when it took over Cementos Nacionales. It began building the current 2.4Mt/yr San Pedro de Macorís line in 2003 and the plant made its first cement in 2005.

Cementos Cibao is the second-largest cement producer by installed capacity, with a dry process upgrade taking its capacity to 2.0Mt/yr in 2009. The joint third-largest producers are Domicem and Cemento Panam, both with 1.0Mt/yr integrated plants. The Domicem plant was the first overseas turnkey project carried out by China's Sinoma / CBMI Construction. The Cemento Panam plant was established first as a grinding plant before upgrades to reach an integrated 1.0Mt/yr in 2017.

El Salvador

El Salvador's cement industry traces its history back to the establishment of Cementos de El Salvador in 1949. It began production at the now-closed Playa las Flores plant in 1953. A second plant was built between 1965 and 1970 at El Ronco and the company acquired its Maya plant in 1993. Both are now in the hands of Holcim El Salvador, a part of LafargeHolcim, although the Maya plant has been mothballed since 2008. The company recently announced that it may restart the plant in the coming months. A third plant, a 0.1Mt/yr Cemengal Plug&Grind Classic modular grinding plant was established by Guatemala's Cementos Regional in 2019.

Guadeloupe (France)

An Overseas Département of France, Guadeloupe has a 0.4Mt/yr grinding plant operated by Lafarge Ciments Antilles. This is a 59.73%-owned subsidiary of LafargeHolcim that has been present on the island since 1971.

Guatemala

The Guatemalan cement industry comprises three integrated plants (5.3Mt/yr), all operated by Cementos Progreso, and three grinding plants (1.1Mt/yr). Cementos Progreso has operated since 1899 and made its first cement in 1901 from its plant in La Finca Le Pedrera plant in Guatemala City, now with a capacity of 0.2Mt/yr. The company launched its 2.9Mt/yr San Miguel plant in 1974 and its 2.2Mt/yr San Gabriel plant in 2019.

The country's grinding plants are run by Mexico's Cemex (2 plants, 1.0Mt/yr) and Cemento Regional (1 plant, 0.1Mt/yr). Like the Cemento Regional plant in El Salvador (see above), this is a Plug&Grind Classic modular grinding plant from Cemengal.

Haiti

The poorest country in the Americas, Haiti only has one cement plant, the 0.6Mt/yr wet-process integrated

Smaller Nations and Territories

Antigua & Barbuda: A major cement importer in Antigua & Barbuda is Caricement Antigua.

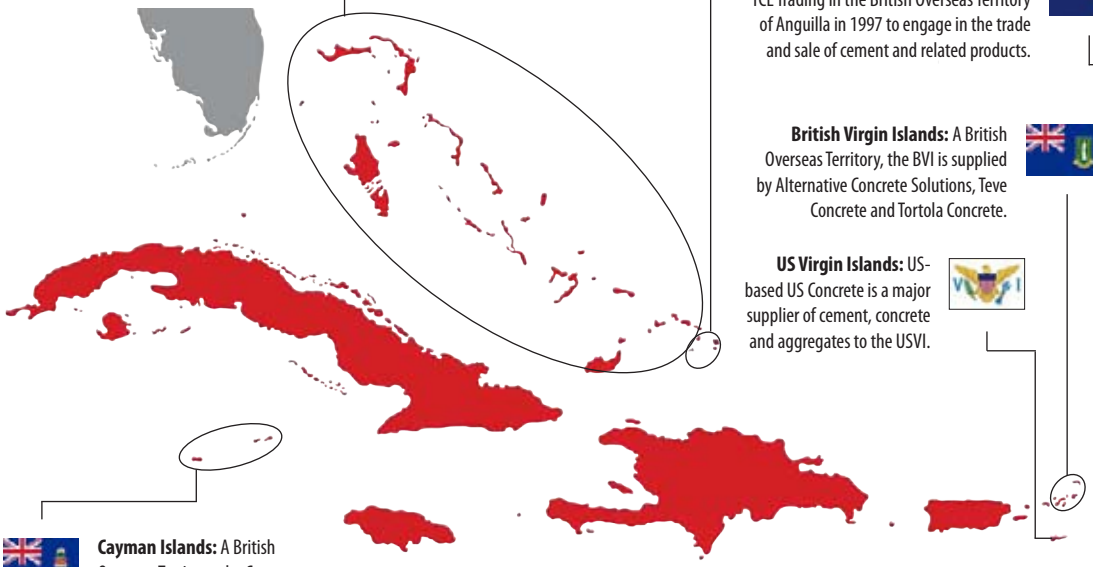
The Bahamas: The Bahamas is supplied by Bahamas Cement, Cemex Bahamas, Island Cement and others.

