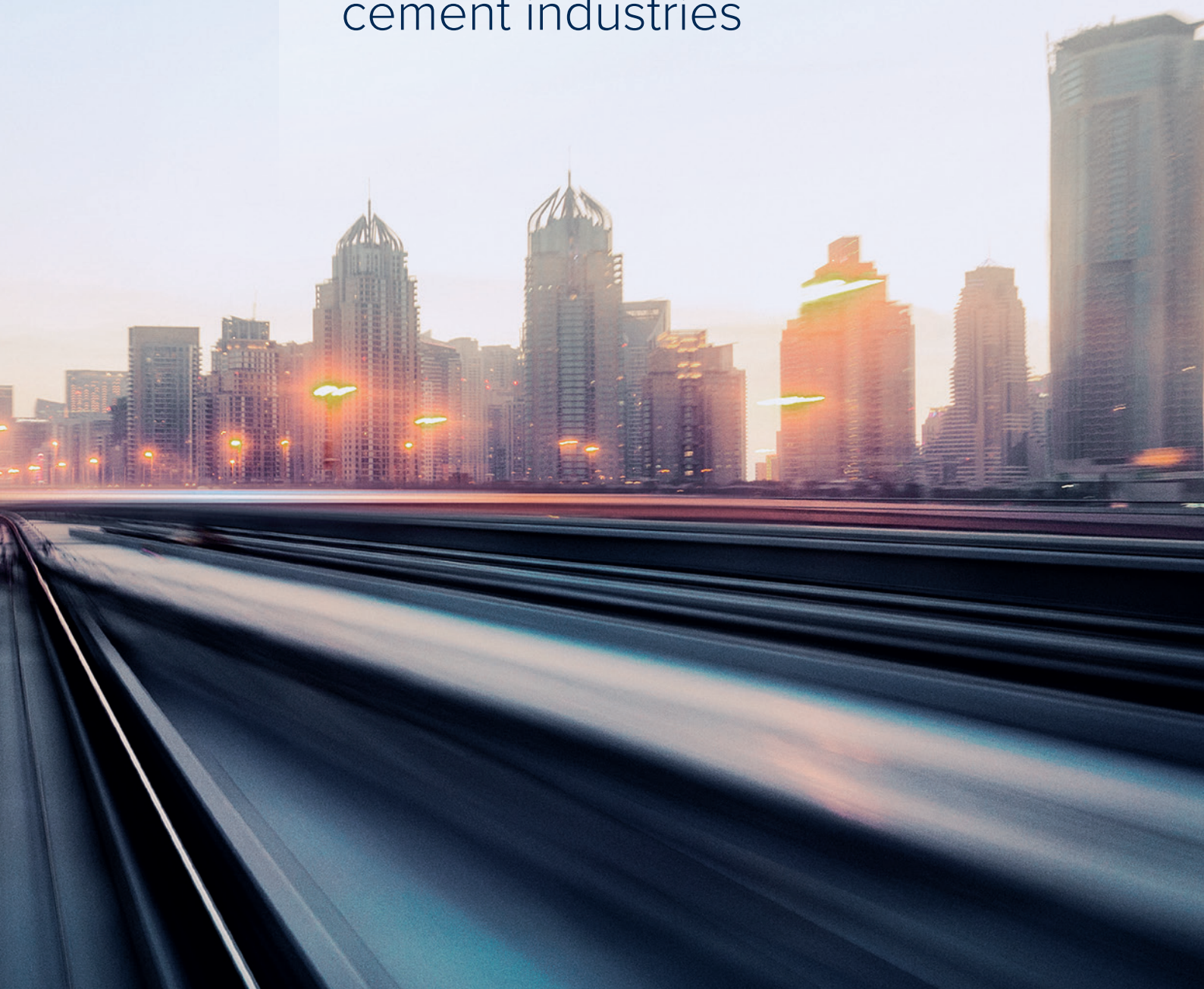


# **TOWARDS A SUSTAINABLE TOMORROW**

in the mining and  
cement industries





# FAST FACTS

FLSmidth delivers sustainable productivity to the global mining and cement industries. As the market-leading supplier of engineering, equipment and service solutions, FLSmidth improves performance, drives down costs, and reduces the environmental impact of operations.

EBITA margin

## 8.4%

up from 7.1%

ROCE

## 10.4%

up from 8.5%

Order intake  
(DKKm)

## 19,170

up from 18,303



We employ

## 11,700

people



Operations in more than

## 100

countries

54% Mining | 46% Cement



58% Service | 42% Capital



Suppliers assessed for environmental and social performance

## 113



Lost time injury frequency rate

## 1.8



# WE TAKE DIGITALIZATION TO THE NEXT LEVEL

THOMAS SCHULZ, CEO

Our customers' constant pursuit of productivity has generated a growing interest in digital solutions. At FLSmidth, we're committed to take digitalization to the next level.

Since the third industrial revolution in the 1970s, automation equipment has replaced physical labour in almost all processes. Now, on the verge of Industry 4.0, we are connecting that equipment with sensors that collect data. In the cement and mining industries, this is currently done in some areas of the flowsheet. If we are able to use that data for the full flowsheet, we can significantly improve productivity.

Digitalization by itself doesn't do it. It's how we use the data that makes a difference. And that's where FLSmidth has the strongest knowledge. By capturing data and pairing it with our in-depth knowledge of the entire value chain, our specialists are able to translate data into solutions that can help our customers diagnose the health of their equipment, anticipate failures, predict spare parts needed, and optimise processes. All of which help optimise performance and deliver sustainable productivity.

Collaborating with customers and partners to find new solutions is the way forward. We do that by entering into partnerships that broaden our horizons, inspire us, and lead to the right solutions that can help our customers solve the challenges they face.



**The cement and mining industries play a vital role in global industrialisation and urbanisation.”**

By working together towards a common goal, we can make quantum leaps in productivity improvements. Everyone needs to be involved if we are to break free from conventional thinking and build new productive structures. And we need to share knowledge and work together in transparent environments.

We have to be bold and explore new opportunities. Even if it means that we don't get it right the first time. That's why we, at FLSmidth, seek to create a work environment that gives people the opportunity to put their curiosity to play – to seek new solutions and new ways of working. We believe this offers the best conditions for finding the answers we need to stay ahead of the game.

Digitalization is the best business opportunity for decades – and we are collaborating with our customers to realise its full potential.

## A FUTURE DRIVEN BY CURIOSITY

In 1882, Frederik Lessøe Smidth embarked on a journey to America. As a pioneering entrepreneur, he set off to explore new opportunities, driven by an inquisitive nature and a curious mind.

And his curiosity paid off. On this journey, Frederik Lessøe Smidth discovered a new technology – the horizontal kiln – that became the foundation on which FLSmidth was built.

Since those early travels, the same pioneering spirit has been the driving force in our business. Today, it's still our role to discover potential. And right now, that spirit – that curiosity – is needed more than ever.

### Driving changes

We're part of an industry that plays a vital role in global industrialisation and urbanisation. All around the world, governments and businesses are improving the infrastructure and standards of living. Such growth creates more demand for cement and minerals.

At the same time, our customers have a greater responsibility to ensure the lowest possible impact on the environment. With stricter regulations, their operations are becoming more complex and expensive to run. They must find smarter, better ways to work.

### Navigating complexity

As the world changes, we help our customers navigate market complexity and release potential. We challenge conventional thinking and explore new opportunities. We bring together a unique combination of technology, process knowledge, and services to help our customers drive success through sustainable productivity.

To do so, we combine the power of 11,700 curious minds, each looking for potential in even the smallest discovery. And we work closely with customers and partners to discover the potential that creates an even better tomorrow. For them, for us, and for society.



## SUSTAINABLE PRODUCTIVITY

# MORE BUSINESS, AT LESS COST TO THE ENVIRONMENT

## GLOBAL CONSUMPTION IN THE PAST 20 YEARS

COPPER  
▲ 89%

CEMENT  
▲ 186%

Sustainable productivity is what our customers are looking for. And it's what the world needs.

