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Dear readers,

Welcome to the June 2021 issue of *Global Cement Magazine* - the world's most widely-read cement magazine. First up, this issue includes the second article in our series on 'better and cheaper cement,' courtesy of Intec Services' Neil Taylor (Page 10). In it, Neil highlights the importance of controlled clinker chemistry and particle size distribution, which are, in turn, related to a raft of other factors. Not the least of these is raw material composition, the optimisation of which will be the subject of the next article in the series. Also in this issue's feature section, we catch up with Charlie Zeynel of supplementary cementitious material (SCM) trader ZAG International (Page 14), ahead of the *Global Slag Virtual Conference* on 15 June 2021. Pandemic-induced steel mill shutdowns caused supply and demand for granulated blast-furnace slag (GBFS) to become even more out of kilter than usual in 2020. Although the global situation has started to settle since the start of 2021, the long-term forecast for SCM supplies is one of decline, just as cement and concrete producers are demanding more. As well as supplies of GBFS, fly ash is also set to become more scarce in the future. Are ash ponds and / or calcined clays the answer? Read Charlie's thoughts on Page 14.

Elsewhere, this issue contains a fascinating discussion with representatives from Kayrros, an advanced data analytics company that is using satellites to offer new insights into global cement production (Page 20). Equipped with IR sensors, a satellite that passes over a given plant every 5-7 days, can track production changes by looking at temperature anomalies (i.e. hot kilns) in near real-time, to generate valuable insights well ahead of official data. Also using AI is Giatec (Page 34). It uses sensors to measure the properties of concrete in built structures, with the aim to reduce cement volumes, cost and CO₂ emissions. In the technical section, there is an unusual fan case-study from Nigeria (Page 24), as well as a Beumer U-shape Conveyor case-study from Austria (Page 30) and a look at compressor lubrication with Klüber (Page 28). Finally, this issue's country report comes from the UK, courtesy of Edwin Trout at the Cement Industry Suppliers' Forum (Page 44).

Enjoy the issue!

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ISSN: 1753-6812

Published by Pro Global Media Ltd

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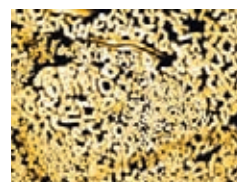
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Neil Taylor, Intec Services P/L

Better and cheaper cement: Optimising the right clinker properties

Neil Taylor of Intec Services presents the second article in his series on better and cheaper cement, this time looking at clinker quality.

Kiln operation is basically about making clinker reactive enough to produce competitive quality cement. Operating the kiln at the highest sustainable output with low energy consumption will also reduce environmental impacts and production costs. Both of these potentially conflicting objectives can be largely satisfied by optimising the right clinker properties:

- **Chemistry/reactivity:** To satisfy product quality requirements;
- **Particle size distribution (PSD):** For process performance (capacity, cost, environment).

Practically improving clinker quality

Once the raw mix has been optimised, the next opportunity to improve product quality is to make the clinker minerals smaller and/or potentially more reactive (Figure 1). Mineralisation and other techniques may be an option to improve clinker reactivity in some plants, but in most cases better reactivity is usually achieved by preparing the feed properly and burning it under oxidising conditions with a kiln temperature profile that gives rapid clinker heating and quick pre-cooling. Specialist

techniques like microscopy or X-ray diffraction and Rietveld analysis are often helpful to identify options to improve reactivity. However, working out what process or material parameters to change, and by how much, can be challenging... especially if the kiln operation is not particularly stable.

Fortunately, kiln conditions that produce smaller and more reactive clinker minerals usually favour good nodulisation, so simply stabilising clinker PSD will often be enough to improve clinker reactivity and reduce product variability. Prioritising clinker PSD also has other advantages. Changes in clinker PSD and cooler performance can be measured in real time through parameters like secondary and tertiary air temperatures, undergrate pressure, grate speed and clinker exit temperature.

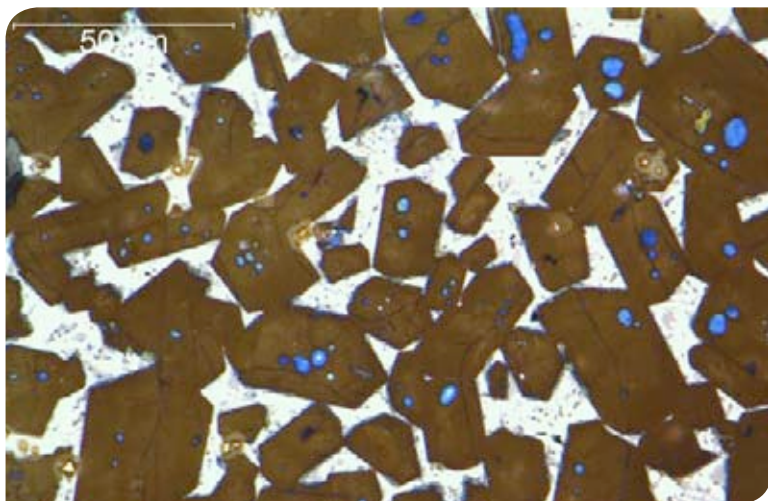
By observing how these parameters respond to material and process changes, a picture of the potential factors that affect clinker properties like PSD and 28 day strength can usually be built up. The factors can then be checked with small, low risk trials and the findings then applied to stabilise clinker properties and kiln/cooler operation. Then, when the process is stable, it becomes much more practical to investigate and apply the options for improving clinker reactivity, if this is still necessary.

Optimising clinker PSD

Any type of cooler will work more effectively when it is fed with correctly-sized clinker nodules. Large clinker nodules (Figure 2) are difficult to cool, transport and grind into cement. Clinker should ideally have a smaller average nodule size and a narrow nodule size range. More uniformly sized clinker is more evenly distributed into the cooler and has more consistent bed porosity, which enables more stable cooler and kiln operation. However, a low clinker fines content is also important for the best process and quality performance.

Fine clinker can contribute to red rivers and other cooling problems, but there are other impacts. Clinker dust carried back into the kiln interferes with heat transfer from the flame, slows nodule growth and encourages even more dust formation.

Below - Figure 1: Clinker with a smaller alite size is considered to be more reactive.





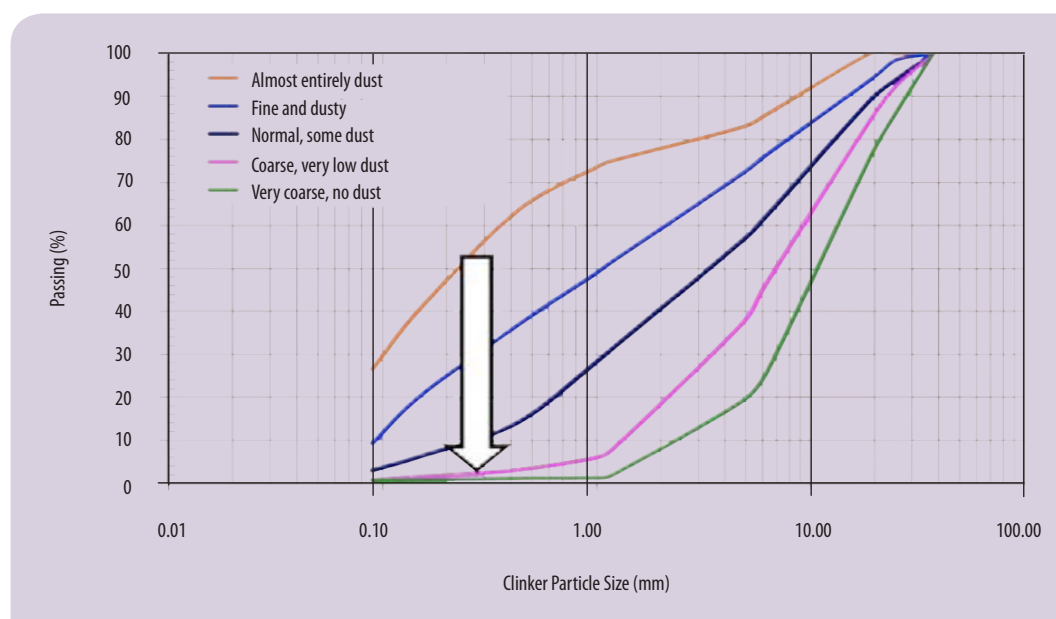
Left - Figure 2: Large clinker nodules can cause all sorts of cooling, process and quality problems.

The recirculated dust also shifts burning zone heat toward the kiln inlet, making back-end rings and build-ups more likely. It also contributes to larger, less reactive clinker minerals. When clinker cooler air is used for coal mill heating, the fine carry-over dust can add large amounts of inert 'ash' to the ground coal. This can interfere with combustion and limit kiln output. The abrasive dust also accelerates equipment wear and makes burner pipe and snowmen buildups more likely. Dusty clinker can also have poor grindability and a higher kWh/t demand and can cause severe vibration and quality problems when vertical roller mills are used to grind clinker. Keeping clinker dust levels as low as possible (Figure 3) has many benefits to cooler, kiln and downstream plant performance.

The main factors affecting clinker reactivity and PSD

Clinker mineralogy and nodule size depend largely on the feed composition and the amount, distribution and nature of the melt phase formed in the burning zone. The clinker melt promotes the reaction between belite (C_2S) and free lime to form alite (C_3S), so it is critical for clinker reactivity. The melt also binds the feed particles into small nodules, which grow by picking up other particles as they move through the burning zone. The melt also sticks feed particles to the kiln bricks to form coating, which protects the refractory, improves heat exchange and reduces heat loss through the shell.

Melt levels that produce small to moderately-sized nodules generally provide coating thick



Left - Figure 3: Keeping clinker dust levels as low as possible can significantly improve kiln and cooler performance.



**Thermal
Profile**

**Kiln Gas
Environment**

**Targets and
Controls**

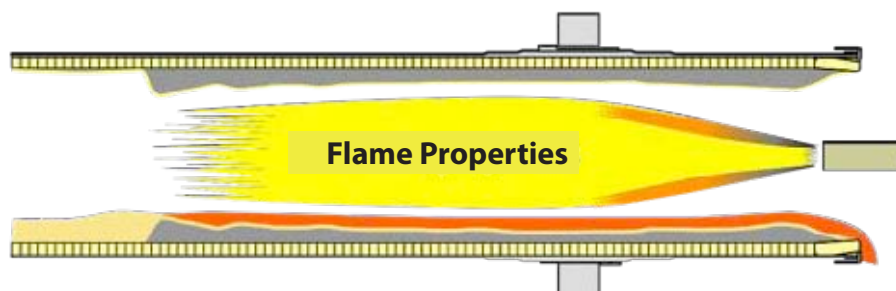
**Fuel
Properties**

**Feed
Properties**

**Burner
Parameters**

**Volatile
Recirculation**

**Secondary
Air Quality**



Above - Figure 4: Some of the main factors that affect clinker melt levels, reactivity and particle size.

enough to protect the refractory but not so thick that it limits draught, kiln capacity and operating costs. Some of the main factors that determine melt levels and directly affect clinker reactivity and particle size are shown in Figure 4.

To flow easily between the feed grains, the melt needs to have a low viscosity, but it also has to have enough surface tension to stick the particles together into strong nodules. Higher burning zone temperatures help the melt flow between the particles and speeds up alite formation, but high temperatures also reduce the surface tension and can make the clinker more dusty, so the burning zone should not be too hot. Melt viscosity and surface tension can be significantly affected by small variations in raw material alkalis, sulphur, magnesia, fluorine and other minor components, which will be covered in the next article in this series.

Setting up the burning zone

Flame properties and combustion conditions also need to be in the right range to generate optimum melt levels. This starts with good burner pipe alignment and positioning to avoid flame impingement and ensure an adequate clinker precooling zone. The burner momentum and fuel also need to be matched and adjusted to produce a moderate length, narrow flame with a relatively uniform heat release profile and rapid fuel burnout.

When this type of flame is combined with appropriate clinker chemistry it will usually generate small, reactive clinker minerals and a burning zone long enough to produce a clinker PSD which can support high kiln rates. Although 'short, sharp flames' are promoted for improving clinker reactivity, excessively short and peaky flames reduce the melt surface tension and limit the time available for

Right - Table 1: Effect on key cooler and kiln parameters of optimising clinker properties.

Parameter	Under Grate Pressure (kPa)	Grate rate (spm)	Clinker Fines <1mm (%)	Mean Clinker Temp. (°C)	Grate Load (t/m ² /day)	Kiln Rate (% BDP)
Before	5.0	20	<20	170 - 200	50	92
After	4.2	18	<5	<130	57	102

Right - Figure 4: A wide range of factors affect the stable production of high-quality clinker, including raw material properties. These will be the subject of the next 'Better and cheaper cement' article, coming in the July-August 2021 issue of Global Cement Magazine.




good nodule growth. This can make the minerals smaller, but the clinker can end up finer and more dusty. Kiln capacity may also suffer. The problems are worsened if the kiln is also operated with too little oxygen, which lowers the flame heat flux intensity and reduces the available melt. Reducing kiln conditions can also affect clinker properties and accelerate sulphur recirculation, which can add to the dustiness and also accelerate kiln build-ups. However, these problems can usually be eliminated with good kiln operating methods.

Case study - Modifying clinker properties to reduce clinker cooling problems

Situation: An unstable inline-calciner kiln was operating with frequent back-end buildups and backspilling, a highly loaded grate cooler and clinker discharge temperatures up to 200°C. To limit process and product problems, the kiln was being operated at 92% of best demonstrated practice (BDP) and a cooler upgrade was being considered.

Response: After adjusting raw mix properties and burner settings, fine tuning several kiln feed and operating parameters and working with the operators and staff to reduce 'freestyle' operating methods, clinker exit temperatures were reduced to <130°C (Table 1). Back-end buildups were virtually eliminated, a new BDP was established and average cement strength was also improved. The planned cooler upgrade was subsequently deemed unnecessary.

Looking ahead

The next article in the 'Better and cheaper cement' series will look at how raw materials and fuels contribute to quality and plant performance. It will also examine a case study in which raw material properties were modified in order to improve kiln performance. 



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Interview by Peter Edwards, Global Cement Magazine

In discussion: Charlie Zeynel, ZAG International

Global Cement recently spoke with Charlie Zeynel, of supplementary cementitious material (SCM) trading firm ZAG International, to discuss current and future trends in granulated blast furnace slag (GBFS), fly ash and other SCMs.



Above: Charlie Zeynel, ZAG International.

Global Cement (GC): What have been the main trends regarding GBFS over the past 12 months?

CZ: The supply of GBFS was affected by the Covid-19 pandemic, due primarily to a reduction in steel production volumes. We estimate that there was a year-on-year drop of 20% in GBFS production for 2020 as a whole. As many readers will be aware, turning a steel mill on and off is not trivial. Several suppliers in major markets restricted production in the second quarter of 2020 and some are only re-starting production now as economies recover.

In terms of demand, surprisingly the major economies that use GBFS in cement, such as the US, UK/EU and Australia, maintained almost the same high level as in 2019. Construction was considered an essential sector in many markets and activity remained constant. In fact in some cases demand actually increased in the latter half of 2020.

The amount of GBFS exported long distance in ocean-going vessels in 2020 was estimated to 22-24Mt. Japan exported over 11Mt, South Korea,

Vietnam, Indonesia and Malaysia exported 4.5Mt combined, with Brazil exporting 1.5Mt. India, China (mostly GGBFS) and other smaller producers contributed around 4-5Mt. Most European slag remained on the continent, with some going to traditional customers in North America and Africa.

GC: How did these trends feed into prices?

CZ: Prices for 2020 were typically set before the start of the year as annual contracts were fixed. This was well before the pandemic hit worldwide. These were slightly above 2019 prices, continuing a sustained and steady upward trend as global demand increased and overall supply remained stable. In Europe the average Free on Board (FOB) price was US\$18-22/t, an increase from US\$16-20/t in 2019. Brazil followed suit, going from US\$15-17/t to US\$18-20/t and prices in Japan rose from US\$8-10/t in 2019 to US\$10-13/t in 2020. The four big North and South East Asian suppliers - South Korea, Indonesia, Malaysia and Vietnam - all adjusted their prices to match the Japanese benchmark. As in the previous three years, China was not a factor in GBFS exports.

So, while cement producers were not faced with rising GBFS prices during the year itself, there were additional challenges with regards to shipment schedules and keeping hold of supplies. However, the reduction in supply due to Covid-19 did not cause as much chaos as we had feared, except in certain countries where the construction sectors did experience major slowdowns and even shutdowns.

GC: What has happened since the start of 2021?

CZ: Many steel plants are now coming back online, so GBFS availability is also increasing as global demand for steel recovers. Ordinarily this would mean that supply and demand would now be better matched. However, in January 2021 there was a rapid,

Below: Slag production fell in 2020, due to a 20% year-on-year fall in steel production.

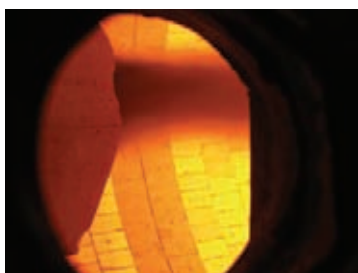


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Above: Shipping rates have doubled since November 2020, stopping many SCM trades in their tracks.

large and quite unexpected increase in freight rates. Everywhere we looked, the rates have basically doubled from where we were in the fourth quarter of 2020. As an example, typical rates for handy/supra max vessels from Japan to the US Gulf Coast, which were around US\$20-22/t in November 2020, are now more than US\$40/t.

This has been a huge shock to the system, not just in terms of cost, but also availability of vessels as many shipowners prefer not to carry 'dirty' cargos such as clinker, cement and SCMs. This development now represents a major barrier to SCM use in several markets, especially where cost is still more important than better concrete performance or environmental benefits.

Furthermore, it appears that many traders and users had anticipated continued low rates and continued to fix ships on a spot basis and did not have agreements for 2021. ZAG has seen orders cancelled at most major steel producers because buyers could no longer find ships to transport the GBFS and / or the purchase no longer made sense due to the prevailing freight cost. This is particularly common for customers in Africa and the Middle East, which are particularly cost-conscious.

