SIEMENS

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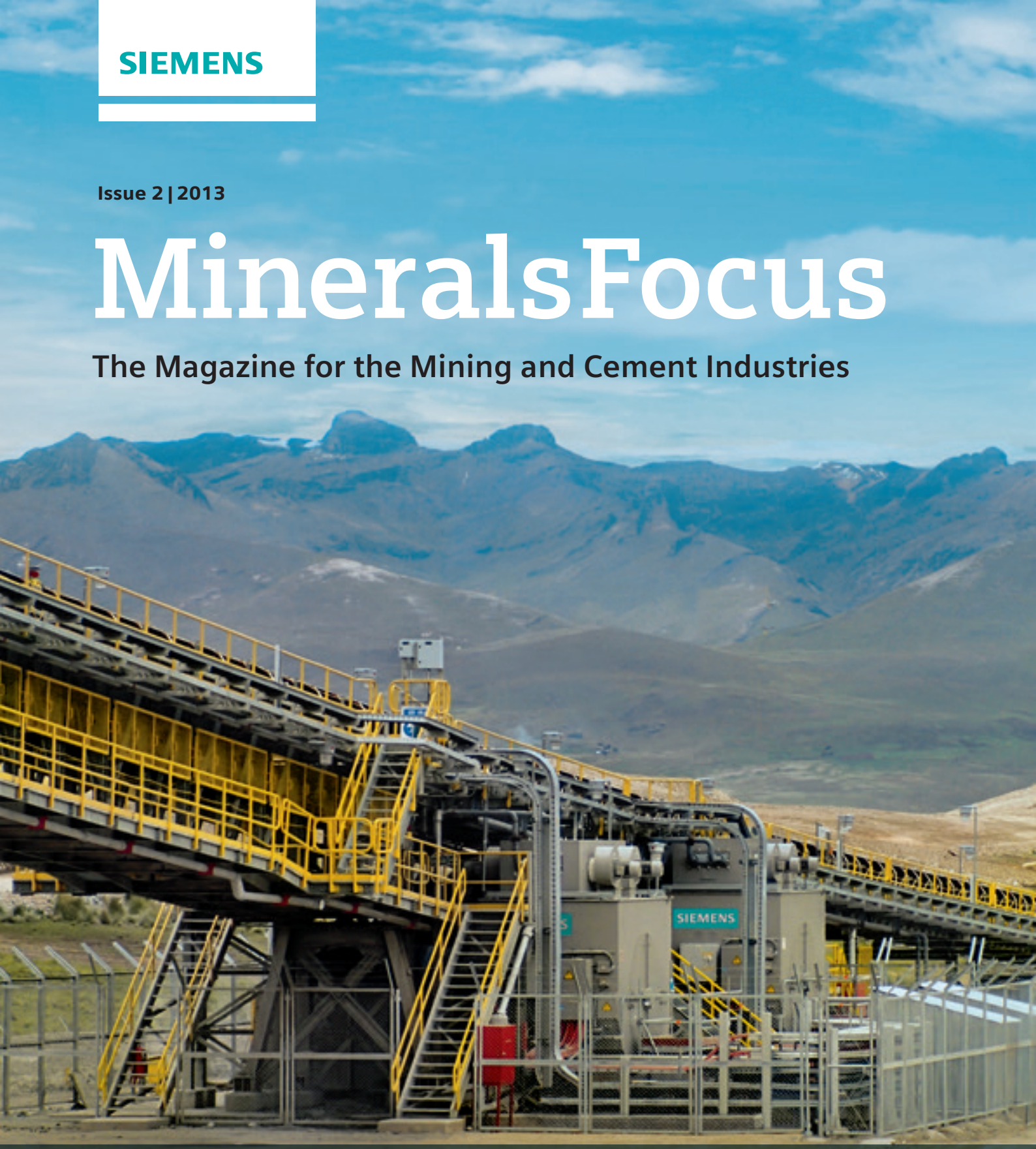
MineralsFocus

The Magazine for the Mining and Cement Industries



Cover Story:
End to end, Siemens has it covered

Mining:
No stop in sight

Cement:
A partner for today and tomorrow

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CEMENTABILITY

SICEMENT – Reliability that enables you to reach the top

At first sight, the various challenges facing the cement industry appear to be contradictory. The high level of competitive pressure demands continuous production and a significant reduction in maintenance costs. Stringent emission restrictions have to be adhered to without impacting on productivity. And in regions with unstable power networks, the first priority is to secure a reliable power supply.

In order to tackle all these competing challenges, we have developed SICEMENT – the world's most comprehensive range of products and solutions for the cement industry. Tap into the potential of modern cement production – while maintaining maximum reliability.

Opt for CEMENTABILITY.

Answers for industry.

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Dear Reader,

Mining was, is and will continue in the future to be the most exciting industry. The demand for raw materials and derived fuels remains unchanged, and in some areas we see a continuing increase in demand even during economic down-periods.

However the economic environment does have an impact on customer decisions regarding new investments and on operational expenses. Considering these circumstances we turn our attention to technologies, systems, solutions and services that help lessen the burden. To meet current mining industry requirements, the solutions must be robust, reliable, energy efficient, safe and environmentally friendly.

Beside these activities we are focusing on Integrated Drive Systems, which cover inverters, motors, coupling, gears and intelligent control. The advantage for our customers is a professionally designed, factory built and tested Integrated Drive System that meets high quality standards – all from a single source, and with a single line of responsibility.

In the cement business too, alongside lowest operating costs, environmental protection takes priority – especially in regard to reducing CO_2 emissions. Of course, it isn't enough to just talk about what the industry needs. As in the last issue of MineralsFocus, we look at projects all around the world. To mention a few: Siemens has established itself as a partner for mining operators in South America. On page 20 we feature Chile and Peru, two very important copper producers who are profiting from innovations and services from Siemens – notably the gearless drive solution implemented in Chile's Antapaccay mine (page 20). On our home turf in Germany, we reveal how we have helped Reichwalde mine optimize technological process chains. The trip continues to the Philippines where we show how we have helped Holcim improve its cement operations – for example through intensive staff training for the Siemens automation system CEMAT based on SIMATIC PCS7 (page 44). We also look at how Siemens is helping Indonesia and Malaysia meet their growing demand for cement. Finally, we take an excursion to the steel sector for an article on new pelletizing technology (page 40).

We hope you enjoy reading this magazine – and we look forward to greeting you at this year's bauma in Munich, Germany (page 63).

Sincerely,

Edzard Lübben
Head of Minerals

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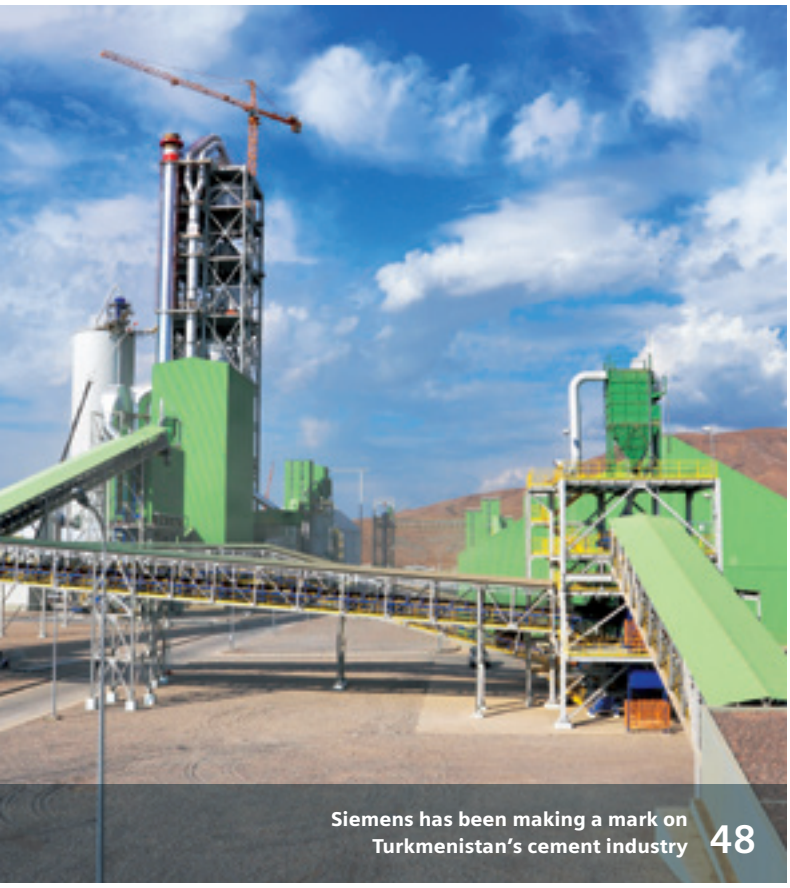
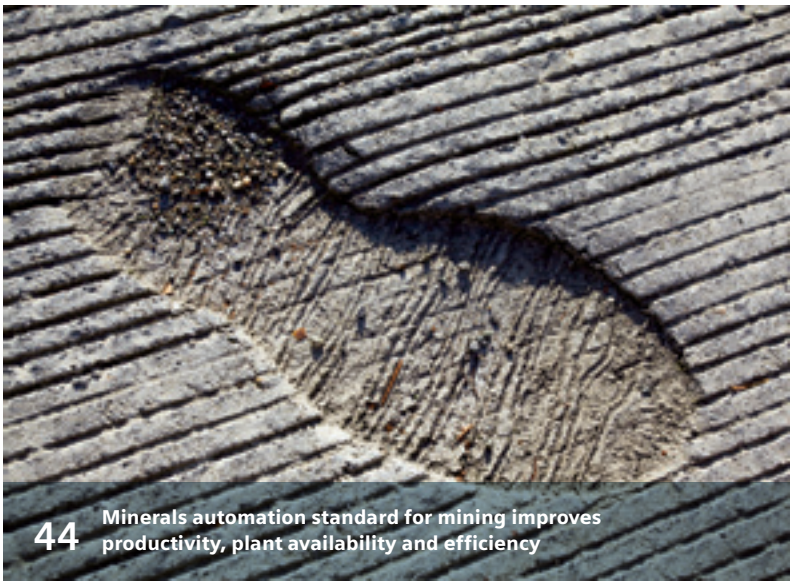




08 Cover Story:

End to end, Siemens has it covered

The cement and mining industries are facing a number of challenges: rising input and energy costs, increased remoteness of deposits, and volatile markets, to name just a few. Furthermore, operators need to be ever-vigilant in the areas of environmental protection and safety. While Siemens does not have a panacea for all the industries' concerns, it does have technologies that can make production as smooth and trouble-free as possible.

Gearless drives

Overland conveyor system in Xstrata's Peruvian copper mine

Las Bambas mine to profit from cost-saving technology

Las Bambas will be the second Xstrata Copper mine in Peru to use gearless drives from Siemens on its overland conveyors.

First the Antapaccay mine, now Las Bambas: Xstrata Copper counts on gearless drives for its Peruvian copper mine operations. The overland conveyors at Las Bambas are being designed and supplied by ThyssenKrupp, and start-up is scheduled for 2014. Each of the two overland conveyors will be approximately 2.5 km long and transport ore from the mine to the processing plant. The belts will be 1,830 mm wide and travel at 6.5 m per second. The capacity is approximately 9,400 tons of material per hour.

The Siemens drive systems for each of the two overland conveyors comprise two low-speed synchronous motors – each with a total power of 4,400 kW – and the associated Sinamics SL150 cycloconverters. This gearless drive solution has a number of advantages over the combination of high-speed motor and gearbox drives usually used on conveyor systems: The size of the motor is not limited by the size of gearbox available, thus eliminating the necessity to install multi-motor drives. The power required to drive a belt can be provided by just one drive per belt pulley. This enables the size of the electrical room to be reduced, thus saving space and weight.

The elimination of a whole series of mechanical and electrical components increases the reliability and efficiency of the overall system by 3–4 percent. Using gearless drives instead of standard motor-reducer packages will eliminate approximately 40 bearings and eight couplings per conveyor. The maintenance requirements of the drive system are also substantially lower. Gearbox maintenance work alone can amount to up to 5 percent of the original annual investment cost per year. Lubrication and gearbox cooling systems, together with their maintenance, are also obsolete for this solution.

Part of Xstrata plc, Xstrata Copper is headquartered in Brisbane, Australia. A side from Peru, it runs mines and production plants in Argentina, Australia, Chile and Canada. The company is the fourth largest copper producer in the world. Construction at the Las Bambas copper mine in the south of Peru is in full swing. From 2015 onward, some 400,000 tons of copper in concentrate will be produced yearly. ■

Contact:
Christian Dirscherl,
christian.dirscherl@siemens.com

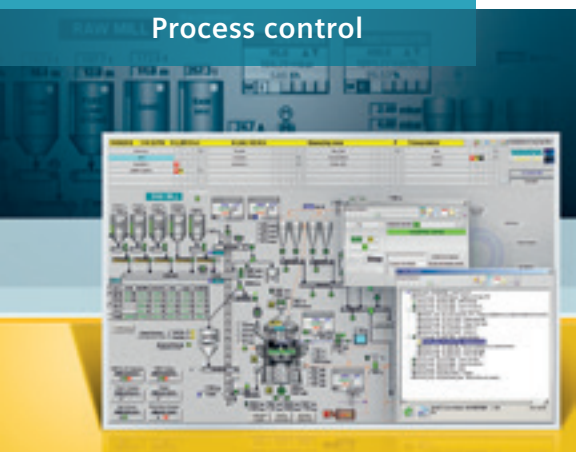
Electrical equipment

Simple and reliable

About 4 million tons of iron ore concentrate are excavated yearly at the Cerro Negro Norte mine.

Siemens is supplying the entire electrical system for an expansion of the Cerro Negro Norte iron ore mine in Chile.

Process control



Since the update to Version 8.0, Cemat is even easier to work with

New features for Cemat

Siemens has added a host of new functions to Version 8.0 of its Cemat process control system for the cement, mining and related industries.