**S**ocieties all over the world are experiencing economic growth. Urbanisation and industrialisation are driving the need for more infrastructure and better standards of living.

This is good news for the cement and mining industries. New roads, ports, and housing constructions depend entirely on the continuous supply of cement. And copper, for example, is a key component in electrical carts, high-speed trains, distribution of electricity, and renewable energy solutions.

But tapping into these growth opportunities is not as simple as it sounds.

Greater scarcity of resources such as energy, water, and raw materials – along with decreasing ore grades and stricter regulations – lead to more complex and costly operations – which, in turn, challenge performance.

To stay competitive in this complex market, cement and minerals producers have to minimise the use of resources, while optimising production and maximising their investment.

That's exactly what we help our customers to do. We call this delivery *sustainable productivity*.

Constant focus on capturing sustainable productivity has led to mounting interest in digitalization, which is currently underutilised in the cement and mining industries. With advanced technologies such as artificial intelligence (AI), robotics, automation, and Internet of Things (IOT), we have powerful tools available. The challenge is how to convert the benefits of digitalization into actual productivity enhancing assets.

### A full flow-sheet offering

FLSmidth is the leading supplier of productivity enhancing solutions to the global cement and mining industries.

We help mine and cement plant owners all over the world increase output, lower operating costs, and minimise the environmental impact of their operations. With our life-cycle approach, customers can reduce the total cost of ownership over the entire life of their plant or mine.

To help our customers achieve sustainable productivity, we have developed a platform that integrates pioneering products, extensive process know-how, and end-to-end services. This full flow-sheet offering relies as much on 136

years' worth of global experience as the latest digital technologies.

Although still a new prospect in the cement and mining industries, digitalization offers one of the most effective ways to improve plant performance and lower the total cost of ownership. At FLSmidth, we already have a strong digital position through our many years of experience in automating cement plants. It's our ambition to take digitalization to the next level. This includes making our entire product portfolio smart and self-learning. Through unified IT platforms and data analytics – where big data are collected, analysed and benchmarked – we will be able to use digitalization to enhance productivity.

In addition to our full flow-sheet platform, we work closely with each of our customers to understand their challenges, so we can combine project, product and service offerings in a way that helps them make the most of growth opportunities, at the least possible cost to the environment.



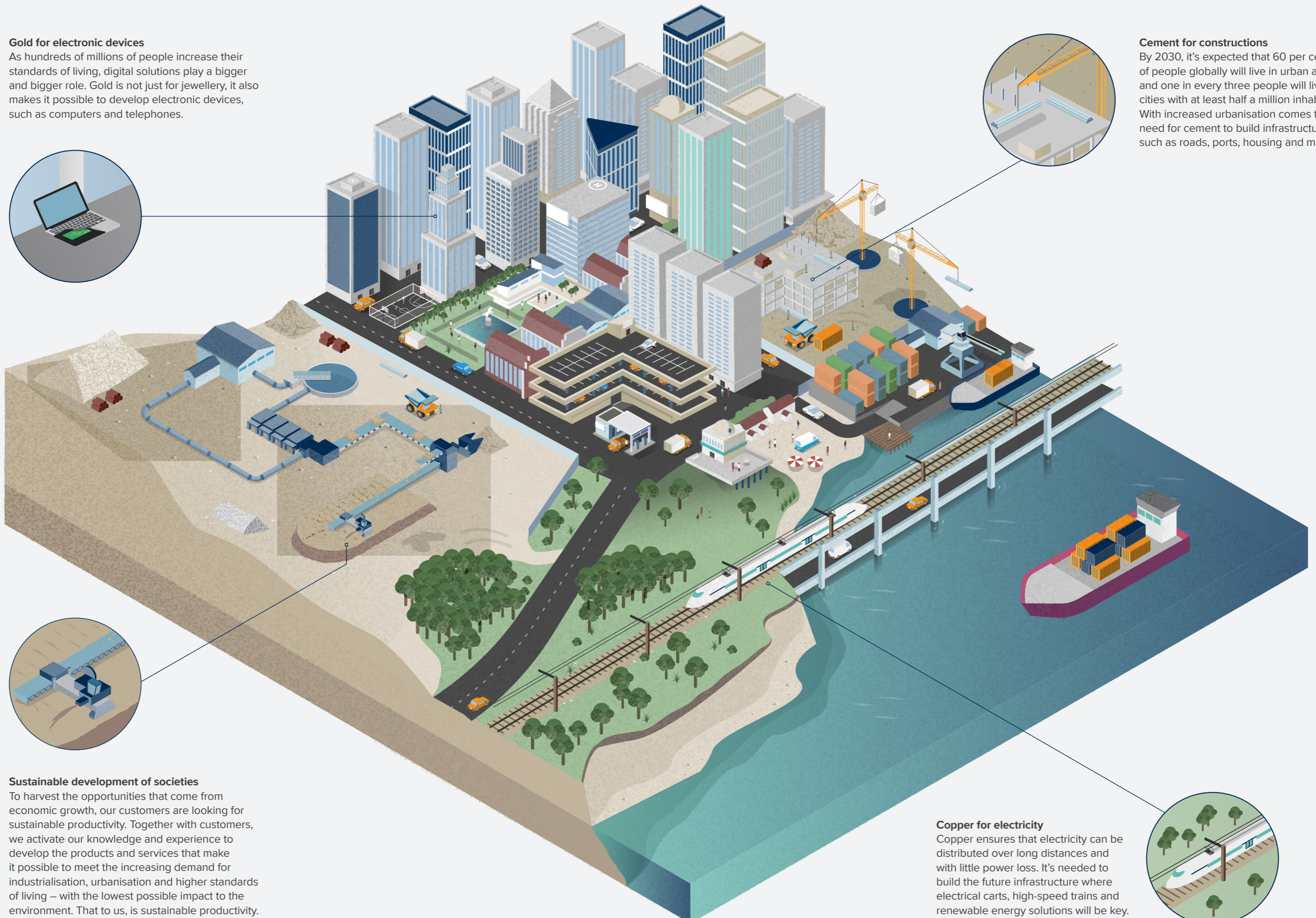
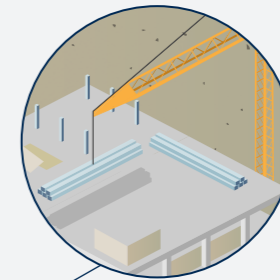
**Gold for electronic devices**

As hundreds of millions of people increase their standards of living, digital solutions play a bigger and bigger role. Gold is not just for jewellery, it also makes it possible to develop electronic devices, such as computers and telephones.



**Cement for constructions**

By 2030, it's expected that 60 per cent of people globally will live in urban areas and one in every three people will live in cities with at least half a million inhabitants. With increased urbanisation comes the need for cement to build infrastructure such as roads, ports, housing and more.

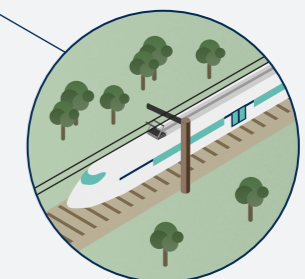


**Sustainable development of societies**

To harvest the opportunities that come from economic growth, our customers are looking for sustainable productivity. Together with customers, we activate our knowledge and experience to develop the products and services that make it possible to meet the increasing demand for industrialisation, urbanisation and higher standards of living – with the lowest possible impact to the environment. That to us, is sustainable productivity.

**Copper for electricity**

Copper ensures that electricity can be distributed over long distances and with little power loss. It's needed to build the future infrastructure where electrical carts, high-speed trains and renewable energy solutions will be key.