GC: What are some other regional trends?

CZ: Established markets like the US, Europe and Australia continue to be strong in terms of demand for GBFS. Starting with the US, cement demand was reasonably strong in 2020, as building continued throughout the pandemic, especially in States with warmer weather. In the third and fourth quarters of 2020, customers saw the need for more GBFS and as result, ordered additional shipments. US GBFS needs are supplied primarily by the few remaining blast furnaces in the Upper Midwest and Lake Ontario region, which service regional cus-

tomers within reasonable rail and trucking distances. However, as has been the case now for over 15 years, all the US coastal markets have been supplied by imported GBFS, primarily from Japan.

Some product is also coming from Brazil and Mexico, the latter being a relatively new supplier, as well as from European steel mills. There is a clear awareness that sourcing of GBFS (and all SCMs) is a strategic imperative. Remember that integrated steel complexes, and especially coal-fired power plants, are both high cost operations and facing increasing environmental pressures. Closures and capacity reductions continue apace. Coupled with that, the Biden Administration has put renewed emphasis on reducing CO₂ emissions. Lower emissions and clinker factor reduction are major goals for all cement producers and SCMs are clearly part of that.

In Europe, demand is strong against a backdrop of reduced supply in 2020. Now that more European steel mills are back up and running, there seems to be a better supply/demand balance in 2021. This is particularly the case in the UK, although whether this is due to market fundamentals, a strong Covid-19 vaccination performance or even Brexit is unclear. Australia continues to be a strong albeit steady market too.

Bangladesh is a major importer of GBFS due to the fact that it has no natural resources for cement production. It is amazing how much clinker and GBFS can pour into that country! On the other side, the UAE, which was once a 5-6Mt/yr GBFS market five or six years ago, has collapsed to ~1Mt/yr.

GC: What's happening in China?

CZ: China left the global market around 2018-2019 and no longer exports GBFS in meaningful quantities. This is due to increased demand at home coupled to lower steel production volumes relating to state-mandated seasonal operating regimes and production limits. These are, in turn, related to environmental targets. GBFS prices in China are well above the international average, so there is no financial impetus to export at all. Some ground GBFS is exported from China, but the amount is modest.

GC: What are the latest new markets and trends?

CZ: South America bears watching, with Colombia leading the way as a growing market for SCMs, perhaps predominantly due to Grupo Argos committing strongly to environmental improvements and the use of low clinker cements. The west coast of South America, for example Peru, Ecuador and Chile, was also a growing market in 2020, but this



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The background of the lower half of the page is a photograph of an industrial slag pouring machine. The machine is a large, dark, metallic structure with a rotating drum that is tilted, pouring a bright, glowing orange-yellow liquid slag into a container below. The scene is set in an industrial environment with various pipes and structural elements visible. Overlaid on the right side of this image is the word "GLOBAL" in large, white, outlined capital letters, arranged vertically.

GLOBAL



Above: Coal-fired power plants are closing more rapidly than expected across developed markets, reducing supplies of fly ash.

has slowed somewhat with the increase in freight rates. The same is true of the Caribbean and Central America, for example in Haiti, Guatemala and Panama.

Following on from our conversations in previous years, Brazil is now a well established supplier. It has started to supply European destinations, particularly the UK and the Netherlands. However as the Brazilian cement industry is again growing quite strongly, it will be interesting to see how domestic demand for SCMs may affect the exports of GBFS.

GC: Aside from the supply and freight costs, what else limits greater uptake of GBFS globally?

CZ: In some markets there is still the perception that GBFS is a waste, which creates import restrictions and hurdles. This attitude is persistent in parts of South and Central America, as well as in some African markets. With the high freight costs at the moment, few see much point in convincing these markets otherwise at the moment. GBFS performance is also an issue: remember that not all GBFS is created equal. Even if you were to improve the quality of all of this material, however, there still wouldn't be enough to satisfy demand.

GC: Is the GBFS market now a 'rich man's' market?

CZ: We are being asked this question more and more often. We are not quite there yet, although that is not to say that it won't get to that point. What is more important right now is whether or not the market in question has 'healthy' pricing. In the US, cement costs ~US\$100/t, in Europe it can cost more. By contrast the price in the Middle East might be

closer to US\$50-55/t. So there is more margin for the cement producer to absorb price rises, as we have seen with the freight rate.

Remember that the US\$20/t increase in shipping cost I mentioned is only part of the overall transport and processing cost. By the time it is unloaded and ground, it could cost a cement or concrete producer as much as US\$80/t. This is an acceptable proposition at a cement price of US\$100-120/t, but not at US\$50-55/t. So as always, supply and demand and market pricing are inextricably linked and the answers are not always easy to divine. This phenomenon explains partially the constantly shifting and evolving trade patterns we see in our industry. This is why we have always maintained that being able to 'see and connect the dots' is a key success factor in our global approach. To be able to do this, one truly needs to have a good view of all major regional markets and how they can impact each other on a global stage.

Fly ash and other SCMs

GC: Can you outline fly ash trends over the past 12-18 months?

CZ: The supply of fly ash is reducing quite rapidly due to the continued rapid closures of coal-fired power plants in developed markets. There has even been an acceleration. In the US we constantly see the closures coming more rapidly than expected. Plants due to close in two years end up closing within 12 months. Those slated for closure in three or four years' time now get cut to two years or less. The same is happening in the UK, which typically uses no coal anymore, and in Germany and Scandinavia, where coal plants are closing fast. Japan is on the same trendline and China is taking similar measures.

Around 5-6Mt of fly ash was traded on ocean-going vessels in 2020 but it will struggle to reach this level in 2021. This is because it is finer and dustier and generally more difficult to handle than GBFS. Ship owners are loathe to carry it. Indeed this attitude is now spreading to GBFS, clinker and cement in some cases, as previously mentioned. They can afford to turn down 'dirty cargoes,' which wasn't the case just six months ago. Added to this, some of the major fly ash suppliers didn't set up sufficient shipping coverage for 2021. Their output is now offered at a discount or is even being landfilled. However, over the long term, fly ash supply is a strategic imperative and will increase in value.

GC: Are the economics of ash pond remediation viable in such a market, or are they just more piles that are impossible to move?

CZ: Ash ponds are somewhere in between. No doubt there is useful material in them, but a lot of it has been there for a long time. A lot of the materials are mixed so you have fly ash with bottom ash, flue-gas desulphurisation gypsum, pyrites and other materials all mixed up. This means potentially high remediation / recovery costs. On top of this, there are potential liabilities attached to such sites. There could be substantial sums in damages to pay if one of these ponds leaked into the water supply, for example. The legal departments at the companies that are best placed to remediate ash ponds are making their boards think long and hard about it. I'm sure that some companies will go for it, but ash ponds are not a simple panacea. However, efforts are underway and we will see more fly ash coming from these sources.

GC: What is your current take on the use of calcined clays in cement production?

CZ: A number of companies are now producing cements with a portion of calcined clay, but a challenge is that these can actually be more expensive to produce than clinker. Having local supply is also a necessity so this will limit usage of these materials. I am sure that this trend will continue, but it will work best in markets that have a financial penalty for producing CO₂. I think there may also be some resistance to developing new quarries, to extract the necessary clays in some countries. It's not a 'slam dunk.'

GC: What should cement producers do now to secure reliable SCM supplies in the current market?

CZ: For too long there has been uneven distribution along the value chain when it comes to SCMs. Traditionally the cement producers enjoyed most of the value chain because they got cheap and ubiquitous SCMs from steel and power suppliers, which were more than happy to offload their 'problem' onto someone else. Then, as supplies started to reduce, suppliers, steel plants in particular, realised that they had a valuable commodity and steadily raised their prices. While there was some push-back against their prices, the situation was then upset by rising freight prices. This chopping and changing gives rise to too much volatility and is not a great way to develop an equitably-shared value chain over the long term.

What needs to happen is for a cross-sector approach to realise the benefits of SCMs over the longer term. This requires a re-set from the mentality that seems to still pervade our business. All parties need to come together to ensure that the benefits, and risks, are shared along the entire value chain. Nobody can sensibly invest US\$10m in a silo at their preferred dockside in the hope that

everything else will fall into place. There needs to be coordination between the supplier, the shipper, agents and off-takers to develop the whole system. This takes time and effort to do, but it is worth it.

GC: Charlie Zeynel, thank you as always.

CZ: You are very welcome!



Below: Ash ponds contain a lot of fly ash, but also contain other ashes and coal combustion by-products. Remediation may be possible in some cases, but others may be too costly, especially when potential liabilities are considered.



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Interview by Peter Edwards, Global Cement Magazine

Kayrros: Measuring cement production from space

Global Cement speaks with Kayrros, an advanced data analytics company that is using satellites to offer new insights into the global cement sector.

Global Cement (GC): Please could you introduce Kayrros and what it does?

Nikolaos Antonopoulos (NA): Kayrros is a global platform for industrial asset observation. It measures and monitors energy, natural resource and industrial activity worldwide by harnessing machine learning, natural language processing and advanced mathematics, as well as satellite imagery, geolocation data, text and other unconventional data. It currently observes more than 200,000 assets worldwide. To keep on top of this we employ a technical team of 140 experts from across finance, heavy industry, shipping, trading, data science and market analysis.

GC: When and why did Kayrros start to monitor the cement sector?

Simon Ben Arous (SB): Kayrros was looking to expand its range of products in 2019. As part of this, we used our access to the Copernicus Sentinel satellite constellation, operated by the European Space Agency, to monitor cement kilns from the end of 2019. This comprises two satellites equipped with visual and near infra red (NIR) cameras. Using them allows us to observe when industrial assets,

such as cement kilns, are hot or cold. We use this as a proxy for whether or not they are making clinker.

Our proprietary AI algorithms then take this information and combine it with the capacity of the kiln to estimate clinker production. Across a large enough sample, this provides accurate estimates of clinker production for a given country or region.

GC: How many plants does Kayrros look at?

SB: Theoretically the satellites could monitor every cement kiln worldwide. We are not there yet, but Kayrros is increasing its coverage rapidly. As an indication, we have found that our modelling, even at coverage levels below 50%, including in China, is sufficient for 90% accuracy. In many countries our coverage is much higher, which increases the accuracy too.

When adding a new plant, we outline a polygon over specific area(s) of interest. Then, when the satellite passes over the plant, it can view the kiln(s) individually and assess whether they are in use or not. Each plant is visited at the same local time each time the satellite passes, always during daylight hours and most often between 10:00 and 18:00. The average time between visits is five days, allowing us to monitor changes in activity with good accuracy.

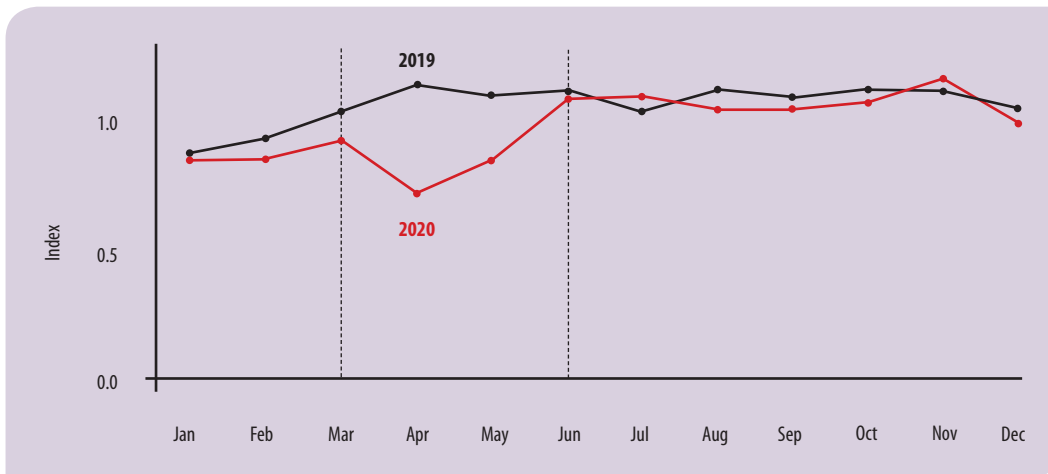
Below - Figure 1: Kayrros uses satellites to assess activity at individual cement kilns.



Above: Nikolaos Antonopoulos is a Market Analyst at Kayrros. He has worked at the company for two years.



Above: Simon Ben Arous is a Senior Data Scientist at Kayrros. He has been with the company since 2019.



Left - Figure 2: Cement production index comparison, for Spain, France, Italy, Germany and the UK, 2019-2020.
Source: Sentinel Hub. Contains modified Copernicus Sentinel Data (2019-2020).

GC: What are the benefits of Kayrros' approach?

NA: What our approach allows us to do is to look at clinker production on the ground, in as close to real-time as possible. This offers unprecedented insights into the industry. Our subscribers can access weekly clinker production reports from any country on the Kayrros cement plant database. Those that opt for Kayrros Studio can drill down into the data for individual kilns at specific sites. This even enables them to track shutdowns for individual kilns. There is also four years of historical production data that can be accessed.

This is powerful data that is updated continuously in granular form from the kiln upwards. It is available way in advance of data from cement associations and producers, which is often released many months after the fact.

GC: So who are Kayrros' clients?

NA: It has long been a common practice to look at economic forecasts and say 'GDP will rise by X% so cement demand will rise by Y%.' but this approach trips up even the best forecasters. Why? The two are linked, but not that way round. It is more the case that cement production is an indicator of where the economy will go, rather than where it has been.

The high quality and timeliness of the data Kayrros can generate makes it of interest for a wide range of clients. It is not just interesting for those in the cement sector, or even just for those that invest in it, but for anyone who wants to look at the overall economic situation. Cement production can be a reliable leading indicator of economic performance. It is also a reliable indicator of future trends like iron ore demand, the other essential ingredient for large infrastructure projects. For this reason, we have clients from mining companies, investors in mineral deposits and other sectors of the economy.

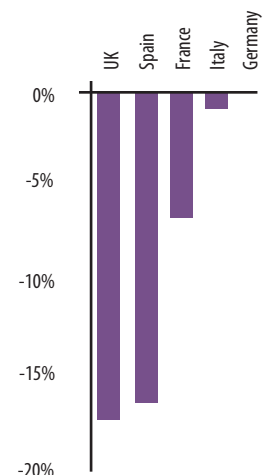
GC: What does the latest aggregate data tell us?



NA: Kayrros recently released summary 2020 data for the 'big five' western European cement markets: Spain, France, Italy, Germany and the UK, which jointly have a capacity of more than 150Mt/yr of cement. The data was gathered from more than 100 cement plants.

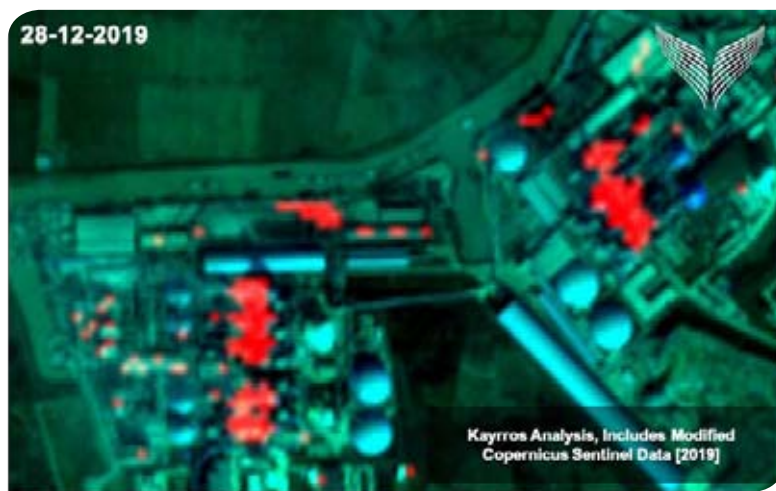
Despite each of these five governments excluding cement production from industrial shutdowns, Kayrros' data shows that being permitted to operate is not a guarantee of producing cement. There were significant declines in demand, particularly in the second quarter of 2020, as shown by Figures 2 & 3. For the rest of 2020, cement production activity recovered to levels similar to 2019. This is consistent with more flexible measures regarding construction and cement being in place for the subsequent lockdowns.

On a country basis, both the UK and Spain experienced a decline in cement plant activity in excess of 15%, with France falling by less than 10%. Surprisingly, Italy, one of the hardest hit European countries for lockdowns and deaths relating to Covid-19, maintained a relatively stable cement plant activity curve according to the sample. The best performer was Germany, which matched 2019 volumes in 2020.



Above - Figure 3: Year-on-year change in cement production index for Spain, France, Italy, Germany and the UK.
Source: Sentinel Hub. Contains modified Copernicus Sentinel Data (2019-2020).

Above Left - Figure 4: Geographical distribution of sample assets
Sources: Kayrros, ©Mapbox, ©OpenStreetMap.



Above - Figure 5: Series of images of a Chinese cement plant at various times between late 2019 and mid 2020. This shows the clear changes as a result of lockdowns in early 2020 and subsequent reopening of the plant later in the year, demonstrating the power of Kayrros' cement kiln data. **Source:** Kayrros. Contains modified Copernicus Sentinel Data.

GC: What data does Kayrros have on the larger cement producing nations?

NA: We are ramping up our coverage in China, India, the US and other major cement producing countries and already supply that data to our subscribers. We will release summaries for 2020 in due course.

GC: What are the technical limitations of the Kayrros approach?

SB: Data acquisition can be limited by cloud cover, which the satellites cannot see through. This can be troublesome in the tropics in particular. You could get an image every five days, but it might be just clouds. Thankfully such conditions don't persist for too long, so the effect is a slight increase in average revisit time, from 3-5 days to every 7 days.

Another potential drawback is that we provide data for clinker, not cement. The ratio between these two can vary quite significantly depending on the market, the plant and other factors. Clients must take care to apply ratios that are appropriate for their analysis. Most clients are experienced data analysts, so errors are rare. In any case, our team is always on hand to help clients get the best out of the data.