Montserrat: Trinidad Cement lists a local business as an importer of its cement, although with a population of little over 5000, imports are very infrequent.

Turks & Caicos has three concrete producers, the largest being Caribbean Building Materials and Services.

St Kitts & Nevis has a number of concrete suppliers.

Anguilla: Trinidad Cement incorporated TCL Trading in the British Overseas Territory of Anguilla in 1997 to engage in the trade and sale of cement and related products.



British Virgin Islands: A British Overseas Territory, the BVI is supplied by Alternative Concrete Solutions, Teve Concrete and Tortola Concrete.

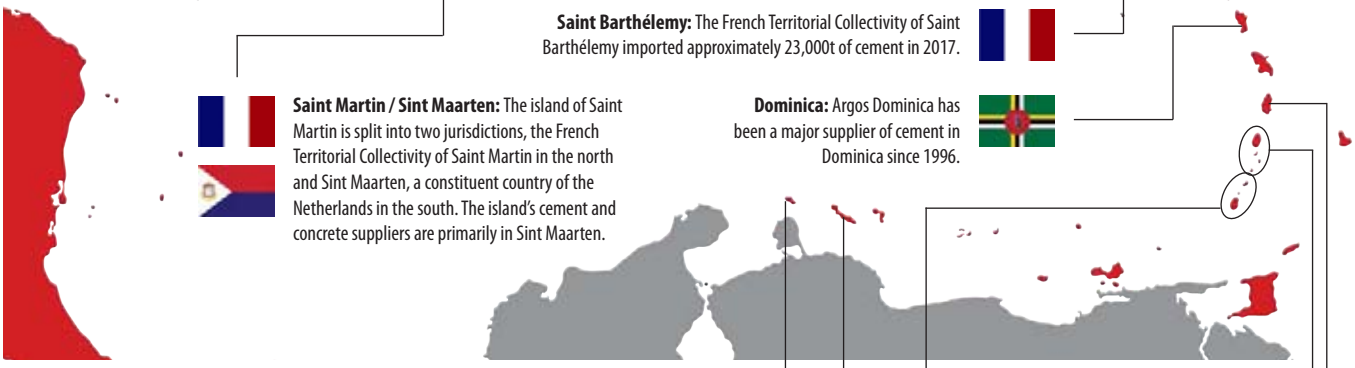
US Virgin Islands: US-based US Concrete is a major supplier of cement, concrete and aggregates to the USVI.

Cayman Islands: A British Overseas Territory, the Cayman Islands are supplied by National Cement and Supermix.

Saint Barthélemy: The French Territorial Collectivity of Saint Barthélemy imported approximately 23,000t of cement in 2017.

Saint Martin / Sint Maarten: The island of Saint Martin is split into two jurisdictions, the French Territorial Collectivity of Saint Martin in the north and Sint Maarten, a constituent country of the Netherlands in the south. The island's cement and concrete suppliers are primarily in Sint Maarten.

Dominica: Argos Dominica has been a major supplier of cement in Dominica since 1996.



Aruba: A constituent country of the Netherlands, Aruba's cement needs are catered for by Thiel Resources, Barcadera Cement and ATCO Concrete Products.

Curaçao: A constituent country of the Netherlands, Curaçao has a single ready mix concrete supplier, Heavy Mix Concrete BV, based near Willemstad.

Grenada: Grenada has several suppliers associated with Trinidad Cement.

St Vincent & The Grenadines: This group of islands is supplied by Rock Hard Cement as well as smaller firms.

St Lucia: Trinidad Cement is present in St Lucia through a local dealership, as is Barbados-based Rock Hard Cement.