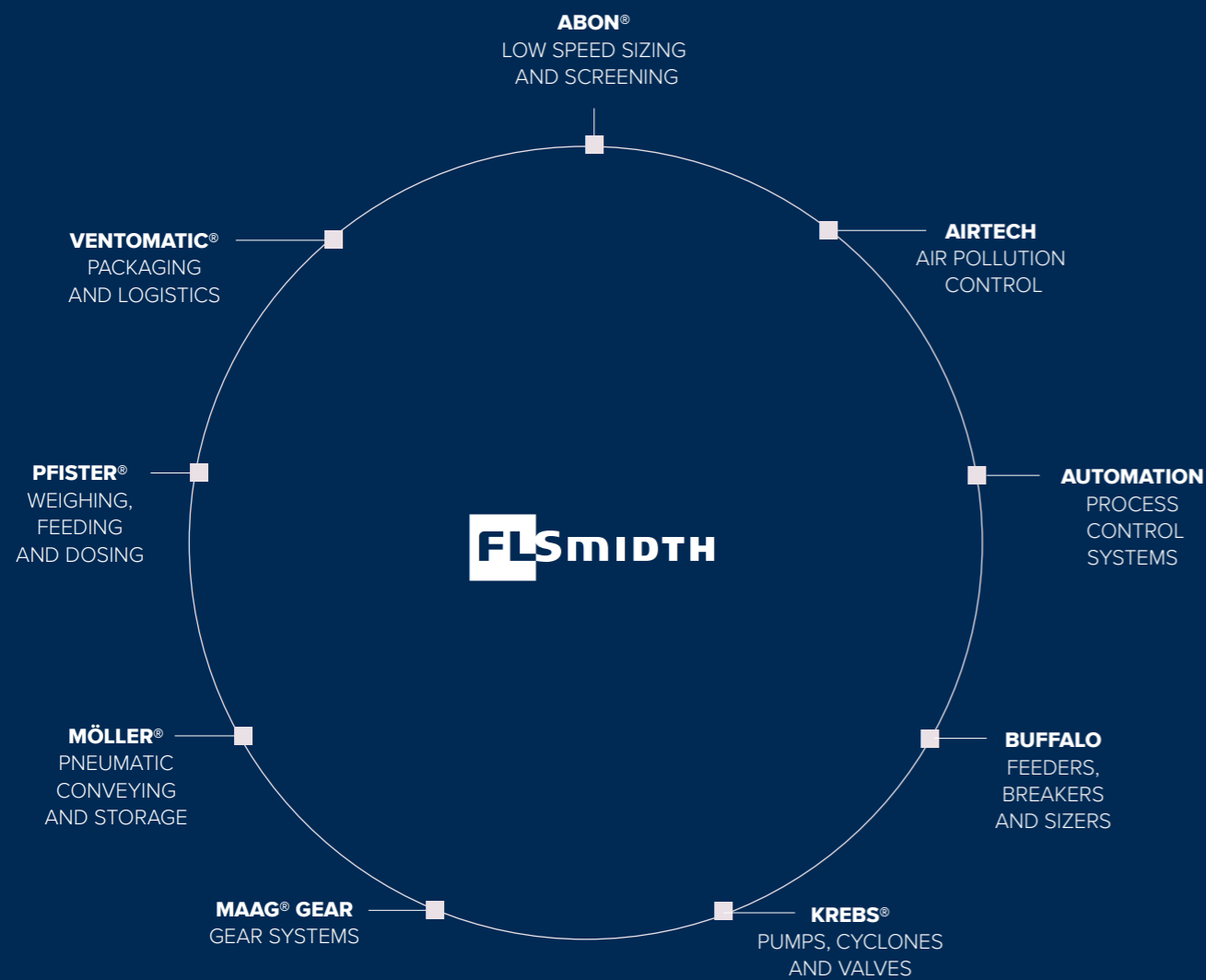




## OUR PRODUCTS

FLSmidth's portfolio includes standardised market-leading products and associated services sold directly to end customers, business partners and into FLSmidth Cement and Minerals projects. All of our niche product brands have significant growth potential to expand geographically or into adjacent industries.

### OUR PRODUCT BRANDS INCLUDE



## STRATEGIC FOCUS AREAS

To further strengthen our position as Productivity Provider #1 we need to stay ahead of our game and continue to challenge the status quo. Our key strategic focus areas help us do that.

### LONG TERM



#### CUSTOMERS

Our customers are our main partners. We build strong customer partnerships through mutual trust and shared values. We earn our customers' trust through local presence, a 'one point of contact' approach, and reliable project follow-through.



#### INNOVATION & DIGITALIZATION

We will take digitalization to the next level in the industries we serve. We deliver key automation technologies that form the basis for digital and data-driven decisions and productivity improvements. Preparing solutions for the future, we are constantly working on new technology applications based on the latest digital technologies.



#### PEOPLE

Only with the right, dedicated talent can we nurture and embrace innovative thinking, stay curious, and stay open to new opportunities. We are committed to creating a safe, flexible, and productive work environment that allows our employees to build an ambitious career, while maintaining a healthy work-life balance.



#### SUSTAINABILITY

We develop eco-efficient products and solutions that help customers lower their energy costs and emissions; increase their production; and obtain permits for new plants. This helps to support sustainable development locally as well as globally.

### SHORT TERM



#### EXPAND WEAR PARTS

Our product line management setup is based on a product life-cycle perspective, which helps us to accurately identify new value-adding spare and wear parts. Wear parts is a missing link in our customer relations and we see it as an untapped growth potential.



#### GROW PRODUCTS

We have a strong portfolio of niche products with a significant growth potential. Some can expand geographically while others are already market-leading and have the potential to expand into adjacent industries.



#### STANDARDISATION

We seek to reduce costs and complexity through standardisation, without compromising functionality and performance. We apply value engineering in our product development, and through the early involvement of R&D and sales we simplify and align product specifications.



## INNOVATION

# DRIVING GROWTH THROUGH INNOVATION

The curiosity and dedication of our people is the reason we can aspire to really make a difference.

In a world where economies are under pressure and resources are becoming scarce, innovation is the key to help businesses and societies achieve sustainable growth.

**I**nnovation is not something we put on formula at FLSmidth. But 136 years of company history testifies a track record of discoveries that all reflect the courage to challenge conventions; the curiosity to explore new territory; and the ability to put solid know-how to use in new ways.

With this mindset, we're able to deliver better and smarter solutions. Some of them small discoveries; others game-changing to the industries we're in. We work just as hard on improving existing products as we do on creating new, pioneering technologies. Whichever category a project falls in to, they share one common goal: to deliver sustainable productivity for our customers.

#### Pushing new boundaries

Over recent years, the mining and cement industries have seen a change in what shapes their growth. The spotlight has shifted from increasing capacity to enhancing productivity.

When it comes to harnessing the potential of digital technologies, the cement and mining industries are still at an infancy stage. Collaborating with customers and external partners, we use our curiosity, courage, and expertise to find ways to realise the opportunities that these new technologies hold. Our experience in automating cement plants gives us a head start here.

Using the latest IOT (Internet of Things) and digital technologies, it is our ambition to make our entire product portfolio smart and self-learning. We will

create IT-platforms and data analytics to collect and analyse big data. With this information, customers will be able to increase the return on their assets – and move up the productivity ladder.

#### Teaming up to create real value

Innovation is not something that comes out of a corner office. Nor is it limited to a particular team, country, or even our own organisation.

Our R&D teams work together across business units and borders. And they team up with customers as well as universities and other external partners. Working together in this way not only helps us to navigate complex challenges; it broadens our horizon and ensures that we develop solutions that deliver real value. To our customers, society, and our business.



**We don't innovate for the sake of it. We innovate to meet customer needs and solve challenges."**

#### SKAGE REIDAR HEM

VICE PRESIDENT RESEARCH AND DEVELOPMENT MINING



Using the latest IOT and digital technologies it is our ambition to make our entire product portfolio smart and self-learning.





## STORIES ABOUT INNOVATION

EVEN A SMALL  
DISCOVERY  
CAN LEAD TO A  
GREAT DEAL MORE

THE NEXT-  
GENERATION  
CYCLONE  
TECHNOLOGY

A GAME  
CHANGER  
IN MINING

# EVEN A SMALL DISCOVERY CAN LEAD TO A GREAT DEAL MORE

“Far too complex and costly.” That was François Koekemoer’s first thought when he saw the hydraulic skip discharge systems available to the customer. So he set out to design a simpler solution.