GC: What challenges does the cement sector give rise to that others don't?

SB: One factor that makes the cement sector somewhat difficult to observe is the sheer number of plants, which run into the thousands. Other sectors have considerably fewer sites to look at. The task of getting full coverage is, as we already mentioned, ongoing. However, once we confirm the capacity, the AI only needs some minor tweaks and it can start collecting. Other sectors, particularly those with larger sites, need more refinement.

GC: What are Kayrros' future plans for its cement sector coverage?

NA: Aside from growing our coverage across the global cement sector, we also plan to estimate the CO₂ emissions from the sector, in line with our wider monitoring of sustainability trends. CO₂ output depends on a number of factors like kiln type, fuels and clinker factor. It sounds like a fairly simple task to calculate the emissions for a single plant, but it is much more of a challenge across several thousand kilns. Tasks like this will keep the team busy going forward.

GC: Thank you both for your time today.

SB/AN: You are very welcome indeed Peter.



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S Xavier Arul Kennedy, Lafarge Africa PLC

In-house factory fabrication and retrofit of a 3.2m-diameter impeller fan

Lafarge Africa's Mfamosing plant has manufactured a 3.2m fan impeller in-house.

The Lafarge Africa Mfamosing cement plant is a 5Mt/yr integrated facility in Cross River State, Nigeria. It is the largest within Lafarge Africa, the LafargeHolcim subsidiary that operates in Nigeria and South Africa. For clinker grinding the plant has two large ball mills and a vertical roller mill (VRM), a 400t/hr LM 70.4.4 supplied by Germany's Loesche.

The plant was commissioned in 2017. After four years of operation the process bag house filter fan (Power = 4000kW, Air flow = 120,000Nm³/hr, Impeller Ø = 3.2m) started to show signs of wear, particularly near the welding joint connected to the centre plate. It became terminally damaged on 8 December 2020. All parts of the impeller were found to be damaged, with the exception of the shaft and centre plate. The fan casing was also 30% damaged.

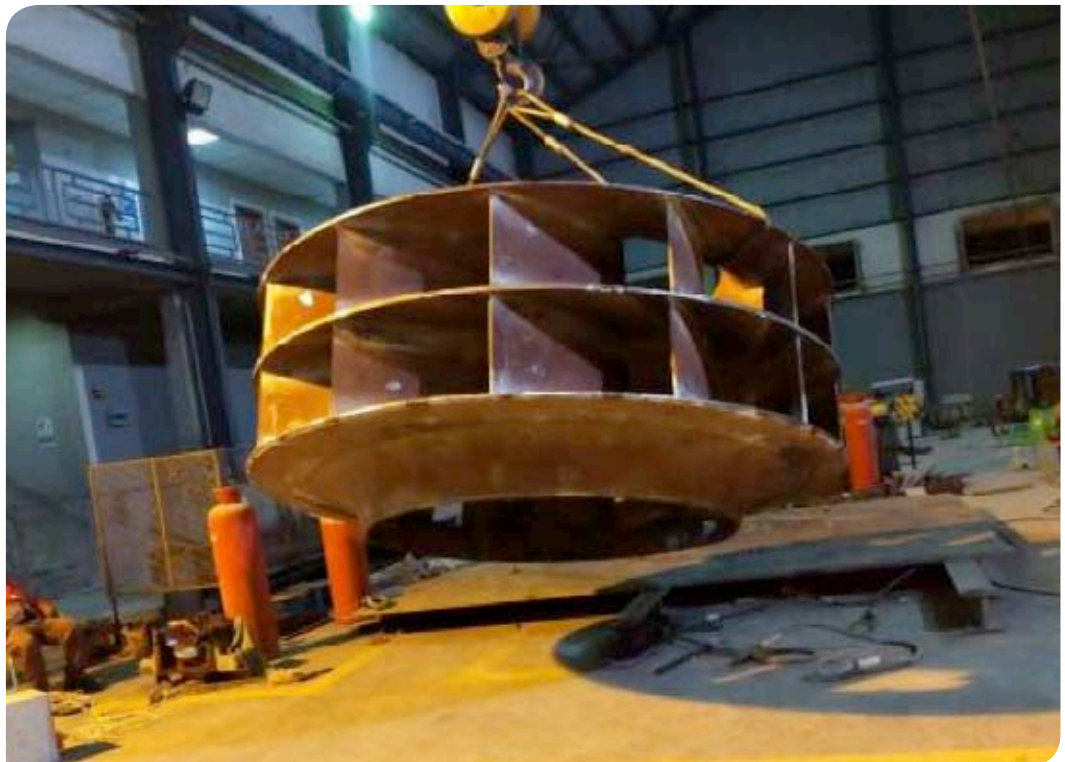
In-house repair project

In a sold out market waiting for a spare impeller to arrive was not deemed an acceptable strategy due to the loss of production and market share. Therefore in consultation with its team of experts, the Mfamosing plant opted to fabricate a new impeller in-house using the existing rotor. Assistance was provided by Reitz India, a well known impeller manufacturer.

A detailed job plan was derived with the support of Reitz expert Arup Kumar Gosh. Due to the special quality of the plates and process machines required to produce vanes and shroud plates, these were fabricated by Reitz and subsequently air-freighted to Mfamosing.

The existing shaft and centre plate was moved to the plant's workshop. The centre plate was removed from the shaft, placed on an elevated platform, surface-cleaned and levelled. The positions of vanes

Right: The impeller is moved from the workshop back to the casing.





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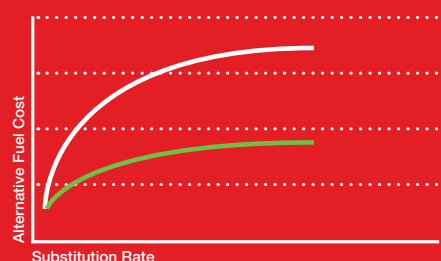
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Right: The vanes and shroud plates arrive from Reitz India.



Conclusion

The in-house fabrication of such a big fan impeller is not recommended by many experts, who advise that the impeller will fail rapidly after installation and damage itself, the casings and foundations. Their advice is almost always to halt production and wait for a spare.

Of course, such large pieces of equipment are critical to the operation of the plant and steps should always be taken to minimise the potential for impeller damage. This includes routine and thorough maintenance and repair of de-dusting equipment. Spares should be kept in-house to avoid any impact on plant earnings. However, Lafarge Africa found in-house fabrication to be a manageable task. It is entirely possible with the advice of the right partner and risk mitigation. If a cement plant has to take the risk on a large impeller retrofit, the Mfamosing plant's experience shows it can be done. 

Right: Welding vanes in the workshop.

were marked. Welding of the vanes was carried out with utmost care under the supervision of a Reitz expert. Dye penetration tests were carried out after every round of welding. Heating the impeller and controlled cooling was carried out at frequent intervals to achieve proper stress relief. When the impeller was ready, it was mounted on the shaft along with the bearing and bearing housing before being moved back to the casing for installation. In the meantime, the fan casing, expansion joints, inlet cones and damaged foundation had been repaired by a dedicated maintenance team.



Right: The impeller nears completion.

Time schedule

The import of vanes and shroud plates took 13 days. The fabrication of the impeller on site took 15 days. The erection of impeller, balancing and commissioning lasted another two days. After two months in operation, the locally-made impeller achieved the required operating air flow at 85% speed, consuming 150kW less power than the previous impeller. Vibrations are less than 3mm/s, and no wear or cracks have been observed.



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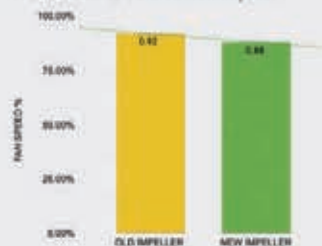
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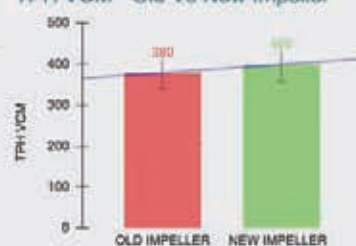
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Stefan Borrmann & Markus Burbach, Klüber Lubrication

Maximise air compressor energy-efficiency with high-performance lubricants

Klüber presents three ways to increase reliability, reduce maintenance cost and maximise the energy efficiency of air compressors with high-performance lubricants.

The number of air compressors installed at a cement plant can range from 5-40 units, or even more, depending on the size of the plant and the size of the compressor units. Usually, there is a central air compressor room, which houses multiple units, as well as additional units spread across the plant. Constant availability of sufficient compressed air at the required pressure is critical for the continuous production of cement. This requires air compressors to operate with maximum reliability and as little maintenance downtime as possible.

However, compressed air systems are notorious for burning through energy and money, which has led to a plethora of literature that deals with improving their energy efficiency. About 70-90% of the operating cost of an air compressor comes from its electricity consumption. This makes the energy efficiency of air compressors a focal area for optimising total cost of ownership. This can offer substantial bottom-line savings, as the electricity used for compressed air usually amounts to 10-30% of a cement plant's electricity costs. It can be the second highest electricity cost driver after grinding mills.

Using the correct high-performance lubricant can significantly improve the operation of air compressors in a cement plant by providing the three following benefits: Maximised reliability, lower maintenance costs and increased energy efficiency. Their potential often remains unexploited, even though they are easy to implement, do not require

additional capital expenditure, improve the reliability of compressors and can save operating costs of US\$30,000-80,000/yr, depending on the prior choice of lubricant.

1. Maximised reliability

Best practice #1: Using high-performance lubricants to maximise the reliability of compressors that are exposed to contaminants, humidity and elevated ambient temperatures.

High machinery availability and low downtime rates are targets that every compressor operator strives for. However, the dirty and dusty environment in cement production can present a significant challenge for equipment. Dust that is sucked into the compressor system with the intake air, in combination with elevated humidity levels and high ambient temperatures, contributes to machinery failures and can lead to unexpected compressor downtime.

The elevated temperatures and contaminants accelerate the build-up of varnish and residues on the rotors, bearings, shafts and housings of the compressor, as well as in downstream components like separators and piping. Strong varnish and residue build-up lead to elevated operating temperatures and compressor failures.

Therefore, the use of high-performance synthetic lubricants is recommended, as these oils contribute significantly towards maximising machine reliability, the reason being that high-performance

Right - Figure 1: Screw-type compressors operated with mineral oil (left) and high-performance oil (right). The conveyor using high-performance oil is sludge and varnish free, bringing the plant operator higher compressor efficiency and lower maintenance costs.



synthetic oils provide much better oxidation stability and resistance to elevated temperatures, moisture and the ingress of contamination. The compressor system runs visibly cleaner, the tendency to build up residues and varnish decreases drastically and the likelihood of a compressor shutdown also falls.

2. Reduced maintenance efforts and cost

Best practice #2: Use of high-performance lubricants to minimise the maintenance work needed for compressors and to reduce TCO.

It is not only the improved reliability of the air compressor and a consequently higher productivity that can be easily achieved by changing the compressor lubricant. There is also a clear savings potential in terms of maintenance tasks. By choosing the right type of oil, in particular high-performance synthetic oils, the general maintenance cycles between two service actions can be extended from 2500hr with standard mineral oil based lubricants to 8000-12,000hr with high-performance lubricants. Fewer service actions on site throughout the year create less demand for lubricant and lower service costs for the operator.

Durable clean and sludge-free machinery reduces time consuming dismantling and cleaning actions and keeps machinery efficiency at a constant high level. Also, additional serviceable parts (e.g. filters, valves, oil separators), which are normally exchanged with the oil, can be used for longer and provide additional maintenance cost savings.

Changing over to high-performance compressor oils is a simple business case for the operator, bringing immediate annual savings in maintenance efforts such as oil volumes, spare parts and labour. Table 1 compares a cement plant's annual maintenance costs assuming 10 compressors operated for 7000hr/yr with an oil fill volume of 60L each.

3. Increased energy efficiency

Best practice #3: Using energy-efficient compressor lubricants to save electricity costs and support CO₂ emission reduction goals.

Compressed air is often the most expensive form of energy available in a cement plant because of its poor efficiency. Most of the energy needed to convert electrical power into compressed air and back into mechanical energy is lost as heat. The typical overall efficiency of such systems is 10-20%.


Energy-efficient, high-performance lubricants can help to increase the energy efficiency of an air compressor by 3-7% compared to conventional mineral oils. Table 2 shows the electricity cost savings resulting from a single air compressor in relation to its power and the plant's electricity costs assuming operation of 7000hr/yr and energy savings of 5% achieved through high-performance

Cost driver	Standard Mineral Oil	High Performance Synthetic Oil
Compressor oil volume (L)	60	60
Oil price (US\$/L)	6	10
Cost of oil for one filling (1 compressor) (US\$)	360	570
Oil filter cost (US\$)	200	200
Air filter cost (US\$)	150	150
Oil separator cost (US\$)	900	900
Cost of spare parts (1 compressor) (US\$)	1250	1250
Manpower per oil change per compressor (hr)	6	6
Manpower cost (US\$/hr)	40	40
Manpower cost per oil change (1 compressor) (US\$)	240	240
Minimum operating life of oil = maintenance cycle (hr)	2500	10,000
Oil change frequency per year	2.8	0.7
Total cost per oil change (1 compressor) (US\$)	1850	2060
Total service cost per year (1 compressor) (US\$)	5180	1442
Total service cost per year (All 10 compressors) (US\$)	51,800	14,420
Savings on service cost per year (US\$) (All 10 compressors)	37,380	

		Power rating of air compressor (kW)							
		25	50	75	100	125	150	175	200
Electricity costs (US\$/kWh)	0.03	263	525	788	1050	1313	1575	1838	2100
	0.04	350	700	1050	1400	1750	2100	2450	2800
	0.05	438	875	1313	1750	2188	2625	3063	3500
	0.06	525	1050	1575	2100	2625	3150	3675	4200
	0.07	613	1225	1838	2450	3063	3675	4288	4900
	0.08	700	1400	2100	2800	3500	4200	4900	5600
	0.09	788	1575	2363	3150	3938	4725	5513	6300
	0.10	875	1750	2625	3500	4375	5250	6125	7000

lubricants. The absolute cost savings per unit is substantial. Assuming an average number of 10 installed units, this can translate into cost savings of US\$10,000-45,000/yr.

Summary

High-performance compressor lubricants can significantly improve compressor operation and help increase an operator's profits. They improve the reliability of compressors as they handle typical challenges found in a cement plant better than conventional mineral oils. They reduce maintenance efforts, lower TCO and free up workforce. Finally, they increase the energy efficiency of compressors and contribute to significant bottom-line and CO₂ savings. All in all, these improvements can result in additional profits of US\$30,000-80,000/yr. 

Above Top - Table 1: Comparison of a cement plant's annual maintenance costs assuming 10 compressors operated for 7000hr/yr with an oil fill volume of 60L each.

Above - Table 2: Electricity cost savings resulting from a single air compressor in relation to its power and the plant's electricity costs, assuming 7000hr/yr of operation and energy savings of 5% achieved through high-performance lubricants.

Green background indicates most common scenarios.



Beumer Group

Reliable transport with a U-shape conveyor

Beumer Group outlines the unique advantages of its U-shape conveyor.

Troughed belt conveyors allow for high mass flows, even in the case of heavy and bulky materials. Their open design makes them suitable for coarse materials at very high volumes and permits operators to skim off the transported material in the rare event of overfilling. The simple design of these conveyors means they can be delivered and installed quickly and are also easy to maintain. Proven components, including belts, idlers, pulleys and drives, ensure that they work reliably and, depending on the depth of trough, they can also be designed as curved overland conveyors.

On the other hand, Beumer's pipe conveyors present different advantages. The idlers form the belt to a closed tube that protects the material against external influences and the environment from emissions of material, dust and odours. Partition plates with hexagonal cuts and idlers in staggered arrangement keep the pipe closed.

Such systems allow the implementation of narrower curve radii and greater angles of inclination than troughed belt conveyors. They require little space and can be adapted to the topography of the plant. As a consequence, the number of transfer towers and power supply units is reduced and the owner saves money. Both the troughed belt conveyor and the pipe conveyor permit a simultaneous transport of different materials in the upper and in the return strand.

Below: The U-shape conveyor supplies the Lafarge Zement Retznei plant's calciner with alternative fuels.



Pipe vs U-shape

When transporting higher volumes with a pipe conveyor, the system has to be enlarged, including the width of the belt and the diameter of the pipe. This directly affects the width of the conveyor and hence the minimum curve radius. But what happens if there is no space for a high-radius curve?

For such situations, Beumer Group now offers U-shape conveyors in different configurations. These allow the implementation of narrower curve radii than a troughed belt conveyor and higher mass flows than a pipe conveyor. At the same time, and unlike the troughed belt conveyor, it protects the material conveyed from environmental stress and the environment from material loss and emissions. The U-shape solution has proven to be a fantastic alternative in the cement industry if high capacity is required with little available space.

The P-U-shape conveyor offers the functionality of a pipe conveyor, but is also able to transport coarse materials. In this version the upper strand is formed into an U, while the return strand keeps its tubular shape. This saves space and prevents loss of material, while allowing the owner the benefits of a significantly higher transport capacity with the same belt.

Consider a pipe conveyor with a belt width of 600mm and pipe diameter of 150mm. Its conveying capacity is 100m³/hr. The P-U-shape conveyor, meanwhile achieves a capacity of 170m³/hr with the same size belt, 70% more.

Conveying lines often have several feeding points. To accommodate these, the pipe conveyor must open and close again at every such point. This requires additional mechanical components, which cost money. The U-shape conveyor, in contrast, does not require these. A cover can be used to prevent materials and odours from escaping.

U-shape vs troughed belt

T-U-shape conveyors are suitable in cases where the owner relies on the advantages of a troughed belt conveyor, but also has to consider specific topographic conditions, for example if narrower curve radii are required or if there are linear sections that need to be narrow. Compared to a troughed belt

conveyor with a capacity of 500t/hr and a belt width of 650mm, a T-U-shape conveyor can achieve the same capacity with a width reduction of 150mm. The wider the troughed belt conveyor, the greater the space saving.