Working with Cemat is now even easier, thanks to the Version 8.0 update. Compared with previous versions, one of the innovations of Cemat V8.0 is that the Quick Trend display can be configured directly from the process screen. This makes it much easier to activate curve groups for display and evaluation purposes.

The operator also has more operating mode options. In addition to complete groups, an operator can now disconnect individual loads within a group – for example as part of an energy management concept. The variants "No interlocks," "Specific interlocks only" and "Safety interlocks only" can be easily configured for manual operation. Previously, these special interlocks had to be painstakingly programmed.

A further advantage of Cemat V8.0 is that the user can employ speed monitors in addition to process values such as accumulated pressure or flow rate. This increases the quality of the information about the proper functioning of the drive. Message blocks, measured values and process feedback messages can now be assigned not just to groups but also directly to individual drives.

The Cemat Object Browser is another new feature: It enables all the objects in the entire plant to be identified and displayed in a specific operating mode, for example "In simulation." New block icons also simplify system operation. For example, block icons in inconspicuous colors indicate a fault-free state, and more conspicuous icons draw the operator's attention directly to important information. Cemat V8.0 is based on the latest Version 8.0 of Simatic PCS7. ■

Contact:
Thomas Walther,
thomas.walther@siemens.com

CAP Mineria (Compania Minera del Pacifico) is the leading company for the production of iron ore concentrates and pellets on the Pacific coast of South America. The company's Cerro Negro Norte iron ore mine, situated about 700 km north of Santiago de Chile, is designed for an annual output of about 4 million tons of iron ore concentrate. In order to meet the growing demand for raw materials on the global market, the site's mining capacities are being expanded. The project consists of a new concentrator located directly in the mine, a pipeline for transporting the iron ore concentrate, and the necessary expansion of capacity at the port facilities at Puerto Punta Totoralillo.

Siemens is supplying the entire electrical equipment preconfigured in E-Houses for a fast start-up and efficient operation of the plant. Delivery will be completed by May 2013. The shipment includes a variety of Siemens components, ranging from energy-efficient medium-voltage frequency converters from the Perfect Harmony series, SWG transformers, Tiastar switchgear and a PCS7 automation solution.

All components are designed to meet the specific requirements of the mining industry and guarantee simple and reliable operation while maintaining maximum availability of the overall plant. For example, the topology of the Perfect Harmony frequency converter, which is scalable to customer requirements, can be expanded with redundant cells that guarantee operation without any restriction of performance, even in the event of a component failure. The automation solution, based on Simatic PCS7 and the Minerals Automation Standard, allows the simple integration of all plant components with maximum efficiency in the operation of the overall plant – from the concentrator, via the pipeline, to the port. ■

Contact:
Hans-Jürgen Seger,
hans-juergen.seger@siemens.com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Siemens Mining Portfolio

End to end, Siemens has it covered

Mills at the Antapaccay mine in Peru

The cement and mining industries are facing a number of challenges: rising input and energy costs, increased remoteness of deposits, and volatile markets, to name just a few. Furthermore, operators need to be ever-vigilant in the areas of environmental protection and safety. While Siemens does not have a panacea for all the industries' concerns, it does have technologies that can make production as smooth and trouble-free as possible.

For engineers and plant operators, the scene is all too familiar: If an ever-increasing load of responsibilities is not enough, there is the additional challenge of managing multiple vendors for a whole range of components. This often entails reviewing offers, features, pitches and service agreements – and of course managing warranties. A further issue is the continuous pressure to maximize productivity and operational effectiveness. Matters only get more complicated when it's time to retrofit, upgrade or expand. Siemens offers an alternative with its Integrated Drive Systems.

An expert in drives

With over 150 years of experience, Siemens knows its way around drives. In fact, the company has an installed base of some 40 million drives in production facilities all over the globe. This puts the company close to its customers, wherever they may be and whatever industry they are involved in – automobile, pharmaceutical, food & beverage, and naturally mining and cement. Thanks to this diverse experience, Siemens engineers can integrate lessons learned from one sector into another.

"Siemens is the only supplier that delivers everything along the entire drive train, including mechanical components."

Edzard Lübben,
Head of Minerals

Through Siemens' Integrated Drive Systems, everything is available from a single source: gear units, couplings, motors and converters all the way up to controllers. But what's more, the components are combined to work as a single system.

The Integrated Drive Systems approach addresses two levels. "On the horizontal level is the entire drive solution, which fits together perfectly to form one consistent structure," says Edzard Lübben, Executive Vice President Minerals. "Siemens is able to offer this complete line thanks to its comprehensive product portfolio. The advantage is that all components are optimally attuned to one another, and the best possible combination can be configured for almost any application."

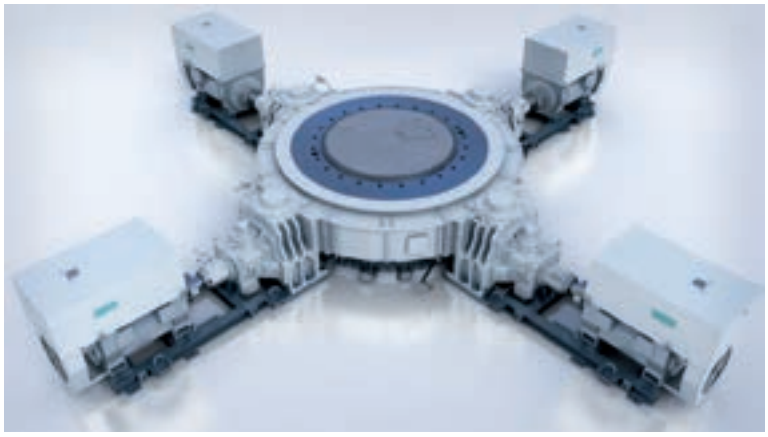
The next level is the vertical. Here, Siemens employs its Totally Integrated Automation (TIA) concept. The added value includes efficient configuration, faster integration and commissioning, greater flexibility in production, higher availability, and the potential to efficiently implement measures to save energy. There are great advantages to having IT integrated throughout a plant: "For one," says Lübben, "plant management has access to key data and can keep an eye on everything. What makes it even more interesting is that a service expert can be sitting somewhere in Europe and monitoring a plant in South America. For our customers with global operations this is a great advantage, particularly because it is possible to consolidate operations and also easier to share best practices throughout an organization."

Engineered to perfection

"Siemens is the only supplier that delivers everything along the entire drive train," says Lübben. In effect, what customers are getting is a solutions-based approach that combines products, application engineering and services into one. "This means that there is nothing piecemeal about solutions from Siemens," he says.

The problem with piecemeal projects is that they fail or exceed the budget because, during the course of the project, it becomes obvious that the interfaces don't fit, that specifications don't match, or that the individual components can't be delivered to the construction site on time. Considering these potential problems, the advantages of a single-source provider with one line of responsibility become obvious: From gears and motors to couplings and drives, everything works together right from the start. The project can also be perfectly coordinated.

The single-line approach also prevents costly over-engineering. Many engineers build in safety reserves for their individual components. When several components are involved, these reserves add up significantly. The result is higher and unnecessary costs. Matching equipment, therefore, can obtain optimal performance, because all components and software are coordinated with one another, and the safety reserve is built into the entire system, not individual components. As a result, energy consumption is lower, as there is no idling or excess heat development. Another important factor is less wear and tear, since unnecessary friction is avoided. "You could say that the performance of the overall system is higher than the sum of its parts," adds Lübben. ►



MultipleDrive components

Lafarge Cement Plant, Hungary

► With everything connected via IT, new possibilities open up for condition monitoring, the permanent monitoring of machine and plant states. The greatest benefit is high system availability owing to the fact that potential sources of errors can be identified early on and scheduled maintenance can be performed at the right time within the production cycle.

From an economical standpoint, an investment in the most reliable solution possible helps ensure against unplanned downtimes. Depending on the plant, unplanned downtimes carry huge price tags – losses of millions of euros per day are not uncommon. Integrated Drive Systems also means that it is easier to take care of maintenance and future upgrades and expansions. And should a problem arise, one phone call is enough – there is no need to contact the individual vendors of different elements.

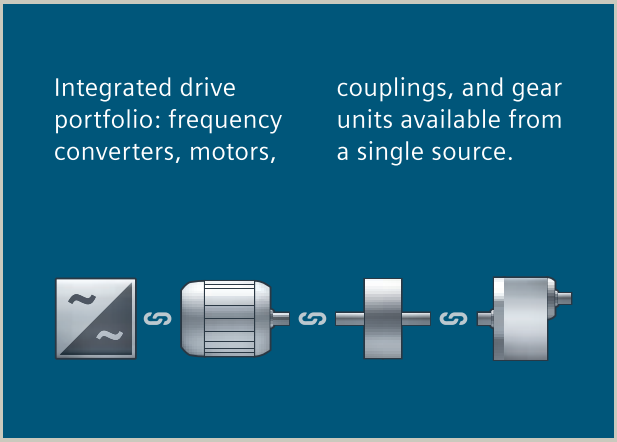
Of course, Siemens solutions can also be mixed with third-party components and software. In these cases, however, there is no single point of responsibility, and vertical integration can sometimes be problematic. Finally, interfaces between the different components cannot be fully exhausted.

Siemens Flender MultipleDrive for vertical cement mills is a new Siemens solution that was developed along the lines of the Integrated Drive Systems approach. On the machine level, the drives are aligned with one another. A special feature is the drive concept that prevents load impulses and optimizes power transmission between the drive and the mill. Simultaneously, plant availability is increased. A power range up to 15 MW is possible with this drive concept. What's more, noise levels from the Siemens Flender MultipleDrive are particularly low, even under heavy loads. There are currently two references for this technology – one in France and the other in India. Furthermore, plants in Brazil and Australia are currently being constructed and will be operational by the end of 2013.

Single point of contact

Technically Siemens has a solution no other market competitors can meet. With a further strengthening of the concept of global key account managers, working with Siemens is even easier than before. In the past, separate contact persons were responsible for each component along the drive train. "Understandably, this sometimes led to confusion," says Lübben. With the account manager, each customer has one point of contact who coordinates all the different areas within Siemens to give customers the products and solutions best suited to their needs. The concept also extends to the entire lifecycle, from consultation and proposals, to delivery, installation and maintenance. Furthermore, the account managers keep an eye on what customers are doing in their operations all over the world to try to better understand their needs.

"In regard to customer needs, we have recognized a common trend of safety, reliability and flexibility," says Lübben. In the cement and mining industries, safety is important because huge machines are at work, and it is best to get people out of the way. Key aspects for greater safety are remote operation and automation.



Integrated Drive Systems allow maximized efficiency from end to end

For some of the most challenging conveying tasks Siemens has developed a gearless drive train, reducing the number of parts, increasing performance and achieving highest availability.

Finally, to protect investments made by mining and cement companies, as a complete lifecycle partner Siemens offers maintenance packages through its Customer Services unit. Customer Services combines all service activities for industry, and there is a dedicated team that exclusively serves customers in the mining and cement businesses. The Customer Services engineers work closely with their colleagues in Mining and Cement, which ensures a faster response time and comprehensive solutions. Different services agreements can be arranged, for example alignment with performance-related indicators such as increased efficiency, lower energy costs and shorter shutdown times. "From end to end and over the entire lifecycle, we have it covered," says Lübben.

Highlights of Integrated Drive Systems

Mining applications

- Mining conveyor: With significant experience and a global footprint, Siemens serves OEMs, EPCs and end-users for mining conveyor needs worldwide. The Integrated Drive Systems incorporate motors, gearboxes, couplings, drives for overland, and roller and mobile conveyors to improve performance and uptime.
- Mining ball mills: Integrated Drive Systems can include motors, gearboxes, couplings and drives for ball mill types, including SAG mills and rod mills. Integration into the Simine Mill Drive Systems profile makes it easier to address challenges.
- High-pressure grinding (HPG): In applications like HPG, Siemens' drives, motors, gearboxes and couplings drive the roller press with reliability.
- Crushers: Siemens' integrated drives and motors are used in jaw and cone crushers worldwide, and custom installations result in improved reliability.

Cement applications

- Vertical roller mills: Used in cement as well as mining installations, Siemens single-unit integrated gearbox and motor (Flender Electrical Mill Double Planetary Drive – MultipleDrive – EMPP) for vertical mills increases plant availability.
- Kiln drives: Integrated drives, motors, couplings and gearboxes rotate the kiln effectively.
- Separator drives: Centrifugal cyclone drives are driven by motors, VFDs, gearboxes and couplings.

Edzard Lübben, Head of Minerals

Since mid-2012, Edzard Lübben has been at the helm of the Siemens Minerals business. Previously he headed the company's high-speed train division. At first glance, minerals and trains may not seem to have much in common but Lübben is quick to differ: "A great deal of underlying technology is essentially the same, though the dimensions may be different."

Trains, for instance, have to be able to withstand many of the same strains as the trucks used in open-pit mines – such as extreme temperatures, shock and vibration. Secondly, both industries are driven by a strong focus on the project business. This naturally means that excellent project management capabilities need to be in place to be able to meet customer requirements. Finally, train and minerals customers have similarly high expectations in regard to safety, dependability and cost effectiveness.

In his first months on the job, Lübben has made an effort to get to personally know as many customers as possible. And given Siemens' international footprint, he has been on the road quite a bit – South America, North America, South Africa and Australia are some of the longer journeys he has recently taken – not to mention appointments with contacts in Europe. "The most important thing is to experience first hand what is important for customers – and to make an effort to thoroughly fulfill those expectations," says Lübben. ■

Info:
www.siemens.com/mining
www.siemens.com/cement
Contact:
mining@siemens.com

Focus on mining

No stop in sight

Siemens has been involved in the mining industry since 1920, initially in Germany and today at mines all over the world. And in these 93 years, the company has kept pace with changes on all levels.

Energy-efficient and maintenance-friendly solutions and products help mine operators get a grip on spiraling costs

As metallic concentration in deposits diminishes, mine operators are having to transport and process greater and greater amounts of ore. This calls for larger equipment capable of higher output to keep production levels steady. To complicate matters, prices for metals have taken a downward turn, and across the board market players have experienced a slump in their revenues. So with cash at a premium, capital expenditures (CAPEX) and operational expenditures (OPEX) have become even more important for mining operations.