### Crunching the problem

When one of our customers in South Africa needed a skip discharge system for their platinum mine, François Koekemoer, Mechanical Design Engineer at FLSmidth, was asked to find the right solution.

The hoisting system is the heart of an underground mine. If it doesn’t work, production stops. So François was all too aware of what was at stake.

He looked into several options on the market. Most of them were based on a hydraulic design. Considering the simple functionality the system had to perform – opening and closing a skip door – this seemed a far too complex and costly solution.

François explains. “A hydraulic discharge system converts electrical energy via hydraulics into linear motion. It also requires a large oil reservoir, along with multiple control valves, accumulators and coolers. All this calls for specialised maintenance. Fire hazards need to be considered too. So the capital expense for such a solution is substantial.”

François knew there had to be a more cost-effective solution. Determined to find the right solution, he got to work.

### Less is more

The Crank Type Dump Mechanism (CTDM) is a simple mechanical discharge system, based on a crank motion concept.

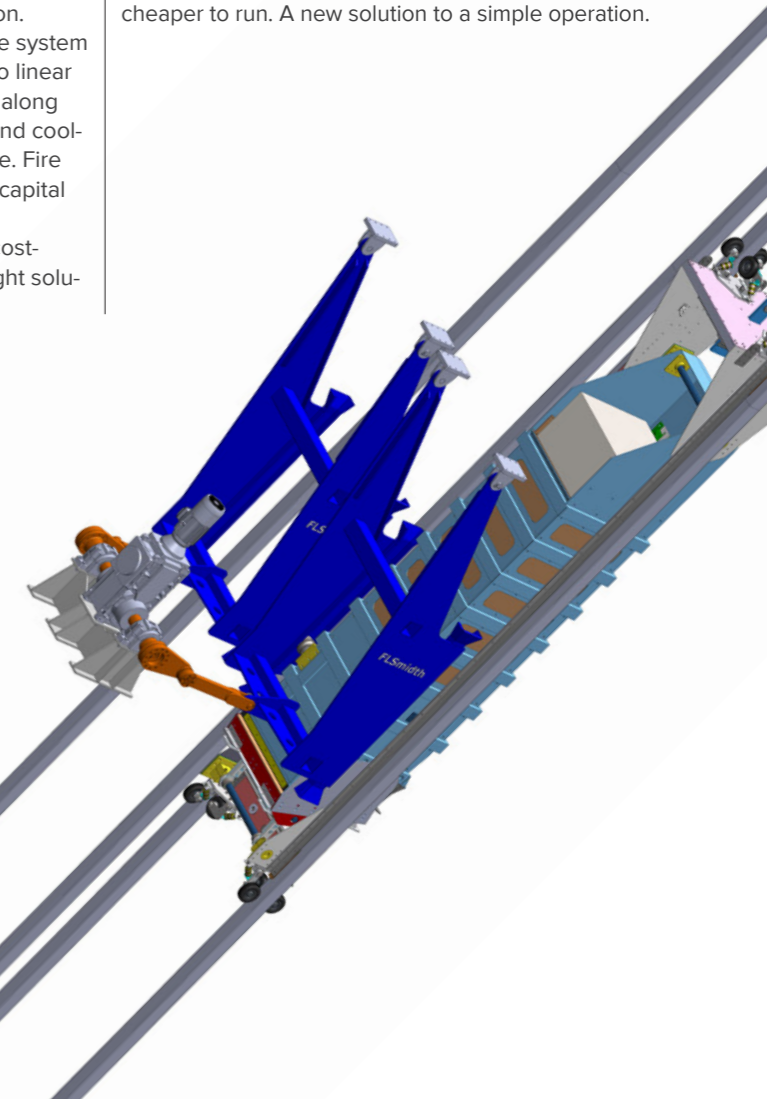
“The crank motion generates a smooth velocity profile perfectly suited to open and close a skip door. The CTDM uses standard, off-the-shelf components like a motor and gearbox. So no custom-engineered drive solutions are needed,” explains François.

The CTDM is just as efficient as existing hydraulic systems, but far easier to use and significantly cheaper to run. A new solution to a simple operation.



The CTDM is significantly cheaper in total cost of ownership than the hydraulic system. And the low level of complexity makes it possible for operators to maintain it themselves.”

**FRANÇOIS KOEKEMOER**  
MECHANICAL DESIGN, ENGINEER, FLSMIDTH





# THE NEXT-GENERATION CYCLONE TECHNOLOGY

The Counter Current Cyclone (CCX) pre-heating system brings down installation costs and improves productivity at cement plants.

## Early adopters

Ivano-Frankivskcement in Ukraine has been an FLSmidth customer for nearly 20 years. Having already used our Down Draft Cyclone system, the company was keen to commission the new Counter Current Cyclone pre-heating system on one of its production lines. And the results have been remarkable.

## Better heat transfer

The CCX makes the pre-heating process in a cement plant's production line more cost effective. Traditional preheater cyclones mainly separate dust from gas. The CCX merges heat exchange and separation of dust and gas into one process. This improves the transfer of heat and cyclone efficiency. As a result, the raw material leaves the cyclone at a much higher temperature than the exit gas.

With better heat transfer, cement plants can reduce the number of cyclone stages. So instead of a five-stage pre-heater, a four-stage pre-heater will do. This reduces the plant's structural and installation expenses.

## Investing less, producing more

Cement production in Ukraine has been rising steadily. As an early adopter of the next-generation cyclone technology, Ivano-Frankivskcement is able to take advantage of the current market situation and reap the benefits of the new CCX technology.

After almost two years in operation, industrial tests at the plant show that production has increased by approximately 6-8 per cent and improved heat exchange by a factor of 1.8.

Following Ivano-Frankivskcement's lead, cement plant owners all over the world can now reduce power and heat consumption, and boost plant production – at a lower cost.

## THE BENEFITS OF THE CCX

- Lowest civil cost in new preheaters
- Lowest operating costs
- Low installation costs
- Increased productivity
  - Brings down loss in pressure (by 30-40%)
  - Reduced net heat consumption (by 8-10 kcal/kg)



## THE BENEFITS OF ROL

- Leaches 97-99% copper on site
- Works with concentrates as low as 5%
- Is quick and simple to perform leaches chalcopryrite in less than six hours
- Producers can bypass costly smelting by utilising their existing processing infrastructure

# A GAME CHANGER IN MINING

Rapid Oxidative Leaching (ROL) is a breakthrough technology that helps copper mines become more profitable and sustainable.

## Abundant, but not available

Copper is in high demand globally. The only problem is, there's not enough of it. One way to tackle this shortage is by working with lower grade copper ores. This is done through a method called leaching – an extractive metallurgy technique for converting metals into soluble salts in water. Until now, leaching has only been used for oxide and simple sulphide ores. Nobody has been able to identify an economically viable process for dissolving chalcopryrite – the most abundant copper mineral on earth.

Gary Roy, Director, ROL Technology at FLSmidth, and his team of chemical engineers, geologists and minerals processing engineers solved the challenge that had troubled scientists for years.

## Cracking the code

"Chalcopryrite has an in-built defence mechanism," Gary explains. "When it begins to leach,

it creates a passivation layer that slows the chemical reactions that leach copper."

After more than five years of researching and experimenting, the research team finally found a way to overcome the passivation issue. This discovery allowed the team to develop the breakthrough technology now known as Rapid Oxidative Leaching (ROL) – a mechano-chemical process that makes it possible to leach chalcopryrite concentrates to produce cathode copper on site, using existing equipment and bypassing the costly smelting process.

ROL is a true game changer in the mining industry. This technology not only changes the way copper mines operate; it also makes them more sustainable by helping them save energy and cut costs.





MARKETS

# LEADING IN CEMENT AND MINING

Our product and process expertise, coupled with complete lifecycle support, offer customers unique solutions for better productivity.

**W**e lead the market in the premium segment of the cement industry. Our portfolio includes a range of products, systems, and services. They extend from single-engineered and customised equipment like vertical mills, kiln systems, and clinker coolers to process excellence services and applications based on the latest digital technologies.