U-shape conveyor at Lafarge Zement Retznei

Lafarge Zementwerke GmbH, part of LafargeHolcim, operates the Retznei cement plant in Styria, Austria. The plant not only places particular emphasis on high-quality products, but also on sustainable, energy-efficient and environmentally-friendly production. Alternative fuels are therefore increasingly being used to fire the new calciner.

“During the transport the material should be protected against external influences such as wind, rain or snow and the environment against possible material loss and emissions,” explains Karl Filarowski, Sales Director at Beumer Group Austria. In addition, the conveyor needed to transport both coarse material and very fine material.

Beumer suggested a U-shape conveyor for the Retznei plant. “In this solution, a special idler configures the belt in to a U-shape,” explains Filarowski. At the discharge station, an idler configuration similar to that for the shaping opens the belt. The unique feature of this solution is that it brings together the advantages of open troughed belt conveyors and closed pipe conveyors. “Our U-shape conveyor can be used in all industries, especially when large grain sizes have to be transported or the available space is not sufficient for an open troughed belt conveyor.”


Retrofits and conversions

In the event that a cement plant operator wishes to increase the capacity of its existing pipe conveyor, it can be converted into a U-shape conveyor. To do this, the partition plate cut-out in the upper strand is enlarged to enable the optimal use of the existing conveyor width. The staggered arrangement with six idlers can be changed to five idlers allowing the belt to open automatically and form a U-shape. At the same time, the hexagonal cut-out in the return strand remains. Thus the belt runs in tubular shape and avoids loss of material on the running line. If an owner relies on a pipe conveyor and nevertheless wants to be prepared for future capacity expansions - with little space in the plant - Beumer technicians can plan for optional modification to an U-shape conveyor during the planning phase.



Above: Idlers form the belt into a U-shape.

The company recently carried out a project with such requirements. The plant owner intended to transport alternative fuels with a pipe conveyor, but wanted to ensure that the plant could adapt in the event of future changes. “We designed the steel structure like that of an U-shape conveyor with corresponding partition plate cut-outs in the upper strand,” reports Filarowski. The technicians additionally mounted adjusting pieces with idlers to ensure the tube shape of the pipe conveyor at the upper edge of the U-shape cut-out. In case of modification, these adjusting pieces can be removed and the system adjusted. Thus a narrow design with corresponding curve radii is kept. Special covers can be optionally mounted.

“Our customers must always be able to react flexibly in the market,” concludes Karl Filarowski. “Higher capacities due to an increase in demand or modified products require future-oriented and tailor-made concepts to be successful in the long run. U-shape conveyors are therefore a safe investment that can be easily integrated into existing infrastructure.” 

Below: Tighter curve radii than a troughed belt conveyor and higher mass flows than a pipe conveyor can be realised using a U-shape conveyor.





Israel: EConcrete provides space for marine life

EConcrete has developed technologies that allow marine life to make concrete structures its home. It does this by mimicking natural features such as pools and small holes for fish to live in, as well as surfaces that encourage seaweed, oysters and coral, in combination with a proprietary admixture.

The company says that its concrete is stronger than conventional OPC blends, has a lower CO₂ footprint and acts as an effective CO₂ sink due to the accumulation of biomass over time.



El Salvador: Holcim expands concrete base

Holcim El Salvador, part of Switzerland-based LafargeHolcim, has invested US\$4.0m to establish three new 70m³/hr-capacity ready-mix concrete plants and one aggregates plant. Local press has reported that the plants have increased the company's concrete production capacity by 60%. The concrete plants are situated at Apopa, La Paz and Sonsonate, enabling the producer to serve a wide area. The new plants have generated 100 direct and indirect jobs. As part of the investment, the company acquired 22 new concrete trucks. It plans to establish two further concrete plants in El Salvador in 2021.

US: Low-CO₂ concrete producer raises US\$78m

Solidia Technologies has raised US\$78.0m-worth of private investment via a funding round. The latest investors include Imperative Ventures, Zero Carbon Partners and Breakthrough Energy Investors. Existing backers that provides new funds included BP, John Doerr and OGCI Climate Investments, which is the venture capital arm of the Oil and Gas Climate Initiative, a consortium of multinational oil companies. Solidia Technologies produces reduced-CO₂ concrete with lower-energy cement and water-free CO₂ curing.

Qatar: Sika expands concrete admixtures plant

Switzerland-based Sika has expanded concrete admixture production capacity at its Doha plant. It has also announced the start of epoxy resin production in Qatar. It says that its present investments target growth to serve the expanding regional construction market. Numerous major projects and the expansion of energy and utilities infrastructure have driven a growing demand. Qatar's state sourcing policy further increases consumption of building materials produced in the country.

US: Concrete additives made from seashells

A research team at Washington State University has developed admixtures using chitin derived from seashells. The Moscow-Pullman Daily News has reported that the substance enhances concrete's performance when substituted for some of the cement. The lower clinker factor may also decrease net emissions. Work has shown that lower volumes of the supplementary material are required compared to existing admixtures.

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Netherlands: Nation's first 3D-printed home

A couple have taken up residence in the Netherlands' first 3D-printed concrete residential building, located in Eindhoven. The house is the first in a series of five by Project Milestone, a joint construction and innovation project from Eindhoven University of Technology, the local municipality, real estate investor Vesteda and three sector specialists: construction company Van Wijnen, building materials maker Saint-Gobain Weber Beamix and engineer Witteveen+Bos.

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FUTURE CONCRETE



Interview by Peter Edwards, Global Cement Magazine

Giatec: Optimising concrete with AI

Concrete producers can reduce CO₂ emissions, lower production costs and save time with AI-led batch optimisation.



Above: Andrew Fahim has been Senior Manager for Research and Development at Giatec since 2017.

Global Cement (GC): Please could you introduce Giatec?

Andrew Fahim (AF): Giatec is a Canadian company based in Ottawa. It was founded in 2010 with the aim to revolutionise the global concrete sector. Our position is that you can't optimise what you don't measure. So to optimise concrete, Giatec has developed sensors to measure concrete temperature, humidity, compressive strength and other parameters. Typically, these are attached to the rebar before the concrete is poured. A mobile app can be used to scan the sensor through the concrete to download the data, which is collected every 15 minutes. This shows what is happening in the construction phase of the building, allowing concrete producers to identify patterns and improve future mixtures.

GC: Giatec recently launched its SmartMix™ AI concrete optimisation solution. What led the company to develop the solution?

AF: Giatec has now installed tens of thousands of sensors in 8000-plus projects in 80 countries. This has generated a vast amount of data: Where projects are located, what time of day the concrete was poured, the ambient temperature, the types of cement and aggregate and so on.

What SmartMix does is use Artificial Intelligence (AI) to optimise concrete mixtures using

this data. It can optimise individual batches based on a large number of variables and was launched in March 2021.

Some of the changes, for example altering the amount of cement to take seasonal temperature variations into account, are already made by excellent human decision-makers in the field. However, AI can take far more relationships into consideration and uncover new connections. It can also make far more granular changes, for example taking into consideration that a concrete truck pouring in the middle of the day will need less cement than one that goes out early in the morning when it is cooler.

GC: How does the AI work?

AF: The algorithms used by SmartMix rely mainly on deep learning by neural networks. These are essentially large collections of inter-connected equations. Every neuron represents a network parameter, connected to others by equations. On one side there are inputs, for example, cement chemistry, water ratio, time of day, gravel particle size distribution, etc. On the other side are the outputs, i.e.: the properties of the concrete as it is poured, sets and develops strength, including temperature, slump characteristics, compressive strength and so on. The neural network adjusts its internal parameters to optimise the output-input relationships. Normally the objective is to use these networks to reduce cement content, as this is the most expensive and CO₂-intensive component in concrete.

GC: What kinds of inputs are considered?

AF: SmartMix currently considers more than 200 parameters. Just think about the cement. It is not just important to know how much is used in the mix, but what kind of cement it is, what its particle size distribution is, its alkali content, even how long it has been in the silo. The same applies to coarse aggregates, for instance. Our AI considers the number of particles in different size classes, as well as mineralogy, aspect ratios and so on. Many other variables are considered: How humid is it today? How hot or cold is it? How long was the truck stuck in traffic?

Below: SmartRock™ active sensor installation on rebar.



The range of inputs is growing rapidly.

Concrete production is an industrial process, but one that is at the mercy of factors beyond producers' control. Producers don't have the luxury of temperature and humidity control outside of the mixer. Our AI lets producers optimise their mixes to take environmental and raw material changes into account.

GC: What are the benefits to concrete producers?

AF: We estimate that, by using the SmartMix AI solution, concrete producers could collectively reduce CO₂ emissions by at least 400Mt/yr over the course of the next 10 years. Individual concrete producers could see reductions in cement use of up to 20% depending on their prior quality control performance. This reduces their cement usage costs and, in markets that have a financial penalty for emitting CO₂, they will save even more.

There is also the potential to gain time during construction projects. Imagine that a concrete floor is laid and it must reach a certain strength within a certain time limit before the next stage of construction can start. Rather than manually adding cement to ensure rapid strength development, the AI could forecast when the floor would be strong enough and optimise the mix accordingly to fit the time constraint. The AI would ensure that the target is reached, taking away the guesswork and opportunities for delays.

GC: What are the possible pitfalls of SmartMix?

AF: The main drawback with the AI approach taken by SmartMix is that it is trained on historical data, which is usually specific to certain geologies and regulatory environments. It is not possible, for example, to train the SmartMix algorithm in one country and then switch to using the same set of parameters to optimise mixes in another country. The geology is different, the standards are different, the cement will be different, the weather will be different... a lot of the parameters will be different. It would need to be retrained.

Another limitation is that the AI works very well in the 'box' of data it is used to, but it can't think 'outside of the box' very easily. An analogy is a neural network that has learned to differentiate between images of cats and dogs. Show it a wolf and it may identify a dog, but show it a penguin and it won't know what to do. Penguins are outside the realm of its experience.

GC: Which markets will be the first to adopt SmartMix?

AF: The first markets will be those that have a financial penalty for emitting CO₂. At the moment that



means the countries covered by the EU Emissions Trading Scheme and other countries with trading schemes, like Canada, New Zealand and parts of the US and China.

GC: What is the biggest challenge that the rollout of SmartMix faces?

AF: Concrete production is a conservative industry. There may well be scepticism that AI can offer better advice than someone with 20-plus years of ready-mix concrete optimisation and there will be concern that people will lose their jobs. Our position is that SmartMix is not there to replace people, but to help them to optimise their mixes, lower CO₂ emissions and costs. This will free up the human skills to look at the bigger picture.

GC: What else could SmartMix do in the future?

AF: Even though it can look at 200-plus inputs, we consider new features every single day. There will always be a client that wants to consider another input or output. Some capabilities we are trying to add now include predicting how easy it will be to finish the AI-suggested concrete mixtures. There are actually well-defined rheological definitions that could be used to define this, but applying them is difficult. We start to enter the realm of subjectivity.

Beyond extra inputs and outputs, we want to develop self-optimising algorithms that can identify and optimise new trends that human operators haven't alerted it to. If this was possible at present, such a system might optimise for the inclusion of ground limestone and / or recycled glass, both growing trends. In time, we will teach it to think outside of the box!

GC: Thank you for a very interesting discussion.

AF: You are very welcome indeed!

Above: SmartMix optimises concrete use, providing a way to reduce CO₂ emissions while saving time and money.


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Norway: FLSmidth to prepare Brevik plant for full-scale CCS project

Norcem, part of Germany-based HeidelbergCement, has awarded a contract to Denmark-based FLSmidth to provide modifications to allow for downstream CO₂ removal at its integrated Brevik cement plant (right). The supplier will begin work in the unit's winter 2022 shutdown. Its upcoming carbon capture and storage (CCS) installation is scheduled for commissioning in September 2024.



Senegal: FLSmidth contract for Kirène plant

China-based Sinoma Group subsidiary CBMI Construction has awarded a contract to Denmark-based FLSmidth for the supply of three control systems for one new and two existing lines at the Kirène cement plant in Thiès region. The lines will share a digital infrastructure built on the FLSmidth ECS/ControlCenter platform with ECS/PlantDataManagement software. Additionally, the supplier will equip the new Line 3 with its ECS/CemScanner and QCX/BlendExpert. It said that the setup will use 12,000 data points on Line 3 alone.

India: ready2grind plant for Gallantt Industry

Gallantt Industry has ordered a ready2grind compact grinding plant for its Gorakhpur factory in Uttar Pradesh, the first on the Indian sub-continent. The plant will produce 65t/hr of cement at a fineness of 3750cm²/g according to Blaine. The planned MVR 2500 C-4 represents the medium size of the portfolio of ready2grind plants. Due to the planned installation in the vicinity of a steelworks, blast furnace slag, steelworks slag from an induction furnace and fly ash from an in-house power plant will also be considered as supplementary cementitious materials, in addition to clinker and gypsum. The mill will be equipped with a 1270kW main drive and an integrated SLS 2650 VC high-performance classifier.

Saudi Arabia: FLSmidth to upgrade Rabigh plant

Arabian Cement has placed an order with FLSmidth for the supply of equipment for an upgrade of its Rabigh cement plant. The order includes new DDX top cyclones, a quenching chamber and an ABC Cooler Inlet. Installation and commissioning is expected to be during the fourth quarter of 2021.

Ghana: Bedeschi equipment for Takoradi

Italy-based Bedeschi has been awarded a contract to supply and install cargo handling equipment for the Port of Takoradi. The project includes the supply of handling equipment and services for importing clinker and exporting bauxite and manganese. Bedeschi will supply five conveyor belts with a total length of 3km, two type 50/1400 A-frame shiploaders and one eco-hopper. The shiploaders and the eco-hopper will be delivered fully erected from the supplier's shipyard directly to the client jetty with a dedicated heavy lift vessel.

Burkina Faso: Intercem to upgrade Cimasso plant

Cim Metal Group has ordered an upgrade to its Cimasso cement grinding plant in Bobo Dioulasso from Germany-based Intercem Engineering. The cement producer has decided to double the plant's production capacity to at least 4Mt/yr by ordering an extension production line and upgrading the original line. The plant, which was also supplied by Intercem, was originally commissioned in 2018.

The new order includes: three truck unloading stations; raw material handling systems; a raw material hopper station; a cement grinding unit with a vertical roller mill; four 5400t cement silos; five 12 spout rotary packers; 10 truck loading stations; 10 truck weighing bridges; and an upgrade to the existing cement grinding plant. Intercem is in charge of the engineering, all mechanical and electrical plant components and project management. It is also responsible for the supervision activities for the civil, mechanical and electrical assembly works and the commissioning of the plant.

Germany: ECOPlanet launch for Holcim Deutschland

Holcim Deutschland, part of LafargeHolcim, has launched its new ECOPlanet Zero CO₂-neutral cement. The producer says that it will offset the product's CO₂ emissions through a peatland rewetting service provided by MoorFutures. The cement also has a low clinker factor due to the use of ground granulated blast furnace slag-enriched binders.



Doppelmayr Transport Technology GmbH

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Doppelmayr RopeCon® for Bardon Hill restoration

Austria's Doppelmayr is installing a 1000t/hr RopeCon® system at Aggregate Industries UK Ltd's Bardon Hill Quarry in the UK.

Bardon Hill Quarry near Leicester in Leicestershire is one of the UK's oldest continuously operated quarries. Aggregate Industries UK Ltd, a member of LafargeHolcim, has recently developed a new quarry extension at this strategically important site. In order to sustain quarrying activities, a separate material handling system is required to extract, process and transport overburden for emplacement within the existing quarry as part of its restoration.

Doppelmayr Transport Technology has worked closely with Aggregate Industries UK Ltd to develop a unique solution that will dramatically reduce CO₂ emissions and environmental impact compared with road haulage or the footprint associated with a conventional surface conveyor system.

The proven RopeCon® system is a combination of ropeway technology and conventional conveying technology. Track ropes will span 850m across the entire pit, upon which the belt that transports the overburden will travel. The RopeCon® system includes a reversible second belt that will enable simultaneous conveying and emplacement activities. During the life of the operation, the RopeCon®

track ropes will be periodically retensioned to allow the system to be lifted above the placed material.

The ability to control the drop height will minimise the impact from noise and dust during operation of the system. Currently under construction, this will be the first such installation in the UK. It will transport up to 1000t/hr of overburden during operation.

Technical details

SECTION 1

Length:	470m / 494m
Difference in elevation:	-145m / -55m
Conveying capacity:	1000t/hr
Speed:	3.3m/s
Motor rating continuous	-371kW / -74kW

SECTION 2

Length:	100m
Difference in elevation:	0.0m / 4.5m
Conveying capacity:	1000t/hr
Speed:	2.6m/s
Motor rating continuous:	7 / 35kW



Left: View of Aggregate Industries UK Ltd's Bardon Hill Quarry in Leicestershire, UK.



BMGZ belt scales from FMS

The Swiss engineering firm FMS introduces its BMGZ belt scale range.

Over the past 25 years, the Swiss engineering firm FMS has quietly established its BMGZ belt scales as a robust and accurate solution for measuring material flow. They are used in conveyor belt applications across Europe, including quarries, gravel works, construction sites, loading stations and tunnel drilling operations.

Unique design


Unlike alternative designs, the speed sensor of the BMGZ belt scale is housed inside the measuring roller. There are no exposed cables, which greatly reduces the risk of damage from debris and the prevailing weather conditions. This helps maintain uninterrupted conveyor belt operation, critical in the cement sector.

Scales that do not have the BMGZ's integrated speed sensor typically use a friction wheel that is exposed to the elements. This in turn makes it susceptible to contamination and relies on a spring-loaded lever for contact with the conveyor. The resulting possible slippage makes the speed measurements, and consequently the calculated flow rate, less reliable. By doing away with the friction wheel, the BMGZ system can achieve unparalleled accuracy.