"We help our clients operate more cost-effectively and at the same time adhere to strict environmental regulations."

Norbert Becker,
Vice President Mining

"When it comes to CAPEX, the formula is quite simple: all projects must be in line with market requirements," says Norbert Becker, who is responsible for the Mining business area at Siemens. On the OPEX side, the focus is on energy-efficient and maintenance-friendly solutions and products. "In this regard, we can help our clients operate more ▶

cost-effectively and at the same time adhere to strict environmental regulations," comments Becker.

Quiet and flexible

A topic that has been getting a good deal of attention lately is noise emissions from mines and processing plants. "The high noise levels from a mine can cause distress to people living in the area as well as to wildlife," says Becker. Drive systems from Siemens have become quieter with every development stage. However, flexible operation schedules can also help alleviate the problem of noise pollution. Becker recalls an example of a mine located near a community: "The decision was made to operate the conveyor belt at different speeds depending on the time of day. At night lower, quieter speeds were used. Then higher speeds during the day, when fewer people are likely to be disturbed."

As in all other industries, there is also a strong focus on reducing the CO_2 footprint. One Siemens innovation involves diesel-electric drives in haul trucks. Here the trucks draw power from an overhead trolley system. The truck trolley system has proven most cost-effective on ramps, where the most energy is required. In addition, in some mines trolley assist for flat hauls reduces diesel consumption even more. The figures are impressive: at a diesel engine's top speed, the fuel rate is 450 liters per hour, but with trolley assist the fuel rate can drop to 40 liters per hour.

"In all areas, the golden rule of a manufacturer is to help customers avoid stillstands and unplanned downtimes," says Becker. Therefore, CAPEX and OPEX are also considered in design and service. "The ability to service and maintain a component is figured in right from the beginning." This also entails adapting monitoring and service approaches to current personnel challenges. Becker explains: "In the mining industry in general it has become more and more difficult to find qualified professionals. Typically, mines are located far away from cities, often in rural areas with little infrastructure. For many, not an attractive workplace."

Siemens therefore has developed automation solutions that require as little human intervention as possible. In the process, safety for on-site employees is greatly increased. Furthermore, through remote monitoring many problems can be solved by experts who are in a central location. Here, the on-site employee and the off-site expert coordinate to find solutions. In the case of a breakdown where every minute carries a high price tag, a quicker reaction is possible, since the expert does not have to be physically dispatched to the site. Thus, reliability is increased.

Bigger – and simpler

In regard to machines, two trends come together: To excavate ores with lower metallic concentrations, larger and larger machines are employed. And with fewer experts on site, the focus is on simplicity. The result: machines are getting bigger and bigger – as well as simpler. Benefits of this approach include faster troubleshooting and shorter installation times, while maintenance can be performed more easily.

In addition, large components are being assembled and tested in the factories where they are produced – "Instead of on site as was previously the case," adds Becker. Safety can also be more easily ensured in the controlled environment of a factory. Siemens is able to implement this approach thanks to its global set-up with plants all over the world. "We usually try to manufacture as close to the customer as possible to streamline logistics and delivery," says Becker.

Since the 1950s, the worldwide copper market has grown by 3 percent every year. "Crises over the years have impacted prices, but not demand. There is no stop in sight," points out Becker. In regard to copper alone, upcoming trends such as electromobility and smart grid are expected to crank demand up a few notches. "The market is vital and it will remain so," says Becker.

Siemens is a trusted mining partner, and the new organization at the Minerals unit means that mining experts can work closely with colleagues in the product area as well as with OEMs to come up with the optimal solution. The result is drive solutions tailored for specific mining applications. For the most effective products and solutions, cooperation should take place ideally at an early stage. ■

Using trolley-assist from Siemens, fuel consumption and thus CO_2 emissions can be cut significantly

Author:
Norbert Becker,
norbertbecker@siemens.com

Focus on cement

A partner for today and tomorrow

The two big topics in the cement industry today are energy use and CO_2 emissions. Siemens offers solutions to optimize energy use today, and the company has its sights on solutions for tomorrow, as Dieter Schletterer, Vice President Cement – Minerals, explains.

When it comes to CO_2 emissions, the numbers are staggering: For every ton of cement manufactured some 700 tons of CO_2 are emitted. For the typical German plant producing 3,000 tons of cement per day, this equates to 2,100 tons of CO_2, and for large plants in Asia where production of 10,000 tons per day is not uncommon, 7,000 tons of CO_2 are emitted. "And this day after day," underlines Schletterer. Two-thirds of these emissions result from the chemical transition of limestone into cement; the remaining third comes from energy consumption.

Siemens therefore works with its customers to get CO_2 emissions from the plant itself as low as possible. "Since drive technology is responsible for more than 90 percent of a cement works' electrical energy requirements, the focus is usually on the introduction of energy-efficient motors," says Schletterer. Depending on the application, Siemens motors can reduce power loss by up to 40 percent. Furthermore, variable-speed drives are used with frequency converters, which adjust the rate of flow to the actual need. Here, up to 70 percent savings are possible.

Through the use of Cemat, Siemens' process control system for the cement industry, processes are continually optimized, also in regard to energy use. Another area in which Cemat has an impact is fuel consumption through optimization of the kiln fuel feed, whether fossil or alternative fuels are used. "Cemat makes a great contribution to plant reliability," says Schletterer, "especially in view of the fact that many plants run for 50 years and longer."

Cemat automation was introduced to the market 35 years ago, and all along it has been further developed. "Large cement players such as Holcim, Lafarge and HeidelbergCement have been using the software for their global operations for many years," says Schletterer. The software is adapted to the customer's needs, all the way to the user interface, which can be customized to go with the customer's corporate design. In the case of updates – Version 8 was recently issued – the database is naturally retained and moved to the new system. Cemat updates are installed in the framework of scheduled maintenance shutdowns.

> *"Cemat makes a great contribution to plant reliability, especially in view of the fact that many plants run for 50 years and longer."*
>
> Dieter Schletterer
> Vice President Cement – Minerals

A flexible partner

Just as Siemens adapts its products – like Cemat – to fit to customer needs, it also adjusts its approach to match the customer's project requirements. "End customers often ask suppliers like Siemens to submit offers for electrical turnkey packages. Concurrently, the end customers may also seek out several EPCs to submit offers covering various packages, such as mechanical and elec-

trical," explains Schletterer. The end customers must then decide to either use only one EPC that coordinates the complete project, or to employ a mixture of OEMs and Siemens.

When Siemens is already involved at an early stage of the offer, the company's engineers can support both the end customer as well as the EPC to define the optimal products and solutions. "On top of that, due to the early involvement, we are also able to assist the planning of life-cycle services," adds Schletterer. "All in all, we offer our competence through different sales channels to suit the end customer's structure. We adapt our sales approach to the end customer, not the other way around."

A recent contract shows how different project collaborators work together to integrate Siemens solutions: A Malaysian cement manufacturer issued a contract to a major EPC player with the wish that as many products as possible come from Siemens due to its active local service ability. The EPC company ordered individual applications from Siemens. The drive package and instrumentation were sourced from Siemens Germany, and the switchgear from Siemens China. For all these aspects, the EPC company had a single contact at Siemens.

In all project phases, Siemens engineers are dedicated to safe working conditions. And for everyday operations, Siemens offers solutions that aid site safety. One is Sicement Instrumentation, which analyzes gas to enable optimal combustion, which in turn leads to optimized production. Naturally, Sicement Instrumentation is designed to withstand the harsh demands of the cement industry.

A partner for tomorrow

Research and development for the cement business concentrates on improving plant performance even further. A current innovation driver is the new energy economy. "As alternative energy sources expand, big users like the cement industry must adopt models that take advantage of supply fluctuations and price structures," explains Schletterer. For instance, using intelligent energy software, silos can be turned "on" and "off" to help cement companies use energy more intelligently.

Furthermore, in anticipation of the next round of new environmental regulations to go into effect in Europe, Siemens is taking steps to ensure that customers are ready. For today and tomorrow, Siemens' strong relationship to the cement industry helps the company adjust its products and approach to match customer needs. "We evolve our business to match what's going on in the industry," says Schletterer. The approach is certain to ensure a long partnership to come. ■

Research and development concentrates on improving plant performance even further.

Author:
Dieter Schletterer,
dieter.schletterer@siemens.com

Siemens Chile and Peru

Serving the world's biggest producers

The Andean republics of Chile and Peru are rich in minerals. In fact, the two countries are the world's biggest producers of copper, gold and silver. Siemens Chile and Siemens Peru support globally active copper producers in the two countries with new innovations and a varied range of services.

The demand for copper is often seen as an indicator for the stability of an economy. In emerging countries, this increased demand is usually a sign of the advancement of the middle class; a better standard of living that is expressed in higher demand for consumer goods and an expansion of the local infrastructure. Copper is used in a number of areas: to transmit electricity and for communications, for consumer goods and computers, in modes of transport, for building infrastructure, industry motors and much more.

Chile is home to state-owned Codelco (Corporación Nacional del Cobre de Chile), the world's largest copper producer, which is responsible for about 15 percent of the country's public revenue. In 2011, Codelco excavated around 1.8 million tons of copper. Codelco operates a total of six mines in Chile, including the Chuquicamata mine, about 15 km north of the city of Calama. Chuquicamata was opened in 1910, and today it is the world's largest open-pit mine.

Around 75 km south of Santiago, in Sewell, is El Teniente, the world's largest underground mine: the total length of the mine's road network is 2,400 km. Further Codelco mines are Radomiro Tomic (in operation since 1997), El Salvador and Andina (in operation since 1959), Gaby (in operation since 2008) as well as Ministro Hales (begin of operation in 2013). Chris Vains from Siemens Industry Automation stresses the necessity for mining companies to continuously invest in new technologies to satisfy demand for raw materials. By doing so they can ensure highest productivity, efficiency and dependability.

Continuous innovation is also necessary given the fact that copper mines in the Andes are exposed to extreme conditions: severe frost and meter-high snow in the winter, not to mention temperature and moisture fluctuations throughout the year. The installations are located at an altitude of more than 3,500 m above sea level, and the equipment needs to be adapted to these conditions. In addition, the grinders, conveyors and processing plants are exposed to heat, dust and strong vibrations. For years, Siemens has provided mining companies in Chile and Peru with robust and dependable technology.

Siemens Chile – a partner for services

Siemens has been operating in Chile for 106 years. In fiscal 2012, sales with customers in Chile amounted to over €235 million. Currently some 2,000 people in the country work for Siemens, and the Customer Services Division has in the meantime taken a leading position in maintenance for mining companies.

Last year Codelco commissioned Siemens to take over maintenance in one of their processing plants in the Andina region, initially for five years. The Andina mine is around 80 km northeast of Santiago, in the Los Andes province. The mine consists of open-pit and underground operations at an elevation of 3,000 m. Every year some 248,000 tons of copper and 7,200 tons of molybdenum are excavated. In the framework of the contract, Siemens is responsible for preventive maintenance as well as maintenance for the entire processing equipment – from copper ore crushers, the conveyor belt system, mills, the flotation basins in which the copper is separated, all the way to the filters. The contract also includes the molybdenum facilities, the shaft hoisting system as well as the piping system for the copper and molybdenum concentrate. The service contract for Codelco is designed as a long-term partnership in which billing is performed according to agreed-upon figures such as production volume, plant availability, safety and environmental compatibility. To minimize risks, maintenance is carried out according to the risk-based maintenance concept, which Codelco introduced in Andina at the beginning of the year.

"This new contract is proof of trust in Siemens as a provider of sustainable service solutions," says Julio Bugueño, Siemens Service Manager from Chile and the customer's contract partner. "It is very well one of the most comprehensive maintenance contacts in the mining industry worldwide, which depends on an on-site workforce of around 800 people." The contract volume is €190 million and it also encompasses maintenance of all mine buildings.

"The Andina mine is the third Codelco mine for which Siemens has taken over maintenance for the tech- ▶

nical facilities. Siemens also performs service contracts for the ore crusher and conveyor belt system as well as for the hydro-metallic facilities at the Radomiro Tomic and Minera Gaby mines," says Bugueño. In 2010, a new ore crusher for the sulfide copper ores excavated at Radomiro Tomic was installed – as well as a new conveyor belt system to transport the ore to the processing facilities in Chuquicamata. Siemens is responsible for maintenance of the mechanical and electrical components as well as the instrumentation of the ore crusher and conveyor belt system. The company also performs the design, planning and implementation of all maintenance activities. Since 2008, around 140 Siemens employees have been looking after the hydro-metallic facilities at the mine, including systems for leaching, solvent extraction and electrolysis.

Siemens delivered drive technology as well as automation, energy distribution and monitoring systems for the Los Pelambres and El Teniente mines. And for more than ten years, the company has been responsible for service and maintenance of the complete conveyor belt system, including the management of spare parts in Los Pelambres. A computer-based maintenance system keeps track of agreed-upon key performance indicators in regard to the availability and dependability of the system.

Siemens' presence is not limited to the above-mentioned customers. In sum, Siemens delivered 26 gearless drive solutions in Chile and nine in Peru. In Chile these are Escondida, Caserones, Los Bronces and Candeleria; in Peru Las Bambas, Antapaccay and Antamina.

Siemens Chile helps keep energy flowing

In order to cover the constant need for energy in mining installations with renewable energy, Siemens is building in Chile 50 wind turbines type SWT-2.3-101 with a power rating of 2.3 MW, a rotor diameter of 101 m and a total capacity of 115 MW. The wind power plant El Arrayán is a joint venture of the companies Pattern Energy and AEI. The Chilean mining company Antofagasta PLC (parent company of Minera Los Pelambres) also has a stake in the El Arrayán project.

As a provider of integrated electrical solutions on the basis of mobile substations for energy distribution, Siemens was able to win two new projects with Mining Pacific Company (CAP) and the Codelco company unit El Teniente.

For years, Siemens has provided mining companies in Chile and Peru with robust and dependable technology.