In the mining industry, we're recognised as a market-leading provider of premium solutions and services. We provide a range of products, systems and services to mines all over the world.

From ball mills, gravity concentrators, thickeners or flotation cells, which are part of our single-engineered and customised equipment – to bundled equipment, as well as complete plants and maintenance solutions.

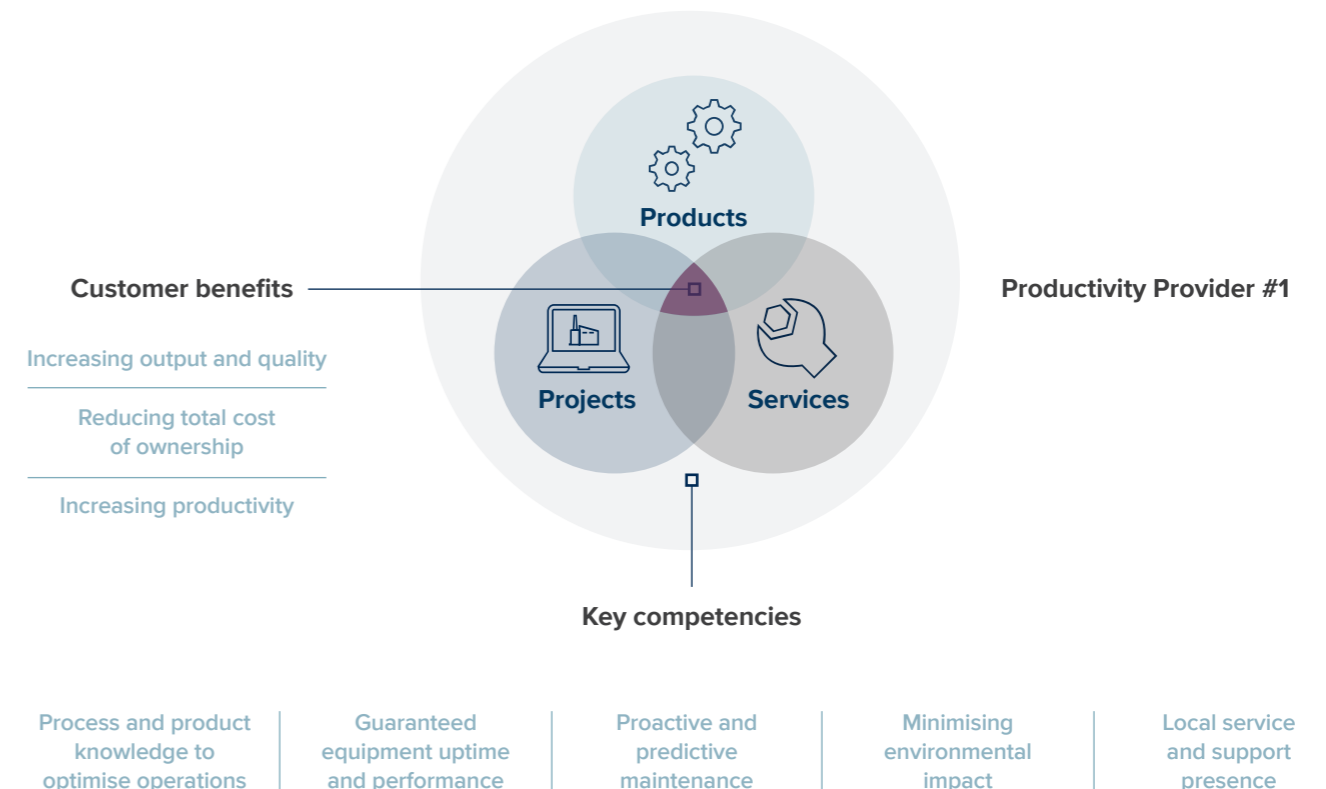
We have a strong presence in material handling, comminution (crushing, grinding and sizing) and separation, with state-of-the-art materials testing capabilities to support these offerings.

**Synergy for better productivity**  
Although distinct, the cement and mining industries use similar products and

systems for crushing, grinding, material handling, automation, and air pollution control. This gives us the opportunity to combine our product, service and project management know-how and put it to effective use in both industries.

We combine this collective know-how with co-innovation, shared procurement and digital solutions – to offer customers operational synergies that improve their productivity.

BUSINESS MODEL  
A UNIQUE COMBINATION OF PROJECTS, PRODUCTS AND SERVICES







STORIES ABOUT

# HOW WE WORK IN THE CEMENT INDUSTRY

SUPPORTING GROWTH IN PAKISTAN

A FLEXIBLE SOLUTION TO MEET DOMESTIC DEMANDS

DIGITALIZATION. WHAT'S THE BUZZ ABOUT?

GET CONNECTED TO THE ONLINE SUPPORT CENTRE

SMOOTH OPERATIONS IN THE SAHARAN SANDS



““

Having FLSmidth on board gives us peace of mind. They go out of their way to meet their commitments, overcoming any challenges along the way.”

**KASHIF SHAH**  
GROUP ADVISOR TO GROUP CHAIRMAN MR. ARIF HABIB

## SUPPORTING GROWTH IN PAKISTAN

Economic development in Pakistan has accelerated in recent years. Greater political stability, a growing population, and foreign investments have fired growth. And such growth calls for more cement.

### The demand for more

Economic growth has translated into infrastructure initiatives that offer a better standard of living for the people of Pakistan. These developments have had a significant impact on the Pakistani cement industry, which has seen an annual growth of about 8 per cent over the last decade.

“There is a shortage of about seven million housing units and a growing need for better infrastructure, including roads and water reservoirs for power stations. It all adds up to a bigger need for cement”, says Tahir Iqbal, CFO of Power Cement in Pakistan.

### Cementing growth

Power Cement is part of the Arif Habib Group. The Group works on infrastructure projects in Pakistan and plays an important role in regional development. To help deliver the infrastructure needed to improve the standard of living, the Group decided to ramp up capacity at Power Cement’s Nooriabad plant, increasing capacity there from 3,000 tonnes/day to 10,700 tonnes/day.

### Going for the best

For such a flagship project, the Arif Habib Group was not only looking for competitive offers. They were looking for the best equipment on the market that provided the lowest total cost of ownership – and an experienced partner to supply it.

“Having FLSmidth on board gives us peace of mind. They go out of their way to meet their commitments, overcoming any challenges along the way”, says Kashif Shah, Group advisor to Group Chairman Mr. Arif Habib.

The new production line underlines FLSmidth’s strong position in Pakistan.

“It emphasises the value of a highly efficient modern cement plant with minimised environmental impact,” explains Per Mejnert Kristensen, Group Executive Vice President, Cement Division. “We are proud to be working with one of the strongest Groups in Pakistan, helping them achieve sustainable productivity – so they, in turn, can support the new opportunities for growth in Pakistan.”



# A FLEXIBLE SOLUTION TO MEET DOMESTIC DEMANDS

Riyadh Cement Company (RCC) draws on FLSmidth's expertise to realise its vision: To become the main supplier of white cement on the domestic market.

## An ambitious goal

Saudi Arabia is experiencing an increase in demand for white cement. At the same time, there's a local shortage of supply. Riyadh Cement, a subsidiary of Saudi White Cement Company, is tapping into this opportunity. They want to capture 100 per cent of the local white cement market. With a current market share of 30 per cent, this is a bold ambition.

RCC established its first cement production line in 2007. Only three years later, a second was commissioned, increasing the plant's combined production capacity to 11,000 tonnes/day.

But to meet the current demand for white cement – and RCC's own goals – the company had to improve productivity even further. This involved increasing flexibility by switching from grey to white cement production.

## A flexible solution

An obvious, yet costly, solution would be to build a new line on site specifically for white cement. The FLSmidth team came up with a better idea: converting the existing grey line to produce grey and white cement.

"We have performed similar conversions at other plants around the world. So RCC representatives were able to visit one of these sites to see how a dual production line worked in practice", says Omar Rabia, Sales Manager for Products and Upgrades at FLSmidth.

