

# The Magazine

for the mining and cement industries

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**Digitalization is key – industry trends and challenges**

**Mining**  
The next generation of direct drives

**Cement**  
A holistic approach for cement plants



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## Success is a matter of drive and partnership

Over the last three years in the mining industry, we have seen substantial changes – from the all-time high prices of gold, copper, and iron ore in 2011 to the historic lows of today's commodity prices. When asked when the market will recover, experts are hesitant to make precise predictions – but as Deloitte's 2016 trend outlook for mining suggests, we may not be there yet. Instead of hoping for the best, operators, engineering companies, and equipment suppliers should focus on exploiting synergies and optimization potential in order to remain competitive in an increasingly challenging and volatile market.

Digitalization can provide several levers for this. From improved asset management to smart sourcing and efficient global collaboration, software and data can help companies streamline their processes. For example, simulation tools can help increase the output of existing equipment, such as gearless drives (see page 18). Another area for operational improvement is energy efficiency. As mining operations expand and the grades that can be mined deteriorate, the amount of material that needs to be transported and the transport distances increase – resulting in higher emissions and costs. Our experts have devised several solutions that address this issue, for example, energy-storage systems for small trucks (see page 14) and an efficient drive solution for a new pipe conveyor system for open-pit mining (see page 16).

As a trusted partner to the mining and cement industries, we support operational excellence first and foremost with our proven products, systems, and solutions for electrification and automation: robust, reliable, and efficient integrated drive systems and integrated automation solutions that provide both the control and the data needed to optimize operations, including sourcing and maintenance. These solutions are complemented by our digitalization portfolio. Tools such as Comos for integrated engineering and highly-efficient operations can help streamline the design and implementation of new projects, and our operations intelligence software XHQ can help operators collate and assess data from various sources for informed decision making.

With this issue of our customer magazine, we want to provide you with some insights into how companies can improve their operations with our solutions. For a more detailed and hands-on experience of our products, systems, and services, come visit us at the BAUMA 2016 exhibition (booth 325 in hall C2) in Munich, April 11–17. We look forward to seeing you there!

Kind regards,

A handwritten signature in blue ink, appearing to read "Mikael Leksell".

Mikael Leksell,

CEO, Process Industries and Drives - Process Solutions

## Imprint

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## Order from B2Gold, Canada

# Siemens supplies drive systems for two gold mills

Siemens project partner FLSmidth was commissioned by Canadian gold producer B2Gold at the end of 2015 to supply two mills for grinding the ore in its new plant in Mali. FLSmidth will be supplying a semi-autogenous grinding (SAG) mill as well as a ball mill. Both mills will be equipped with Siemens Integrated Drive Systems that will help B2Gold reduce its capital investment and save up to 50% on spare parts.

By using converter technology for regulating the rated speed of the SAG mill motors so that the four large Flender gears all work with the same transmission ratio, both mill types can operate with the same gear size and design. This reduces capital investment for the mechanical drives by 17% and spare parts costs by up to 50%.

The SAG mill is driven by two 7,500-kW, air-cooled asynchronous motors from the Simotics HV series; oil-filled drive isolation transformers; and two water-cooled Sinamics GM150 frequency converters. For the dual-pinion ball mill, Siemens USA is supplying two 5,250-kW slip-ring motors, liquid starters, and the frozen charge protection package. The gears, couplings, and lubrication units for the two mills will be supplied by Siemens Flender in Illinois. The frozen charge protection function developed by Siemens protects mills during start-up by ensuring that the charge that has become firmly attached to the mill wall does not detach rapidly and damage the mill. Different operating modes of the mills, such as controlled ramp-up, load balancing, creeping, and inching, all serve to reduce the load on the mechanical components, significantly extending the service life and preventing damage. Additionally, a controlled load balancing function is provided to help minimize mill downtime.



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## Mining technology

# thyssenkrupp Industrial Solutions and Siemens continue partnership

thyssenkrupp Industrial Solutions and Siemens have extended their successful collaboration for mining conveying system solutions for another five years, which ensures that the mining industry will continue to profit from innovative and reliable transport systems and solutions.

The mining industry is faced with falling grades and new mines in remote locations, both leading to the need to transport more material over longer distances. "Conveying technology must keep up with the complex requirements of the modern mining industry. We want to continue offering our customers reliable and highly-efficient conveyor systems," says Jens Michael Wegmann, Chairman of the Management Board of the Industrial Solutions business area of thyssenkrupp. "It is only possible to optimize modern mechatronic belt drive systems like this by working in close collaboration with a partner because the mechanics and the motor form a self-contained unit. That's why we are continuing the tried and tested collaboration with Siemens," Wegmann continues.

In mining, robust, reliable, and easy-maintenance drive technology is a key component of conveyor systems. "We are happy to be able to keep on supporting thyssenkrupp with our well-proven direct drive systems featuring Sinamics cycloconverters and rugged synchronous motors that have undergone continuous development in recent years," says Jürgen Brandes, CEO, Siemens Process Industries and Drives. Both

thyssenkrupp and Siemens have many years of experience in mining and lead the sector in their respective technological fields. The two companies have successfully implemented a number of joint projects in recent years. thyssenkrupp provided the conveyor system for Xstrata Copper in the Antapaccay and Las Bambas copper mines in Peru, for example. And Siemens provided thyssenkrupp with the direct drive for the world's largest conveyor belt. The belt conveyor system is being erected in the Peruvian Cuajone mine belonging to the Mexican Southern Copper Corporation mining company.

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Jürgen Brandes (left), CEO Siemens Process Industries and Drives, and Jens Michael Wegmann, Chairman of the Management Board of thyssenkrupp Industrial Solutions, after signing the contract

## CESA Cement Engineering SA

# Successful collaboration based on a trusted partnership



Together with the well-established engineering service provider and Siemens Solution Partner CESA Cement Engineering SA, renowned for excellence in engineering and consultancy services for industrial, mining, and cement plant projects, from feasibility

studies to commissioning to start-up, Siemens has recently successfully implemented several international cement projects, meeting tight schedules and overcoming challenging conditions.

One particular project to benefit from the smooth cooperation between Siemens and CESA is NOCIBE, owned by Les Ciments du Sahel, currently the largest cement plant in Benin. But CESA and Siemens also collaborated on a new CMS Cement plant in Kuching, Malaysia, and a new cement factory for Germany's Schwenk Group in Ohorongo, Namibia. In every case CESA served as a very reliable consultant and engineering services provider to the end customer, and Siemens is looking forward to future projects with CESA Cement Engineering.

[↗ siemens.com/cement](http://siemens.com/cement)

# Digitalization is key

From tumbling commodity prices and declining global demand to growing safety and security risks, the global mining industry faces major challenges as well as mounting stakeholder expectations. In order to stay competitive, companies must become leaner, stronger, and more innovative. Digitalization is key to achieving these goals.



The main elements of competitiveness are productivity and operational excellence. This reality has not changed over the centuries. What has changed, however, are the possibilities modern technology offers – especially to those who are open to rethinking the entire mining process. In this context, digitalization plays a crucial role.