BMGZ belt scale at Holcim Schweiz

One company that has discovered FMS belt scales in recent years is Holcim Schweiz AG, a subsidiary of Holcim Ltd. Nine BMGZ scales are in use at its Hüntwangen gravel plant in Switzerland. Walter Rutschmann, the site's head of maintenance, says, "When it came to purchasing new conveyor belt scales, we looked around the market. We decided on the solutions from FMS. The BMGZ series has turned out to be particularly robust and reliable against disturbances. Since initial start-up, we have not experienced any failures at all. It ensures maintenance-free operation, which is particularly important to me in saving resources and costs."

Spreading the word

The BMGZ series is available in a range of roller widths. Its galvanised mounting frames have slotted end plates and extendable steel legs to fine-tune position, making it compatible with all conveyor types and sizes in stationary as well as mobile applications. Ethernet connectivity allows operators to configure and manage the scales from any connected computer. Scales are installed and maintained by top-notch engineers from the FMS network of service partners. 

Right: A BMGZ belt scale in use at Holcim Schweiz's Hüntwangen gravel plant in Switzerland.



Italy: Buzzi posts improved results for first quarter of 2021

Buzzi Unicem's first-quarter consolidated net sales fell by 1% year-on-year to Euro683m in the first quarter of 2021 from Euro689m in the first quarter of 2020. Cement sales volumes were 6.2Mt, up by 3% from 6.0Mt. Trading conditions were positive in Italy, thanks to stronger domestic demand and to the favourable comparison with the same period of 2020, which was characterised by the lockdown of production activities starting from the second half of March 2020.

In Russia and the US the deliveries of the quarter clearly exceeded the level of last year. On the other hand, in Germany and Eastern Europe, above all in Poland, also due to a particularly cold month of February 2021, cement volumes sold slowed down compared to the previous period. The company called full-year growth prospects for 2021 'encouraging.'

Lithuania: Schwenk seeks to increase Akmenes stake to 97%

Germany-based Schwenk Zement has sought to increase its stake in 50% subsidiary Akmenes Cement (below) to 97%. The company is also seeking the acquisition of a 75% stake in limestone supplier Kalcitas. The producer took over Mexico-based Cemex's stake in Akmenes Cement in 2019.



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Switzerland: LafargeHolcim shareholders approve name change to Holcim

The shareholders of LafargeHolcim Ltd have voted in favour of changing the group name to Holcim Ltd at the company's annual general meeting held on 4 May 2021. The name change applies only to the group company name with all market brands remaining in existence. The new group name will become effective upon entry in the commercial register. LafargeHolcim was officially formed in July 2015 when France-based Lafarge and Switzerland-based Holcim merged.

Switzerland: LafargeHolcim net sales rise marginally in first quarter of 2021

LafargeHolcim's first-quarter consolidated net sales rose by 1% year-on-year to Euro4.86bn in 2021 from Euro4.79bn in 2020. Its recurring earnings before interest and taxation (EBIT) doubled to Euro478m from Euro237m. Cement sales volumes grew by 5.5% to 47.3Mt and ready-mixed concrete

by 2.7% to 10.1Mm³. The group said that it anticipates growth to accelerate in 2021. It expects to achieve its Strategy 2022 targets one year ahead of time.

During the quarter, the group concluded its acquisition of US-based Firestone Building Products and received an A1+ social, environmental and governance rating from UK-based Vigeo.

Switzerland: Cemsuisse publishes Roadmap 2050

The Swiss cement association Cemsuisse has published Roadmap 2050, a plan for the achievement of net carbon neutrality by 2050. As part of the plan, the association says that Swiss cement producers will launch carbon capture and storage (CCS) installations at their plants from 2030. Individual companies' plans also involve the reduction of products' clinker factors and alteration of cement kiln fuel mixes.

Cemsuisse lobbied the government to approve producers' mining permits in order to prevent an increase in imports from 686,000t in 2020. The figure corresponds to 15% of the nation's 4.7Mt cement consumption.



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Germany: HeidelbergCement sales inch up in first quarter

HeidelbergCement's consolidated net sales rose by 1% year-on-year to Euro3.96bn in the first quarter of 2021. Its result from current operations before depreciation and amortisation (RCOBD) rose by 33% to Euro538m from Euro405m in the same period of 2020. Group cement and clinker sales volumes rose by 2% to 28.4Mt from 27.7Mt. Cement volumes rose by 11% in Western and Southern Europe to 6.8Mt from 6.1Mt, by 5% in Asia-Pacific to 8.8Mt from 8.4Mt and by 1% in Africa-Eastern Mediterranean Basin to 5.2Mt. Volumes fell by 5% in North America and by 4% in Northern and Eastern Europe-Central Asia to 3.1Mt and 4.4Mt respectively.

Chairman Dominik von Achten said "HeidelbergCement has made an excellent start to 2021. In all group areas, we have once again been able to significantly increase our results and margins compared with an already strong first quarter in 2020. This is a seamless continuation of our very good development in recent quarters."



Ireland: CRH sales increase in first quarter of 2021

CRH recorded a 3% like-for-like year-on-year consolidated net sales increase in the first quarter of 2021. American regional cement volumes increased by 5% and cement prices increased by 4%. Asian cement sales increased due to stronger volumes despite lower prices. Cement volumes rose in France but fell in Ireland due to the different timelines of the Covid-19 outbreak in each country in the reporting periods. The price of cement rose in Eastern Europe. The group said that there is currently good underlying demand and continued pricing progress across key markets.

In the first quarter of 2021, the company spent US\$200m on acquisitions. It says that it continues to have a 'strong pipeline of opportunities.' It earned US\$200m from divestment of its Brazilian business. The company continues its share buyback programme with a US\$300m tranche to be completed by the end of June 2021. It expects its earnings before interest, taxation, depreciation and amortisation (EBITDA) in the first half of 2021 to be 'well ahead' of first-half 2020 levels.



Russia: New white cement plant

Cemix, a subsidiary of the Austrian firm Lasselsberger, is preparing to open its new white cement plant in Abzelilovsky District of the Republic of Bashkortostan, Volga. The first batch of cement will be manufactured in May 2021, with the plant expected to be fully commissioned in August 2021. The design capacity is 700t/day of cement, with plans to increase to 1000t/day in the future, depending on demand.

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Spain: Consumption rises first quarter

Domestic cement consumption was 3.38Mt in the first quarter of 2021, up by 8% year-on-year from 3.12Mt in 2020. The Spanish Cement Industry Association (Oficemen) partly attributed the increase to export growth, to 665,000t in March 2021, up by 18% from March 2020 levels.

President Víctor Brosa said 'A stable year is expected in 2021 compared to 2020 despite the uncertainty surrounding the arrival of funds to reactivate the economy and the evolution of the pandemic.'

Spain: Molins continues strong form

Cementos Molins has reported its third consecutive quarter with a rising profit, having made Euro33m in the first quarter of 2021, some 39% higher year-on-year than in the same period of 2020. Its revenues came to Euro223m, an increase of 16%.

The quarterly performance of revenues was similar to that of the fourth quarter of 2020, with strong activity in all markets except for Spain. Cementos Molins' earnings before interest, tax, depreciation and amortisation (EBITDA) for the first quarter came to Euro62m, 30% higher than the same period in 2020. It said that this was achieved due to the positive contributions of the higher cement sales volumes, rising sales prices and the results of efficiency plans that offset increases in energy costs.

Spain: Cemex plant reopens

Cemex España reopened its Lloseta cement plant in Majorca in mid-April 2021. The unit has started by operating at a low production level until demand levels build. The plant intends to use alternative fuels such as biomass to reduce its CO₂ emissions. It is also working with the Power to Green Hydrogen Mallorca project to use 'green' hydrogen created partly using solar energy. The plant now employs 20 people, compared to 96 before its closure in January 2019.



Belarus: Peat-powered production

The Belarus Energy Minister Viktor Karankevich has met with energy research institute Belgiprotpgaz to discuss the latter's plans for the transition to the use of peat as fuel for cement production. Business World Magazine has reported that the country launched a major modernisation of peat production for 2021 – 2025 in late 2020. If successful, the domestically produced resource will replace imported natural gas in cement kiln lines.



Poland: Sales drop forecast for 2021

The Polish Cement Association (SPC) has forecast a 2% year-on-year drop in cement sales to 18.5Mt in 2021. SPC President Krzysztof Kieres attributed the fall to growing imports and reduced construction due to a cold start to the year. He predicts that sales will rise again, by 4% to 19.3Mt, in 2022.

The SPC has warned that the industry faces large costs in meeting the European Green Deal's required 40% CO₂ emissions reduction by 2030 and achieving carbon neutrality by 2050. In particular, the local industry noted that the rising European Union (EU) CO₂ price has caused a direct increase in electricity prices. It has called on the government and the EU to compensate it for this rise.

Imports of cement also present a key challenge. In 2020, imports of Belarusian cement increased by 80% to 440,000t and imports of Ukrainian cement increased by 50% to 32,000t. The association expressed strong support for the European Carbon Border Adjustment Mechanism (CBAM) as a means of protecting the industry against imports both from neighbouring countries outside the EU and via polluting shipping from cement exporters further afield, such as Turkey.



France: Upgrade to LafargeHolcim La Malle plant

LafargeHolcim France plans to invest Euro6.2m in 2021 to upgrade its integrated La Malle cement plant in Bouc-Bel-Air, Bouches-du-Rhône Département. Local press has reported that the plans include a Euro4.5m modernisation of the flue gas desulphurisation system of the plant's Line 2 using equipment ordered from Italy-based Boldrocchi. The plant had reportedly received complaints about sulphurous smells in the local area. The producer attributed this to the high sulphur content in its clay. It said that it is altering supply arrangement to include clay from its L'Estaque, Bouc-Bel-Air and Bellegarde, Ain quarries in its clinker mix in order to reduce sulphur content by 20%.

LafargeHolcim plans to invest similar sums in the La Malle plant in both 2022 and 2023.



Above: Sunset over Marseille, 20km from the Bouc-Bel-Air plant.

Russia: New manager for LafargeHolcim Schurovsky plant

LafargeHolcim Russia has appointed Andrey Polezhaev as the director of its integrated Schurovsky plant in Kolomna, Kaluga Oblast.

Polezhaev previously worked at the plant from 2015 to 2017 as head of the repair service and has worked for LafargeHolcim since 1998.

UK: Tarmac extends partnership

Tarmac has renewed its partnership with the Peak District National Park in Derbyshire until 2026. Under the partnership, which began in 2016, Tarmac has assisted with the construction of dry stone walls, footbridge repairs and meadow management. It also funds an engagement conservation job role within the park.

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Edwin A R Trout, Cement Industry Suppliers' Forum



Above: Edwin Trout,
Secretary of the Cement
Industry Supplier's Forum.

Coping with Covid: The UK cement sector in 2020-2021

The Covid-19 pandemic and disruption surrounding the UK's new trading relationship with the EU have both prompted reassessment within the country's cement sector, as with many other aspects of life over the past year. Besides the necessary commercial restructuring and attention to company resilience, fundamental concerns such as net-zero CO₂ emissions have come to the fore.

The UK cement market has been severely disrupted by external shocks over the past 12 months. Not only did demand collapse in March 2020 due to the country's first national lockdown, but the UK's new trading relationship with the EU, which began on 1 January 2021, has provided additional challenges. The Mineral Products Association (MPA) reported unprecedented declines in the sales of ready-mixed concrete, aggregates and mortar during the second quarter of 2020. Ready-mixed concrete sales were down 39% in the second quarter of 2020. However, they rebounded by 50% in the third quarter of 2020. The overall recovery was sustained for the rest of 2020... just, but the total for 2020 was below that of 2019.

The first half collapse was reflected in figures from the broader-based Construction Products Association (CPA), which found that 80% of heavy-side manufacturers had reported a fall in sales in the second quarter of 2020 compared with the first quarter of the year. This was the lowest level since late 2008.

The Office of National Statistics (ONS) reported that new orders in the construction sector fell by

51.5% in the second quarter of 2020 compared to the first quarter of 2020. At Euro7.1bn, the value of new orders was the lowest since records began in 1964. Likewise, construction output fell by a record 35%.

ONS figures show that April 2020 saw a 41.2% month-on-month fall in construction compared to March 2020, a collapse to Euro8.6bn from Euro14.6bn in March 2020. This was the largest decrease since the data series began in 2010. In May 2020 output rose by 8.2%, the highest month-on-month increase on record. However, the May 2020 level was nearly 40% lower than 12 months prior. Growth from a low base continued in June 2020 at 21.8%, although this monthly figure was still 24.8% below pre-pandemic levels. Output finally passed pre-pandemic levels in November 2020, albeit by only 0.6%. The seven-month run ended in December 2020, which was 4% lower than December 2019.

The summer 2020 demand revival even led to some unexpected effects. In early July 2020, supplies of bagged cement were reduced due to lack of available bags, although the situation was back to normal by the end of August 2020.

Individual company performance

Of the five cement manufacturers with production facilities in the UK, only Breedon is headquartered in the UK. As it also operates facilities in Ireland, Breedon's results are a useful measure of the state of the UK and Irish markets. It made a pre-tax loss of Euro11.6m in the first half of 2020, with revenue falling by 25% from Euro515m to Euro386m. Breedon's cement volumes were 0.8Mt for the first half of 2020, down from 1Mt in the same period of 2019. However, the group reported an encouraging performance once demand began to return in early May 2020. Its improving trend continued into August 2020, broadly in line with the UK's national experience. Performance continued to exceed expectations to December 2020, albeit from a low base, and the full year results were considered

Below - Table 1: Change in key UK construction indicators, April 2020 - February 2021.

Sources: ONS, IHS Markit / CIPS.

Year	Month	Construction Output change (% Month-on-Month) (ONS)	Construction Total Activity Index (IHS Markit / CIPS)
2020	Apr	-41.2	8.2
	May	8.2	28.9
	Jun	21.8	55.3
	Jul	17.2	58.1
	Aug	3.0	54.6
	Sep	2.9	56.8
	Oct	1.0	53.1
	Nov	1.9	54.7
	Dec	-2.9	54.6
2021	Jan	0.9	49.2
	Feb	1.6	53.3

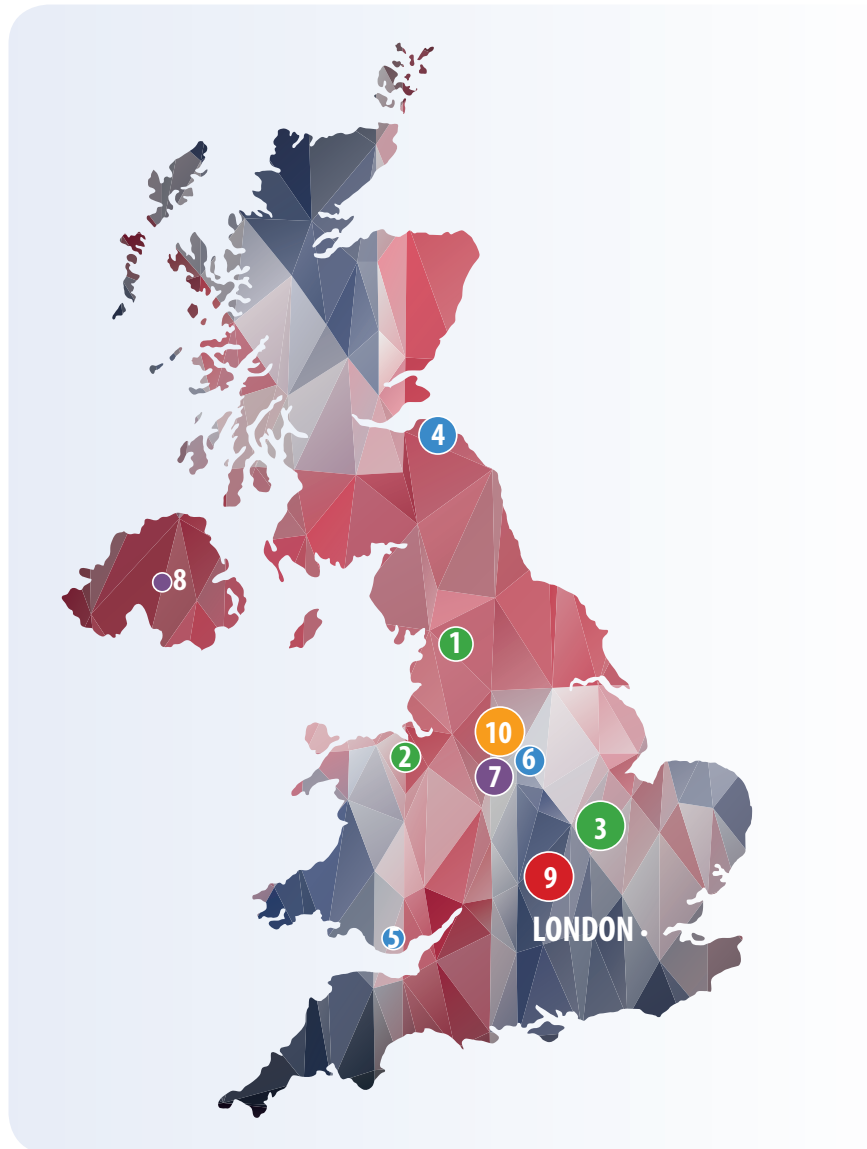
satisfactory – given the circumstances. Pre-tax profit was down from Euro109m in 2019 to Euro55.4m, on revenues of Euro1.07bn. Like-for-like sales were down 6%, attributable to Covid-19. In terms of volume, Breedon sold 2.6Mm³ of ready-mixed concrete, down from 3.0Mm³ in 2019, and 2Mt of cement, unchanged year-on-year.

For Ireland-based CRH, the Europe Materials business saw like-for-like sales and operating profit in the first half fall 11% and 59% respectively, reflecting the impact of site closures from mid-March 2020 to late May 2020. The UK, Ireland and France were particularly badly affected.