Siemens Peru

Siemens has been active in Peru since the beginning of the 20th century. Back then, in collaboration with the German company J.M. Voigt GmbH, Siemens won contracts for the construction of three water power plants for the state-owned power utility Empresa Eléctrica de Arequipa. In 1968, Siemens S.A.C. in Lima was established, and in 2003 Siemens S.A.C. merged with Siemens Building Technologies (SBT) Peru. Today Siemens Peru offers a comprehensive range of solutions and services, and holds leading positions in the country in the Siemens sectors Energy, Healthcare, Industry, and Infrastructure & Cities. In fiscal 2012, Siemens had sales of almost €262 million in Peru. The company currently has a workforce of around 350 in the country.

At the Constancia copper mine, owned by the Canadian company Hud-

Bay Minerals, Siemens Peru is now installing the complete electrical equipment for the low- and medium-voltage power supply, including 12 E-houses, the low- and medium-voltage drives for mills and conveyors, and the DCS automation system. E-houses are tailor-made electricity distribution systems for the medium- and low-voltage levels. The individual modules in an E-house are completely assembled and tested before they are transported to the installation point. Due to the high degree of pre-assembly, they can be quickly set up and commissioned, so deadlines can be kept. The scope of delivery includes two office containers, a permanently installed substation with medium-voltage switchgear, three diesel generators and six capacitor banks with the associated distributor transformers.

The Peruvian copper mine Constancia lies high up in the Andes at an elevation of 4,300 m, and around 100 km south of the city of Cusco. The mine is the first project with a sulfur concentration plant at an elevation of over 4,200 m. The mine, which carries a project volume of €1.128 billion, is expected to go into operation in 2014 with an estimated yearly production of 80,000 tons of copper.

Another success for Siemens was the contract valued at €970,000 for service and maintenance of the Cerro Verde concentration plant. Siemens also delivered variable-speed medium-voltage drives and a desalination system to the copper, lead and zinc mine Cerro Lindo in Chincha, operated by Compañía Minera Milpo S.A.A., with the goal to increase energy efficiency and reduce costs. Cerro Lindo is the first mine in Peru to use seawater in its operations.

Last November, Siemens commissioned gearless drives for the belt conveyor at the new Peruvian copper mine Antapaccay, which is owned by Xstrata. The powerful system – the second of its type worldwide – moves 5,260 tons of ore per hour at a speed of over 6 m/s. The system requires considerably less maintenance than conventional systems. "Instead of the typical configuration consisting of a high-speed motor, couplings and drives, here the low-speed gearless drives power the belt conveyor. The drive power demand delivered by Siemens enables optimal start-up and stopping. In addition, the load distribution on the two drives can be adjusted according to the requirements of the belt conveyor. Siemens also delivered the power distribution, the converter transformers as well as the completely pre-assembled E-house. This system is much more dependable, productive and cost-effective than a conventional installation," says Norbert Becker from Siemens Large Drives Minerals.

In 2012, ThyssenKrupp Robins, headquartered in Greenwood Village, Colorado, placed a further order for the delivery of a gearless drive system for the belt conveyor at the Las Bambas copper mine in the south of Peru. The owner of the mine is also Xstrata Copper, which is the world's fourth largest copper producer. Construction is currently in full swing, and starting in 2015 some 400,000 tons of copper concentrate will be produced yearly at the mine. Each of the two belt conveyors is approximately 2.5 km long and will transport ore from the mine to the processing plant. The Siemens 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 Siemens SL 150 cyclo-converters.

Other mines, too, employ the latest technology to increase productivity and time to market. The Peruvian mine Constancia and the Chilean mine Cerro Negro Norte are both equipped with Siemens control with mining-specific libraries that allow better monitoring, higher flexibility and increased productivity. Cerro Negro Norte is also a great example of how technology can be applied to meet the increasingly demanding needs and accelerating pace of a sustainable future. "We've designed a system around the unique needs of a mine, which, compared with a generic version, leads to greater results with lower economic, social and environmental costs," says Vains. ■

Author:
Felipe Contreras Fuentes,
contreras.felipe@siemens.com

The world's second conveyor belt system equipped with gearless drives is located at the Antapaccay mine in Peru

Gearless drives

Belts rolling

at Antapaccay

Siemens has commissioned the world's second gearless conveyor system in the Antapaccay copper mine in Peru. This is the first time this technology has been implemented on a large scale outside Germany.

The belt conveyor transports ore from the mine to the processing plant at a speed of 6.2 m/s

The Siemens Drive Technologies Division has commissioned a gearless belt conveyor system in the Antapaccay copper mine in Peru. This is the first large-scale reference for this technology outside Germany. The mine, 4,200 m above sea level, belongs to Xstrata Copper and is scheduled to produce an average of 160,000 tons of copper in concentrate per annum in the initial years of its more than 20-year projected mine life. The gearless drives will help to boost the efficiency and reliability of the conveyor system in Peru and reduce maintenance requirements when compared with conventional systems. In addition, the Siemens' scope of supply includes the entire switchgears and gearless drive systems for a 40-ft SAG mill and two 26-ft ball mills with the associated power supply.

Efficient, reliable and safe

The belt system in the Antapaccay copper mine was supplied by ThyssenKrupp and transports ore from the mine to the processing plant over a distance of around 6.5 km. With a belt width of 1,370 mm and a conveyor speed of 6.2 m/s, approximately 5,260 tons of ore can be transported in an hour. The conveyor system is the second of its

kind worldwide. The first belt system with gearless drives was installed back in 1986 by Siemens and ThyssenKrupp (previously O&K) in the Prosper-Haniel mine of Deutsche Steinkohle AG. The Siemens drive system for the belt conveyor consists of two low-speed running synchronous motors, each with a power rating of 3,800 kW, and the associated cycloconverters Sinamics SL150 and convertor transformers. Compared with the combination of high-speed motor and gear units otherwise used in belt conveyor systems, this gearless drive solution offers a range of benefits (see "Advantages of gearless drives" below). In short, the gearless drive system ensures highly reliable and efficient drive systems under the harsh environmental conditions typical for high altitude mountainous regions – a decisive criterion for mining.

In addition, Siemens supplied the high-voltage and gas-insulated medium-voltage switchgear for the main distribution, as well as the low-voltage switchgear for the overall plant. The equipment enables safe and reliable power distribution. The maintenance-free long-term operation for these products is also noteworthy.

Xstrata Copper, based in Brisbane, Australia, is part of Xstrata plc and operates mines and production plants in Argentina, Australia, Chile, Canada and Peru. The company is the fourth largest copper producer in the world. The Antapaccay copper mine in the south of Peru began production in the fourth quarter of 2012. Siemens was entrusted with the conveyor belt project in 2010, having already been awarded the contract to supply the electrical equipment for three grinding mills for the mine in 2008. These have also been fitted with gearless drive systems. Siemens was responsible for the configuration, manufacturing and supply of the electrical equipment for the grinding mills. The SAG mill was fitted with a gearless drive with a power rating of 24 MW and the ball mills were also fitted with gearless drive systems, each providing 16.4 MW. Also included in the scope of supply were transformers, E-houses, the drive control, the cooling system, protection equipment and operator control systems.

Advantages of gearless drives

In the future, for mining companies it will be more and more important to reduce energy consumption and increase reliability. Therefore, gearless drives for conveyors can be an interesting alternative for power requirements above 2.5 MW. The investment costs are similar or even less compared with a conventional geared solution. Furthermore, a solution with gearless drives offers several advantages compared with the traditional arrangement with high-speed motors and gear reducers.

- The drive size is no longer limited by the available gearbox size, so for the required drive power demand only one drive per drive pulley is necessary. This, in turn, decreases the number of drive pulleys.
- If gearless drive systems instead of a conventional drive system with two drives per drive pulley are used, some 20 bearings and 4 couplings per drive pulley can be saved.
- The necessary drive power demand can be made available with only one drive per pulley. As a result, electrical components such as converters and switchgears are not needed and the E-house can be of smaller dimensions.
- By eliminating a series of mechanical and electrical components, availability automatically increases and less maintenance is required.
- Drive stations with a gearless drive system can be built more compactly. This is especially the case in drive stations in tunnels or underground applications.
- With the possibility to increase the drive power demand per drive pulley, longer belt conveyor systems are conceivable, and the number of drive and transfer stations can be reduced.
- The efficiency of the entire system increases 3 to 4 percent, since gear and other losses are eliminated.
- The maintenance needs of the drive system are also lower. Gear maintenance activities alone account for up to 5 percent of the original investment costs.
- Fewer spare parts and as a result lower inventories lead to lower investments.
- The noise level is also lower through the elimination of fast moving mechanical components.

With gearless drive systems, a low-speed synchronous motor replaces the high-speed asynchronous motor, the gearboxes and the couplings. The rotor of the motor is flanged directly to the shaft of the drive pulley, which means that gearboxes, couplings and the associated lubrication and cooling systems are no longer necessary. The motor also does not require motor bearings. Compared with conventional solutions, in which the drives have to be mounted on both sides of the drive pulley for larger power requirements, only one gearless drive has to be mounted on just one side. This allows better access for maintenance as well as shorter installation and commissioning times. ■

Author:
Christian Dirscherl,
christian.dirscherl@siemens.com

Drive station at open-pit mine, Reichwalde, Germany

Modern drive technology for belt conveyors

Smoother, faster and more efficient

Regulated drives can considerably improve the effectiveness of belt conveyor systems while lowering wear on mechanical components. Siemens has installed converters in the conveyor drive stations at Vattenfall Europe's Reichwalde open-pit mine. New systems and procedures help optimize technological process chains.

Since the 1950s, belt conveyors have become established as an effective means to transport bulk material. The largest and most powerful belt conveyors are found in mining applications, which were the first to be equipped with converters. In fact, variable-speed belt conveyors use up to 20 percent less electricity, especially in view of the fact that they function as regular motors as well as generators. In all operating scenarios, a frequency-controlled drive can be adjusted for optimal torque and optimal speed, which means it can be accelerated more smoothly and without any jerking. This type of operation goes easy on the drives, bearings, belt pulleys, brakes and rolls, and avoids belt vibration and tears.

Belt conveyor project at Vattenfall Mining Europe

Time and again, experience gained during operation proves to be an important source of inspiration for the further improvement of different components in a belt conveyor. The case is no different with the belt conveyor at Vattenfall Mining Europe's Reichwalde open-pit mine. Here, the operator and planers met at an early stage and got the requirements down in writing.

Vattenfall – Europe's fifth-largest electricity producer and the leading heat supplier – excavates lignite coal in ▶

different open-pit mines in the east of Germany. The mines are among the most sophisticated in regard to system engineering. Around 60 million tons of lignite coal are turned into electricity at the Jänschwalde, Schwarze Pumpe and Boxberg power plants. To ensure a steady supply of coal for the Boxberg power plant, starting in 2010 coal excavation was resumed in the Reichwalde open-pit mine.

To transport the lignite coal, Siemens supplied a belt conveyor system with a total length of 13.5 km. With a width of 2,000 mm, the conveyor belt can transport around 6,000 tons per hour. The system includes six conveyor flights with a total power requirement of 19,350 kW: three drive stations have drives with a rating of 1,250 kW each, and three with 900 kW each. Four of the belt conveyors are stationary and two are shiftable.

Vattenfall poured its experience gained over the years – in mechanical as well as electrical engineering – into a complex package of requirements to be implemented in the new conveyor, in particular with the help of modern drive systems. In all six drive stations, modern variable – frequency drive systems based on the Sinamics S120 converter were installed. These very compact inverters run in four-quadrant operation and feed the energy generated during braking back into the grid. In the following, the many options for a tailored, multi-motor drive solution are described.

Load-dependent conveyor belt speed

The loading capacity of a belt conveyor can often change, for example as a result of conditions in an individual layer or the number of coal excavators at work. Therefore, from an economic as well as an ecological standpoint, it makes sense to adjust the conveyor speed to the current volume. A reduction in speed at lower average loads means fewer belt circulations and thereby less wear. This type of operation prolongs the service life of components such as bearings, load-bearing rollers and motors, and reduces energy use. The Siemens control function is set up so that load is measured on the first belt conveyor that functions with constant speed, and the speed for the following belt conveyors is adjusted accordingly.

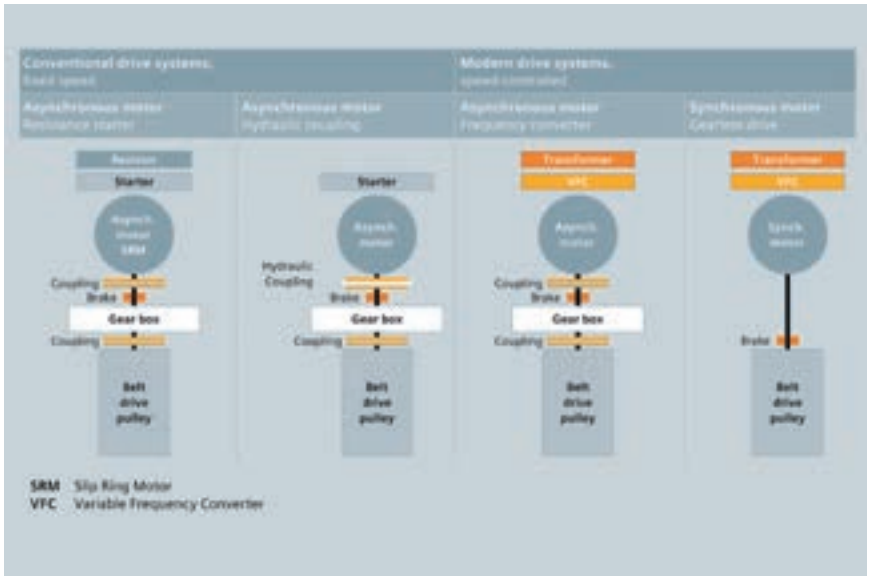
The operational mode described above has the additional advantage that with the change in the conveyor speed, the trajectory parabola on the hand-over point changes, and as a result, so too does the point of impact in the transfer chute. This means that a larger area is exposed to wear – in contrast to wear on one specific point, which is typical for a conveyor belt operating at a constant speed. The lifetimes of the individual plates are therefore higher.