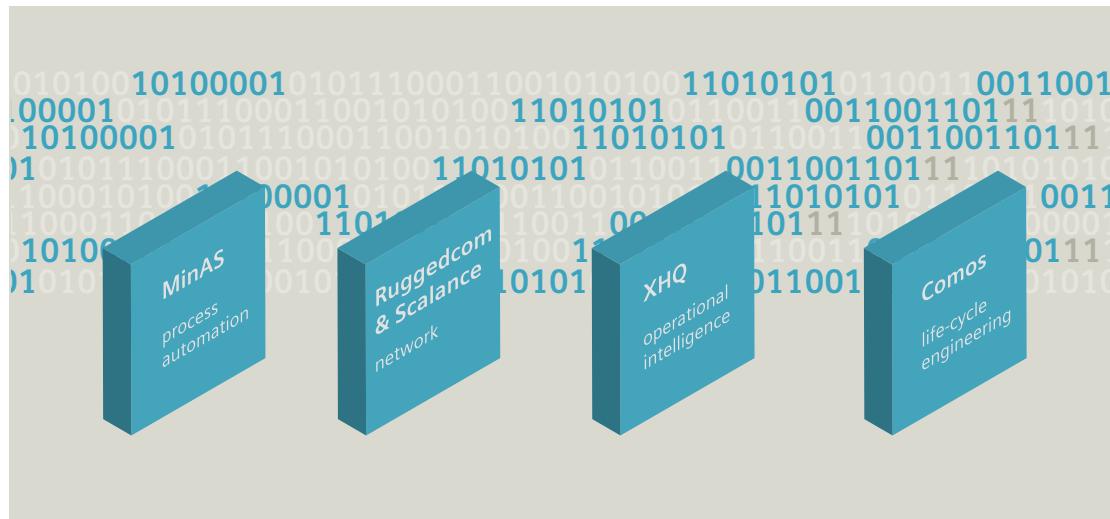
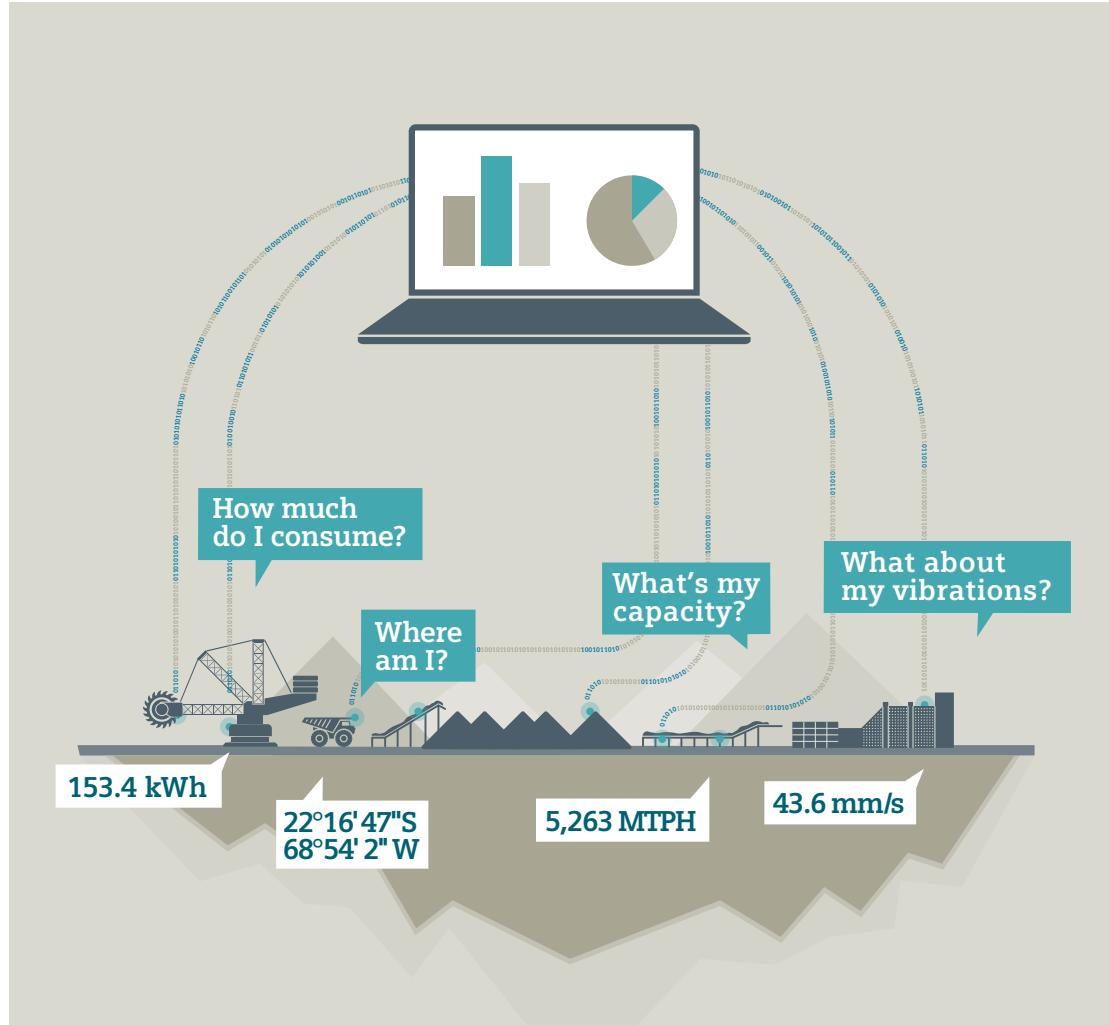
#### Operational excellence today

In the past, enhancing operational excellence in the mining industry often meant nothing more than simply cutting costs. But now, modern technology is opening up new ways to achieve breakthroughs in productivity. Leading mining companies all over the world are continually investing in state-of-the-art automation, energy, and drill-

ing systems in order to increase mining intensity with lower personnel and energy costs. Some companies are able to achieve energy savings of 10% to 40% through renewable energy installations, innovative energy technologies, and highly automated mining processes.

Advanced distributed control systems (DCSs), such as Simatic PCS 7, are critical here. The open, flexible, and scalable architecture of PCS 7 ensures maximum productivity and reliability. Thanks to its integration with safety, industrial security, and energy management systems, it helps protect personnel, machinery, and the environment – and lays the foundation for the digital enterprise. Its integrated Advanced Process Library (APL) provides the best

&gt;





route to higher efficiency in operation and engineering. In addition, Siemens has released the Minerals Automation Standard, a tailor-made solution that is designed to meet all mining requirements and that ensures the highest levels of efficiency and reliability.

#### **On track to support the future energy mix**

As the global energy mix shifts and technology advances, companies in the mining sector can benefit from emerging opportunities to control their energy costs. The sector's best

*Some companies are able to achieve energy savings of*

# **10% to 40%**

*through renewable energy installations, innovative energy technologies, and highly automated mining processes.*

partner in pursuing these opportunities is Siemens – for example, through the substitution of thermal coal with renewables, or through the identification of energy savings potential with Simatic B.Data. This holistic and proven state-of-the-art energy management solution covers all relevant business areas, from purchasing to controlling, and thereby ensures efficient energy and cost controlling. Innovative Siemens solutions also contribute to maximum vehicle operating efficiency, which minimizes the cost per ton

#### **Virtual team, real benefits**

Anglo American Platinum Limited is the world's leading primary producer of platinum group metals and accounts for about 40% of the world's newly mined platinum. Anglo American mining operations consist of managed mines, joint-venture mines, and associate mines across South Africa and in Zimbabwe.

Recently, Anglo American contracted Siemens to migrate the company's piping and instrumentation diagrams (P&IDs) and process flow diagrams (PFDs) into Comos. For this project, Siemens chose a virtual team approach in which the Siemens engineers in India worked with the teams of the project owner in South Africa using the working layer of Comos. This reduced travel expenses and ensured efficient and timely project execution. With Comos, Anglo American benefits from a consistent database for its P&IDs and PFDs that always reflects the as-is state, facilitating maintenance and process improvements.

of hauled material by improving overall system efficiency and reducing maintenance. A good example of this technology is an onboard energy storage system that allows for the reuse of stored regenerative energy at low-efficiency operating points. This significantly reduces emissions.

#### **Driven to perform**

Implementing innovations in the mining industry always demands a certain degree of openness, as innovation goes hand in hand with a change in tradition and culture. Today it is no longer enough to optimize existing equipment and possibly outdated technology. Any mining company striving for better and more economical extraction must embrace innovation. Many of today's game-changing technologies are highly automated or even entirely autonomous. The spectrum includes robotic and GPS-supported mining systems, as well as autonomous rail systems, among others. With its expertise in >



## XHQ Operations Intelligence in mining

XHQ Operations Intelligence solutions deliver real-time, actionable views based on real-time operational and business data. In mining operations, there are several areas in which this can help improve operations:

- Real-time energy management using both leading and lagging indicators helps reduce energy consumption and costs, provides faster access to critical information for planning and production tuning, and enables the exploitation of opportunities to capitalize on energy spot market price fluctuations for buy/sell.
- Integrated equipment monitoring for fixed (rock crushers, conveyors, etc.) and mobile (excavators, bucket wheels, draglines, haulers, etc.) assets helps reduce incidents and equipment downtime and facilitates maintenance.
- Asset management dashboards help companies improve reliability, plan and control maintenance budgets, and manage assets by exception.
- An equipment and work order browser solution can bridge the gap between engineering and maintenance information systems and processes, improve work processes, and reduce equipment lifecycle costs.
- Fleet management enables real-time oversight of mobile equipment, enhances site safety by reducing incident risk, and enables faster access to information for incident prevention and remediation.
- Real-time performance management provides a global data aggregation and presentation context for fast access to critical information for decision making and a reduced risk of operational incidents and losses.

automation and robotics, Siemens can help deploy these technologies in mining.

Another innovation issue that must be addressed is improving asset management so that it can help mining companies look past tomorrow. Enhanced asset management is key for the implementation of smart repair and maintenance strategies – and therefore contributes to maximum availability and productivity with minimum effort. Among the most valuable assets in the mining industry are the drive systems. They must meet ever rising demands in extraction, transportation, and beneficiation. Gear-

less drives; perfect interaction between sensors, IT, and mechanics; and intelligent service strategies are key here – and with Siemens, mining companies always benefit from cutting-edge technology. Siemens offers the world's first true one-stop solution for entire drivetrains, setting new standards with Integrated Drive Systems (IDS). IDS ensure perfect interaction of all components, reduced engineering effort, maximum investment security, and lower operating costs.

Digitalization also paves the way for enhanced efficiency in employees' daily routines by providing the right information to the right per-



son at the right time. With its unified data platform, the Comos engineering and collaboration software provides all involved parties with a continuous flow of data that meets their specific needs across all project phases.

#### **Data. Mining. Industrie 4.0**

With global trends such as digitalization and Industrie 4.0 becoming more and more relevant to the mining industry, companies need solutions that not only collect and visualize operational data but also manage them across different sites. The good news is that today's systems already offer most of the functionality that is needed: they make it possible to share valuable experience and insights with other sites via a seamless data transfer – and thereby not only help solve problems but also allow for company-wide process and plant performance comparison and optimization. ■

*Innovative Siemens solutions also contribute to maximum vehicle operating efficiency, which minimizes the cost per ton of hauled material by improving overall system efficiency and reducing maintenance.*

# The next generation

Declining ore grades, leading to increased material transport and plant throughput requirements, are one of the major challenges in the current mining environment. With direct conveyor drive systems, mining operators can surpass the mechanical limits of conventional drive systems and benefit from economies of scale – as demonstrated in several projects in South America.