Above - Figure 3: Smaller islands in the Caribbean are supplied by a wide range of cement producers and traders.

Cimenterie Nationale plant in Aubry. The plant began production as Ciment Haiti in 1952 and is now owned by Cementos Argos. The government previously mooted a new 2.0Mt/yr plant in Gonaives in 2015 and 2017 but this appears to have since stalled.

Honduras

Honduras has two integrated cement plants (3.0Mt/yr) and one grinding plant (0.3Mt/yr) operated by two producers. The larger is Cementos del Norte, which operates one of the two integrated plants (2.0Mt/yr). Its plant at Rio Bijao is the oldest in the country, tracing its history back to 1958 as part of the former Cementos de Honduras.

The other integrated plant (1.0Mt/yr) and grinding plant (0.3Mt/yr) are operated by Colombia's Cementos Argos. Both assets were part of the former French cement producer Lafarge until September 2013 when Cementos Argos bought them for US$232m.

Jamaica

Jamaica has one integrated cement plant, which is located near to the capital, Kingston. It is operated by Caribbean Cement Company (CCC) part of Trinidad Cement, itself owned by Mexico's Cemex. CCC claims that 90% of all structures on the island of Jamaica have been built using its cement, which it first produced in 1952.

Martinique (France)

Martinique became an Overseas Département of France in 2007. Like nearby Guadeloupe it also has a 0.4Mt/yr grinding plant that has been run by Lafarge Ciments Antilles since 1971.

Nicaragua

Nicaragua's cement needs are met by three plants (1.3Mt/yr): one wet integrated plant run by Cemex Nicaragua (0.6Mt/yr) under a 25 year lease from the government, and two grinding plants (0.7Mt/yr), which are operated by Holcim Nicaragua (0.3Mt/yr) (80%-owned by LafargeHolcim) and Cemex Nicaragua (0.4Mt/yr).

The integrated plant at Rafael del Sur made its first cement in 1942 as Compañía Nacional Productora de Cemento CANAL. Cemex is now 19 years into its 25-year lease (2001 - 2026) and has made significant improvements in terms of operational efficiency, health and safety and new technology. It has so far spent more than US$100m on the plant. Even though the plant is one of the few Cemex-run facilities that uses wet technology, this inherent technological inefficiency has been reduced as much as possible, with biomass fuels introduced in the early 2010s.

Cemex's 0.3Mt/yr grinding plant at Ciudad Sandino has been in operation since 2017. The plant is close to the capital Managua. The 0.4Mt/yr grinding plant at Naragote became part of Holcim in 1997 and part of LafargeHolcim in 2015.

Panama

Mexico's Cemex operates Panama's only integrated cement plant, located at Bayano (2.1Mt/yr). The plant was built on a turnkey basis by the Danish cement plant manufacturer FLSmidth in 1978 on behalf of the government. Cemex took a majority stake in 1994 and upgraded the plant in due course, including the installation of one of its first automation systems.

There used to be a second integrated cement plant, the Cemento Panamá plant in Panamá City. The plant was first established in 1948 but has only ground cement since 2001. The 0.8Mt/yr plant is now run by Cementos Argos.

Puerto Rico

The Commonwealth of Puerto Rico is a self-governing US Commonwealth territory. It has two cement plants that support its four million inhabitants, with a combined cement capacity of 2.0Mt/yr. Cemex switched the former 1.2Mt/yr Ponce integrated plant to grinding only in early 2018, stating that the island only needed around a third of the capacity it had installed. The other cement plant in the territory is located close to San Juan, the capital of Puerto Rico. It was built as a wet process line in 1970. Today the plant has a dry production line with a capacity of 0.8Mt/yr and is operated by Cementos Argos, which recently acquired it from HeidelbergCement.

Trinidad & Tobago

Trinidad & Tobago is home to Trinidad Cement, 69.8% owned by Mexico's Cemex. Its 1.2Mt/yr plant has been located in Claxton Bay, Trinidad, since 1954. A new kiln was installed in 1996, two years after Cemex had taken its initial 20% stake.