Optimized start-up and stopping

A comparison of the start-up process of a belt conveyor with and without a controller reveals considerable differences: In an uncontrolled system, the individual belt conveyors are started one after the other. This means that for every start-up there are several minutes of unproductive time until the entire facility is up and running, and material can be transported. This type of start-up is necessary to prevent overflows at the transfer points. Speed-controlled drives allow individual belt conveyors – independent of their load – to be started up or stopped at the same time. Efficiency is improved with drive control. This mode of operation has been used in many Vattenfall conveyors, and has also been integrated in the new coal conveyor.

Furthermore, a gentle start-up of the belt conveyor avoids mechanical peak loads on the belt. The converter changes the speed and torque according to a defined ramp. These peak loads from non-steady-state operation also impact the dimensions of the components. If peak loads are avoided, a

Overland conveyor at an open-pit mine, Reichwalde, Germany



belt with a lower tensile strength can be used, which considerably reduces the investment costs. At the same time, optimization of the start-up, especially in the non-steady-state periods, can stop the conveyor belt from lifting up in certain areas, which prevents further peak loads during start-up. This is especially important, since the topography in the Reichwalde open-pit mine with its many concave sections poses a particular challenge.

In normal operations, with the help of the converter and the defined ramp, the belt conveyor is stopped. Consequently, the brakes are not used, which translates into a considerably higher lifetime for the brake pads. The brakes are therefore only designed for emergency situations. In normal operations they are employed at about 5 percent of the nominal speed. This is necessary to avoid the brakes from rusting. In effect, the brakes have the function of a holding brake.

Improvement in dynamic behavior

With longer belt conveyors, especially during start-up, translatory vibrations often occur. These vibrations represent a high additional load for the entire facility. With a variable drive, the start-up ramp can be designed so that there are no translatory vibrations.

During commissioning, Siemens engineers measured the natural frequency and other resonant frequencies to ensure that the entire facility is not operating in a critical speed range. The measurements showed that there was no resonance in the intended speed range. Otherwise, the drive would have to be protected and the relevant speed range quickly passed. The converter offers the respective system functions.

Along with the described impact on operations, the use of converter technology results in other effects that allow for better system dimensioning, require lower dynamic ranges and reduce mechanical stress. For example, slippage between the drive pulley and the belt can be reduced when the implemented drive control software compares the speed of non-driven pulleys with the speed of the drive pulleys. If differences are detected, a signal is sent to the drive, which either increases its speed or brakes, thereby avoiding relative motion between the belt pulley and the conveyor belt.

Load distribution in multi-drive pulley operation

In this project, multi-drive pulleys were used. Minimal differences in the average diameter of the pulley – as a result of production tolerances and wear – can result in speed differences between the drive pulleys. The consequence is relative motion between the conveyor belt and the drive pulley. This type of relative motion always leads to increased wear on the pulley laggings. The drive control software now monitors the load distribution and compensates deviation so that the required performance corresponds precisely to the respective drum shaft and to the previously planned ratio. In general, the ratio between drive pulley 1 and drive pulley 2 is 1:1, though other ratios, for example 1.1:0.9 are possible. This enables exact settings. At Vattenfall, two drives work on drive pulley 1. As described above, these drives are monitored and regulated according to the load distribution. In this way, overloads on individual drive components and the transfer of inadmissible peaks on the conveyor belt are avoided. This increases the lifetime of pulleys and friction linings.

Project experience

Siemens handed the coal conveyor systems over to Vattenfall Mining AG after six months of trial operation. The operators' expectations in regard to functionality and operational performance were thoroughly fulfilled.

The many years of good collaboration between Vattenfall and Siemens have resulted in one of the world's most advanced belt conveyors at the Lusatian lignite coalfield. Siemens integrated the new facility in the existing control center, from where the two complete open-pit mines, transport of coal from the mines to the stockyard, and all the logistics at the stockyard can be monitored and controlled. The Boxberg power plant is fed with coal from the stockyard, and rail loading facilities can supply other power plants in the Lusatian area.

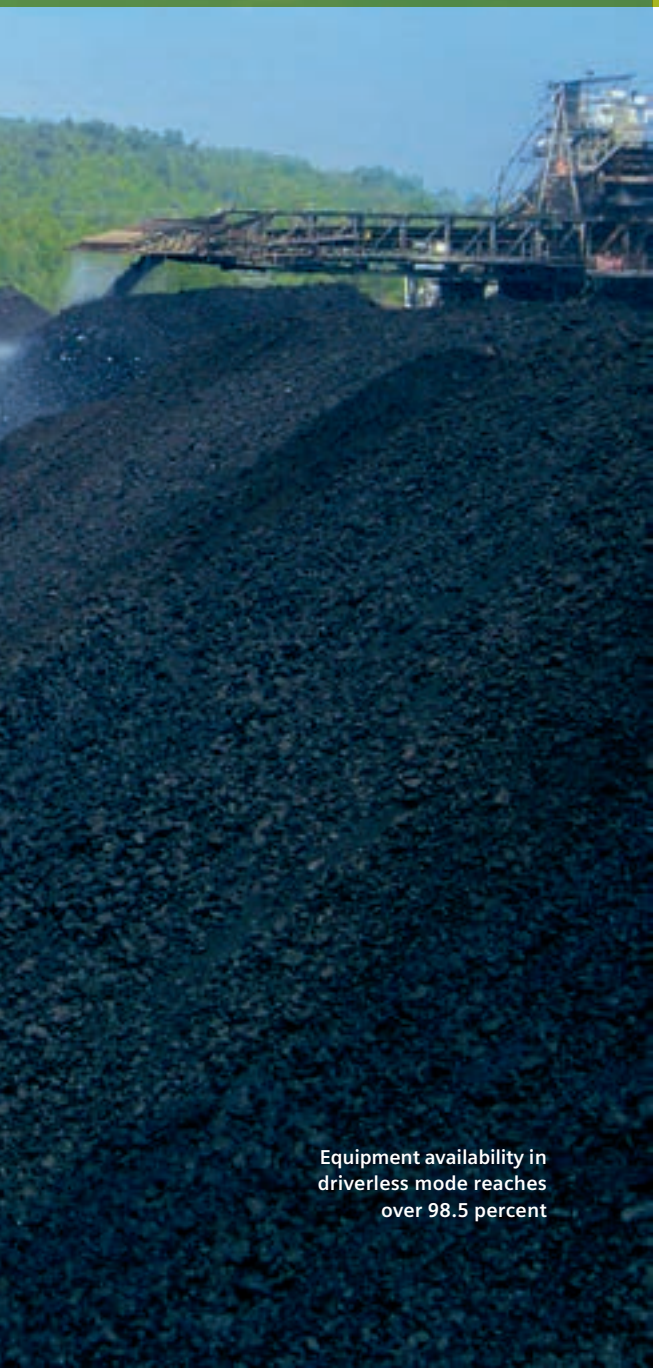
Integration in the control center ensures better access to plant parameters and a secure, detailed history, which builds the basis for the design of future belt conveyors. ■

Author:
Dr. Torsten Hellmuth,
torsten.hellmuth@siemens.com

Stockpile management

Unmanned operation

boosts reliability



Equipment availability in driverless mode reaches over 98.5 percent

For the stockpile management of RWE Power's lignite mines in Germany's Rhineland area, Siemens unites unmanned operation with a quality management system. One important outcome: higher reliability.

Storage and transport systems that optimize throughput times and guarantee requested quality output are an important part of advanced facilities for the transfer of bulk materials. Significant savings and improvements to get the requested material in the specified quality can be achieved through unmanned operation of stackers, reclaimers and combined machines. The answer from Siemens is Simine MOM, a unique method to reliably and safely optimize reclaiming operations in unmanned operation. The patented solution achieves over 98.5 percent availability at RWE Power's lignite mines in Germany's Rhineland area. ►

Cutting-edge technology greatly increases efficiency and therefore leads to a tremendous reduction of CO_2 emissions.

RWE Power is the largest German producer of electricity with around 17,000 employees and a yearly output of 180 TWh. Lignite makes up a good third of the installed capacity and is therefore an important pillar in the energy portfolio. With its yearly excavation of around 100 million tons, RWE Power is the world's largest producer of lignite. Around 90 percent of the lignite excavated at the company's open-pit mines in Garzweiler, Hambach and Inden is transformed into electricity. In the last years, a dozen rail-bound stackers and reclaimers at RWE Power's Hambach and Garzweiler open-pit mines have been equipped with Simine MOM for unmanned operation.

Siemens entered the picture in 2002 with the implementation of unmanned operation at the stockyard of the Niederaußem power plant. The trigger for this project was the addition of a new 1 GW power station to the existing lignite power plant. The cutting-edge technology implemented for the first time in this project greatly increases efficiency and therefore leads to a tremendous reduction of CO_2 emissions. But in order for the technology to work, the lignite has to be of a consistent quality. This target could only be ensured by introducing an integrated stockpile management system that covers quality management for the stockpile together with unmanned operation of the stockyard machines. Simine MAQ, the material and quality management system for bulk material from Siemens, is an integral part of Simine MOM. With the first implementation of Simine MOM in combination with Simine MAQ at an RWE Power stockyard, the goal to secure the delivery of the requested amount of lignite in the specified quality could be achieved. The availability of the equipment in driverless mode reached over 98.5 percent, which meant that for the long term the stockpile machinery could be operated without personnel.

Automatic operation in Hambach and Garzweiler

Owing to the positive experiences in the first project, RWE Power again awarded Siemens with the implementation of unmanned operation in the stockyards of the open-pit mines at Hambach and Garzweiler. The lignite excavated at the adjacent open-pit mines is temporarily stored at the stockpile facility before it is transported by train or on conveyor belts to the different lignite power plants and finishing plants. The stockyards are made up of two stockpiles, which can hold up to 400,000 tons of lignite. Each stockpile is 800 m long and divided into several sections for different quality levels. The average daily intake of the power plants and finishing plants is 140,000 tons of coal per open-pit mine.

A special challenge for both stockyards was commissioning unmanned operation of the stackers and reclaimers during running operation. The optimization of the stackers and reclaimers in unmanned operation as well as the training of the operating personnel in the control room took place during running operations. All required performance values for the entire modernization were verified and reached during a test phase. The implementation of the unmanned operation was finalized in 2008 for the stockyard in Hambach and in 2009 for Garzweiler.

Storage management based on a 3D model

A core component of Simine MOM unmanned operation is the 3D model of the stockpile. The model was implemented in a separate project before the introduction of Simine MAQ for material and quality management in the stockyards of Garzweiler and Hambach. The material parameters of the lignite necessary for quality tracking by Simine MAQ are integrated in the 3D stockpile model at up to cubic-meter accuracy. Based on the current position of the stacker and reclaimer, and the current stacked or reclaimed volume measured on each stockpile device, the model is updated continuously using mathematical algorithms for each stacking or reclaiming method. For the initial image of the stockpile and the case that the volume scanners mounted on each device fail, the height in the model can be measured and updated by a laser scanner.

For unmanned operation, the control-room personnel specifies the working area and parameters for each job based on the model described above. A 2D view of the 3D model provides the possibility to select the desired working area, type of job and device. Further necessary operation data for the unmanned operation job are calculated automatically and, after approval by the operator, the new job is transferred to the device itself. During execution of the job, no additional support from personnel in the central control room is necessary.

Integrated stockpile management covers quality management of the stockpile along with unmanned operation of stockyard machinery

Additional operational support for the personnel in the central control room, like interrupting a running job, initiating a new job for the same device and restarting an interrupted job, is provided. This reduces the support required for the unmanned operation to a minimum.

Along with the core components of Simine MAQ and Simine MOM like stockpile management as well as job management for the unmanned operation, all status information from the new unmanned operation mode was integrated in the central stockyard control system based on Simatic PCS7.

The success story continues

In the last few years, RWE Power awarded Siemens with further projects. For example, Siemens equipped the new Garzweiler II mine, an extension of the Garzweiler mine, with a new DCS system based on Simatic PCS7 including a new central control room and several other systems like video, communication network OTN, simulation and training systems, which are all necessary for operation of the mine. The electrical equipment for the new conveyor system for the extended mine was also delivered. The successful implementation of the new control system at Garzweiler II and RWE Power's positive experience with the Siemens regional mining competence center in Cologne were among the drivers that led to the order for the control system and conveyor system for the extension of the company's Inden mine. ■

Author:
Hans-Jürgen Seger,
hans-juergen.seger@siemens.com

Siemens introduces the Minerals Automation Standard

A decisive step

The Minerals Automation Standard is an innovative automation concept for mining that improves productivity, plant availability and efficiency. Standard automation and control system components from Siemens backed by years of experience and engineering know-how gained in projects in the cement and mining industries are at the heart of the concept.

The Minerals Automation Standard delivers everything necessary to seamlessly meet the most pressing demands of the mining industry: productivity, plant availability, and energy efficiency

Mining companies are facing a number of new challenges. Stricter environmental regulations as well as increasing complexity in mining and treatment processes are driving prices up. To counteract these developments, additional information from the different processes is needed. Transparency is therefore an important step on the way to higher productivity in all areas of the mining industry, from energy management and product quality through to the balance sheet at the end of the month. The Minerals Automation Standard ensures Siemens delivers the right solution to meet the challenges of the modern mine.

Standardization leads the way

The technology behind today's automation solutions barely differs from the technology that was used ten years ago. However, the demands placed on automation technology have increased continuously during this period. The reasons are many, ranging from measures to make plants more flexible and energy efficient, to the integration of new communication technologies. With this in mind, the focus of modern automation technologies is to ensure a high level of standardization and high degree of repeatability. This leads to efficient and cost-effective solutions both with respect to the initial engineering effort and to continuous maintenance work.

Siemens is now integrating solutions into the mining industry that have proven successful in other process industries. To achieve this, Siemens engineers are drawing on their vast experience within the mining sector. The system platform for the Minerals Automation Standard is the Simatic PCS7 process control system with its open, flexible and scalable architecture. One advantage here is that the Minerals Automation Standard benefits from the innovative Advanced Process Library (APL), which integrates many years of experience from project engineers and plant operators. The basis for the industry-specific functionality is Cemat Version 8.0, the leading process control system for the cement industry, which has been enhanced with new functionalities and components based on the specific requirements within the mining industry.