A direct conveyor drive system comprises a low-speed synchronous motor, a cycloconverter or voltage source converter, drive control, power distribution, an E-House, and a cooling system. Eliminating various components of the drivetrain reduces maintenance effort and spare parts inventories and allows the system to offer uniquely high availability. Even in challenging applications, direct conveyor drives can achieve a benchmark availability of more than 99% – as confirmed by real-world data from the Antapaccay mine in Peru. There, the belt system transports approximately 5,260 tons of ore per hour from the mine to the processing plant over a distance of around 6.5 km. The Siemens drive system for the belt conveyor consists of two low-speed synchronous motors, each with a power rating of 3,800 kW, and the associated Sinamics SL150 cycloconverters, E-House, cooling system, and convertor transformers.

## Triple challenge

In 2015, Siemens commissioned direct conveyor drive systems for two additional copper mines. One was for one of the largest copper mines in the world, which is located in Chile (5 x 5,000 kW). For the over-

Las Bambas mine, located at 4,000 m in the Peruvian Andes

# *»Siemens provided solid support during construction, precommissioning, and commissioning. As a result we were able to complete the overland conveyor commissioning very quickly – in just under two months. This was a fantastic achievement.«*

Peter Mizera

General Manager for Project Delivery, MMG

land conveyor provided by thyssenkrupp with a length of more than 10 km, Siemens supplied five direct drive systems (for a total of four conveyors) with the largest conveyor motors in operation at present.

The overland conveyors at Las Bambas copper mine in Peru were designed and supplied by thyssenkrupp and have been in operation since the fall of 2015. Each of the two overland conveyors is approximately 2.5 km long with a lift of almost 300 m and transports ore from the mine to the processing plant. The belts are 1,830 mm wide, travel at 6.5 m per second, and are designed to transport approximately 9,400 tons of material per hour. The stockpile at the end of the conveyor system is more than 50 m high and can supply the processing plant with up to three days' worth of copper ore for processing. The drive system for each of the two overland conveyors comprises two low-speed synchronous motors – each with a total power of 4,400 kW – and the associated Sinamics SL150 cycloconverters.

## **Smooth execution and start-up**

The overland conveyors at Las Bambas were commissioned very quickly and the conveyor system is now in operation. "The project has been very successful and we are running the conveyors at nominal capacity with few issues. The gear-

less drives are beneficial from a service point of view, given that there are no motor bearings or gearboxes, which simplifies ongoing maintenance requirements," says Timothy Mess, project director at thyssenkrupp. Peter Mizera, MMG's general manager for Las Bambas project delivery, shares this positive view of the project outcome: "Las Bambas has been a great success, and Siemens was a large contributor to this outcome. Siemens provided solid support during construction, precommissioning, and commissioning, and as a result we were able to complete the overland conveyor commissioning very quickly – in just under two months. This was a fantastic achievement."

## **Next project on track**

Following Las Bambas, Siemens recently supplied the world's highest-powered direct conveyor drive system to the Cuajone mine in Peru. The modernization project will entail the installation of a new gyratory crushing and conveyor system from thyssenkrupp by 2016. Siemens proposed an Integrated Drive System with direct conveyor drives to power this conveyor system, which has an output totaling 12,000 kW.

The conveyor belt system comprises three individual sections that are equipped with a total of five Integrated Drive Systems. For

the largest of the belt sections, Siemens is supplying two drive systems with an output of 6,000 kW each, comprising a low-speed synchronous motor and a Sinamics SL150 cycloconverter. The two smaller feed and discharge belts will be driven by two 500-kW low-voltage motors using Sinamics S150 converters with regenerative feedback capability and one 1,200-kW medium-voltage motor. The converters and motors as well as the gearboxes and couplings for these drives are all supplied by Siemens. The automation components and the drive and power distribution technology are provided in modular electrical rooms (E-Houses). Over the years Siemens has improved and optimized the cooling system, the modular design of the E-Houses, the power distribution, and the automation and drive control so that they are perfectly aligned with the mining industry's specific requirements.

At Cuajone, Siemens will continue the company's impressive track record of successful projects in South America – and reinforce its position as one of the leading suppliers of electrical and automation systems for the global mining industry. ■



Fitting off-road mining trucks with onboard energy storage systems can significantly improve efficiency and profitability

# A major overhaul

In the mining industry, energy efficiency and productivity are paramount. Incorporating onboard energy storage systems could generate gains in both of these areas, thereby significantly improving hauling operations.

# *The battery systems consist of standardized modules encased in robust, specially designed housings.*

A typical mining facility uses off-road mining trucks to haul materials such as coal, ore, and overburden from the pit to a stockpile where the material can be stored or processed. A conventional haul truck operates with a diesel engine, which adds considerable fuel expense to the entire mining operation.

The main objective of haul trucks is to achieve the lowest cost per ton of hauled material, which means that improving overall system efficiency and reducing maintenance for any given payload is critical. One way to improve efficiency is to fit the truck with an onboard energy storage system. These systems store regenerative energy and reuse it at low-efficiency operating points, thereby reducing fuel consumption, decreasing emissions, and increasing profitability.

## **Opportunity for improvement**

Use of diesel-electric trucks for payloads of more than 200 tons has been on the rise in recent years. And among diesel-electric trucks, the trend has been moving toward AC drive technology. Although significant improvements have been made to electric drive and control technology, the use of energy storage systems is practically nonexistent in trucks, resulting in a lost opportunity to improve fuel economy through regenerative braking and engine-idle operation.

Mining trucks have onboard diesel engines that serve as their fixed source of power. Because these engines have parasitic losses and other auxiliary loads, not all of the engine capacity is available for propulsion. This is where energy storage comes into play. A suitably configured energy storage system can store a portion of the regenerative energy and feed the auxiliary systems, making 100% of the engine capacity available for propulsion without consuming additional fuel. The speed of a truck is directly proportional to the available power; hence, if the energy storage could provide 10% additional power, the speed of the truck would increase by 10% – resulting in reduced cycle time and increased productivity.

## **Overcoming the challenges**

Mines present a unique set of challenges when it comes to the selection of suitable energy storage devices, as they are often located in remote locations

with extreme climatic conditions. In addition, mining trucks are subjected to extreme shocks and vibrations during operation, which means that any energy storage device would need to operate reliably under these conditions. Batteries offer excellent energy storage potential. Their high energy density makes them well suited to delivering power for longer durations. Advances in lithium-ion-based high-performance battery systems have made it possible for these systems to be used in a wide range of applications for public transport, commercial vehicles, and stationary storage systems, among others.

The space on the truck deck is limited, and hence system integration is very important. The modular configuration of the lithium-ion batteries allows them to be adapted to any load profile and type of installation. The battery systems consist of standardized modules encased in robust, specially designed housings. The battery-management system incorporated into these modules constantly monitors cell voltages and temperatures while balancing differences in potential. Communication takes place via a smart controller area network (CAN) interface. The battery systems offer high cycle stability and outstanding protection against thermal runaway, and their high efficiency and low maintenance translate into a very favorable cost/benefit ratio for mining operations. In addition, the systems are designed to be both intrinsically safe and environmentally friendly.

## **Increased efficiency, productivity, and sustainability**

Reducing fuel consumption in hauling trucks through the implementation of onboard energy storage systems from Siemens can have a significant impact on the efficiency, productivity, and sustainability of mining operations. This ultimately results not only in higher profits for the mining industry, but also in a cleaner and safer environment for local communities. ■

## Conveyor systems

# Pit perfect!

An open-pit mining operation involves dozens of trucks that are loaded by excavators, transport mined material over steep and sometimes unsurfaced roads out of the mine, and then return empty. This truck operation over long distances is not always efficient or economical, resulting in enormous fuel costs and CO<sub>2</sub> emissions. ContiTech, Siemens, and thyssenkrupp show that there is another way.

**I**mproving productivity of open-cast operation has been and will always be a challenge. The quality of the ore body continues to deteriorate and therefore more ore needs to be transported in the most economical way to optimize productivity. The aim is to lower the cost per ton of transported ore and improve the environmental footprint.

Typically, uncrushed ore is transported by trucks, which often leads to congestion on busy road stretches. The trucks usually travel fully loaded with ore one way to the dump or to the crusher station outside the mine and travel back to the pit empty. And the process repeats itself. The cycle can easily take up more than 30–40 minutes, depending on the depth of the pit.

In order to optimize the truck utilization, to reduce the fuel consumption, and to increase the productivity of the mine, a new transportation system, the Chevron MegaPipe conveyor has been developed.

ContiTech, Siemens, and thyssenkrupp, in a joint research and development consortium, have developed a solution that can reduce this heavy-duty traffic and the associated emissions and risks: the Chevron MegaPipe conveyor. This new continuous conveyor for bulk materials requires just one primary crushing stage in the feeding station area and sets new standards in terms of ascent capability and transport capacity.