India: CMA urges regulatory clarity for mining sectors

The Cement Manufacturers Association (CMA) has contacted the Department for the Promotion of Industry and Internal Trade (DPIIT) to urge its reconsideration of an expected decision that the CMA says will disrupt the mining sector, upon which eight key industries, including cement, depend.

Local press reports that the DPIIT may be considering the deletion of a provision of the Mines and Minerals Development and Regulation (Amendment) Act that gives a captive lease to reconnaissance permit (RP) and prospecting licence (PL) holders to begin mining for minerals discovered in the licenced area. The CMA has argued that introducing any additional stage between explorations and extraction 'would not go well with the spirit of 'ease of doing business.' It added that, "The industry would like development policies to be predictable and consistent to usher in fresh investments as well as to protect the efforts and hardships that go into establishing an industrial setup."

India: Ambuja bucks coronavirus trend

Ambuja Cement's net profit in the first half of 2020 was US$22.1m, up by 1.5% year-on-year from US$21.7m in the first half of 2019. Revenues decreased by 15% to US$127m from US$149m. The company sold 9.95Mt of cement over the period, down by 18% from 12.2Mt.

Managing director and chief executive officer (CEO) Neeraj Akhoury said, "Volumes were impacted during the second quarter of 2020 as a result of Covid-19 lockdown. Cement demand is expected to rebound, presupposing a normal monsoon and various policy support measures to enhance rural and agricultural incomes. Continued infrastructure, development and affordable housing investment are expected to boost demand growth in the mid-term. The health of our employees and partners is accorded the highest priority."

Pakistan: Sales rise in 2020 fiscal year

Cement producers dispatched 47.8Mt of cement in the 2020 fiscal year, which ended on 30 June 2020, up by 2% year-on-year from 46.9Mt in the 2019 fiscal year. Data from the All Pakistan Cement Manufacturers Association shows that the largest area of growth was in cement exports from southern Pakistan, up by 46% to 5.88Mt from 4.01Mt, while northern exports fell by 22% to 1.97Mt from 2.53Mt. Conversely, domestic dispatches fell by 29% in the south to 5.64Mt from 7.98Mt, and rose by 6% in the north to 34.3Mt from 32.4Mt, thus constituting 72% of total dispatches.

India: ACC sales slump 40%

ACC's profit in the first quarter of the Indian 2021 fiscal year (1 April 2020 – 30 June 2020) was US$36.3m, down by 40% year-on-year from US$60.9m. Sales fell by 38% to US$338m from US$544m. This was due to a 33% fall in cement volumes to 4.80Mt from 7.16Mt and a fall in cement prices.

India: The India Cements profit halves

The India Cements recorded a profit of US$4.70m in the fiscal year ending 31 March 2020, down by 49% year-on-year from US$9.18m in the 2019 fiscal year. Sales fell by 10% to US$669m from US$744m. The company attributed the fall in revenue partly to the suspension of operations in the fourth quarter following the beginning of the nationwide coronavirus lockdown in late March 2020.

Turkmenistan: Lebap plant grows

Construction firm Turkmen Enjam has begun the second stage of construction of the 1Mt/yr Lebap plant in the Lebap region with the laying of foundations for several auxiliary facilities. The Zolotoy Vek newspaper has reported that development of the 370,000m^2 site is scheduled for completion in 2022 and will produce cement using gypsum and porphyritic basalt from the Ufra deposit in the Balkan region.

Philippines: Fifth mill for Eagle Cement

Eagle Cement has shared plans for the installation of a fifth mill at its 7.1Mt/yr integrated cement plant in San Ildefonso, Bulacan Province, which will be installed at a cost of US$30m. The upgrade will raise the plant's capacity to 8.6Mt/yr. Eagle's President and CEO John Paul Ang said, "Our strong financial position will allow us to weather this health crisis battering the economy without giving up major components of our expansion plans."

Eagle said that it 'ramped up production following the national coronavirus lockdown in June 2020 in order to support the government's push for accomplishing critical infrastructure projects. It is currently working towards the launch of an online customer portal for placing and tracking cement orders.