The easy scalability of Simatic PCS7 with regards to system size, functionality and performance ensures an optimum layout for every process area and offers sufficient scope for future enhancements – whether for individual machines such as crushers, mills or conveyor belts with local operation and monitoring, or for complex, networked systems with central operation and monitoring at a single production location, for example a processing plant or a stockyard area.

The integration of components and systems from other manufacturers is supported by technological interfaces that allow the simple integration of components such as the Motor Control Center (MMC), drives and switchgears (integration of medium-voltage switchgear on the basis of IEC 61850) and intelligent process instrumentation.

With the Manufacturing Execution System Simine MES, developed by Siemens specifically for the mining industry, seamless information exchange of plant processes with business systems like ERP can be ensured. Information such as consumption and inventories, production orders and specifications as well as data concerning plant availability and equipment switching cycles for preventive maintenance, ensures complete cost transparency of the total production process and optimization of the production and supply chain in the mining industry.

One system for all challenges

The Minerals Automation Standard is more than a library with its own mining modules: The Minerals Automation Standard is an operating philosophy, and a diagnostics, messaging and safety concept with industry-specific software packages specially developed to fulfill the requirements of the mining industry. The system helps reduce operational and maintenance costs as well as increase plant availability and productivity. The mining-specific functionalities including software packages and components for Simatic PCS7 cover:

- Highest engineering efficiency and reduced commissioning times thanks to modular libraries for mining applications
- Control of automation components and their communication
- Improved efficiency and security through operational and monitoring features for simple and intuitive operation and an intelligent reporting system ►

- Reduced downtime through fast fault detection with the help of an innovative diagnostics system and additional functions such as signal tracing and signal status information, as well as through the implementation of the latest safety and IT security concepts
- Support of remote plant operation through web-enabled visualization of process images and faceplates bearing in mind the specific plant and environmental conditions in mining and enabling operation from both a central control room and/or from remote locations
- Increased transparency thanks to management information using protocol and statistics functions as well as long-term archiving

With the Minerals Automation Standard, Siemens sets the benchmark for high-performance automation, cost-effective operation and an efficient lifecycle management for the mining industry.

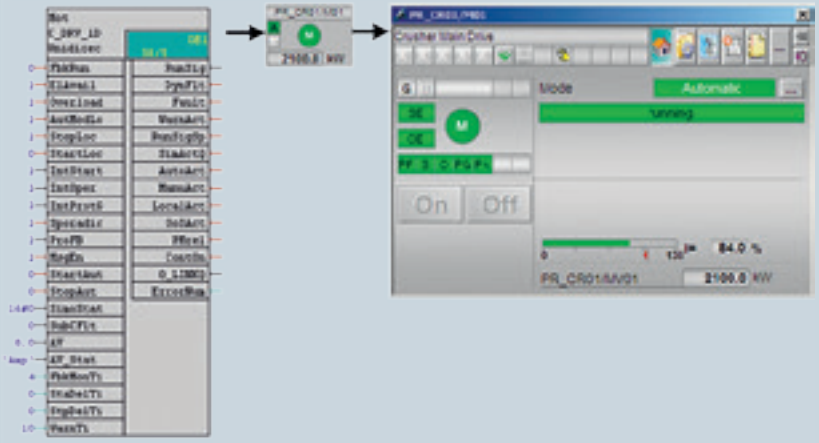
Efficient and simple operation is the key to success

The visualization of process data follows the respective predetermined process hierarchy and structure. For example, a simple block icon in the display shows the status, operation mode, plant identifier and the most important values for each component. The visual navigation reflects the technological hierarchy of the plant and shows a summary of alarms and warnings from substructures. This means that complete process groups can be started and stopped at the click of a mouse, for example when restarting a specific process. An object browser makes it possible to identify and display all objects within the plant in a certain operational phase – for example "In simulation." Process values such as pressure or flow rate can be used for the feedback signal "Drive on." This considerably increases the quality of information on the correct functionality of the drive. The additional new operational mode "Out of service" is used for components and aggregates that are not available, for example, due to maintenance or service.

An integrated power control system for the mining industry combines process and power control on the basis of the IEC 61850 standard.

Using a library-based dashboard in the optional Energy Management System, the operator can get information on the energy data in the main and auxiliary systems. The display of key performance indicators helps reduce energy costs and ensures a timely reaction, if required. The data is available to plant operators as well as management for company-wide prognosis and planning.

Integrated plant asset management provides information on the maintenance requirements of electronic and mechanical components. Asset information is automatically generated and displayed according to the process hierarchy.

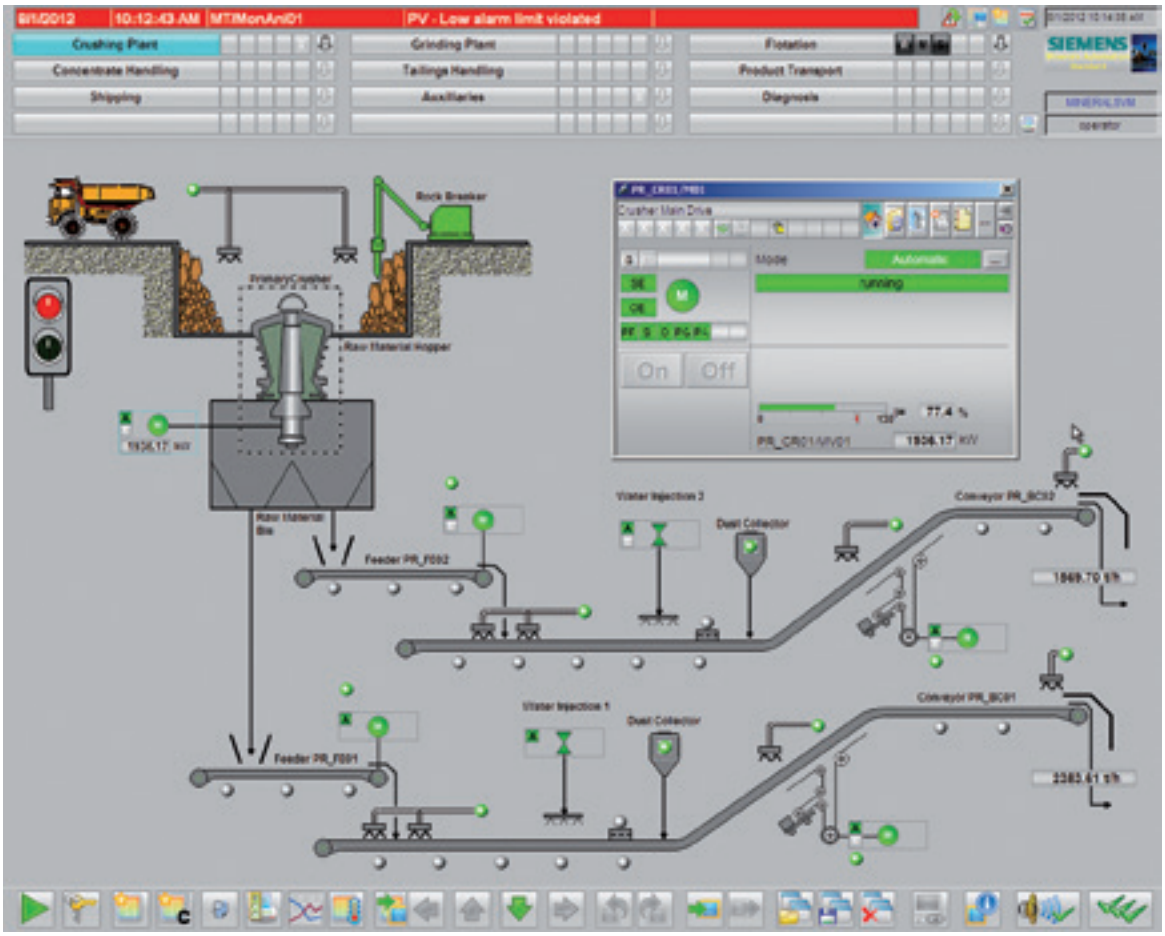


Each library object covers PLC program block and visualization modules

Simple plant engineering

A guided engineering process ensures the highest software quality. This is achieved with centralized and integrated engineering tools according to the Totally Integrated Automation (TIA) principle to ensure coordinated, simple and reliable engineering. The Minerals Automation Standard comprises over 25 technology-based components with integrated operation and alarm functions as well as the respective visualization components. The concept ensures consistency from the control level all the way through to the management level.

Special methods and tools in the Advanced Process Library lead to the



Main Visualization screen of a concentrator plant implemented with the Minerals Automation Standard

easy and cost-effective implementation of Advanced Process Control (APC) applications. They support personnel to effectively operate the large variety of process components and systems in a production and processing plant. APC encompasses different process control methods in a higher control level and includes, for example, model-predictive control, soft sensors, neural networks, fuzzy control and much more. With the help of integrated APC applications, throughput can be considerably increased, product quality homogenized and energy consumption reduced.

The Minerals Automation Standard can be easily adjusted to the requirements of individual customer plants thanks to the standard components specially developed for the mining industry. At any time, the system can be adjusted to accommodate changing conditions with regard to the location, plant and process. Standard interfaces between the individual software modules minimize errors, and open interfaces enable easy integration of third-party components. The Simatic Process Device Manager, a central tool for all intelligent field devices, enables central parameterization, diagnostics and loop check of each individual field device. Support of open communication standards such as Profinet, Profibus, Foundation Fieldbus, Industrial WLAN, IEC61850, Modbus and OPC enables easy integration of external devices like switchgears, drives, MCCs and other intelligent field devices.

With the Minerals Automation Standard, Siemens sets the benchmark for high-performance automation, cost-effective operation and an efficient lifecycle management for the mining industry. The solution, developed in collaboration with experts from the field, is already being successfully employed in different mining regions of South America. ■

Authors:
Ralf Franke,
Ralf.franke@siemens.com
Hans-Jürgen Seger,
Hans-juergen.seger@siemens.com

Market innovation

World's most compact

Due to the ever-increasing portion of iron ore fines and concentrates available on the global market, pelletizing is growing in importance for the agglomeration of iron ores. In response to this trend and simultaneously to reduce investment costs for the installation of new plants, Siemens VAI has developed Circular Pelletizing Technology (CPT). This new generation of pelletizing plants, featuring a circular induration furnace, is characterized by its compact layout and lightweight construction design. This facilitates the efficient and cost-effective installation at the mining site or within an existing steelworks. The first CPT plant is currently under construction in India, and is scheduled for start-up in late 2013.

CPT – a compact and cost-efficient solution for the production of quality pellets

pelletizing plant

A growing number of iron and steel producers are looking into the possibility of introducing pellet production directly at their production sites. This would not only provide independence from escalating prices for pellets on the world market, it would also enable the flexible adjustment of the pellet chemistry and quality to ensure optimized iron and steel production. However, up until now, the space required for a conventional pellet plant was too large for an efficient and cost-effective integration within an existing iron- and steelworks. This meant that producers had to either purchase pellets from commercial suppliers or operate their own pellet plants near the iron ore mine. The latter often incurs complicated transport logistics and the related higher costs.

In response to this challenge, Siemens VAI recently developed Circular Pelletizing Technology, or CPT. The process is based on and is virtually identical to well-proven travelling-grate pelletizing technology, with the difference that a circularly designed induration furnace greatly reduces the footprint size of the pelletizing plant. Overall space requirements for CPT plants are approximately one half of those needed for a conventional pellet plant. Capital expenditures for civil works, ►

CPT boasts a compact layout and lightweight construction design.

- equipment and steel structures are reduced accordingly, and plant installation can be completed far more quickly. Annual production capacity of a CPT plant ranges between 0.8 and 3.0 million tons of pellets.

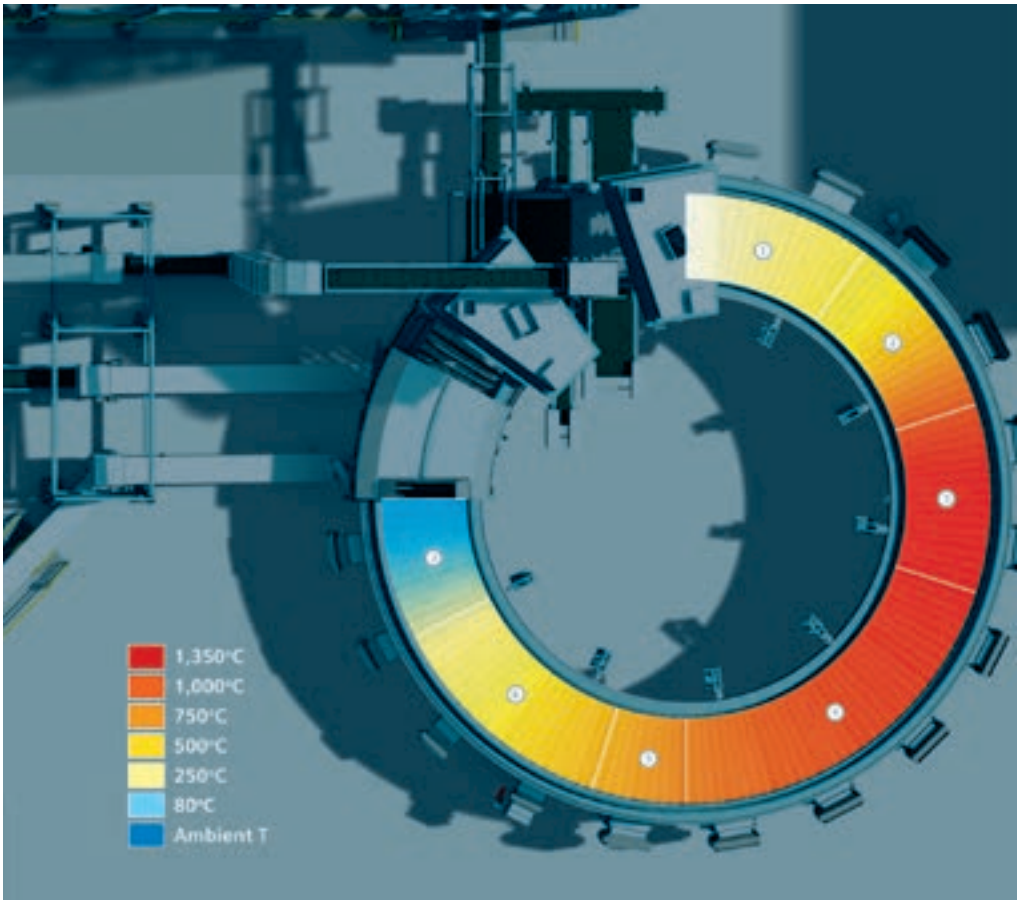
Process and plant description

A CPT plant includes the pre-processing facilities for grinding, storage, mixing, balling and screening of the iron ore and other input materials; a green pellet charging area; a circular induration furnace; a combustion system; process-gas cleaning; the service area for material feeding and product discharge; a secondary dedusting system; the respective transport and conveying systems; and the pellet storage area.