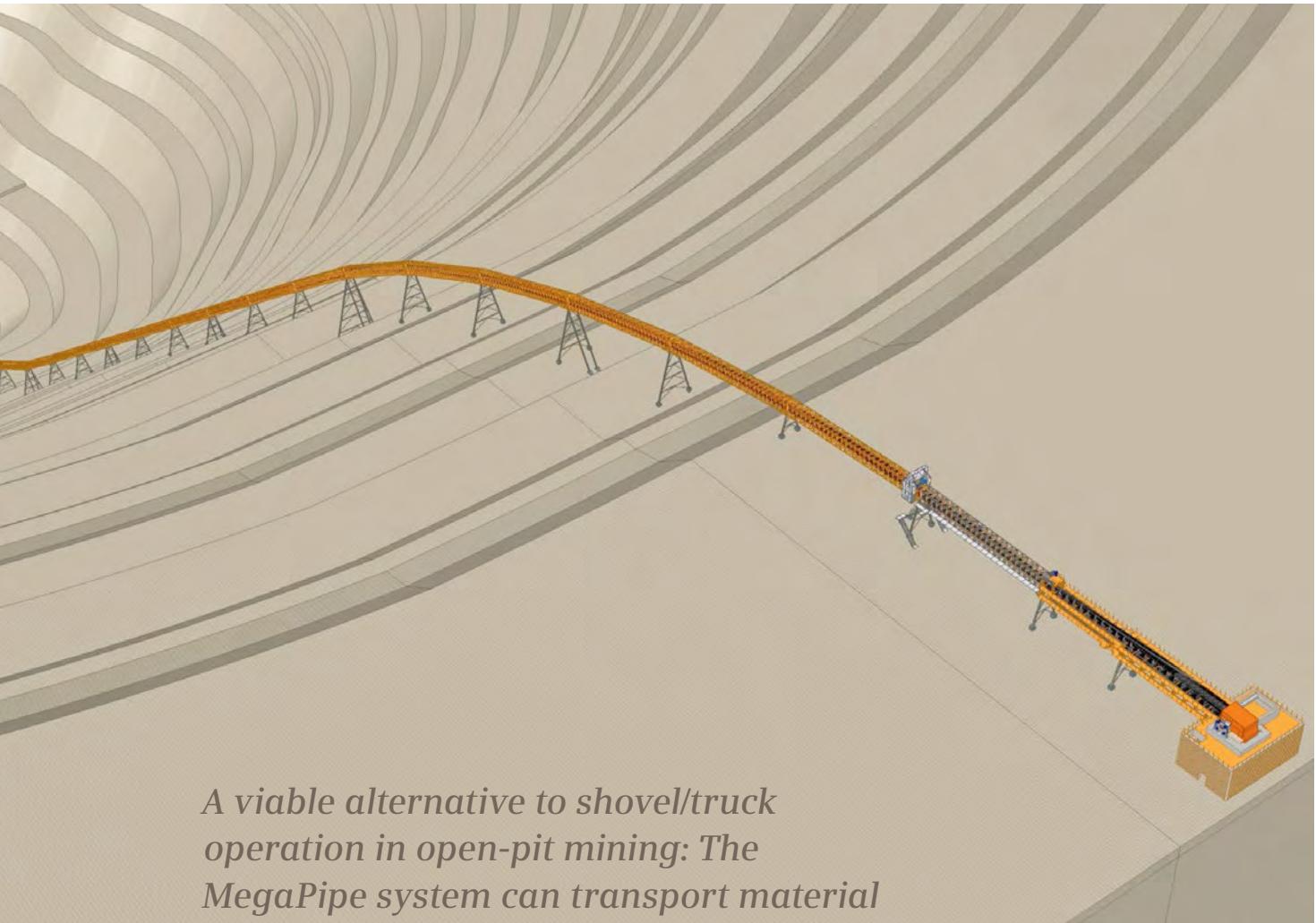
The new conveyor is a further development of traditional conveyor systems, which are already being used instead of trucks in extensive open-pit mines with general slope angles of under 30°. The conveyor system consists of a tubular belt with profiled cover plates on the carrying side. When the MegaPipe is rolled up from a troughed form into a tubular form in the material feeding area, the material in the pipe is “compressed,” which wedges the product particles together and thus increases the internal friction coefficient of the bulk materials. This compression, together with

the special profiling on the belt, enables the economical transport of large material flows over slopes with moderate incline angles and open-pit mine depths of several hundred meters, right after the primary crushing stage.

**Direct drive for high performance**  
The drive technology is another key component of the new conveyor system. About five years ago, Siemens and thyssenkrupp developed a direct drive for powerful conventional belt conveyors based on the also jointly developed Bandberg Prosper, a 3.8 km-long under-



thyssenkrupp



*A viable alternative to shovel/truck operation in open-pit mining: The MegaPipe system can transport material with grain sizes of up to 350 mm over steep slopes from 30° to 50° and over several hundred meters.*

ground conveyor system rising approximately 800 meters, installed at RAG Prosper-Haniel in 1985. Thanks to the simple and robust mechanical design, integrated drive drums, and a direct drive motor in combination with cutting-edge converter technology, as well as the proven control system, the drive solution allows large belt conveyor systems to be operated economically. The complete drivetrain, consisting of a flange for the disc brake, drum/motor bearings, and a rotor flange with rotor and stand, was designed to use just a few robust components

that can be integrated into the belt conveyor station in a space-saving, maintenance-friendly way.

#### Nonstop benefits

The consortium has now also investigated the feasibility of the MegaPipe concept and has confirmed that the conveyor system can economically transport ores and waste material with grain sizes of up to 350 mm over slopes with inclines of 30° to approximately 50°.

Alternative conveyor systems like the Chevron MegaPipe conveyor are becoming increasingly attractive in

view of the fact that in many mines around the world the ore content is diminishing, and thus an increasing amount of material needs to be transported. These systems also help mine operators overcome the logistic challenges of extracting raw materials in an environmentally friendly, efficient, and safe manner. ■

# Mining for productivity and profit

Kalumbila Minerals Ltd., a subsidiary of First Quantum Minerals Ltd., had ambitious output goals for Sentinel, its copper mine development project in northwest Zambia, and needed to recruit an entire workforce to build the infrastructure from scratch, all while minimizing costs. Siemens was happy to assist.



**H**arsh environments, rising energy costs, and water scarcity are just a few of the challenges facing the world's mines. Kalumbila Minerals was not only confronted by these challenges but also had more to grapple with when building two mines in an isolated area 150 kilometers west of Solwezi, Zambia.

#### Benefits of Siemens' gearless drive technology

- Reliability – rugged design that assures 99.5% availability
- Low cost – optimized electrical efficiency and no wear and tear
- Integrated solution – end-to-end technology and services that keep the mills running
- Minimized downtime – dedicated maintenance modes that keep performance high
- High productivity – efficiency of 95% thanks to the gearless design

The region had practically no infrastructure for transportation or energy supply, and no workforce with the skills to build one. The local population worked in farming and ranching and had no experience with large construction projects. But having committed to source at least half of its workers locally, Kalumbila Minerals needed to find and train at least 4,000 people to lay roads, weld pipes, erect pylons, and even construct a new airstrip. A further challenge was Kalumbila Minerals' ambitious production targets: 300,000 tons of copper and 38,000 tons of nickel concentrate per year within the first six years of operation. Meeting this output target would demand advanced drive technology that could power all the mining machinery around the clock with minimal downtime.

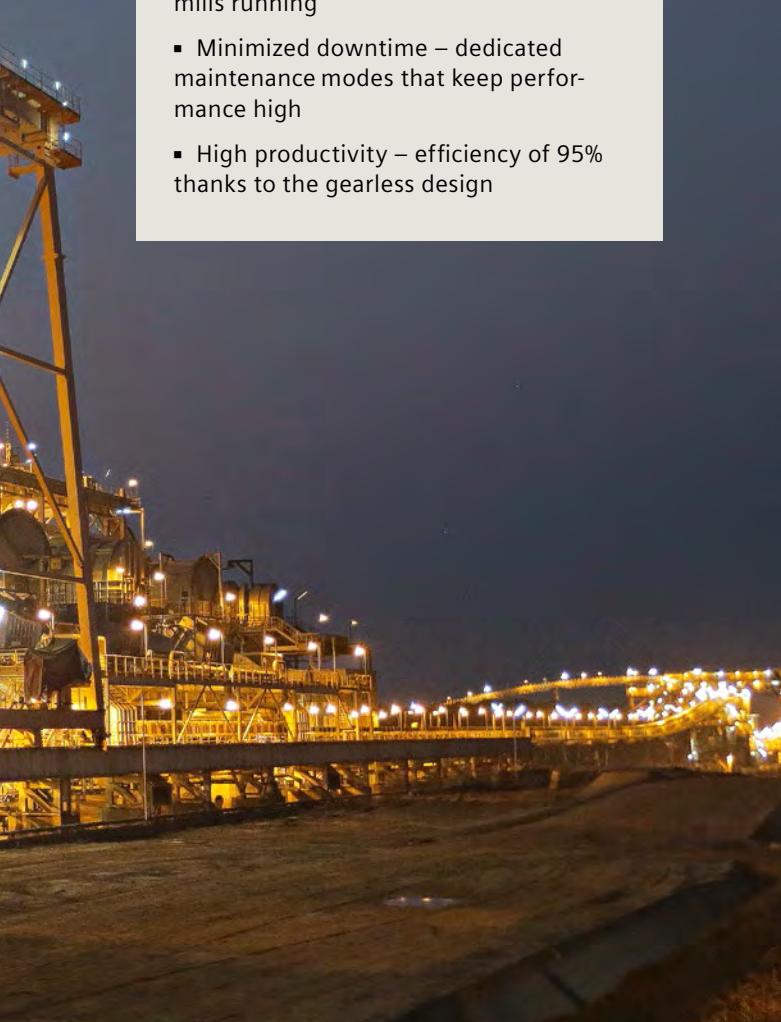
To overcome the challenges and make the project a success, Kalumbila Minerals recognized the need for a partner that could offer a comprehensive solution for both training new workers and providing high-performance integrated drives. End-to-end process optimization was the only way the company could hope to overcome its production challenges while minimizing operational and extraction costs.