Malaysia: CMS profit falls by two thirds

Cahya Mata Sarawak (CMS) has reported a first quarter profit of US$4.04m, down by 64% year-on-year from US$11.4m in 2019. Sales fell by 32% to US$65.9m from US$97.6m. The company said, "Ordinarily, there is a lower level of activity in the first quarter;" however it predicted a 50% year-on-year profit drop for its cement division in the first half of 2020. It said that it expects its construction materials and trading division's performance to "pick up and remain strong" in the second half of 2020.

Nepal: UN award for Build Up Nepal

Ashden Environment and the United Nations Science, Technology and Innovation Forum have awarded Build Up Nepal their respective highest awards for its low-cement disaster-resistant concrete blocks. The Nepal Time newspaper has reported that the blocks contain a mix of 10% cement, 40% clay and 50% sand, all sourced from near Build Up Nepal's Mitra Marg, Patang plant. The company has supplied its unique building materials to projects in 300 different communities, including the construction of 4500 homes. It says that the blocks, reinforced with iron rods, have a greater earthquake resistance than concrete.

Build Up Nepal said, "Interlocking brick is a highly suitable construction technology in Nepal, reducing the cost of construction as well as the carbon footprint of building a house. With this technology Nepal's houses can be stronger, more affordable and its air cleaner."

China: Big production rebound

Chinese cement companies produced 249Mt of cement in May 2020, up by 8.6% year-on-year from 229Mt in May 2019. Xinhua News Agency has reported that cement production in the first four months of 2020 was 520Mt, down by 18% from 637Mt over the corresponding period of 2019. Four-month sales revenue fell by 13% year-on-year to US$32.9bn from US$37.8bn. Net profit fell by 18% to US$4.99bn from US$6.01bn. April 2020 was the first month of the year in which sales and profit grew, by 4.4% and 0.6% respectively.

Bangladesh: Huge new plant

Bangladesh Chemical Industries Corporation (BCIC) and Saudi Arabian-based Engineering Dimension International Investment (EDII) have formed a joint-venture called Saudi Bangla Integrated Cement in order to build a new integrated cement plant. The proposed unit will have a clinker production capacity of 12,000t/day, according to the Dhaka Tribune newspaper. It will be supplied with limestone from Meghalaya in India via a long conveyor belt. If realised the project is expected to create up to 700 direct and indirect jobs. Government-owned BCIC previously signed a partnership agreement with EDII in late 2018.

Vietnam: 13.6Mt exported in five months

The Vietnam National Cement Corporation (VICEM) has reported that Vietnamese producers exported 13.6Mt of cement between 1 January 2020 and 31 May 2020, down by 1.4% year-on-year from 13.8Mt in the corresponding five months of 2019. Producers exported 7.07Mt of cement to China, up by 26% from 9.55Mt, 2.08Mt to the Philippines, down by 29% from 2.93Mt, and 1.36Mt to Bangladesh, down by 9.9% from 1.51Mt. The total value of exported cement fell by 14% to US$505m from US$590m.

Qatar: QNCC earnings slump

Qatar National Cement Company (QNCC) recorded a profit of US$27.5m in the first six months of 2020, down by 32% year-on-year from US$18.8m in the same period of 2019. Sales were US$79.8m, down by 23% from US$104m. The company attributed the decrease to a decline in demand due to the coronavirus outbreak.

Senegal: First half sales rise

The Chambre des Mines du Sénégal (CMS) has reported a 5% year-on-year increase in domestic sales and a 0.6% year-on-year increase in cement production in the first half of 2020. The Le Journal de l'Economie Sénégalaise newspaper has reported that exports fell by 13%.

South Africa: Capacity utilisation halves compared to 2019

Cement plants were working at roughly 50% of the capacity utilisation level in June 2020 compared to that in June 2019 following the restart of production due to the relaxing of the coronavirus lockdown to Level 3 from Level 4 on 1 June 2020. The Sunday Tribune newspaper has reported that a construction slowdown is behind the decision to scale down production.

PPC head of inland business Bheki Mthembu said, "Demand is less than the supply. Most of our cement goes to retailers and then local builders, but we still cater to larger companies when bulk deals are required. The lack of large-scale construction projects has left the industry heavily dependent on residential construction. The government needs to support us through infrastructure maintenance and other projects. We were already in survival mode; Covid-19 has almost been the final nail in the coffin."