Convinced by what they saw, the order for a dual process cement line was placed.

## More than expertise

"The value of our proposal was a flexible solution, the right pricing, and a proven



## A COST-EFFECTIVE SOLUTION

The conversion of RCC's existing cement line to a dual process cement line for white and grey cement included:

- installation of FLSmidth DUOFLEX® burner inside the kiln

- minor changes to the existing preheater tower

With the proposed modifications, the kiln is expected to produce approx. 2,000 tonnes white cement per day, with a heat consumption of max. 1,350 kcal/kg clinker.



## WHAT IS WHITE CEMENT?

White cement is used to add architectural and aesthetic value to cities. Based on advanced technology, cement producers can make white precast concrete for urban furniture, flooring or structural elements, but also white or coloured mortar that gives character to the facades of houses and buildings.

track-record of working on similar projects", reflects Omar Rabia.

With a target of full production capacity for white cement by end of 2018, our installation team and external partner have been hard at work.

"It's an advantage to have an equipment supplier with proven know-how of the technology used to produce white cement," says Sultan Al Dhuwaihi, Chief Projects Officer at Saudi White Company. "No one else has the same high level of know-how."

For us, know-how is more than technological expertise; it's the ability to work with the customer to find the solution that's right for them – and help them realise their ambition.

# DIGITALIZATION. WHAT'S THE BUZZ ABOUT?

Economic growth drives the need for more cement. But rising operations costs and strict government regulations put pressure on productivity. Going forward, how can cement producers increase plant performance in a sustainable way? For us, the answer is clear: Go digital.

## Tapping into new technologies

Digitalization has become a fundamental part of everyday life. And the cement industry is getting ready to take on the new technologies.

Over the past decade, we've tapped into the potential of digital technologies and found ways to integrate them into our offerings. Taking our digital ambition to the next level, we will use automation, big data, and Internet of Things to develop solutions that help customers improve productivity and generate sustainable growth.

## Putting digital data to good use

But when it comes to improving productivity, digitalization by itself isn't enough. It's how we use the data generated by digital technologies that makes a real difference. And that's where our specialists come in.

Using expert product and process know-how, they help to translate data

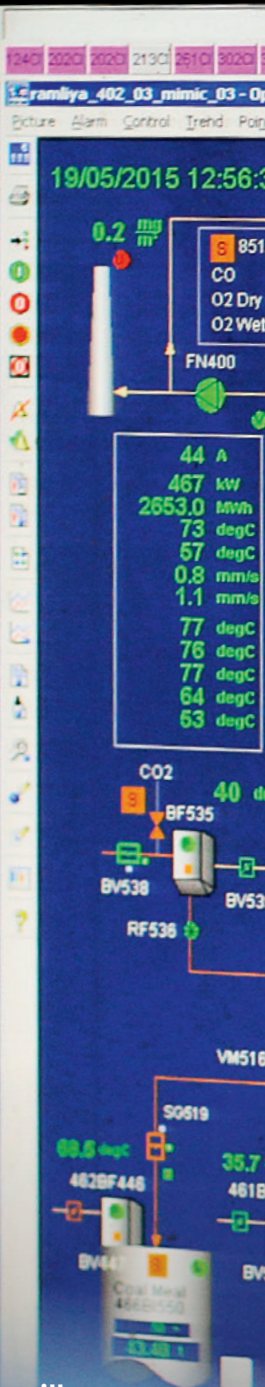


Going forward, we will continue to pair a century's worth of solid expertise with the latest technological developments."

## PER MEJNERT KRISTENSEN

EXECUTIVE VICE PRESIDENT,  
CEMENT DIVISION

into productivity enhancing solutions. Solutions that help our customers diagnose the health of their equipment, anticipate failures, predict spare parts needed, optimise processes, and improve productivity.





# GET CONNECTED TO THE ONLINE SUPPORT CENTRE

Our Online Support Centre gives customers insight into how their plant is performing. And what they need to do to optimise operations. Accurately and in real-time.

## On-site and in the cloud

One of the most effective ways of cutting costs and avoiding critical breakdowns is to make sure the plant is properly maintained, that the spare part inventory is under control, and all processes are running smoothly.

For our cement industry customers, we've developed digital platforms, designed to provide plant owners with the real-time data, assistance and support they need to monitor and optimise operations.

The Online Support Centre combines on-site technologies and systems – such as machine and plant control systems, process optimisation systems, and other IT applications – with remote services, which include condition monitoring, predictive maintenance, power and fuel optimisation, and spare parts management.

"The Online Support Centre allows us to offer services remotely," explains Claus Christian Torbøl, Senior Vice President in Operation & Maintenance at FLSmidth. "With the new digital technology at hand, we can now extract data from the systems at plant site and store it in a cloud-based solution at our regional or central centres. From here, it is exported to our digitalization platforms, where it is prepared and analysed, so that plant managers and owners can follow all important parameters related to their operation and make the necessary adjustments."

## Designed to suit your business

Through the Online Support Centre, we offer customers our expertise in technology and operations, customised to tackle their unique challenges and meet their business needs.

Customers have the flexibility to choose from a range of different services with distinct benefits. Each level of service builds on our unique digital Productivity Platform.



## THE BENEFITS OF THE PRODUCTIVITY PLATFORMS

### Plant skills are improved by

- Online access to FLSmidth's specialists
- Virtual training of site personnel
- Specialised classroom training of site personnel
- On-the-job training by our advisors

### Output is maximised by

- Structured, continuous long-term improvement of all areas of the site
- Ensured plant availability through de-bottling
- Defined KPI's, follow up and benchmarking
- Re-commissioned equipment for efficient operation

### Risks are minimised by

- Performance-based payment models
- Updated operating procedures following latest standards
- Issuing reports, work lists and shutdown lists with recommendations
- Direct operator support and guidance in challenging situations

By translating available data into sound advice and prompt action, the Online Support Centre delivers the operational excellence and higher productivity cement plant owners need to run a better and more sustainable business.

# SMOOTH OPERATIONS IN THE SAHARAN SANDS

FLSmidth has provided Online Support Centre packages to customers in the Middle East and Africa. For the Arab Union Contracting Company (AUCC), the Online Support Centre platform solved critical problems at their Libyan plant.

## Online and onsite support

FLSmidth has been cooperating with AUCC since 2008 when the company set up their first 4,200 tonnes/day production plant in Zliten, Libya. Two years later, a second 5,000 tpd. production line was added, giving the Libyan plant a total production capacity of 9,200 tpd. clinker and 9,600 tpd. cement.

After a 13-month shutdown during the Libyan civil war, the plant was successfully re-commissioned and opened in 2013. But stability did not last long. Risks and other disruptions caused further setbacks on site.

To turn this development around, the plant was connected to the Online Support Centre in Cairo, Egypt. And a team of dedicated FLSmidth specialists came on site to help the local operational management team with daily operation and maintenance and ensure the necessary supply of spare parts and production consumables.

## Solving problems

Correlating on-site experience with data generated by the Online Support Centre platforms, the two specialist teams were able to identify and solve some of the critical problems at the Zliten plant.

Data showed fluctuations in the axial movement of one of the central kilns. Logging on to the control system, the Online Support Centre specialists made the necessary adjustments. Timely interventions of this nature not only prevented costly damage to plant equipment; it could also be carried out remotely, avoiding production standstill.

The combination of on-site expertise and Online Support Centre platform services has ensured stable operations in Zliten. The data from the plant is impressive: risks have been brought down, unplanned stoppages avoided, and plant performance has increased from 99 to 105 per cent.



99% → 105%

PERFORMANCE INCREASE





# TEAMING UP TO TACKLE THE TAILINGS CHALLENGE

Scarce water resources and tailings dam failures are well-known challenges in the mining industry. Partnering with Goldcorp, we've taken a hard look at these problems. And come up with a solution that reuses up to 95 per cent of process water.