"For projects involving limited local skills and complex equipment, what we look for in a technology provider is a robust product and a skilled team with the ability to transfer knowledge to our local expert teams," says Nevin Scagliotta, commissioning manager for First Quantum Minerals Projects Division. "With mills of this size, reliable and high-efficiency drives are top priority and crucial to project economics."

#### Driving recruitment and power

As a technological leader in the global mining industry, Siemens was the obvious choice to provide the advanced drive technology that would give Kalumbila Minerals the power and the cost optimization it needed. With its experience in implementing and managing large-scale mining projects all over the world, Siemens also knew what steps to take to successfully source and train the new workforce.

To fulfill its commitment of hiring 50% local staff, Kalumbila Minerals recruited 4,000 workers from the surrounding towns and hired 4,000 indirectly through on-site contractors. Siemens' project team, comprising professional engineers, seasoned assembly supervisors, and on-site start-up engineers, then transferred its expert knowledge to the local teams



The two milling trains of Kalumbila Minerals process 55 megatons of ore per year and achieve a top ranking in terms of performance and efficiency

so the mine could be running productively in the shortest possible time.

#### Rugged power and close control

With projects of this size, it is advantageous to reduce the number of supplier interfaces, and thus to have the entire drivetrain supplied by a single source. Integrated Drive Systems from Siemens offer the only true one-stop solution for drive systems worldwide.

To power the extraction of 300,000 tons of copper and 38,000 tons of nickel concentrate per year, Siemens provided the motor and drive systems for two 40-foot semi-autogenous grinding (SAG) mills powered by 28-MW gearless mill drives (GMDs) and two 28-foot ball mills powered by 22-MW GMDs.

Among the world's biggest and most powerful drives, the integrated GMDs from Siemens provide Kalumbila Minerals with the end-to-end process optimization essential to maximize efficiency and minimize cost. The drives also provide outstanding reliability due to the advantages of the gearless design. With no moving gears, there is no variance in the motor and no vibration. This vastly reduces energy loss, as all the force is transferred touch free via the magnetic field. The lack of moving parts also virtually eliminates wear and tear and the risk of downtime. In the event that maintenance is required, the drives maintain high availability thanks to their dedicated maintenance modes, such as creeping or inching with rollback of the mill.

"Torque and speed control, and especially the frozen charge protection keep the mill operating in the safe range, minimize downtime, and keep production high," says Axel Fuchs, project manager at Siemens Process Industries and Drives. "The Siemens GMD offers 28 MW and a 150% overload – no other drive is able to do that at 9.1 rpm."

The integrated drive train came along with Simatic PCS 7 and Sinamics SL150 cycloconverter technology. The Simatic PCS 7 controller for the mill drive and Kalumbila Minerals' existing distributed control system could be seamlessly integrated thanks to their common platform, while the rugged Sinamics SL150 offers exceptional overload capacity and high efficiency through direct energy transformation, which

*»Torque and speed control, and especially the frozen charge protection keep the mill operating in the safe range, minimize downtime, and keep production high.«*

Axel Fuchs,  
Project Manager at Siemens Process Industries  
and Drives



Siemens AG

results in availability of more than 99.5%.

**A proven mining partner**  
Siemens proved itself to be a trusted partner with the provision of a quality service. This included the professionalism with which its team managed the project and the engineering expertise demonstrated by its gearless drive technology. Ultimately, Siemens' know-how and experience were successful in helping Kalumbila Minerals increase the productivity of its mines while reducing costs, demonstrating why

Siemens continues to be regarded as the partner of choice for the world's global mines.

"For a critical and complex piece of equipment like the mill drives, it is vital to have a self-managing and professional vendor. This is what Siemens has provided with its gearless mill drives and the commissioning team," says Nevin Scagliotta of First Quantum Minerals. ■

# Increasing throughput the smart way

**A**fter years of operation in mining processes, mills often require higher throughput from the gearless mill drive (GMD) or even the entire concentrator. This in turn demands more power. Siemens has developed a structured study to analyze whether a power increase is feasible on preinstalled GMDs.

A power upgrade could be required, for example, if the rock hardness increases as a result of excavating at deeper levels, causing the throughput of the grinding mill to decrease. To keep the throughput constant, the power of the GMD needs to be increased.

Power can be increased by modifying the motor voltage or the current, or a combination of the two.

Every solution has specific considerations in terms of costs for replacement parts and implementation time. To accurately evaluate all the options, detailed knowledge is required regarding the GMD system (especially its most important parts – the motor itself, the transformers, and the cyclo-converter) and the relationship between the different variables.

The mechanical calculation for the motor lies at the core of the analysis: if the design of the motor does not support the power increase, the required power level cannot be achieved – not least because strengthening the motor structure on-site is complex and uneconomi-

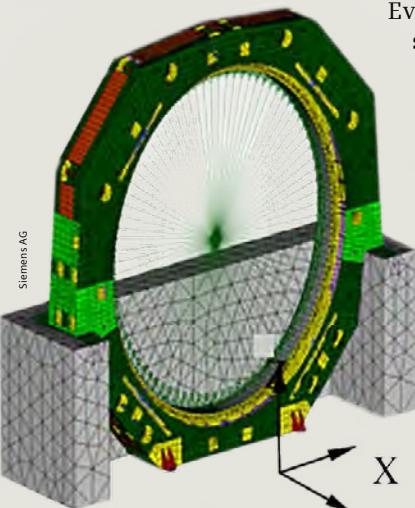
cal. The mechanical study is based on the finite element (FE) model of the motor (see illustration) and different load cases. Once the mechanical study is complete and indicates sufficient reserves, all the other components of the GMD system must then be verified.

The Siemens study structures the engineering process in consecutive steps to determine the new power level, with each step building on the results of the previous one. If a step is not completed successfully, the next one cannot begin, and the study must be restarted using a different technical solution or a lower power level.

## A rewarding investment

Together with the analysis report, Siemens provides a price indication for the necessary new equipment, as well as a draft shutdown and sequence plan for the implementation – all the information needed by the customer to evaluate whether the project offers a satisfactory return on investment (ROI).

Based on the experience of recently implemented power increase projects, the power level typically increases by approximately 10% to 15%, and the ROI can be achieved within one year or less. The combination of the comparatively low investment and short implementation time for the GMD systems offers clear advantages for the mining industry. ■



Siemens utilizes advanced modeling to assess the feasibility of a power upgrade, performing studies based on a finite element model of the GMD motor

# Steep challenge

Continuous 24/7 operation, 100% availability, and maximum energy efficiency: the requirements for the mill drive solution in a new copper concentrator project were quite a challenge for Siemens. The solution – a dual-pinion drive with an induction motor – not only hit the mark in terms of reliability and efficiency but was also implemented in a very short time.



**T**he two dual-pinion mill drives for two new 24' × 40' ball mills, each with  $2 \times 6.5$  MW ( $2 \times 8,700$  hp) power, are the first two mill drive systems using slow-speed squirrel-cage induction motors with cycloconverter technology in grinding mills, and they combine the benefits of both systems. Cycloconverters are well proven in mining, especially for ring motor (wraparound motor) applications. They are perfectly suited for mill drive applications due to the low-frequency drive, the robustness and efficiency of the thyristor technology, and the low number of semiconductors. Consequently, the solution designed by Siemens features the highly reliable components and high system robustness required by the application.

#### Integrated solution for maximum efficiency

The Siemens scope of delivery included the induction motors and the cycloconverters for variable-speed drive operation with the corresponding insulating transformers, as well as premanufactured E-Houses and 13.8-kV switchgear, perfectly coordinated with the drive, and the complete harmonic study. The water-cooled, compact, and totally enclosed IP55 motors were shipped fully factory-tested in one piece. The motors have a nominal speed of 180 rpm and a torque of 345 kNm and are equipped with sleeve bearings, including a jacking unit. The motor shaft is directly coupled to the pinion via a torque-limited coupling. The cycloconverter is an air-cooled Sinamics SL150 with a power rating of 8 MVA. For smooth operation of the two motors on a dual-pinion drive system, they are equipped with a controller that provides accurate load sharing under all working conditions. The mill technology control package also includes smooth start-stop operation modes, creeping mode for maintenance, and inching mode for positioning the mill in case of liner exchange, as well as the required frozen charge protection. The drive system is designed for an overload capability of 150% during the mill start-up and 115% continuously (1.15 service factor). The oil-cooled insulation transformers are sized according to the mill drives' requirements. To minimize installation and commissioning time, the air-cooled drives were installed and precommissioned by Siemens, including the 13.8-kV circuit breakers, in a new containerized E-House.