DRC: Initial steps in plant reopening

The Council of Ministers has approved a proposal of the Ministry of Industry to appoint auditors to perform an inventory and evaluation of the 0.3Mt/yr integrated Cimenterie Nationale (CINAT) Kimpese cement plant in Kinshasa Province with a view to re-launching cement production there. Current estimates place the cost of reopening the plant at US$82,000. CINAT is 92% state-owned.

The government established the Kimpese plant in 1974 and production ceased in 2011 due to a fuel shortage. CINAT employees have kept the plant in working order and guarded it in order to prevent it from being salvaged for scrap.

Image: Table Mountain, Cape Town, South Africa.

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Nigeria: Dangote profit rises in first half

Dangote Cement recorded a net profit of US$422m in the first half of 2020, up by 5.8% year-on-year from US$308m in the first half of 2019. Net sales were US$1.23bn, up by 2% from US$1.21bn. Nigerian sales made up 70% of the total at US$861m, up by 1.2% from US$850m in the first half of 2019.

The company said, "Most Covid-19 lockdown measures started at the end of March 2020 and peaked in April 2020. The response by the authorities varied in nature from specific temporary restrictions in some countries to a complete temporary lockdown for non-essential businesses. Our operations in South Africa, Congo and Ghana were shut down due to full or partial lockdown in most of April 2020. By early May 2020, lockdown had eased, and all our businesses were operational."

Regarding its Nigerian operations, it said, "Lagos, Abuja and Ogun states locked down from 31 March 2020 to 4 May 2020. As a result, April 2020 volumes were heavily impacted and 28% lower than in April 2019. Other states joined with complete or partial lockdown during the month." It estimated that a recession would strike the economy before 31 December 2020, compounded by the Covid-19 outbreak and a first-half global oil price slump.

Zimbabwe: Solar plant for PPC

PPC Zimbabwe has announced that it has entered into a preliminary agreement with a Zimbabwe-based energy investor with 'technical partners in South Africa' that will build and operate the company's planned 32MW solar power plant in Matabeleland South. 16MW will power PPC Zimbabwe's cement production and the rest will be fed to the national electricity grid, according to the Herald newspaper. The unit will be located adjacent to PPC Zimbabwe's 0.5Mt/yr integrated Colleen Bawn plant.

Rwanda: Prime plant launched

In July 2020 Milbridge Group subsidiary Prime Cement said that its 0.6Mt/yr Prime Cement grinding plant in Musanze, Northern Province would enter production in August 2020. KT Press News has reported that the US$66.6m plant will create 600 jobs.

Plant manager Eric Rutabana said, "We hope that with our coming to the market, the cement prices will be reviewed downward. Sincerely speaking, the existing price is beyond purchasing power on the local market."

Mozambique: New 1.8Mt/yr integrated plant

Dugong Cimentos says that construction of its new 1.8Mt/yr integrated cement plant in Matutuíne District, Maputo Province, is 90% complete. The Noticias newspaper has reported that the plant cost US$330m and was paid for by private Chinese investors. It will permanently employ 500 people, including 400 Mozambicans, when operational. The plant will consume 400,000t/yr of coal and produce cement as well as supply clinker for grinding at other Mozambican plants that currently import it.

Oman: 10% revenue fall for Oman Cement

Oman Cement's net profit for the first half of 2020 was US$5.39m, down by 9.9% year-on-year from US$5.98m in the first half of 2019. Sales rose by 1.1% to US$68.6m from US$67.9. The results are subject to approval by the audit committee and board.

Nigeria: BUA Cement to build cement plant at Guyuk

BUA Cement has shared plans to establish a 3Mt/yr-capacity integrated cement plant in Guyuk, Adamawa State. The Sun newspaper has reported that the company also plans to establish a 50MW power plant in nearby Lamurde, also in Adamawa State. BUA Group chairman Abdul Samad Rabiu said, "We will use new technologies to supply power to the proposed cement plant and communities of Guyuk and Lamurde." The state's limestone deposits with provide the raw material for clinker production.

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: Ethiopia, India, Kazakhstan, Kenya, Nigeria, Pakistan and Philippines.