## In a nutshell

Wet tailings ponds are needed in most of today's minerals processing. But they pose two significant challenges: water consumption and the risk of dam failure. Both are important issues that have significant environmental impacts and can also affect the long-term success of the mining industry. Unless someone discovers a more sustainable solution.

We teamed up with Goldcorp – one of the world's largest gold producers – to do just that.

## A shift in paradigm

EcoTails™ represents a new way of thinking about mine waste management and water conservation. It tackles two big environmental footprints in mining operations: the tailings facility and the waste rock facility.

Using a fast filtering technology, EcoTails dewater tailings and recycles the water back into the process. It then combines the dewatered tailings with waste rock, creating a stackable Geowaste™ product, which has a smaller impact on the environment than individual waste rock and tailings. This dramatically improves the tailings and waste rock disposal process and recovers up to 95 per cent of the water used in the concentrator.

"When combined with FLSmidth's latest filter technology, EcoTails makes dry stacking on a large scale a reality," says Simon Hille, Vice President of Technical Services at Goldcorp. "It also allows for the elimination of wet tailings dams. This will ultimately make mining safer and more sustainable – without increasing the lifecycle cost. For these reasons, we believe this solution has the potential to change the way the mining industry operates."

## Tailings made sustainable

EcoTails can dramatically reduce the total footprint of a mining operation by combining two of the major footprint consumers, the tailings facility and the waste rock facility, into a single facility.

"Improving return on investment and being socially and environmentally responsible, are not mutually exclusive," says Todd Wisdom, Director of Tailings Systems at FLSmidth. "Investors today expect mining companies to do both."

For many mining companies, inefficient water management will be the challenge to overcome to meet those expectations. By reducing risks and saving more water, EcoTails offers them a new solution that's not only eco-friendly but also competitive in terms of total costs, when compared with traditional solutions.

EcoTails will also allow progressive closure of the tailings management facility (TMF). This will reduce the legacy impact of a mine on future generations. Initial tests indicate that revegetation of the GeoWaste is possible and can be practically done on an ongoing basis. The revegetated surface should be stable from erosion from rainfall and limit the production of dust from the TMF. The GeoWaste can also be placed with FLSmidth stacking equipment into natural looking landforms which mimic the surrounding landscape.

## Leading the way

To help EcoTails make a leap from innovative idea to viable solution, we are running a pre-feasibility study on the EcoTails project. We've also been testing it at Goldcorp's Peñasquito mine in northern Mexico – a place with limited water resources.



## ECOTAILS COMBINED WITH OUR FILTRATION TECHNOLOGY CAN HELP MINES

- Make better use of its water resources
- Store tailings more effectively
- Eliminate the risk posed by dam failures
- Reduce their environmental footprint
- Use a tailings management process that is more sustainable and can match the traditional process in costs.

"Together with FLSmidth, we want to lead the industry in terms of this type of innovation. Goldcorp has a multi-year *Towards Zero Water* water-reduction strategy, and we would like to lead the elimination of wet tailings facilities into the future. Combined with FLSmidth's filtration technology, we believe EcoTails has the potential to do just that," says Simon.

## STORIES ABOUT

# HOW WE WORK IN THE MINING INDUSTRY

TEAMING UP TO TACKLE THE TAILINGS CHALLENGE

LOOKING AT A PROBLEM FROM A DIFFERENT ANGLE

DIGITAL PACKAGE FOR PROCESS CONTROL OF SAG MILLS

AN EXTERNAL PARTNER WITH AN INSIDER'S VIEW





**We asked ourselves what was the better way of solving this problem. And we came up with the solution of installing two EIMCO® Deep Cone® Paste Thickeners. And setting up a pilot thickener.”**

**WALTER GAMERO**

SENIOR PROCESS ENGINEER,  
FLSMIDTH PERU



**The one sound operators do not want to hear is the sound of the mills standing still.”**

**JACK MEEGAN**

GLOBAL PRODUCT LINE MANAGER  
FOR MILL LINERS

## LOOKING AT A PROBLEM FROM A DIFFERENT ANGLE

A fresh approach from a team of savvy engineers helped the Volcan Compañía Minera processing plant improve productivity and save precious time and money.

Things were not running according to plan at Volcan Compañía Minera's new processing plant in Cerro de Pasco. The plant had a production capacity of 2,500 tonnes of gold and silver oxide per day but the total output was only 900-1,200 tonnes/day.

**Different, but better**

A team of FLSmidth engineers went to visit Cerro de Pasco to have a closer look at the processing plant.

“Together with the customer, we ran a series of tests at the plant”, says Walter Gamero, Senior Process Engineer at FLSmidth in Peru.” The team discovered that production could be improved if the technology was changed from filtration to thickening.

“After 20 days of testing, we found that tonnage would be increased using two of our EIMCO® Deep Cone® Paste Thickeners. This is a cost and time effective solution to solve the customer's production challenge”, says Walter.

**2,500**  
TONNES/DAY

After only a week, the Volcan oxide plant was able to exceed its original capacity of 2,500 tonnes/day.

Volcan's engineering team was invited to FLSmidth's minerals technology centre in Salt Lake City to learn more about the technical aspects of the thickening technology. Based on what they had seen, Volcan awarded FLSmidth the contract to supply the processing equipment needed.

**Back on track**

Working closely with the customer, FLSmidth's team managed to complete the installation in just six months. After only a week, the Volcan oxide plant was able to exceed its original capacity of 2,500 tonnes/day.

A bottleneck was solved and productivity soared. Thanks to clever thinking and close collaboration. “Sometimes you just need to take a step back and look at the problem from a different angle,” reflects Walter.

## DIGITAL PACKAGE FOR PROCESS CONTROL OF SAG MILLS

Operating a SAG mill is a costly and challenging task. Protecting mill liners from damage to keep repairs and shutdowns to a minimum, is key. Our digital solution, SAGwise™ total process control helps plant operators do just that.

For decades, experienced plant operators have depended on their fine-tuned skills for listening to the SAG mill load. They listen out for undesirable steel-on-steel impacts. And if they hear such impacts they manually adjust the SAG mill operation to reduce the undesirable impacts inside the mill, protecting the mill liners from breaking, while avoiding wasting large amounts of energy.

Mill loading is key to running the mill more efficiently and at lower expense. If a load is too full, inefficient ore reduction leads to high energy consumption. If the load is too low, critical impacts damage grinding media and mill liners, threatening downtime, which is the most inefficient thing of all for a processing plant, costing hundreds of thousands of dollars each hour.

What if one could harness the manual skills of the operators in a digital solution? Thanks to clever combination of sensors and advanced process control technologies, that's now possible.

**SAGwise™ total process control**

Our new digital process-control optimisation package, SAGwise total process control, uses acoustic sensors close to the SAG mill load listening for undesirable, high-energy critical impacts inside the mill. And it uses proprietary software to predict and adjust the SAG mill operation according to impacts on the mill and other main process parameters, such as mill power and mill load.

“Within seconds, SAGwise has analysed the audio frequencies as well as taken on board power usage, mill weight, and bearing pressure,” explains King Becerra, Global Product Line Manager for Automation Process Optimisation at FLSmidth. “It can then automatically take corrective action if needed and adjust parameters such as the mill ore feed rate, mill speed, or water usage.”

**Reducing mill liners damage and downtime**

While an operator may make adjustments every few minutes, SAGwise can make less drastic adjustments more frequently and in matter of seconds. Our tests show that these adjustments reduce damage to mill liners by up to 40 per cent – which means less unscheduled downtime.

The productivity figures from the test results showed a decrease in energy consumption of 6 per cent, a 6 per cent production increase and a reduced process variability by up to 30 per cent. Given that mills are the largest power consumer in minerals processing, this is a significant achievement.

Going digital on process control and optimisation clearly delivers what modern mills are looking for: productivity that's both reliable and sustainable.



# AN EXTERNAL PARTNER WITH AN INSIDER'S VIEW

When FLSmith signed a service and maintenance contract with Antofagasta Minerals 17 years ago, a partnership was formed. One that has ensured smooth operations and consistent productivity at one of the world's largest copper mines ever since.