#### Rising to the challenge

The customer received a perfectly tuned drive system from a single source. The solution is the most robust, reliable, and energy-efficient option currently available on the market. Over the first year of commercial operation, it has demonstrated excellent reliability and performance, even running occasionally at over-rated capacity, and incurring minimal maintenance costs. ■



The solution for the Arizona copper concentrator features the world's largest dual-pinion drive systems with low-speed induction motors

#### Maximum drive reliability and efficiency for horizontal mills

Horizontal mill pinion drives are widely used in the mining industry to grind materials to a requested size. To maximize productivity and cost-effectiveness of operation, the equipment needs to operate at optimum efficiency. Carefully selected drive solutions, which are needed for speed and torque control, can improve speed control, lengthen maintenance intervals, and lower energy costs.

The benefits at a glance:

- Up to 24 MW of mill power (higher power upon request)
- Smooth mill start to minimize wear on the entire drivetrain
- High flexibility and availability at low cost
- Availability of frozen charge detection
- Excellent load sharing for twin drive systems to reduce wear and tear
- Water-free solution to preserve valuable water resources
- Suitability for installation at up to 5,000 m elevation



Nickel mining companies have been achieving significant gains in both productivity and efficiency in recent years by improving the operation of conveying and crushing systems through automation. In a typical configuration, nickel ore is loaded onto a conveyor belt, where it is uniformly distributed by a profiling gate located at the infeed. After traveling on the belt, the nickel is discharged into a surge hopper above the jaws of a crusher. The efficiency of the crusher depends on a consistent flow of material being fed into it – which in turn requires a monitoring system capable of quickly and accurately identifying process upsets.

#### Monitoring critical to process performance

When it comes to nickel production, the automation of conveying and crushing systems presents a number of challenges. First, monitoring instrumentation must be able to reliably determine the amount of material on the conveyor belt so as to establish a flow rate that is optimal for operation of the crusher.

Second, the level of the material in the crusher must be continuously monitored so that the speed of the conveyor belt can be changed accordingly. If the level of the crusher gets too low, the belt must be sped up to increase the rate of delivery of raw material. Conversely, if the level gets too high, the belt must be slowed down. The second condition is especially critical because if there is too much ore in the bin, the additional load on the jaws can strain the crusher and reduce its effectiveness.

Most importantly, the measuring devices need to be able to work together effectively to communicate these situations to the control room so that appropriate action can be taken and process upsets can be prevented.

#### Integrated solution for conveyor and crushing systems

Such an integrated solution can be easily set up using aligned systems for material weighing and level monitoring from Siemens. To meet the needs of flow rate monitoring, producers can install a Milltronics MSI belt scale, a Sitrans WS300

# Coming full circle

A powerful combination of Siemens technologies is allowing nickel producers to come full circle in terms of plant automation. And it's producing significant benefits in the process.



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A Milltronics belt scale and speed sensor on a conveyor belt moving mining material

speed sensor, and a Milltronics BW500 integrator. This solution delivers instantaneous measurement to ensure that raw material is conveyed from the infeed into the crusher at a variable rate that is based on the level of material in the crusher. The second system needed is for level measurement in the crusher. The best option in this case is a noncontacting device such as the Echomax XPS15 transducer mounted in the open air above the bin and connected to an ultrasonic level controller, for example, a Sitrans LUT420 device.

#### **Detailed process data help optimize control**

With this configuration of Siemens equipment, nickel plant installations have two systems that work

together with high and low alarms on both the crusher bin and the conveyor belt. The milliampere output of the Sitrans LUT420 acts as an analog input into the variable-frequency drive of the conveyor to control its belt speed so that when the level of raw material drops in the crusher hopper, the belt speeds up. When the level gets too high, the belt slows down.

Additionally, the onboard relays of the Sitrans LUT420 make it possible for high and low set points to activate an alarm to ensure that maintenance crews perform visual inspection and diagnose any problems. Similarly, the milliampere output of the Milltronics BW500 can monitor flow rate, as the unit has onboard relays for load-based high and low set points – allowing

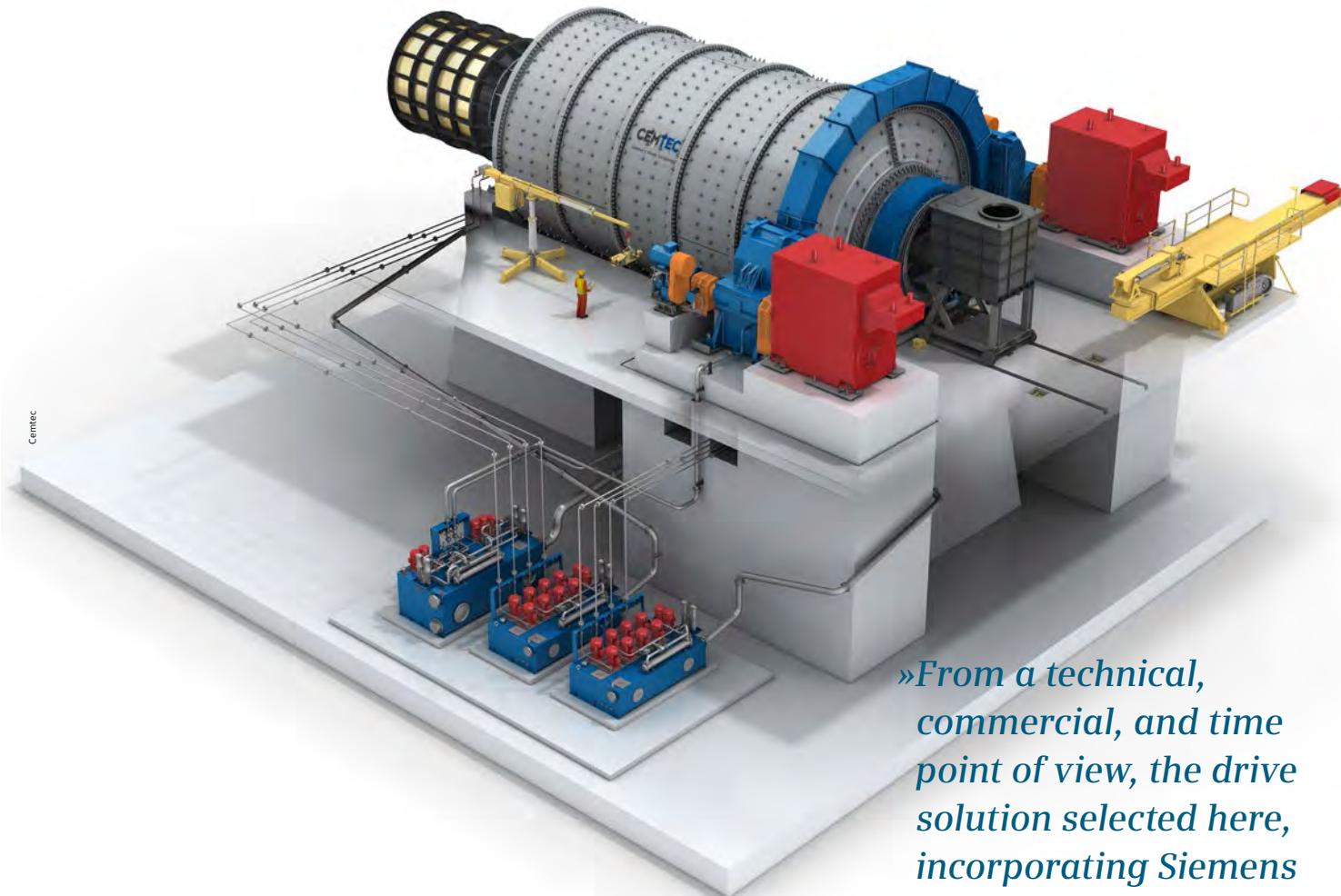
proper action to be taken in the event of feed starvation on the conveyor.

#### **Integration leads to higher efficiency and additional savings**

With an integrated solution for the crusher application, a nickel producer can come full circle in terms of plant automation. This circle begins with the removal of manual operator intervention, resulting in safer practices, improved plant efficiency, and reduced maintenance costs. The money saved can then be invested into further plant automation. ■

# Powering the gold rush

One of the world's largest mechanically driven horizontal mills has been built for a gold mine in Russia. The mill is driven by gear units designed especially for this application. Their load-sharing system transmits high power loads to the mill via a girth gear for an extremely efficient ore grinding process.



*»From a technical, commercial, and time point of view, the drive solution selected here, incorporating Siemens DMG2 gear units, was the best solution.«*

**Stefano Pellisetti**, Authorized Manager and Purchasing Director at Cemtec GmbH

**C**emtec – Cement and Mining Technology GmbH, an Austrian family-run company with some 240 employees and now managed by the second generation of the family – plans, develops, and executes projects for the cement and processing industry worldwide. One of its latest projects is the delivery of a mill system to Russia, where, following initial start-up in 2014, two gigantic mills process up to 30,000 tons of ore every day to extract gold. In only 10 months' construction time, Cemtec, together with the drive specialist Siemens, developed and built a complete solution – one that is unique in terms of its size, performance, and speed of implementation.