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

China: All-China 42.5 grade cement spot prices from sunsirs.com. 6 August = US$61.08/t; 7-9 August 2020 = US$61.54/t; 10 August 2020 = US$61.80/t; 11 August 2020 = US$61.89/t. The price on 11 August 2020 was around 4.1% higher than a week earlier (US$59.46/t) but only around 2% higher than at the start of July 2020.

EU ETS: CO_2 emissions permits cost Euro26.68/t on 10 August 2020, a 0.4% fall week-on-week from Euro26.78/t on 4 August 2020, a 7.9% fall month-on-month from Euro28.98/t on 10 July 2020 and a 7.3% fall year-on-year from Euro28.10/t on 9 August 2019. This is the first time since the onset of the coronavirus that our analysis has shown falls for week-on-week, month-on-month and year-on-year prices.

Egypt: Ordinary Portland cement prices as at 11 August 2020: Arabian Cement Co (Al Mosalah) = US$46.59/t; Arabian Cement Co (Al Nasr) = US$46.05/t; Cemex (Al Fahd) = US$44.62/t; Minya Portland Cement (Minya) = US$45.25/t; Minya Portland Cement (Horus) = US$45.06/t; El Nahda Cement (Al Sakhrah) = US$45.25/t; Wadi El NIle Cement = US$45.56/t; Lafarge (Al Makhsous) = US$45.56/t; Medcom Aswan Cement (Aswan) = US$45.37/t; Arish Cement (Alaskary) = US$45.56/t; Sinai Cement (Sinai) = US$44.24/t; Suez Cement (Al Suez) = US$46.31/t; Helwan Cement (Helwan) = US$45.56/t; Misr Beni Suef = US$47.75/t; El Sewedy Cement = US$46.62/t; Misr Cement Qena (Al Masalah) = US$45.25/t; Al Watania Cement (Askary Beni Suef) = US$45.25/t.

White cement prices as at 11 August 2020: Sinai White Cement (Alabid Elnada) = US$156.25/t; Sinai White Cement (Super Sinai) = US$153.75/t; El Menya Cement (Super Royal) = US$149.38/t; El Menya Cement (Royal Elada) = US$151.88/t; Menya Helwan Cement (Alwaha Alabiad) = US$151.57/t.

Blended cement prices as at 11 August 2020: Sinai Cement (Al Nakheel) = US$41.25/t; El Menya Cement (Al Omran) = US$41.25/t; Helwan Cement (Al Waha) = US$42.06/t; El Sewedy Cement (Sewedy Tashtibat) = US$41.88/t. Sulphate-resistant cement prices as at 11 August 2020: Arabian Cement Company (Moqwem Mosalh) = US$47.51/t; Cemex (Al Mukawem) = US$48.44/t; Minya Portland Cement (Asec Sea Water) = US$47.38/t; Lafarge (Kaher Al Behar) = US$47.81/t; Suez Cement (Al Suez Sea Water) = US$47.69/t; El Sewedy Cement (El Sewedy Al Mukawem) = US$47.81/t.

Mauritius: The price of Kolos branded cement was increased on 15 July 2020 as a result of the coronavirus pandemic and depreciation of the Mauritian Rupee against the US Dollar. Wholesale prices for bagged cement (including VAT) are now: Kolos Plus = US$3.45/bag (25kg); Kolos = US$3.39/bag; Kolos Eco Plus = US$3.26/bag; Kolos Finish = US$3.13/bag.

Rwanda: Cimerwa has announced standard cement prices that it advises the general public not spend above, in a bid to reign-in the recent high prices set by speculative traders amid cement shortages. Builders claim that the shortage of cement has resulted in the sharp rise in market prices to US$13.54/bag (50kg) from US$8.85/bag.

According to Cimerwa, the final retail price for each of its three cement products should be limited to: Surewall = US$9.16/bag, Surecem = US$10.20/bag; Surebuild = US$10.80/bag.

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

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Sustainability, now more than word juggling...

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

An editor's job is to package text for the clear and efficient transfer of information. Much of this involves 'extracting the juice' from information presented by authors, interviewees or PR firms, so that they can be shown in the best possible light. A large part of this is knowing what to omit, as the clarity and order of the text are also critical.