CPT sets new benchmarks for cost-efficient iron and steel production on the basis of iron ore pellets.

Pre-process facilities

The pre-processing facilities include storage, dosing, mixing, balling of the raw materials and the related transport facilities. The raw and input materials – including ground ore, bentonite, hydrated lime or limestone, coke or anthracite, and dry dust – are stored in a series of bins. Grinding mills for iron ores and additives can also be provided. The different materials required for the pelletizing process are extracted from the bins and charged onto a belt conveyor by dosing devices. The material is then conveyed to an intensive mixer for thorough homogenization, after which it is transported to the balling section to produce the so-called green pellets.



Induration furnace

Green pellets from the balling section are charged in a uniform layer onto a 100-mm hearth layer of the travelling grate of the induration furnace. The height of the green ball bed is approximately 350 mm for a total bed height of about 450 mm. The actual bed height is continuously measured by ultrasound probes to ensure the proper speed of the travelling grate.

The induration furnace features a circular design that allows the furnace hood to cover more than twice as many pallet cars compared with a straight-type induration furnace. Multiple fuel burners are installed in the induration hood. The combustion system can use various energy sources such as coal gas from a coal gasifier in combination with liquid or other gaseous fuels. If required, Siemens VAI can supply a complete tailor-made coal-gasification system to meet the combustion requirements of a CPT plant.

The CPT furnace is comprised of seven process zones where the following activities take place: up-drafting (zone 1), down-drafting (zone 2), pre-heating (zone 3), firing (zone 4), after-firing (zone 5), primary cooling (zone 6) and secondary cooling (zone 7). The length of each zone is designed on the basis of the results from pot-grate tests conducted on the iron ores to determine their pelletizing characteristics. The induration time for pellets in the CPT furnace is 40–55 minutes, depending on the iron ore material. The cooled pellets are discharged from the induration machine at a temperature of 100°C or less. Figure 1 shows the various process zones of the induration furnace and the respective temperature levels.

Process gas cleaning and secondary dedusting

Exhaust gases from the wind boxes and hood are cleaned in electrostatic precipitators (ESP) or in a bag-filter system. The separated dust is pneumatically transported to the dry dust-bin in the storage area from where it is recycled to the pelletizing process. The dust arising at all material transfer points is exhausted and separated in the central bag-filter system followed by recycling to the process.

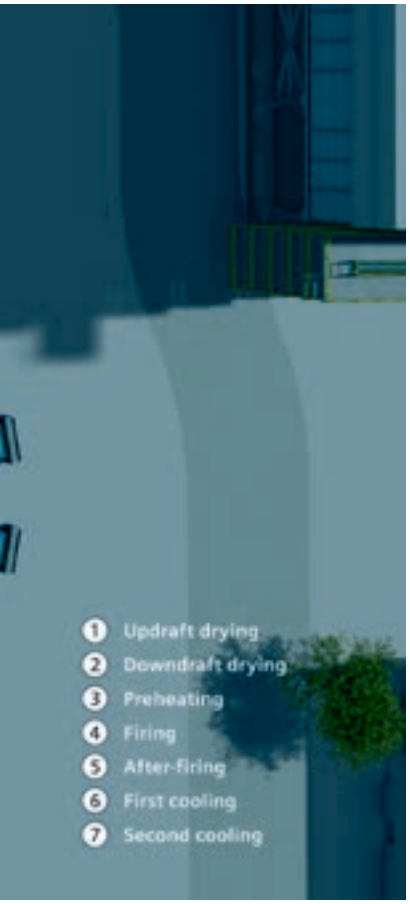


Figure 1: Process zones and temperature levels of the CPT induration furnace

Machine service area of the induration furnace

The service area includes the green pellet feeding section and the product pellet discharging section. The finished pellets are discharged into a hopper from where they are fed onto a conveyor belt for transport to the screening building. Here, the material required for the hearth layer is screened and returned to the induration machine. The bulk of the pellets is conveyed to the product storage pile or bins.

Consumption figures

Expected consumption figures of a CPT plant with pellet capacities between 800,000 t/a and 3 million t/a can be seen in Table 1. The figures are based on a hematite iron ore concentrate with typical physical and chemical properties.

World's first CPT plant

The first order for a CPT plant is now being implemented in Orissa State, India, together with an Indian supplier of beneficiation plants (Figure 2). The plant will have a nominal production capacity of 1.2 million tons of pellets per year. Total space requirements of the complete facility – which extends from raw material dosing and balling to process gas cleaning, and also includes a coal-gasification plant for energy generation – is less than two hectares (five acres). The CPT induration furnace will be fired using a combination of coal gas and heavy fuel oil. Plant start-up is scheduled for the second half of 2013 and the produced pellets will be mainly used by the Indian iron and steel industry.

Features and benefits of CPT plants

CPT represents the world's most compact plant for pelletizing and sets new benchmarks for cost-efficient iron and steel production on the basis of iron ore pellets. Plant modules are available for pellet-production outputs ranging from 800,000 t/a to 3 million t/a. Thanks to the circular design of the induration furnace, space requirements for a complete CPT facility are less than 50 percent of those needed for a conventional pelletizing plant of similar capacity. Capital expenditures for civil works, equipment and steel structures are reduced accordingly. Faster plant completions and start-ups allow producers to quickly commence with profitable pellet production.

The circular induration furnace results in a far more efficient utilization of installed equipment because more than 75 percent of the pallet cars are in use within the induration furnace. This is in contrast to a conventional pelletizing plant where less than 40 percent of the pallet cars are actually involved in producing pellets. (This is due to the linear layout of a straight-type induration furnace, which means that the pallet car strand returns empty to the green-pellet charging area.) The optimized utilization of recovered hot process gases in CPT minimizes the energy consumption required for pelletizing. Total recycling loops for waste materials and steel-mill reverts lead to a low environmental impact. Plant operation is based on the use of well-proven Siemens automation systems for equipment and process control.

CPT thus represents a new generation of pelletizing plants that allows both iron ore producers and operators of iron and steel mills to quickly and profitably respond to the ever-increasing quantities of fine iron ores available on the global iron market. ■

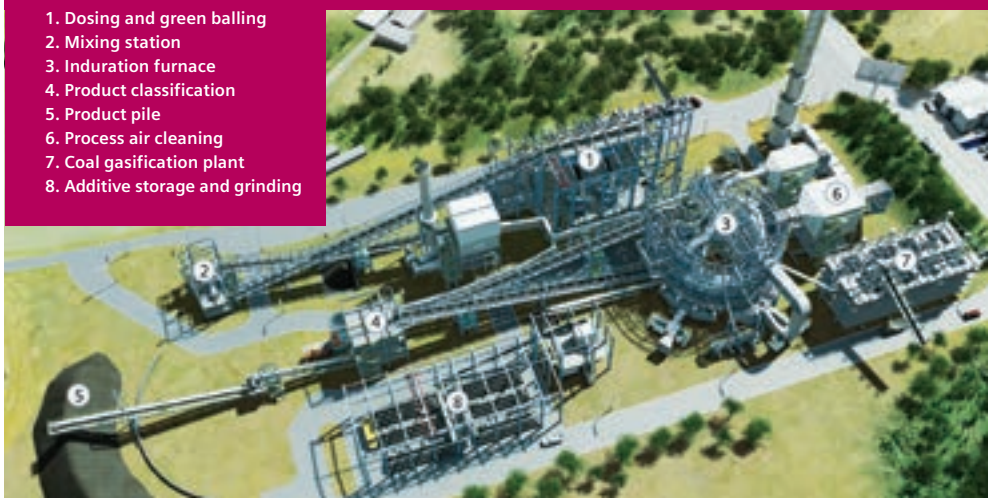
Authors:
André Fulgencio,
andre.fulgencio@siemens.com
Dr. Lawrence Gould,
lawrence.gould@siemens.com

Table 1: Expected CPT consumption figures

Coke	<11 kg/t pellets
Bentonite	<7 kg/t pellets
Limestone	<11 kg/t pellets
Compressed air	<25 m³/t pellets
Water requirements	<0.2 m³/t pellets
Electric energy requirements	<40 kWh/t pellets
Heat energy requirement	<250 Mcal/t pellets
Refractories	<0.1 kg/t pellets

Figure 2: Schematic view of the 1.2 million t/a CPT plant under construction in India

1. Dosing and green balling
2. Mixing station
3. Induration furnace
4. Product classification
5. Product pile
6. Process air cleaning
7. Coal gasification plant
8. Additive storage and grinding



Efficiently upgrading multiple cement plants with Cemat process automation

Strength to strength

Global market player Holcim reaches new levels of operational efficiency and manufacturing excellence through a structured and unified approach in upgrading its Philippine plants' automation systems.

Holcim's primary objectives of the upgrade program are operation sustainability, overall equipment efficiency maximization and process stability.

Operating in the Philippines for the last 40 years, Holcim has built a formidable presence in the country with four plants across the archipelago – namely in Bulacan, Davao, La Union and Lugait – employing a total of 1,700 people. And business is looking good, thanks to increased public spending on infrastructure developments combined with a steady rollout of residential and commercial projects from the private sector.

According to Roland van Wijnen, Holcim Philippines' Chief Operating Officer as of press time, while the company is certainly benefiting from the robust market, the high performance is also due to a number of recent initiatives, chief of which is the massive, region-wide upgrade of its four plants' automation systems, complemented with programs aimed at developing stronger customer focus and more effective cost management.

"The capability to provide reliable supply and consistent superior quality is critical, especially in a very strong and dynamic market such as the Philippines. It is to our huge advantage that all our manufacturing and distribution facilities across the country are able to rise to this challenge," said van Wijnen.

Risks and challenges

During a plant tour at the company's Bulacan facility, which is located in Norzagaray, some 40 km north of Manila, David Cajander, Holcim Philippines' Head of Projects, explains the issues and challenges which led the company to go for a region-wide automation systems upgrade to replace its previous systems installed in 1996. "Operational stability, equipment obsolescence, difficulty in obtaining spare parts and other maintenance issues were becoming significant risks to the sustainability of our operations. Unplanned downtime is our worst enemy. In this business, you absolutely cannot afford to have production equipment out of action for any length of time."

The Bulacan facility is a complete cement manufacturing plant, from the crushing and transport of limestone, clay and shale from nearby quarries, all the way to packing and shipping the final product. In between, the cement manufacturing process consists of raw material preparation, grinding and homogenization, limestone calcination and clinkering (pyroprocess), cooling and cement milling.

While the company's four plants in the country are currently at various stages of the region-wide upgrade program, the cement production process and the automation systems described for Bulacan are similar to those in the three other facilities. ►

Standardization and uniformity

In line with a global initiative aimed at reducing the complexity and variation of automation systems installed in its worldwide facilities, Cajander's teams led Holcim Philippines in the implementation of a carefully considered and extremely structured replacement strategy, which was anchored on standardization and uniformity.

Holcim's primary objectives for the upgrade program are operation sustainability, overall equipment efficiency maximization and process stability. Their long-term goal is to streamline manufacturing technologies across the company by standardizing the plant equipment and engineering processes in its global operations.

Ideally, whichever automation brand is implemented in a particular region, it would have the same architecture, wiring concept, engineering and documentation approach. So whatever country you are in, their plants' electrical, instrumentation and automation systems should all look essentially the same.

Reliable partner

In their search for a suitable automation partner, the number one criteria was local presence. It was important to them that their automation supplier had the necessary expertise and could guarantee centralized and dedicated support over the long term.

Cajander emphasizes: "Compared to some years ago, the field of automation has strongly evolved. A myriad of factors such as advancements in technology and changing market needs have led to its growing complexity. As such, you need to develop expertise in various fields including IT, electricals, instrumentation, and process and control systems. This means you also need to cultivate a much closer relationship with your supplier.
Of course, price and other commercial aspects are important, but with a 24/7, capital-intensive operation such as ours, ensuring uptime of the plant and equipment is top priority."

The commercial and technical aspects of the contract explicitly stated Holcim's design criteria for each phase of the upgrade program, defining what it expected of its automation partner Siemens left no stone unturned in its pursuit of a truly standardized automation system – right down to technical specifications for all electrical, network, fiber optic, automation and software elements.

The system implemented in Holcim is based on Siemens' flagship automation product, PCS7 (version 7.1) with Cemat "Holcim Library" as an add-on module. Cemat is a Siemens-patented software specially designed to meet the process requirements in cement manufacturing. Its pre-engineered software modules and operator interfaces are distilled from Siemens' several decades of partnership with the world's major cement manufacturers.

At the field level, a separate S7-400 PLC is provided for each major process department. The PLCs link to the I/Os (>10,000 per production line) via a combination of Profibus DP fieldbus, Profibus OLM (optical link module), fiber optic cable and ET 200M remote I/O units.

Up in the control room, from where incidentally you can get a fine view of the massive rotating kiln, the operator stations (HMI) for each process department, the engineering station, plus the redundant PCS7 servers are connected via Ethernet cable and Scalance switches.