**High-performance technology**  
Two mills are used to grind up the ore: a semi-autogenous mill measuring 10.4 m x 6.1 m with a drive output of 15 MW, and a ball mill with a drive output of 18 MW. The first mill grinds down lumps of rock with a maximum size of 250 mm ( $F80 = 152$  mm) to 2 mm, and the second then grinds these 2 mm grains ( $F80 = 1,000$   $\mu\text{m}$ ) down to particles as small as 74  $\mu\text{m}$ . Only then can flotation take place to extract the gold. The ball mill measures 8.2 m x 14 m, and in terms of its power, which is transmitted mechanically by means of gear units, it is one of the world's largest horizontal mills, if not the largest. It is driven by two 1RR5108-6FA90-Z three-phase asynchronous motors from Siemens that feature slip ring rotors delivering an output of 9 MW each. The two motors in operating mode S1 have an efficiency of 97.2%. They are started in parallel by a liquid starter, which was also delivered by Siemens. However, the highlight of the drive technology, apart from the gigantic size of the two mills, is in fact the gear-unit technology. The semi-autogenous mill and the ball mill are each driven by two of these gear units. On a conventional drive variant, only one engagement per pinion with the girth gear is possible per side, which creates a power limit of about 8 MW per drive. With its spe-



Two gigantic mills driven by up-to-the-minute Siemens-built motors and gear-unit systems for a gold mine in Russia

cial DMG2 gear units, Siemens was able to increase this to as much as 12 MW per drive. "So the DMG2 was the right choice here," says Stefano Pellissetti, authorized manager and purchasing director at Cemtec.

#### Compact solution

One reason for the high power transmission is the self-aligning drive pinions, which guarantee an optimum contact pattern. The gear unit has an internal load-sharing system that ensures the power being transmitted is always optimally and evenly distributed between the two drive pinions, which mesh with the girth gear, thanks to the free axial movement of the intermediate shaft. The gears are case hardened and have ground flanks – the tooth quality according to DIN 3990 is at least 6 or higher. The output pinions can tilt to ensure that they are always optimally adjusted to the profile of the girth gear. Two fundamental advantages result from this dual-pinion construction: at 570 mm, the mesh width of the tooth flanks is considerably smaller than on a conventional single-pinion solution, and it does not require expensive helical gear teeth and a large-dimensioned thrust bearing. Consequently, the DMG2 is about 30% smaller than conventional gear-unit solutions.

#### Room to move

FEM (finite element method) analyses were used to optimize the gear-

unit housing – making bearing replacement on the input shaft, for example, significantly easier. In addition, wear-free labyrinth seals are used on the drive shaft. On the output side, a flexible bridge creates an oiltight connection between the housings and the girth-gear hood. An innovative oil lubrication system ensures optimum lubrication of the pinion/girth-gear connection, resulting in higher efficiency and ultimately a longer overall system service life. While a size 25.4 gear unit for the semi-autogenous mill weighs about 36 tons, a size 30 ball-mill gear unit weighs as much as 70 tons. "Here too, this very compact design has important advantages, because transporting such gigantic mill systems, along with their drive systems, is in itself an incredible challenge," explains Pellissetti. "As far as I know, there is no other solution of this magnitude operating in the mining environment."

But Cemtec is already thinking much further ahead. With the Siemens drive solutions, it could be possible to generate outputs of up to 24 MW or more in this type of application, so the productivity of future systems could be 30% higher than the current maximum output. Such a massive increase in output would be worth a mint to mining operators. ■

# Retrofits raise profits

Integrated Drive Systems are the heart of machinery and industrial plants. They have to run reliably and safely for years in harsh environments. But inevitably, wear and tear takes its toll and they need to be replaced. Retrofit for Integrated Drive Systems can avert these risks and provide significant support for maintaining reliable plant operation over the long term.

To extend the life of machines and plants and avoid the risk of unscheduled downtime, old drive systems must be replaced. But rather than representing a capital loss on the balance sheet, retrofitting an Integrated Drive System can actually pay for itself within months and boost profits for years to come. The replacement of existing drives creates the perfect opportunity to implement new energy-saving technologies that can improve efficiency and reduce costs. Siemens has been helping companies gain these benefits with its retrofit service for decades. From its enormous inventory of components and design plans, Siemens can upgrade machinery to the latest standards and thus boost performance. "Retrofits for Integrated Drive Systems are Siemens' strength," says Annett Stollberg, Siemens' retrofit product lifecycle manager. "Our approach takes the entire drivetrain into account, not just individual components, in the realization of energy savings potential."



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Drive retrofit not only helps reduce capital expenditure but also improves operations, for example by reducing energy consumption

## Individual retrofit solutions

Siemens offers a comprehensive retrofit program for both its products and those of other brands; the choices are tailored to the needs of the individual customer. The first option is 1:1 duplication of the motor: if the long-standing configuration is already delivering proven performance and low energy consumption, an identical motor can be selected from Siemens' extensive inventory. This eliminates the need for expensive requalification of new machines. The second is replacement: an economical and efficient option, with the lowest up-front investment cost, is to replace the drive with a standard product. Additional customization can then be performed in the factory or on-site. The third option is an upgrade: for the highest efficiency gains, upgrading old motors and drives to the latest cutting-edge technology from Siemens' product range can pay for itself within months through lower energy consumption and optimized processes.



Siemens offers an extensive retrofit program tailored to the needs of the individual customer

Upgrading the entire drivetrain with a fully integrated solution is a long-term investment in energy efficiency and longevity. This can include changing from fixed-speed to variable-speed operation with frequency converters, replacing DC motors with AC motors, or migrating to a gearless design. When these upgrades are combined with diagnostic capabilities, processes can be optimized to reduce energy consumption without lowering performance. "What's most important is to understand the application and the customer's requirements for the production process. In many cases we can offer a variety of solutions so customers can weigh up the differences and advantages," says Stollberg. "Once a customer has chosen a solution, Siemens then handles the entire engineering process, from planning to commissioning."

### A fan of retrofits

Hanson Purfleet now saves £175,000 a year after reducing its energy consumption by 36% following the successful retrofit of an Integrated Drive System in one of its fans. Previously the fan was powered by a fixed-speed drive, running continuously at 350,000 m<sup>3</sup>/hr but

damped to 241,000 m<sup>3</sup>/hr. This meant more than 100,000 m<sup>3</sup>/hr was being wasted, thus adding considerable unnecessary costs to the company's energy bill.

After Siemens retrofitted the fixed-speed motor, the drop in power usage was dramatic. The motor is now constantly monitored with sensors, and the airflow is regulated by a frequency converter. This system optimizes performance while ensuring that energy consumption never exceeds the operational requirements. "The Siemens solution means we are now running with the damper open 100% of the time, yet actual energy consumption has dropped by around 360–400 kW," says Hanson Purfleet electrical engineer Dave Jackson.

Along with energy savings of 36%, the company has achieved a 1,487-ton reduction in CO<sub>2</sub> emissions. The large ongoing savings on energy bills mean that the entire Integrated Drive System will pay for itself within two years, highlighting how a Siemens retrofit turns capital expenses into long-term profits. ■

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↗ [siemens.com/retrofit-ids](http://siemens.com/retrofit-ids)  
✉ [uwe\\_schulz@siemens.com](mailto:uwe_schulz@siemens.com)



### Benefits

- Greater productivity through optimized speed and process performance
- Improved flexibility, with faster run-up/run-down times
- Standardization
- Higher productivity and less maintenance
- Long-term availability of spare parts and simplified management
- Totally Integrated Automation, communication, and diagnostics
- Recovery of up-front cost through lower energy costs



# A holistic approach

In an environment characterized by tightening emissions standards and rising production costs, Cong Thanh cement plant in Vietnam benefits from a one-stop solution comprising an integrated automation and drive system from Siemens.

**V**iетnam is undergoing rapid industrialization and modernization. One of the results of this transformation has been a substantial increase in the country's demand for cement. With a capacity of 12,500 tons of clinker per day, the new production line at the Cong Thanh cement plant was built to help meet that demand. The increased capacity has made the plant one of the largest cement-production facilities in Asia.

Siemens was contracted by the Cong Thanh Cement Joint Stock Company, a subsidiary of the Cong Thanh Group, to provide all the electrical and automation infrastructure for the plant's new production line, including cabling for the medium- and low-voltage

distribution systems, switchgear units, uninterruptible power supply and battery systems, power factor compensation system, transformers, low-voltage distribution panels with intelligent motor control centers, and variable-speed drives. The scope of supply also included the majority of the process instrumentation for the plant, along with the complete distributed control system (DCS), which controls the various stages of the cement production process.

## Single-source advantages

As is the case with any production facility, high up-time and reliability are critical to the operation of the Cong Thanh cement plant. The implementation of an



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Located in the scenic hills of the province of Thahn Hao, the Cong Thanh cement plant is one of the largest single cement production lines in Asia

Integrated Drive System (IDS) from Siemens has been fundamental in achieving these goals, as it provides a single point of contact for the entire drivetrain – which consists of motors for the mill, limestone crusher, and kiln, along with gear units, frequency converters, and control systems. In addition to allowing for rapid resolution of problems in the field, which effectively minimizes downtime, having a single provider eliminates the finger-pointing that is often prevalent in multivendor engagements.

“By having a single provider, we’ve been able to reduce interface losses, resonances, and wear by means of design, engineering, and optimally matched components,” says Le Than, project manager at Cong Thanh Group. “This translates into reduced operational and maintenance costs, outstanding availability, and higher energy efficiency. It also helps facilitate purchasing and lowers warranty costs, which is something many cement manufacturers don’t always take into consideration.”