Covid-19

The Covid-19 pandemic has had multiple impacts on the UK cement industry, from the regulation of working conditions to the collapse of market demand. In common with other sectors, cement makers introduced social distancing and sanitation processes for employers and visitors. Measures have included socially-distanced meeting areas, overflow lunch marquees, 24/7 cleaning services, floor markings and directional signage. With these in place, production facilities were re-opened over the summer of 2020 as regulations were eased and construction activity was resumed.

Although construction was one of the sectors to remain relatively active, with necessary workplace attendance on site, inevitably there were constraints. Cemex was one company to identify products from its range that would help customers continue operation while meeting the challenges posed by site working requirements, products that would allow a reduction in additional materials, optimise the use of labour and minimise the need to work in confined spaces. Where site working wasn't required or justifiable, the cement industry has shared in the universal experience of conducting meetings on-line, with webinars, virtual conferences and on-line training, rather than in-person meetings.



Above - Figure 1: The UK's integrated cement plants. **TOTAL = 9.5Mt/yr.**

More specific to the cement industry and its downstream operations, has been the direction of material to health-related projects and the switch of resources and production to pandemic applications. Cemex's European Mortars & Admixtures division turned to manufacturing hand sanitiser. The Lafarge Cement plant at Caudon supplied nearby doctors' surgeries with personal protective equipment. Aggregate Industries supplied concrete for the NHS Louisa Jordan Hospital in Glasgow, Scotland and at temporary hospitals in Deeside and Manchester, England. Hanson,

HANSON (HC) • 3.0Mt/yr

1. Ribblesdale, Lancashire, England, 0.9Mt/yr.
2. Padeswood, Flintshire, Wales, 0.8Mt/yr.
3. Ketton, Rutland, England, 1.3Mt/yr.

TARMAC (CRH) • 2.4Mt/yr

4. Dunbar, East Lothian, Scotland, 1.0Mt/yr.
5. Aberthaw, Glamorgan, Wales, 0.6Mt/yr.
6. Tunstead, Derbyshire, England, 0.8Mt/yr.

AGGREGATE INDUSTRIES (HOLCIM) • 1.5Mt/yr

7. Caudon, Staffordshire, England, 1.0Mt/yr.
8. Cookstown, County Tyrone, N. Ireland 0.5Mt/yr.

CEMEX UK • 1.3Mt/yr

9. Rugby, Warwickshire, England, 1.3Mt/yr.

BREEDON CEMENT • 1.3Mt/yr

10. Hope, Derbyshire, England, 1.3Mt/yr.



Above: The UK lost one of its integrated cement plants in July 2020, when Cemex UK said its mothballed South Ferriby plant would not reopen.

the UK subsidiary of HeidelbergCement, supplied concrete for the installation of oxygen tanks at a temporary 850-bed hospital in Swansea, Wales.

UK cement producers also followed the international trend towards reduced capital expenditure and other outgoings. LafargeHolcim, for instance, launched an action plan entitled 'Health, Cost & Cash' for immediate execution worldwide, with targets including a reduction of capital expenditure; reductions in fixed costs; realisation of reduction of energy prices and full review of all third party products and services; and reduction of net working capital at least in line with activity levels. At Breedon, capital spending was restricted, and pay rises, bonuses and Performance Share Plan awards were deferred.

Brexit

Covid-19 remains a serious issue for all countries worldwide. However, the past 12 months have seen the UK also dealing with the challenges of working out its new relationship with the EU. In January 2021

Markit/CIPS research revealed 'major delays' in customers receiving imported products and materials from suppliers, though this was across the spectrum of construction activity and unlikely to relate closely to cement supplies.

Of particular interest to the UK cement sector, however, was uncertainty over arrangements for the post-Brexit CO₂ trading system that came into being to replace the EU Emissions Trading Scheme (ETS) in the UK on 1 January 2021. By late February 2021, the Financial Times was reporting concern, while major emitters waited for the government to agree the date for a first auction of CO₂ credits under the new scheme. Meanwhile the Intercontinental Exchange announced its future transfer of carbon contracts from London to the ICE Endex exchange in Amsterdam. In the meantime, EU ETS CO₂ permits hit a record of more than Euro50/t.

Industry restructuring

The UK cement industry has been characterised by mergers, acquisitions, disposals and reorganisations for much of the past decade, most notably since the amalgamation of LafargeTarmac and the creation of Hope Cement in 2013, followed by Hanson's disposals to Forterra and Francis Flower and, latterly, the growth of Breedon Group. In 2020 it was the turn of Cemex to sell certain assets to Breedon, which in turn divested surplus capacity.

The agreement to transfer 100 Cemex operations was announced early in 2020 and the purchase was completed at the start of August 2020, for a consideration of Euro205m. The operations concerned, employing a total of 650 people, included 28 quarries, four depots, one cement terminal, 14 asphalt plants and four factories for precast concrete products. The above assets were then operated as a separate, ring-fenced business known as Pinnacle Construction Materials, in line with instructions from the Competition & Markets Authority (CMA), pending the outcome of its investigation into the deal, which commenced on 1 July 2020.

On 26 August 2020, the CMA, concerned that the deal could result in a substantial lessening of competition, followed by higher prices and poorer quality products, gave the two companies just five days to address their concerns before deciding whether to move to Phase 2 of its investigation. Consequently, in a move to secure regulatory clearance, Breedon proposed to sell 10 ready-mixed concrete plants, an asphalt plant and associated quarry in England, along with two quarries and a cement terminal in Scotland. The prospective buyer, announced in November 2020, was family-owned Tillicoultry Quarries, which purchased the assets for Euro14.4m in cash.

Reflecting the reduction in concrete production capacity, Cemex streamlined its domestic cement operation, confirming the mothballing of its South

Below: While the UK officially left the EU at the end of January 2020, its new trading relationship with the bloc did not begin until 1 January 2021.





Ferriby plant in July 2020, with the loss of 110 jobs. A further 26 jobs at the logistics depot were axed in August 2020.

In September 2020 Quinn Building Materials announced it was changing its name to 'Mannok', six years after the group was taken over by American hedge funds. This represented a move to dissociate the business from its founder and former owner, Sean Quinn. According to the statement, the name derives from Fear Manach, the etymological origin of County Fermanagh, Northern Ireland. The re-brand was formally completed on 16 November 2020. Thenceforth the company's Mannok branding would replace the established names Quinn Building Products and Quinn Packaging. New-look cement bags were launched at about the same time, featuring the letter 'M' prominently on the front and the logo emblazoned on the sides to allow easy identification when the bags are stacked.

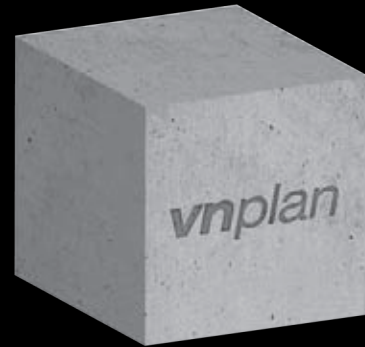
Net-zero

While the industry and wider construction market adjusted to the economic ramifications of Covid-19, the pandemic gave an unexpected opportunity to reflect on longer-term changes and to advance a number of initiatives already in progress. Perhaps most high profile has been the drive to net-zero CO₂ emissions. Though neither new nor unique, this fundamental strategic shift has now received a national expression. In June 2020 the MPA published a framework document called Beyond Net Zero to help direct the delivery of a roadmap for achieving net negative CO₂ emissions by 2050. Rather than relying on offsetting or offshoring, the proposals include a mix of technologies offering enhanced energy efficiency, fuel switching, the use of low-CO₂ cements and CO₂ capture. This was formalised further with the launch of the agreed Roadmap to Beyond Net Zero in October 2020.

This initiative is mirrored by a similar aspiration held by the London-based Global Cement & Concrete Association on behalf of its international membership. Its 2050 Climate Ambition was launched on 1 September 2020, which is claimed as a first statement by the cement industry of global ambition for a CO₂-neutral future. Its target is CO₂-neutral concrete by 2050. The document identifies the various levers that will be required to achieve it.

As elsewhere, the owners of UK cement plant owners have made major statements of intent. HeidelbergCement's Beyond 2020 strategy aims to reduce CO₂ emissions to below 525kg/t of cementitious material by 2025, rather than 2030 as previously planned. This target represents a reduction of 30% compared with the 1990 baseline. In September 2020 LafargeHolcim announced a pledge to cut its CO₂ emissions by 20% during the 2020s and plans to have the world's first net-zero CO₂ cement production facility by 2030.

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Above: Green hydrogen, produced from water using renewable energy, will become a feature of several UK cement operations in the coming years.

Reducing CO₂ emissions has been the driver of much of the industry's investment of late, from fuel use and CO₂ capture to innovative products. Hanson and Cemex UK have each invested in pilot projects, converting international research findings to practical application in UK plants.

Hanson's research project into fuel switching at Ribblesdale is moving into its demonstration stage in 2021. This follows a 2019 feasibility study that found a combination of 70% biomass, 20% hydrogen and 10% plasma energy could lead to cement and lime kilns operating with a net zero CO₂ fuel mix. The project, funded by the Department for Business, Energy & Industrial Strategy, could lead to the elimination of fossil fuel-derived CO₂ emissions from cement production. In December 2020 Hanson applied for hazardous substance consent, allowing the storage of kiln and vehicle fuels, heating oils and quarry blasting explosives necessary to permit the demonstration project to proceed.

Hanson is also collaborating with the Energy Safety Research Institute at Swansea University. A hydrogen demonstration unit, which generates 'green' hydrogen from water and renewable energy, has been developed and installed at Hanson's ground granulated blast furnace slag (GGBFS) plant at nearby Port Talbot, Wales. It forms part of a Euro10.6m project known as Reducing Industrial Carbon Emissions (RICE), financed by the European Regional Development Fund.

Hanson has also recently become a partner in the HyNet North West consortium, which aims to create the world's first low-CO₂ industrial cluster and reduce regional CO₂ emissions by up to 10Mt/yr by 2030. The region from Flintshire, Wales to Lancashire, England has the largest concentration of advanced manufacturing and chemical production sites in the UK. The facilities include Hanson's Padeswood cement plant. Euro83m in funding has been secured by the consortium, enabling Hanson to carry out a CO₂ capture and storage (CCS) feasibility study at Padeswood. Approved in March 2021, this will set out the design basis and provide cost

estimates for a carbon capture plant with connection to the HyNet CO₂ transport and storage system.

In September 2020, Cemex signed an agreement with UK-based Carbon Clean to develop a low-cost method of CO₂ capture, adapting an existing system that uses rotating packed beds to intensify the capture process. It was tested in a pilot project at Rugby in early 2021. By February 2021 the project had expanded. Cemex and Carbon Clean were joined by Oak Ridge National Laboratory and research institute RTI International in a US-government funded scheme to develop the system and to find commercially viable carbon-utilisation outlets. Specifically, the consortium will work on the optimisation of the components of the CO₂ capture process and incorporate non-aqueous solvents, then integrate the CO₂ capture technology into Cemex's production plant before evaluating the transformation of captured CO₂ into new and marketable products.

Cemex is also investing in a new system to replace fossil fuels at Rugby as part of its 'Future in Action' programme aimed at CO₂ neutrality. The new system, which incorporates the use of green hydrogen, is due to be in operation in June 2021. Once fully complete, it should allow the plant to operate entirely with alternative fuels. The project is part of a Euro115m investment programme in the UK, contributing to a wider European target of 35% reduction in emissions from 1990 levels.

Not only have processes been optimised and targets set, but new low-CO₂ materials have been launched commercially. ECOPact from LafargeHolcim, claimed as the world's broadest range of green concrete, was introduced to the UK in September as part of an international rollout over the year. ECOPact Prime offers a 50%-70% reduction of CO₂ through blending higher proportions of SCMs, and ECOPact Max provides a 70% reduction through use of alkali activators. For its part, Cemex launched its Vertua range of low carbon concretes internationally in July 2020, including Vertua Ultra Zero, and its introduction in the UK was announced in October 2020.

Capital investments

With such a focus on process improvement, and restrictions on spending in difficult market conditions, there has been relatively little investment in other areas. Those that have taken place largely concern packaging and transport, along with spending in related aggregate and concrete operations. For example, Hanson's long anticipated new marine-aggregates dredger, the *Hanson Thames*, was launched in September 2020. In October 2020, Hanson also completed a Euro2.3m investment project to double the capacity of its concrete plant at King's Cross, London, installing a pair of 4m³ planetary mixers from Skako.

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GLOBAL CEMENT: UK

Two companies have expanded their use of plastic packaging. In January 2021 Cemex confirmed an investment of Euro5.8m in two new plastic bagging lines at its Rugby plant. Work on the new lines began in early 2021, alongside the existing operation, with completion expected in the summer.


In March 2021, Tarmac claimed to be the first major cement maker in the UK to use 50% recycled plastic in its weatherproof packaging, an improvement on the previous 30%. The company's plants at Aberthaw, Wales and Dunbar, Scotland have already converted to the new bags, with the other packing operations switching as 2021 unfolds.

In June 2020, Tarmac became the first cement maker to sign up to the EV100 scheme, seeking net zero CO₂ emissions in transport. Under the initiative, Tarmac plans to replace its 2000-strong fleet of company cars and vans with electric models by 2030. Tarmac also renewed five-year contracts with four railfreight companies in September 2020. Colas Rail UK, GB Railfreight, Freightliner and DB Cargo will continue to provide haulage services for



Tarmac, one of the UK's biggest users of railfreight, transporting about 9Mt/yr of material.

Concluding comments

At the time of writing, the Covid crisis appears to be receding, but the challenges – and opportunities – of the past year seem likely to continue. While the UK economy seems to be bouncing back, the long-term project to decarbonise cement production may have received even greater impetus, with the potential to accelerate the sector towards the UK government's recently announced CO₂ emissions goals. There certainly appears to be an industry consensus and the MPA's Roadmap shows the way. 

Above: Capital investment in the UK cement sector has been hampered by the Covid-19 pandemic since March 2020.



Mexico: Cemex sales rise in first quarter

Cemex has reported that its sales in the first quarter of 2021 came to US\$3.41bn, a 9% rise year-on-year compared to the first quarter of 2020. Its earnings before interest, tax, depreciation and amortisation (EBITDA) improved by 28% to US\$684m due to a boost in cement sales volumes and higher prices. Its net income for the first quarter was US\$665m.

Cemex's net sales in Mexico increased by 19% to US\$822m, while operating cash flow increased by 27% to US\$299m. Its US operations reported net sales of US\$1.0bn, an increase of 5% compared to the same period in 2020. Its operating cash flow in the US increased by 21% to US\$196m.

In the group's Europe, Middle East, Africa and Asia region, sales grew by 2% reaching US\$1.09bn, while EBITDA was US\$113m, 3% higher year-on-year. In Central, South America and the Caribbean, Cemex's net sales came to US\$424m, an increase of 15% compared to the same period in 2020.

Commenting on the results, Cemex's chief executive officer Fernando González Olivieri said "We achieved some important objectives and made significant progress towards our Operation Resilience goals, despite the persistent challenges that Covid-19 has caused in many markets. The performance during the first quarter convinces me that we must be entering a period of sustainable growth for our main markets and it is likely that we will achieve two of our Operation Resilience goals well in advance of the 2023 target."



Mexico: GCC slides in 2021

GCC recorded consolidated net sales of US\$179m in the first quarter of 2021, down by 2% year-on-year. Its earnings before interest, taxation, depreciation and amortisation (EBITDA) grew by 9% to US\$49.5m. In Mexico cement sales volumes rose by 6% but in the US they fell by 7.7% due to poor oil well cement sales.

The company's chief executive officer Enrique Escalante said "GCC started 2021 with strong financial performance - increasing EBITDA, free cash flow and EBITDA margin. Our results reflect momentum in the industry and show early signs that we are entering into a new phase of the industry's cycle with a stronger demand for most of our products. Therefore, we will focus our efforts in producing cement to supply pent-up demand." Escalante continued "Our backlog and the overall market trends of our business are encouraging in the US and Mexico. Both countries are emerging from tough and uncertain times into brighter months ahead. Our focus continues on maximising production, improving plant reliability, and optimising our logistics network to take advantage of the pent-up demand we are experiencing."

Mexico: Elementia sales up by 18%

Elementia recorded standalone net sales of US\$363m in the first quarter of 2021, up by 18% year-on-year from US\$309m in the first quarter of 2020. The group's Mexican cement sales rose by 25% to US\$74.9m from US\$60.0m. Its US cement sales rose by 6% to US\$58.9m from US\$55.8m and its Central American sales rose by 18% to US\$6.13m from US\$5.19m. Its earnings before interest, taxation, depreciation and amortisation (EBITDA) rose by 52% to US\$51.2m from US\$33.6m. In early March 2021 the group announced that it was starting a spin-off process to form a new company from its metals and building systems businesses as part of an ongoing corporate strategic reorganisation.

Brazil: LafargeHolcim to sell up?

LafargeHolcim Brasil is reportedly seeking to sell its assets, according to the *Diário do Comércio* newspaper. It has not commented on the matter. However, local government officials in Barosso, Minas Gerais said they were waiting for an official confirmation from the cement producer before they could comment. The newspaper also speculated that the group may have already notified the Brazil government of its intent to sell. Under Brazilian law, any sale would require the

approval of the Administrative Council for Economic Defence (CADE). The producer operates three cement plants and two grinding plants in the country.

Meanwhile, CSN's Cement Director Edvaldo Rabelo has said his company is 'attentive to opportunities' in a call with analysts that discussed the rumoured exit. In a call with Reuters, he said that the move had been 'expected.' CSN CEO Benjamin Steinbruch reportedly added that the company was interested in 'potential merger and acquisition activity' in its cement business.



Canada: St Marys / McInnis merger completed

Brazil-based Votorantim Cimentos and Caisse de dépôt et placement du Québec (CDPQ) have completed the transaction to merge their cement operations in North America. After having obtained regulatory approval from authorities in Brazil, Canada and the US, St Marys Cement (Canada), a wholly owned subsidiary of Votorantim Cimentos, can now commence with the integration process with McInnis Cement. As part of the transaction, the parties will combine their North American assets in a jointly-held entity. Votorantim Cimentos International, the international investments platform and wholly owned subsidiary of Votorantim Cimentos, will hold 83% and CDPQ will indirectly hold 17% of the shares.