### Onsite and in the know

In a cool, dry valley in the Salamanca district in central Chile, you find one of the world's biggest copper deposits: Los Pelambres.

At 3,100 metres above sea level, this is the workplace of more than 5,000 people. 250 of these are FLSmith employees. For more than 17 years, we've had a team on site in charge of process performance and maintenance of the concentrator plant.

### An insider's view

The team plays a key role keeping productivity high at Pelambres. "We propose maintenance improvements, recruit specialist engineers, order spare parts, and schedule the maintenance programme", explains Francisco Gonzalez, Manager of Maintenance Services at FLSmith Chile.

Over the years, the team has helped to lower operational costs at the plant. "We've reduced the number of parts required, minimised points of failure, and

not least provided continuity for employment of local workers," says Francisco.

### Building local know-how and trust

Almost one-third of the team's base staff comes from the local villages and have been hired and trained for the job. "Trust is decisive here," says Francisco. "We have a very strong local engagement. Some of our workers have been with us since the very beginning. And we've had no strikes in 17 years!" In an industry where strikes are frequent and very costly, this is a remarkable track record, testifying team loyalty and good leadership.

Investing in local workforce and building know-how over time has clearly paid off at Los Pelambres. This well-oiled team has managed to streamline maintenance operations, minimise shutdowns, and save costs – ensuring smooth operations and a significant increase in productivity.



### HIDDEN TREASURES

The Los Pelambres copper mine was discovered back in 1920. It's located 200 km north of Santiago and 45 km east of Salamanca along an agricultural valley with more than 40 communities. The valley is bursting with buried treasures. Apart from large copper reserves, the soil holds significant stores of bornite, chalcocite, chalcopyrite, and covellite.

## THROUGH DEEP INSIGHT AND CONTINUITY OF A PARTNERSHIP, THE ONSITE FLSMIDTH TEAM HAS



Reduced operational costs by a significant percentage since 2000



Reduced the number of pieces needed for the SAG mill by 30%



Increased availability of the SAG mill which means more production



Minimised points of failure; and increased the power available for grinding by using lighter material liners



OUR PEOPLE

# UNLOCKING POTENTIAL

We create a work environment that gives people the opportunity to put their curiosity to play – to seek new solutions and new ways of working.



**At FLSmidth, our people are our most important resource. They are the reason we can aspire to make a difference.**

**F**or more than 130 years, colleagues from across the organisation have done just that – delivering pioneering projects, products, and services to customers to help them run a profitable and sustainable business.

These solutions have all come about because clever and curious minds have worked together, driven by the dedication to discover better ways of doing things.

#### **Strong values and the freedom to explore**

The curiosity and dedication of our people rely on a strong culture. “Our values of competence, cooperation, and responsibility are the common ground we all share, irrespective of our

role, function, or geography,” explains Carsten Riisberg Lund, Managing Director & Country Head, FLSmidth India.

To nurture innovative thinking and help curiosity grow, we’re committed to help colleagues in our team realise their potential. That’s how we develop the next generation of leaders, innovators and pioneers.

We don’t have the answers to all the challenges that face the industries, let alone those that lie ahead. But by giving people the freedom to explore new territory and put their curiosity to play, we believe they will find them. And that, for us, is what discovering potential is all about. For the individual and for our business.



# LEADING THROUGH DIVERSITY

Our flagship training programme, Flying More Flags focuses on building our next generation of leaders.

Created in collaboration with Henley Business School, the Flying More Flags leadership programme gathers colleagues from across the organisation to enable different styles and skills to solve complex problems and achieve our ambitions.

Strengthening our leadership pipeline, the programme is designed for colleagues who aspire to take on, and show the potential for, senior management roles. Participants learn about strategy, finance and marketing. More importantly, they learn from each other.

Building on the success of the Flying the Flag programme, previously conducted for top

leaders, three sessions of Flying More Flags have been delivered in 2017, and the programme will continue into 2018.

“To me, Flying More Flags was a revelation on how to use differences to my advantage,” says Chris Toomey, Market Manager, Minerals Division and a Flying More Flags participant. “It taught me to view differences in cultures, personalities, and skills as a positive trait. One that offered us diversity of thoughts, perspectives, and expertise. It also gave me the tools to turn this diversity into a, collective strategy that delivered great results.”



## OUR FLAGSHIP TRAINING PROGRAMMES INCLUDE

- **Leadership Transition Training** – to help our leaders build the skill sets they need to lead successfully at different organisation levels
- **Flying More Flags** – to strengthen our leadership pipeline with high potential talent
- **Specialist Transition Training** – to help specialists broaden their expertise by strengthening their behavioural competences
- **Accountability Accelerator** – to foster transparency and strengthen our culture of accountability
- **Making the Matrix Work** – to give leaders and specialists in matrix organisations the tools to maximise their performance

# BUILDING CONNECTIONS, BOOSTING KNOW-HOW

Specialist Transition Training is our programme for specialists, focused on building a global network of knowledge.

Our business relies on the unique expertise and dedication that specialists all over the world bring to their job. To help them connect with each other and to broaden the scope of their expertise, we offer the Specialist Transition Training programme.

The programme encourages our specialists to challenge the way they work; to learn from each other; and to work across areas of specialisation. It helps them build behavioural competencies in areas like work values, time application, and change leadership. And it encourages them to adopt a more global, collaborative mind-set.

“During the Specialist Transition Training programme, I had the chance to meet specialists from across the company. We discussed challenges and shared our experiences,” explains Mads Mikkelsen, Global Chief Engineer Belt Conveyors, Cement and Specialist Transition Training participant.

“When I got back from the programme, I had a problem to solve. I had to find an effective way of using a variable frequency drive on the motors – one that would make a slow start up of the belt conveyor possible. So I reached out to Carsten, whom I met during the programme. Carsten is the Global Chief Engineer for Motors and Drives, and I knew he would be able to help. We worked together and came up with a solution that streamlines integration of the variable frequency drive between the mechanical and electrical departments and helps cut costs.”



**I had the chance to meet specialists from across the company. We discussed challenges and shared our experiences.”**

**MADS MIKKELSEN**

GLOBAL CHIEF ENGINEER BELT CONVEYORS, CEMENT

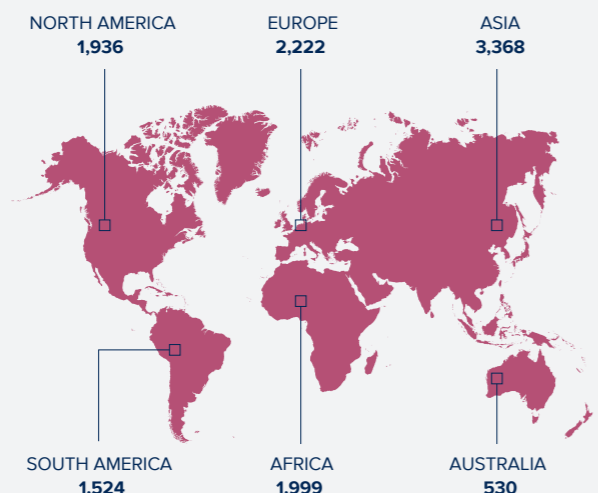
## PEOPLE FACTS

### BY AGE

**53%**

of FLSmidth's employees were below the age of 40 at the end of 2017

### BY REGION



### BY SENIORITY

**79%**

of the employees have more than 2 years' seniority




# WE DISCOVER POTENTIAL

## **FLSmith A/S**

Vigerslev Allé 77  
DK-2500 Valby  
Copenhagen

Tel +45 3618 1000  
E-mail [info@flsmidth.com](mailto:info@flsmidth.com)  
Web [www.flsmidth.com](http://www.flsmidth.com)

 [flsmidth.com/linkedin](https://www.flsmidth.com/linkedin)

 [flsmidth.com/twitter](https://www.flsmidth.com/twitter)

 [flsmidth.com/facebook](https://www.flsmidth.com/facebook)

 [flsmidth.com/instagram](https://www.flsmidth.com/instagram)

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