#### Optimization through integration

At the heart of the plant’s automation system is Cemat, an integrated process control system from Siemens. Cemat has been installed at more than 800 facilities worldwide and is based on Simatic PCS 7. “Cemat offers many unique features that make operation of the cement plant simpler and more efficient, such as numerous blocks and modes for advanced control functionality,” explains Amos Todt, senior project

manager at Siemens. “It also provides the capability to monitor all process components of the plant in real time, which allows operators to quickly diagnose problems and evaluate the status of various areas of their facility.”

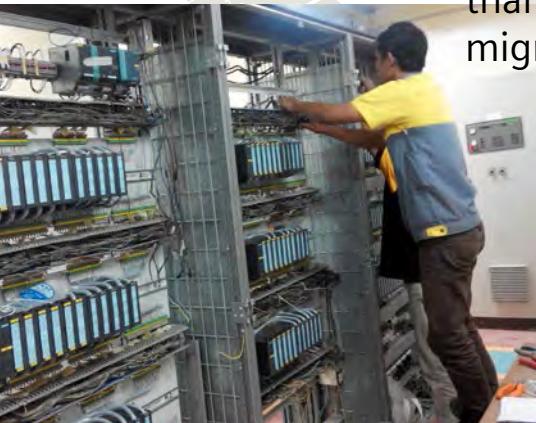
In addition to providing the framework for interconnecting drives, belt conveyors, dampers, and measuring equipment, the scalability advantages offered by Cemat and Simatic PCS 7 were a major reason for the solution’s implementation at the plant. “We needed a highly innovative DCS that could help us stay competitive over the long term,” adds Than. “Cemat not only offers great compatibility with legacy systems, but it also gives us the ability to expand the plant if needed and integrate current infrastructure with future innovations.”

#### Maximum productivity

Sourcing from a single vendor allowed the Cong Thanh cement plant to leverage automation systems beyond the cost of their implementation, according to Le Tien Dung, deputy general director of the Cong Thanh Group. “Partnering with Siemens to implement the IDS met the needs of our facility,” he says. “We’ve benefited greatly from high energy efficiency, reliability, and reduced operational and maintenance costs – in simple terms, maximum productivity.” ■

# Smart move

In Indonesia, a collaboration between long-standing partners Indocement Tunggal Prakarsa and Siemens demonstrated how cement production facilities can benefit from increased integration and process optimization thanks to a smart control system migration.



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Excellent teamwork ensures short downtime: Siemens engineers from Indonesia during the hardware installation

The cement industry is booming in Southeast Asia. Indonesia, for example, has made significant investments in new infrastructure in recent years in an effort to modernize and promote economic growth. One of the results of this effort has been an increase in the country's demand for cement. Indonesian cement producers are thus coming under increased pressure to boost output and improve operational efficiency in order to meet this demand and avoid supply shortfalls.

#### An important industry player

Indocement Tunggal Prakarsa is Indonesia's second-largest cement producer, yielding over 20 million tons of cement per year. The company was founded in 1975 and in 2001 was acquired by the German multinational giant HeidelbergCement. Indocement operates a total of 12 plants in Indonesia, located at three integrated cement factory sites. The company's largest installation is its integrated megaplant at Citeureup, which features nine dry kilns and has a total production capacity of 13.6 million tons of cement per year.

#### Migration for success

From its inception, Indocement has been committed to continuous improvement through integration and process optimization – hence the company's decision in 2013 to commission its long-standing partner Siemens to migrate the outdated control systems at three production facilities (Citeureup, Cirebon, and Tarjun) to the Cemac integrated process control system, which is based on Simatic PCS 7.

With a presence in Indonesia that can be traced back more than 160 years, to 1855, Siemens offers a unique combination of expertise and local resources that made the company a logical choice of partner for Indocement.

*Simatic PCS 7 also offered superior compatibility with legacy systems and provided the flexibility to expand plant capacity in the future if needed.*

Furthermore, Cemac has been installed at more than 800 facilities worldwide and represents a proven solution for helping cement producers reduce costs through advanced resource management and productivity monitoring.

#### A significant improvement

The primary goal of the upgrade project was to improve reliability and efficiency at the production facilities so that Indocement could reach its production goal of 30 million tons of clinker per year by 2018. In addition to maximizing uptime and decreasing the overall cost of production, the company wished to replace the existing distributed control systems with a more advanced and integrated platform that could provide added visibility into the overall operation of the plants.

The project scope involved the migration of seven production lines – four at Citeureup, two at Cirebon, and one at Tarjun. A new coal mill (a future project) will also be integrated into the new control system. The migration of the production lines required the replacement of programmable logic controllers (PLCs) as well as the addition of remote I/O substations and HMI upgrades. Prewired I/O rails with connectors were selected due to a need for short exchange time. Work at the facilities was performed by a combination of Indocement personnel and Siemens engineers based throughout Indonesia. Having the advantage of worldwide presence, Siemens also involved experts from India to speed up the commissioning. Safe migration with minimum downtime was Indocement's main priority, and together with Siemens, this target was achieved.

Cemac provided an advanced framework for interconnecting drives, belt conveyors, dampers, and measuring equipment and allowed Indocement to access relevant cement production data in a virtual real-time environment. Simatic PCS 7 also offered superior compatibility with legacy systems and provided the flexibility to expand plant capacity in the future if needed. Standardized libraries for automation functions also helped ensure better maintenance and service – leading to lower costs and increased efficiency at each of the facilities.

#### Leveraging expertise

The expertise and global presence offered by Siemens, coupled with the operational experience of Indocement, allowed for a smooth upgrade at all the facilities. The success of the migration project has led to further collaboration between the two companies: the new P14 kiln line will also be controlled by the Cemac system. This partnership is just one example of how a perfect fit between portfolio and expertise can create cost-efficient solutions that help improve reliability, reduce complexity, and achieve long-term operational success for cement plants. ■

# A greener brownfield



More than 50 years of cement production: The Rezzato facility not only has a long tradition within Italcementi but, since the modernization, is also a leader in terms of technology

All photos courtesy of Italcementi

Through an extensive modernization project that combined new technologies with sustainability and involved upgrading the process control systems with a state-of-the-art industrial network, Italcementi Group has not only improved the productivity and efficiency of its Rezzato plant, but has also built the foundations for future innovations.

**W**ith a production capacity of 61 million tons per year and subsidiaries on four continents, Italcementi Group is one of the world's largest cement producers. The company has repeatedly won awards for its commitment to innovation and sustainability, and continually sets new standards – for example, with the modernization of its plant in Rezzato, Italy, originally put into operation in 1964.

#### A step into the future

The Rezzato project, given the green light in 2010, is proof of Italcementi's future orientation. One of the company's main objectives was to transition from a semidry clinker manufacturing process to a modern, more energy-efficient, and sustainable dry process. For the automation and process control of the new line, Italcementi chose Simatic PCS 7 – as it had for various successful installations in the past. The complete engineering, supply, and commissioning of this main control system (MCS) was awarded to Fast S.p.A., an experienced automation services provider and systems integrator for Siemens.

#### New possibilities with Profinet

Because the assets of a cement plant are often dispersed over a wide area, the design of the communication network architecture is a critical issue in MCS engineering. Normally, a centralized layout is the solution of choice – with all smart devices located near the central control room, all peripherals in the distributed electrical rooms, and all the devices connected via a Profibus DP-based star or ring network.

Rezzato chose a different approach and became the first project worldwide to use a unique Profinet ring with Simatic PCS 7, which connects all the controllers to all the Profinet users. This solution, devised by C.T.G. (Italcementi Group Technical Center), was designed by Siemens and Fast S.p.A. and significantly simplifies the network architecture. Any peripheral device in any electrical room can be connected to any MCS controller, anywhere in the plant – simply by means of optical fibers. In addition, it is possible to easily link third-party local programmable logic controllers (PLCs) into the network and to access them for mainte-

nance or service from wherever an engineering station is plugged in.

#### More than one reason to celebrate

During the installation and commissioning of the system, experts from CSMT (Centro Servizi Multisettoriale e Tecnologico – the Profibus and Profinet Competence Center headquartered at the University of Brescia) conducted extensive surveys and performance audits and also assisted in the detail engineering phase. With their diagnostic tools, they could examine all network nodes, resolve connection and configuration issues, and release network performance certification reports.

Thanks to the close collaboration of all the participants, the modernization project was a big success. The Rezzato facility, which began operating in 1964 during the 100th anniversary of the founding of Italcementi, started up its new line in November 2014 in time for the 150th anniversary. ■

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✉ Claudio Locatelli

Italcementi Group, Italy

#### The project at a glance

Italcementi improved the sustainability and eco-footprint of its operations at the Rezzato plant by replacing and upgrading several process units:

- Replacement of the two existing long kilns with a new kiln that includes a five-stage suspension preheater
- Installation of a new raw meal grinding unit
- Installation of a high-temperature bag filter downstream from the clinker cooler

- Installation of a selective non-catalytic reduction (SNCR) system and a selective catalytic reduction (SCR) system for nitrogen oxide abatement
- Installation of a sulfur dioxide abatement system based on dry injection of sodium bicarbonate
- Process automation upgrade with Simatic PCS 7 and Profinet

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