The combined entity will comprise operations in Bowmanville and St Marys, in Ontario, Canada and in Detroit and Charlevoix in Michigan, Dixon in Illinois and Badger in Wisconsin in the US, along with a distribution network concentrated in the Great Lakes region - plus the Port-Daniel-Gascons plant and its distribution operations, including terminals located in Quebec, Ontario, New Brunswick, Nova Scotia and the Northeastern region of the US.



Colombia: Argos loan depends on emissions and equality

Bancolombia has granted a US\$108m loan to Grupo Argos. The loan's interest rate is linked to two indicators, namely greenhouse gas emissions reductions and the increase in participation by women in the group's upper management. These factors can decrease the interest rate by up to 100 basis points. The group said that signing the deal constitutes another milestone in realising its environmental, social and governance commitments. The financing agreement modifies current conditions for debt and will have a five-year maturity. As such, it does not increase Grupo Argos' current levels of indebtedness.

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Argentina: Malagueño plant upgrade completed

Holcim Argentina, part of LafargeHolcim, has completed a US\$120m upgrade at its integrated Malagueño cement plant in Córdoba Province. In a meeting with the Minister of Productive Development, Matías Kulfas, the cement producer said it was planning to inaugurate the newly refurbished 0.5Mt/yr production line at the site in late May 2021.

The work also included adding a vertical roller mill and new bagging area with a capacity of 120,000 bags/day. The project was originally announced in late 2017 and Germany-based KHD was awarded a related contract in early 2018.

Cuba: Siguaney plant back online

Corporación Cementos Cubanos' integrated Siguaney plant has resumed production of grey cement after stopping in late 2020 due to technical problems. The plant is targeting grey cement production of 65,000t in 2021, according to the Escambray newspaper. In 2020 local media reported that the plant produced 87,000t of grey cement and 3000t of white cement. At present the plant has 4000t of white cement in inventory and its annual production target for 2021 is 8000t.

Brazil: CNC acquires CRH Brasil

Companhia Nacional de Cimento (CNC), part of Buzzi Unicem's 50% subsidiary BCPAR, has acquired CRH Brasil following approval by the Brazilian antitrust authority (CADE). The deal was originally agreed for US\$218m although changes in the financial positions of the acquired companies changed this. Buzzi Unicem supplied CNC with US\$242m to support the deal.

CRH Brasil's assets included three integrated cement plants and two grinding plants in the south-east of the country. The company sold approximately 2.8Mt of cement in 2020.

US: XPrize awards CCS prizes

XPrize has named CarbonBuilt and CarbonCure Technologies as the winners of carbon capture and storage (CCS) design prizes worth US\$20m.

The competition ran at two power plants in Wyoming, US and Alberta, Canada. CarbonBuilt won the contest at the Wyoming plant with a concrete-curing based system. The concrete produced has a lower CO₂ footprint than conventionally produced concrete, according to XPrize. CarbonCure Technologies won the Alberta contest with a design based on carbonating the water used in washing cement trucks. This reportedly formed a concrete-strengthening slurry.

XPrize has partnered with Elon Musk and the Musk Foundation to launch a second round of CCS design prizes worth a total US\$100m.

Bolivia: Cal Orcko upgraded

Fábrica Nacional de Cemento (FANCESA) has increased the clinker capacity of its Cal Orcko cement plant to 2100t/day with the inauguration of a new clinker line. The La Razón newspaper has reported that the company launched the project in May 2018 at an investment cost of US\$215m. The work employed 1390 people, and a further 4000 indirectly. The producer expects the expanded plant to reach full capacity by mid-2021.



Mexico: Holcim launches EcoEtiquetas label

Holcim Mexico, part of LafargeHolcim, has launched the new EcoEtiquetas label. The label designates products that conform to a set of ecological criteria set by the company. These include a certain level of recycled content or a reduced CO₂ footprint, as specified by the label on each product. The label is now found on Holcim Apasco, Maestro and Supra Cemento cement bags. These products offer CO₂ reductions of 30-60% compared to Ordinary Portland Cement.



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China: First quarter results round-up

Anhui Conch's consolidated net profit rose by 20% year-on-year in the first quarter of 2020 to US\$917m from US\$763m. Its total operating income rose by 48% to US\$5.31bn from US\$3.58bn. The group attributed the rise in operating income to the negative effects of the coronavirus pandemic in 2020.

China Shanshui Cement recorded a net loss of US\$38.7m in the first quarter of 2021, a 34% year-on-year drop from US\$59.0m in 2020. The company's operating sales increased by 70% to US\$481m.

China Resources Cement's turnover grew by 51% year-on-year to US\$1.1bn in the first quarter of 2021 from US\$720m in the same period in 2020. Its profit rose by 16% to US\$166m from US\$143m. Sales volumes of cement increased by 65% to 18.4Mt and concrete sales rose by 80% to 2.87Mm³.

Tangshan Jidong Cement net loss fell by 82% year-on-year to US\$7.93m in the first quarter of 2021, down by 82% year-on-year from US\$43.3m in the first quarter of 2020. Its operating income rose by 64% to US\$785m from US\$478m.



China: Anhui Conch chairman resigns

Gao Dengbang has resigned as the chairman and an executive director of Anhui Conch. The company has proposed appointing Wang Cheng as an executive director subject to shareholder approval at the next annual general meeting.

Wang, aged 55 years, holds a postgraduate degree in economic management from the Central Party School. In March 2021 he joined Conch Holdings. He is currently the party secretary and chairman of Conch Holdings.

Australia: Adbri expects growth

Adbri says that it expects growth in domestic cement demand to continue beyond a present residential construction boom. The Australian Financial Review newspaper has reported that Adbri chief executive Nick Miller believes that house building has undergone a nationwide 'pull-forward' in the wake of the coronavirus outbreak. The producer says that the government's planned US\$116bn infrastructure spend would ensure a medium-term increase in cement demand. It gave as an example the Western Sydney Aerotropolis, which will require 500,000m³ of concrete. The company currently derives 45% of sales from non-residential construction.

Vietnam: Production rises in first four months

Data from the General Statistics Office shows that cement companies produced 32.4Mt of cement in the first four months of 2021, up by 7% year-on-year. Its projected April 2021 cement production was 9.4Mt at the time of going to press, a 17% year-on-year rise. The country produced 100Mt of cement in 2020.

Philippines: Republic bets on 2021 recovery

Republic Cement has said that it expects the cement sector in the Philippines to grow strongly in 2021 following a 10% decline in demand in 2020. Speaking to local press, the company's president and chief executive officer Nabil Francis said that the drop in demand in 2020 was actually less severe than the expected 15%.

Nabil said "We strongly believe that we will get back to 2019 level in 2021. That means 12% growth compared to 2020." Francis added that the industry is expected to sell 35Mt of cement during 2021. The main driver is the bagged cement segment, with infrastructure and the non-residential likely to grow less rapidly.





Iran: 2021 financial year report

National cement production increased to 68.3Mt in the 2021 financial year, which ended on 20 March 2021. The figure corresponds to 79% utilisation of the country's 87.0Mt/yr production capacity. The Tehran Times newspaper has reported that Iranian cement consumption during the year was 65.0Mt and exports were 11.0Mt. Iran supplied both cement and production equipment to its neighbouring countries.

Kazakhstan: Steppe up

Steppe Cement's cement sales in the first quarter of 2021 came to US\$11.3m, a rise of 22% year-on-year from US\$9.27m in the first quarter of 2020. Volumes increased by 13% to 266,000t from 236,000t. The company said that it remained close to full capacity utilisation. It says that it increased its Kazakh cement market share to over 13%. The market grew by 12% year-on-year in total. The producer reported an 11% price rise and constant levels of tariffs and rental expenses.

Steppe Cement forecast an increase in domestic cement demand due to government infrastructure and housing projects.

Thailand: SCG registers 15% revenue rise

Siam Cement Group's first-quarter consolidated net revenue was US\$3.91bn, up by 15% year-on-year from US\$3.39bn. Its earnings before interest, taxation, depreciation and amortisation (EBITDA) rose by 68% year-on-year to US\$758m from US\$452m. Net profit more than doubled to US\$478m from US\$223m. It attributed the growth to its cement and chemical businesses.

The group's cement and building materials segment recorded an EBITDA of US\$211m, down by 2% from US\$216m. Its revenue remained stable. Demand for cement in Thailand grew by 3% during the quarter.

India: Dalmia Bharat revenue rises 9%

Dalmia Bharat's consolidated revenue rose by 9% year-on-year to US\$1.43bn in its 2021 financial year from US\$1.31bn in the same period in 2020. During the period, which ended on 31 March 2021, its sales volumes of cement grew by 7% to 20.7Mt from 19.3Mt. Its earnings before interest, taxation, depreciation and amortisation (EBITDA) increased by 32% to US\$377m from US\$285m.

Puneet Dalmia, the managing director of Dalmia Bharat said "I am delighted with our company's performance this year. The performance is backed by broad-based revenue growth of 9.0% across each region of our operation and EBITDA margin expansion. Through a much disciplined execution, we have successfully increased our capacity by 16%, while simultaneously pre-paying our gross debt."

Pakistan: DG Khan improves

DG Khan Cement recorded a consolidated net profit after tax of US\$18.5m in the first nine months of the 2021 Pakistan financial year, which runs from 1 July 2020 to 30 June 2021. This compares to a US\$12.0m loss in the corresponding period of the 2020 financial year. Net sales rose by 8% year-on-year to US\$213m from US\$198m. Cement sales volumes fell by 5% to 4.09Mt from 4.32Mt in the same period a year earlier.

The company praised Pakistan's 'smart lockdown' as a mitigating factor of the damaging effects of the coronavirus outbreak. Clinker production was 94% of capacity, compared to 101% in the first nine months of the 2020 fiscal year. Total kiln operating days fell from 883 to 813. Depending on on-going outbreak conditions, the company forecast continued momentum gains in housing and infrastructure. It expects to commission a new waste heat recovery (WHR) power plant in the fourth quarter, reducing costs.

Pakistan: Lucky profit jumps by 303%

Lucky Cement has reported a 303% increase year-on-year in its unconsolidated profit after tax (PAT) in the first nine months of the 2021 Pakistan fiscal year, a reporting period that ran from 1 July 2020 to 31 March 2021. Its PAT for the period was US\$72.6m, compared to just US\$18.9m in the same period of the prior fiscal year. Lucky Cement's net sales for the nine month period came to US\$306m compared to US\$208m a year earlier. Its net sales for the January-March 2021 quarter increased to US\$111m from US\$71.6m in the same period of 2020.





Japan: CO₂ capture demonstration project for Taiheiyo's Kumagaya plant

Taiheiyo Cement plans to start a CO₂ capture demonstration project at its Kumagaya plant in Kumagaya City, Saitama. It will use technology for CO₂ chemical absorption supplied by UK-based Carbon Clean, which has been awarded by Japan-based Marubeni Protechs in Japan. The project will have a capacity of 10t/day and demonstration tests will begin in September 2021. Taiheiyo Cement says that it believes that CO₂ recovery technology from cement kiln flue gas will require compact equipment that could be installed in cement plants and that suitable amine solvents for cement kiln flue gas are essential conditions. Its ultimate goal is to establish a technology that can be used to help it reach carbon neutrality by 2050.

The cement producer has been developing this technology as a sole grant recipient of the 'Development of Carbon Circulation Technology for the Cement Industry,' a project funded by the New Energy and Industrial Technology Development Organization (NEDO) which was awarded in June 2020. It also launched its internal Carbon Neutral Technology Development Project Team in April 2020, which has led on the project.

Marubeni Protechs, a wholly owned subsidiary of Marubeni Corporation, which invested in Carbon Clean, has been involved in a variety of domestic and international projects involving equipment supply and construction. The project at the Kumagaya plant is expected to be the first CO₂ capture plant that Marubeni Protechs and Carbon Clean have introduced in Japan. Marubeni Protechs and Carbon Clean intend to jointly introduce CO₂ capture plants in the future.



India: LafargeHolcim subsidiaries supply oxygen to Covid-19 hit communities

Ambuja Cements and ACC, LafargeHolcim's Indian subsidiaries, have started supplying oxygen concentrators, cylinders and generating plants in various locations to help the government as it tackles a second wave of the coronavirus pandemic.

In Rajasthan, Ambuja Cements is setting up an oxygen generating plant at the JLN Hospital in Nagaur with a capacity of 40-50m³, with daily refilling of around 175 - 200 cylinders. The process to set up the oxygen plant has commenced and should be ready by the end of May 2021.

ACC and Ambuja Cement have also placed an order to procure 100 oxygen concentrators, each with a capacity of 10L/minute for communities of three districts in Rajasthan.

In Gujarat, Ambuja has installed an oxygen generating plant at Ambujanagar Multi-Specialty Hospital. The oxygen generating unit has a capacity of 35 - 40 cylinders/day at the flow rate of 10Nm³/hr and has

been set up in two weeks. Similar schemes to supply oxygen and related equipment are being prepared in Delhi, Madhya Pradesh, Uttar Pradesh and Chhattisgarh, according to the Press Trust of India.



Pakistan: New bagging plant for Hub

House of Habib subsidiary Thal Limited has invested US\$11.0m to establish a polypropylene woven bag plant in Hub, Balochistan. Germany-based Windmüller & Hölscher will supply the plant, reportedly able to produce 90 million bags/yr.

Japan: Taiheiyo explosion

An off-grid power system at Taiheiyo Cement's Hidaka plant in Saitama prefecture exploded overnight on 27 April 2021. Fire services quickly extinguished a fire in woodland near the plant. None of the 14 people working at the site at the time was harmed.

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Ad Index

Nigeria: Investments sought against backdrop of overcapacity

The Senate of Nigeria has called for the federal government to introduce policies, such as tax breaks, to encourage local investments in cement production. The upper legislative chamber made the resolution following a debate about a bill intended to relax rules surrounding cement policy in the country. It also requested the federal government to provide more industrial incentives and protections such as offering concessionary loans and larger tax incentives for new entrants in order to boost production of cement, reduce prices and encourage more 'valuable' local producers.

Senator Lola Ashiru, one of the co-sponsors of the bill, noted that cement was one of the few building materials in which Nigeria was self-sufficient with production capacity reportedly over twice as high as estimated consumption in 2018. However, he said that cement prices in the country were about 240% higher than the global average.

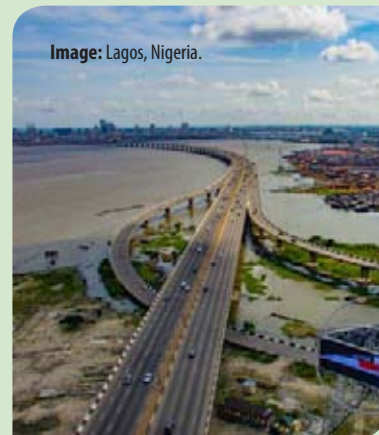


Image: Lagos, Nigeria.

Morocco: Souss-Massa to open in July 2021

LafargeHolcim Morocco plans to open its new 1.6Mt/yr plant in Souss-Massa region in July 2021. The project has a budget of around US\$330m. The unit is located 45km southwest of Agadir. As part of the group's 'plant of tomorrow' concept, it is intended to use automation technologies, robotics, artificial intelligence and predictive maintenance to improve its production efficiency. The plant is also planning to use wind power and alternative fuels. The company has also built new roads to support the plant as well as installations to establish a local drinking water network for local villages.

Turkey: Price probe

The Turkish competition authority has launched a probe into alleged collusion by nine cement producers. It is investigating AS Çimento, Bastas Baskent Çimento, Çimsa, Goltas Goller Bolgesi Çimento, Konya Çimento, Kupeliler Endustri, Limak Çimento, Oyak Çimento and Brazil-based Votorantim Cimentos.

Kenya: ARM to be liquidated in September 2021

ARM Cement is preparing for liquidation and delisting from the Nairobi exchange following the failure of its administrators to revive operations. The East African newspaper has reported that PricewaterhouseCoopers advised liquidation in a letter of 19 April 2021. The joint administrators reached their conclusion based on the understanding that the producer will not otherwise be able to settle in full with its creditors. The company plans to liquidate on 30 September 2021.

ARM Cement went into administration in August 2018 following a default on a loan. Its operations in Kenya were sold to National Cement in October 2019. China-based Huaxin Cement acquired its Tanzanian subsidiary Maweni Limestone in May 2020. In 2019 ARM Cement's administrators fought an attempt by minority shareholders to buy out its majority stake in South Africa-based Mafeking Cement. In January 2021 the administrators received approval from the Rwanda Development Board's Registrar-General to commence the liquidation of ARM-owned Kigali Cement.

Oman: Raysut granted CE and NF markings

Raysut Cement has been granted the CE and NF markings by France-based AFNOR Certification for some of the cement products manufactured at its Salalah plant. The cement producer has been advised that it is now able to export its CEM I 42.5R CE PM CP2 NF and CEM II/B-LL 32.5N CE products to the European Union. It follows the plant upgrading its quality management to meet the CE and NF requirements. The producer has also passed certifications for CE002:2020 or NF002:2019, NFP 15-317:2006 and NFP 15-318:2006, allowing it to export cement to islands in the Indian Ocean. Raysut Cement was advised by Switzerland-based Quadra Trading on how to comply with the quality requirements of the international standards.





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Aït Baha Cement Plant, Morocco,
by Ottavio Tomasini, Turboden SpA





Mali: Sacko plant takes step forward

Sacko Holding has completed a feasibility study at the site of its upcoming integrated cement plant in Bema, Bamako District. Local press has reported that the plant will directly employ up to 300 people, increasing to up to 400 people after two to three years. Chief executive officer Ousmane Koné said that the plant would aim to meet local demand and export some cement. Construction is set to begin by the end of 2021.