We 'juggle' a lot of words at *Global Cement* and, in our December 2019 issue, we looked back at the trends of key words and phrases used throughout the 2010s. The top words in the December 2009 - January 2010 issue (after removal of a number high-frequency words) were: slag, emissions, production, CO_2 and fuels. The most popular two word phrases included alternative fuels, CO_2 emissions and low-carbon, an indication that discussion of sustainable practices has long been part of our industry.

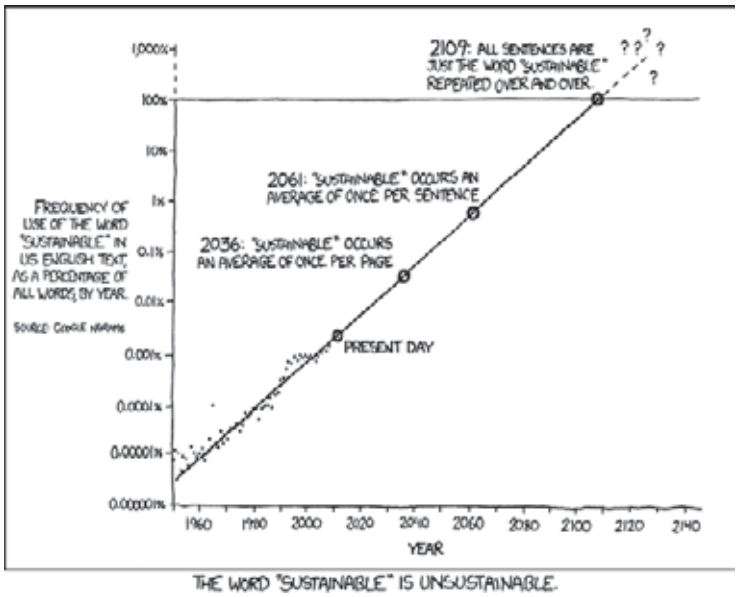
When I began the analysis, I had anticipated that 'green' phrases would become more prominent over time. However, by the time of the analysis in late 2019 not much had changed. 'Production' was once again the top 'non-frequent' word in the November 2019. The prevalence of sustainable phrases was broadly the same throughout the decade. It seems that sustainable practices were just one of several factors to consider during the day-to-day process of making cement.

I must admit that the methodology I used was fairly unwieldy and did not permit the analysis of as many issues as I would have liked. Had I been able to delve into more issues, it is possible that deeper patterns would have been revealed, as shown in Figure 1. Taken from the popular web comic xkcd, Figure 1 is a logarithmic plot that shows the prevalence of the word 'sustainable' in English-language text since 1950. The data up to 2016 is based on Google Ngrams data. Randall Munroe, the polymath behind xkcd, then extrapolates the line of best fit to its illogical conclusion. By 2109, he 'predicts' that all sentences will just be the word 'sustainable' repeated over and over.

Figure 1 certainly shows an increase in discussion of sustainable practices over time, but rather less about how that translates to sustainable industrial and business practices. Given the topics of some other xkcd comics,[1] I think that's the point: Too much word juggling, not enough action. This is a common criticism.

However, as I look over the content of this September 2020 issue (during yet another >30°C day in the UK), I think we may be at a tipping point. This issue is packed not with distant promises but solid actions from cement producers, suppliers and associations. Every major producer now has some form of low-CO_2 cement or concrete product and many are using offsetting to go completely CO_2-free. There are myriad competing CO_2 capture technolgies, several of which are now commercial. Ternary cements containing calcined clays are a reality. Digitisation has opened the door to greater process and resource efficiency. These are some of the technologies and actions that will help our sector towards meeting its 2050 Paris Agreement targets. For its part, *Global Cement* will continue to juggle sustainable topics to the top of the pile, to further help the sector in its goals.

1. For arguably the clearest visual demonstration of the historical, ongoing and future changes to our climate visit: https://xkcd.com/1732.



Left: 'Sustainable' by xkcd's Randall Munroe. The main text of this page uses 'sustainable,' eight times. This is 1.48% of the total words in the text, giving it an 'xkcd sustainability date' somewhere in the 2060s. **Source:** https://xkcd.com/1007.

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