Tanzania: Tanzania Portland to invest in plant

Tanzania Portland Cement has announced plans to invest a total of US\$15.0m in modernising its 2.0Mt/yr-capacity Tanzania Portland Cement plant in 2021. Local press has reported that the producer says its main challenge is cargo delays at the port of Dar es Salaam. This has caused concern for potential investors, according to the company. Senior commercial manager Danford Semwenda lobbied the government to help solve the problem.

Qatar: QNCC profit rises 29%

Qatar National Cement Company recorded a profit of US\$19.3m in the first quarter of 2021. Reuters has reported that the figure represents a 29% year-on-year rise from US\$14.9m from the same period in 2020. The cement producer reported a 6% year-on-year fall in revenue to US\$182m and a 13% fall in net profit to US\$40.8m in 2020.

Saudi Arabia: Hold up for Yanbu project

Yanbu Cement says that a two-month modernisation project on Line 4 at its integrated Yanbu plant that was first reported in mid-February 2021 has been delayed. This has been caused by a hold up in receiving certain spare parts. The cement producer said that the financial impact would be limited to the increase in production costs only since the start of the shutdown date. It also stressed that sales would not be affected by the stoppage due to its existing clinker stocks.



Saudi Arabia: Yamama to move kiln line

Yamama Cement plans to transfer and install the seventh production line from its old plant in the south of Riyadh to the plant's new location in Northern Halal in Al-Kharj governorate of the Riyadh region. The line has a clinker production capacity of 10,000t/day. Following the completion of the move by the end of 2024 the new plant will have a capacity of 30,000t/day. The cement producer said that cost of the move would be funded from the available company's resources.



Egypt: Sinai Cement improves in 2020

Sinai Cement's net loss before minority interests was US\$35.6m in 2020, an increase of 26% year-on-year compared to 2019.

Egypt: South Valley sales drop by a fifth

South Valley Cement's full-year sales in 2020 were US\$22.3m, down by 20% year-on-year from US\$28.0m. Loss also fell by 20%, to US\$16.0m from US\$20.1m in 2019.

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AFRICA



Oman: Government could sell majority stake in Oman Cement

Oman's government is reportedly considering selling its majority stake in Oman Cement. Unnamed sources quoted by Bloomberg say that the authorities have been discussing the matter with financial advisors but that no final decision has been reached. The government owns a 54% stake in the cement producer through the Oman Investment Authority.

In separate reporting, Oman Cement Company has postponed its proposed US\$250m Duqm cement plant project while it confirms the availability of fuel. In March 2021 the cement producer issued a tender for a related power plant project, according to the Muscat Daily newspaper. The proposed plant will have a clinker production capacity of 5000t/day.



Nigeria: Dangote increases revenue by a third

Dangote Cement's revenue grew by 35.5% year-on-year to US\$874m in the first quarter of 2021 from US\$655m in the same period in 2020. Cement sales volumes rose by 18.7% to 7.5Mt from 6.3Mt. Earnings before interest, taxation, depreciation and amortisation (EBITDA) increased by 56% to US\$468m from US\$300m. Revenue and sales volumes increased fastest in Nigeria but earnings increased faster in the rest of Africa.

"We took the strategic decision to pause our clinker exports to ensure we meet the rapid volume growth in the Nigerian domestic market. We are improving the output of our existing and new assets and aim to recommence clinker exports in the second quarter," said Michel Puchercos, the company's chief executive officer. He added that the company had also ramped-up its new 3Mt/yr Obajana Line 5.

South Africa: PPC offloads non-core lime operation

PPC has agreed to sell its lime business to Kgatelopele Lime for US\$36m. The cement producer previously identified PPC Lime as a non-core operation and the sale process started in December 2020. Kgatelopele Lime was formed to buy PPC Lime. Its shareholders are mineral resources trader IMR Resources, investment holding companies Kolobe Nala Investment Lime, HEX2M and JJL Mining. The divestment is subject to consent by competition authorities and the government by the end of 2021.

PPC Lime originally started operations in Lime Acres, Northern Cape in 1954. PPC Lime continues to mine out of two quarries, mining dolomite and limestone respectively, along with a rotary kiln plant to manufacture the burnt product. PPC Lime generated revenue and earnings before interest, taxes, depreciation and amortisation (EBITDA) for the financial year that ended 31 March 2020 of US\$59m and US\$7.6m respectively.



Turkey: New Türkçimento chair elected

Fatih Yücelik has been elected as the 24th chair of the board of Türkçimento, the Turkish Cement Manufacturers' Association. He succeeds Tamer Saka in the role.

Yücelik has worked as a senior executive in the construction sector. He currently works as the vice chairman of the board of directors and chairman of the executive board of Erçimsan Holding. He holds a number of positions with non-governmental organisations, including that of Eastern Anatolian Honorary Consul to the Democratic Socialist Republic of Sri Lanka, deputy chairman of the board of directors of Cement Industry Employers' Union (ÇEİS) and as a board member of Foreign Economic Relations Board (DEİK).



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: India, Liberia, Congo, Ghana and 13 countries in South & Central America.

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

UK: Cement prices are rising steeply in the UK due to shortages amid a strong resurgence in building activity. Some building suppliers have informed customers that they are experiencing issues with supplies from all manufacturers. Unscheduled plant outages and the closure of Cemex UK's South Ferriby plant have not helped. NYEs Building Suppliers warned "Prices are increasing across multiple product groups and some of the increases are sudden and very sharp."

Nigeria: Cement prices continue to be a subject of dispute in Nigeria, as prices rose from US\$6.83/bag (50kg) in late 2020 to US\$10.51/bag in May 2021.

Egypt: Ordinary Portland Cement prices as at 10 May 2021: Arabian Cement Co (Al Mosalah) = US\$56.56/t; Arabian Cement Co (Al Nasr) = US\$54.14/t; Minya Portland Cement (Minya) = US\$52.23/t; El Nahda Cement (Al Sakhras) = US\$53.83/t; Wadi El Nile Cement = US\$53.51/t; Lafarge (Al Makhous) = US\$54.28/t; Sinai Cement (Sinai) = US\$49.81/t; Suez Cement (Al Suez) = US\$58.11/t; Helwan Cement (Helwan) = US\$54.92/t; El Sewedy Cement = US\$55.56/t; Misr Cement Qena (Al Masalah) = US\$52.36/t; Al Watania Company for Cement in Beni Suef (Askary Beni Suef) = US\$48.40/t; Al Watania Company for Cement in Beni Suef (Al Sahm) = US\$53.64/t.

White cement prices as at 10 May 2021: Sinai White Cement (Alabid El-nada) = US\$159.56/t; Sinai White Cement (Super Sinai) = US\$157.01/t; El Menya Cement (Super Royal) = US\$152.54/t; El Menya

Cement (Royal Elada) = US\$155.10/t; Menya Helwan Cement (Alwaha Alabiad) = US\$154.78/t.

Blended cement prices as at 10 May 2021: Cemex (A.one) = US\$43.26/t; Sinai Cement (Al Nakheel) = US\$43.39/t; Helwan Cement (Al Waha) = US\$44.35/t. Sulphate-resistant cement prices as at 10 May 2021: Minya Portland Cement (Asec Sea Water) = US\$54.88/t; Suez Cement (Al Suez Sea Water) = US\$56.48/t; El Sewedy Cement (El Sewedy Al Mukawem) = US\$56.48/t; Al Watania Company for Cement in Beni Suef (Al Sahm) = US\$54.88/t.

China: All-China 42.5 grade cement spot prices from sunsirs.com: 5 May 2021 = US\$81.48/t; 6 May 2021 = US\$81.54/t; 7-9 May 2021 = US\$81.64/t; 10 May 2021 = US\$81.83/t.

EU ETS: The cost of CO₂ emissions permits within the EU Emissions Trading Scheme (ETS) passed Euro50/t during trading for the first time on 4 May 2021. They ended trading above this level for the first time on 7 May 2021, rising to Euro50.35/t. This represented a 3.7% week-on-week rise compared to Euro48.75/t on 30 April 2021, a 15% month-on-month rise compared to Euro43.77/t on 7 April 2021 and a 159% year-on-year rise compared to US\$19.48/t on 7 May 2020. The price has been above Euro30/t since 9 December 2020 and has stayed above Euro45/t since 20 April 2021.

The rapid increase has prompted rising calls for the EC to speed up the implementation of its Cross Border Adjustment Mechanism (CBAM). The CBAM would charge parties that bring products into the ETS depending on the CO₂ emissions of products entering the market. This is to avoid 'carbon leakage' and ensure that EU-based producers remain competitive, while encouraging those bringing products into the EU to reduce their own CO₂ emissions.



Do you have your finger on the cement price pulse where you are?
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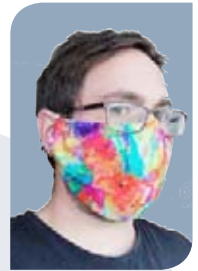
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In daddy's car, the sound's so good...

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



During the pandemic, I have taken to working more with headphones, often exploring the many musical genres offered by YouTube. Having established my pre-existing liking for guitars and 80s synths, its 'algorithm' led me down the path to 'post-punk,' Serbian 'drum-and-jazz,' suggested I try Norwegian 'darkwave,' and presented me with 'Zamrock,' a mixture of Western rock and traditional music from 1970s Zambia. Other algorithm trips took me to early electronic music, strange time-signatures and bands with incredible range. Much of this music would have been completely inaccessible to most listeners 20 years ago, and I'm extremely glad it's out there, waiting to be discovered anew. Many others are too, with a common comment stating that *'the algorithm has found a gem.'*

Recently, the algorithm made a new suggestion: music written by Artificial Intelligence (AI). Not worrying too much about whether this had been its goal all along, I immediately clicked on 'Smother'.¹ This seemed to be a 'new' tune in the style of Nirvana, the 1990s grunge act best known for Smells Like Teen Spirit. 'Smother' was *just* like Nirvana, very catchy and well produced. It seemed impossible that it could have been written by a machine. Indeed, it was too good to be true. When I read the description, I saw that only the lyrics were 'written' by AI. They were the worst element of the song, an incoherent mash of the words that had been fed to the AI. The instruments, vocals and mixing were all the work of one talented human.

Disappointed that the computer had not done more, I looked for other examples and found 'Daddy's Car'.² This is a tune in the style of the Beatles, arranged by researchers from Sony CSL. The lyrics, chord progression and melodies were all suggested by its Flow Machines AI system, with selection, arrangement and performance by humans, acting almost like the producer. The result is definitely a song, although it feels like the researchers have been forced to limit some of the AI's wilder urges. Fed with 45 Beatles tracks, it is not surprising that there are references to the 'taxman' and 'diamond skies.' It seems that 'daddy' has been exploring the YouTube Algorithm too: *"In daddy's car, the sound's so good, like something new, it turns me on."*

The same group also produced Mr Shadow,³ which has a computer-generated voice cut over a string and guitar arrangement. Its AI influences become clearer as it plays, prompting the comment: It sounds like the credits sequence for a film where the robots won.

But what if we *could* remove humans from the creative process? There are already AI symphony generators capable of generating original content, albeit within fairly strict parameters. Critics point out that due to the imposition of these rules, such pieces are generic and simply average out the feed material.⁴ They play it too safe to offer creative value.

There are also examples of systems like OpenAI Jukebox system 'continuing' well-known songs after 'hearing' a sample. These demonstrate an unchained AI basically making stuff up and, in many cases, going off the rails. Most sound like a cover band that has only listened to the song once before coming on stage, if that. The Don't Stop Me Now (Queen) extensions are some of the more amusing.⁵ It is a remarkable feat of coding that the output sounds like music at all. Indeed, there are even flashes of 'inspiration,' where you hear a chord and melody combination that could be the basis of a real song. In the right hands, such approaches could act as an artificial writing partner, muse, or a way around writers' block.

Right now though, whether an AI-generated song is 'bad' or 'good' is up to the listener. Here, there are many opportunities for disagreement. There is no statistically correct move in music like there is in playing games like Chess or Go, or in most other processes taken on by AI. Even something as complex as running a cement plant offers clear targets that can inform the system whether or not it is on the right track.

Music and other creative pursuits do not offer this kind of numerical feedback, although there may be sufficient advancements that make it possible for AI to judge its own creations in the future. Just look at the algorithm that brought me to the topic of AI music in the first place: It knew what I wanted to hear! In the future, AI could even generate music for single-use listening. Just ask for Latin-infused jazz versions of simulated Led Zeppelin songs and the algorithm will oblige. Would that be original and creative, or just random guesses? And, more importantly, would it be worth listening to?



1. <https://www.youtube.com/watch?v=GogY7RQFFus>

2. https://www.youtube.com/watch?v=LSHZ_b05W7o

3. <https://www.youtube.com/watch?v=lcGYEXJqun8>

4. <https://www.youtube.com/watch?v=Mxa6k3AgNqs>

5. <https://www.youtube.com/watch?v=mDH2KD8V5Ys>



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Advertising deadline: 18 June 2021

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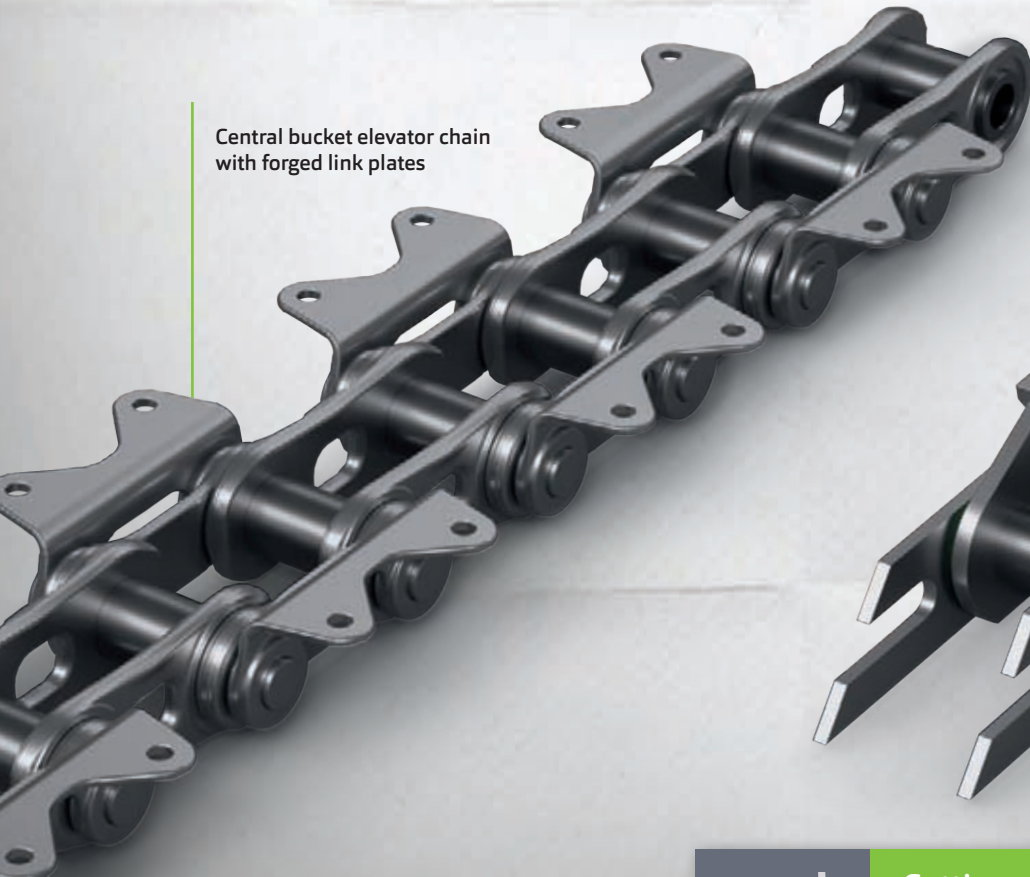
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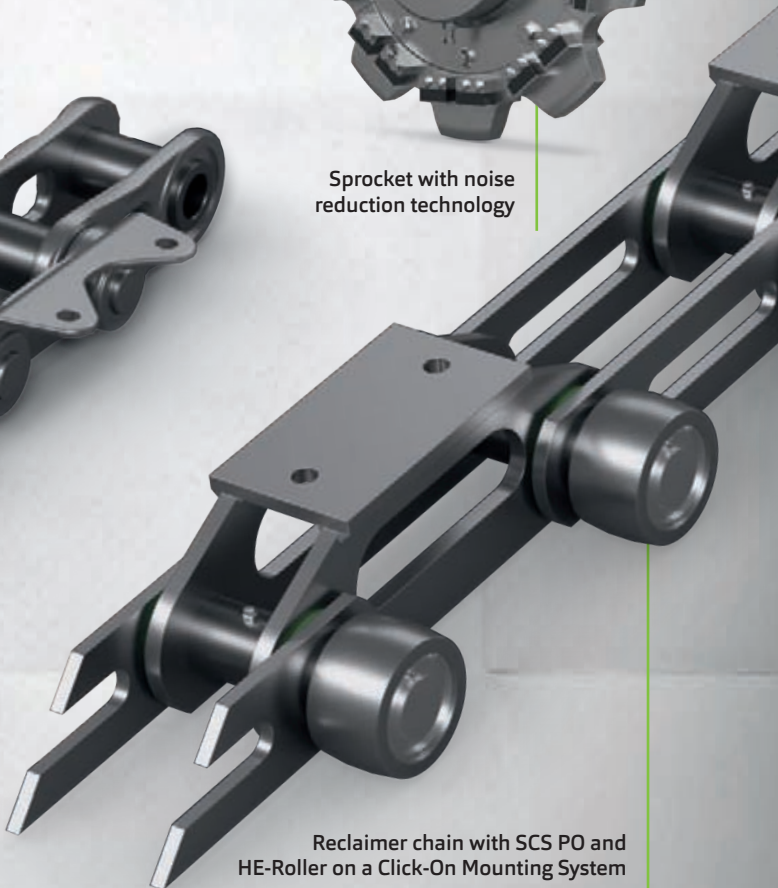
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