Building expertise

Given the large Bulacan facility plus the demands of 24/7 operation, the plan was for the region-wide implementation to proceed in stages. "We started with the finish mills because that was where we had the greatest urgency in terms of downtime risks due to difficulty in sourcing out spare parts for the existing automation system," says Cajander.

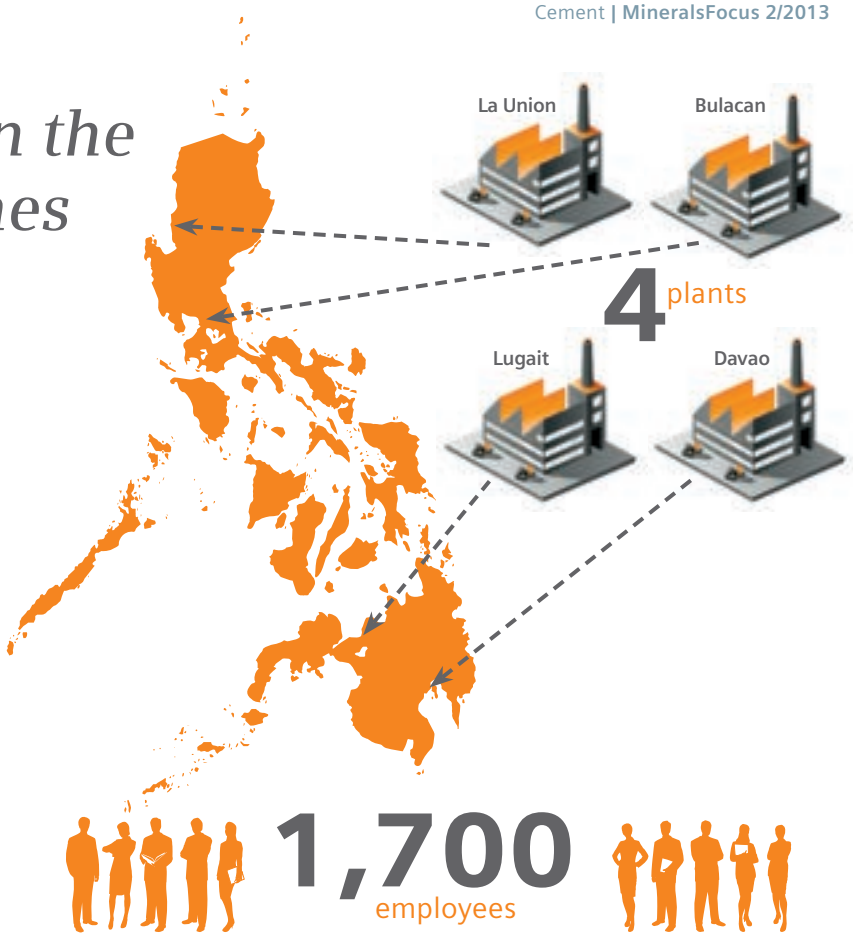
Rather than go the conventional route and use the services and expertise of a systems integrator, Holcim decided to set up its own homegrown team to engineer and implement the project in Bulacan. In fact, all Holcim implementations in the country subscribe to a similar project model, which consists of a core engineering team based in the Manila head-office supported by onsite teams at the individual plants.

Holcim wanted to build considerable expertise within their plants as well as develop a level of know-how capable of rendering fast troubleshooting during operations.

"Before, when we had several different types of automation systems, this would not have been such an appropriate decision, as we would have to build multiple pools of expertise. But now with regional standardization of the electrical and automation technologies specifically tailored to Holcim's design standards, it makes

Holcim staff underwent two months of intensive training in PCS7

Holcim in the Philippines



a lot of sense in terms of enhancing engineering efficiency, maintenance effectiveness and total cost of ownership."

In preparation for this setup, the Holcim Philippines project staff went through intensive two-month training on PCS7 at the Siemens office in Manila. Siemens representatives were also on site during the finish mill implementation, which took place during the 12-day shutdown period in September 2011. "That was an exciting and ultimately rewarding time for the project team as everyone went the extra mile and supported one another to complete the installation against tight deadlines," shares Cajander.

And of course, there were also similar activities going on at Holcim's other plants in the Philippines.

Milestones of success

"We have completed implementation of the first plant in 2012, while the second and the third will be done by the end of 2013. The fourth plant will be finished by 2015. To implement an electrical standardization and automation replacement on this scale, and with multiple projects going on simultaneously, is no small feat," says Cajander, who is also quick to commend the excellent team work and synergy that arose from the partnership with Siemens Philippines represented by senior systems engineer Alwyn Chua and his team, and sales manager Enrico Buergo, the key contact from the commercial side.

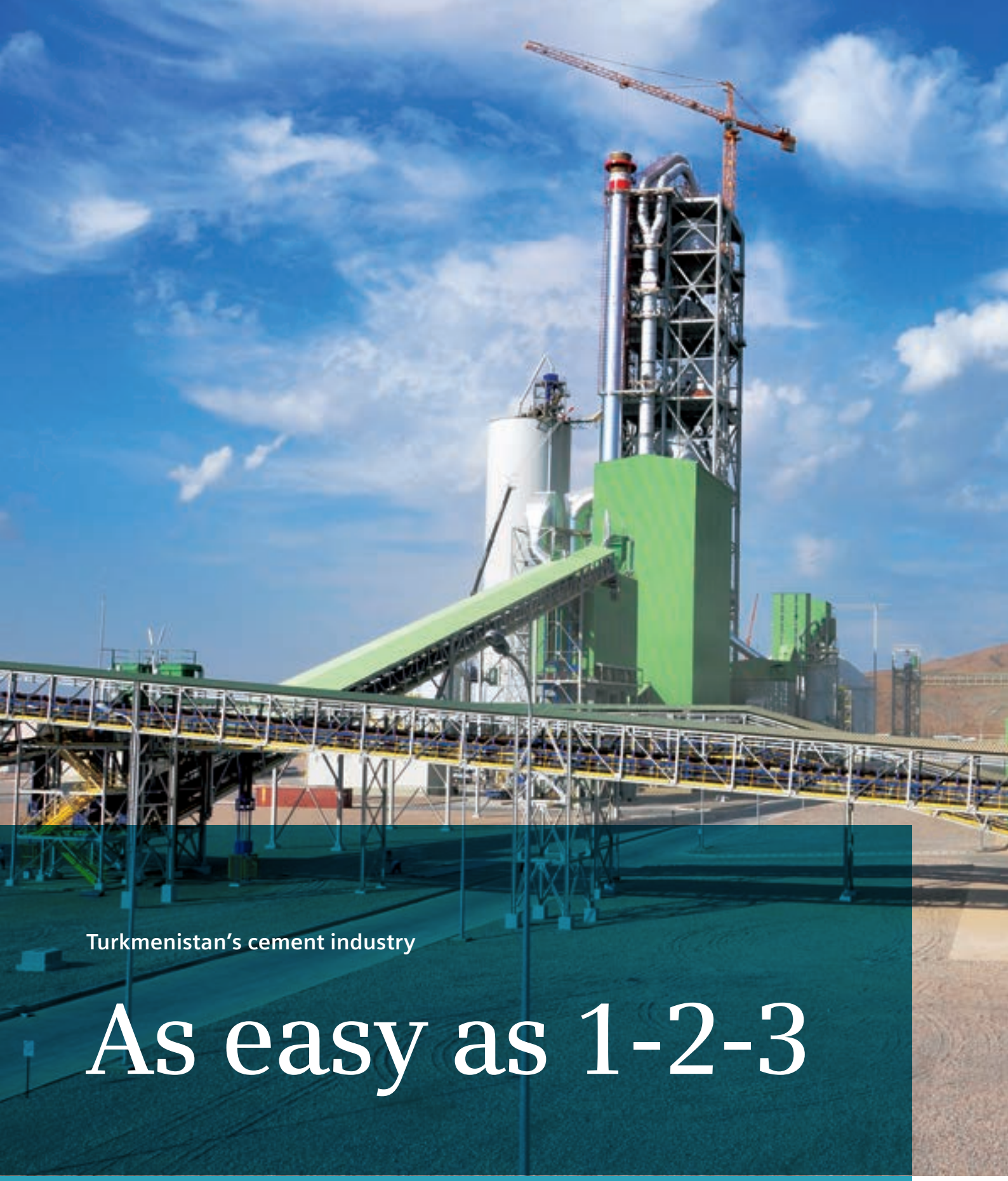
"As Holcim's automation partner, our vision is to fully support them as they strive to achieve their manufacturing goals," notes Enrico Buergo. "We are happy to help them reach a level of plant optimization never before realized in their Philippine operations."

Already the milestones of a successful implementation are evident. A fully automated production line translates to optimized processes and operational efficiencies, which result in higher production volumes. In particular, the PCS7 automation with its reliable control performance and effective maintenance capability leads to new MTBF (meantime between failure) records and a higher OEE (overall equipment effectiveness), which are critical benchmarks in gauging a plant's performance.

Such data can be monitored via the interconnection of the newly installed Siemens PCS7 automation system to Holcim's regional manufacturing reporting platform. This strategic reporting system, which enables continuous monitoring and analysis of critical manufacturing data, supports the company's commitment to operational efficiency and manufacturing excellence.

"As reflected in each of our projects, our market leadership in the cement industry is born from our continuous commitment to four major principles: safety, customer value creation, employee engagement and operational excellence," concludes Cajander. ■

> "Unplanned downtime is our worst enemy."
>
> David Cajander, Holcim Philippines' Head of Projects



Turkmenistan's cement industry

As easy as 1-2-3

Turkmenistan's appetite for cement has grown considerably over the last years due to a whole range of construction projects

The construction boom in Turkmenistan can hardly be overlooked. And where there is construction, there is a need for cement. Today Turkmenistan has three modern cement production lines – all of which are equipped with electrical and automation technology from the Sicement portfolio.

Turkmenistan is home to a veritable construction boom. Recent projects include the conversion of the capital Ashgabat into a cultural, administrative and economic center, and the modernization of the Turkmenbashi Airport. And the list of projects to come is long: a new seaport on the Caspian Sea coast; some 1,700 km of freeways by 2014; the Olympic City Project in time for the 2017 Asian Indoor and Martial Arts Games; modern infrastructure for the Avaza National Tourism Area; ►

"Enormous amounts of cement are needed to deal with Turkmenistan's fast industrialization."

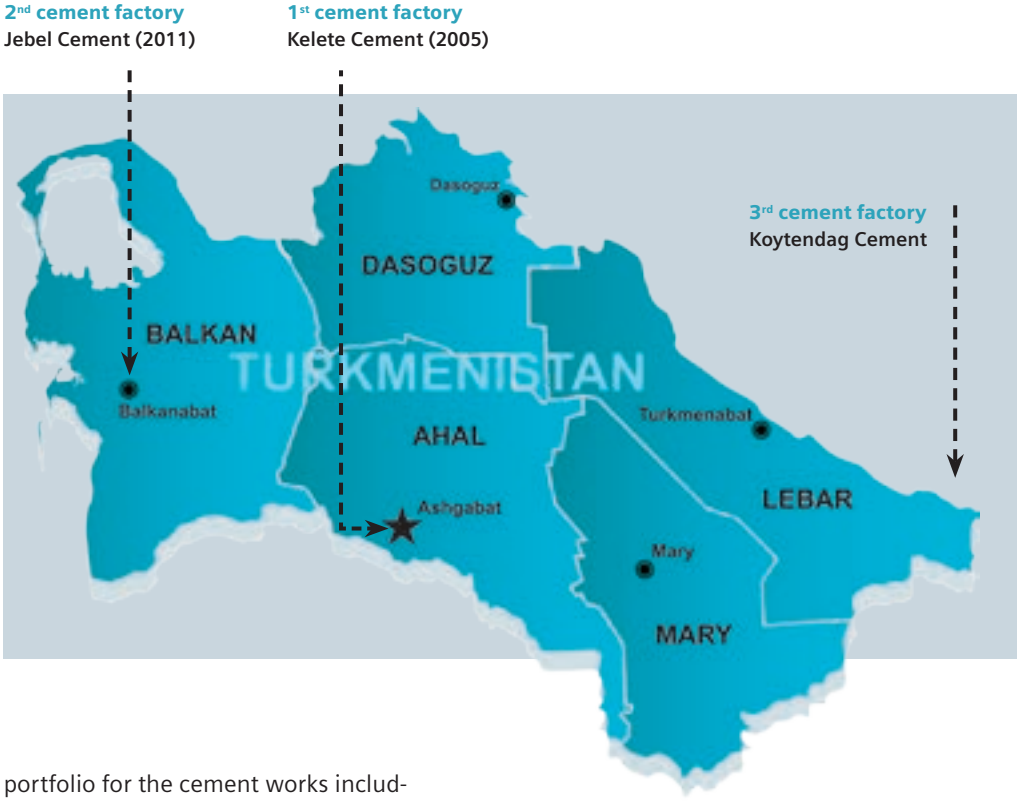
and the Kazakhstan–Turkmenistan–Iran Railway. Furthermore, many energy-related infrastructure projects are either underway or in planning.

Of course, an enormous amount of cement is needed to deal with Turkmenistan's fast industrialization. To satisfy the country's appetite for cement, eight years ago Turkmenistan got its first cement factory: Kelete cement factory, near Ashgabat, with a daily production capacity of 3,000 tons of clinker. Siemens Turkey was responsible for the electrical and automation technology. Two years ago, Siemens Turkey was involved with a further cement factory – the Jebel cement factory, which derives its name from the nearby city of Jebel, not far from Balkanabat, the capital of Balkan Province.

Electrification and automation from a single source

In 2011 the Jebel factory, which covers an area measuring 500,000 m², was put into operation. In addition to heavy-duty Portland cement, the plant produces oil-well cement for the oil and gas industries, and sulfate-resistant cement used in the construction of foundations, bridge supports and other hydraulic structures. The plant's clinker production capacity is 3,000 tons daily and 1 million tons annually. The prime contracting company for the Jebel cement factory was Polimeks Insaat Taahhüt ve San. Tic. A.S., which is one of the largest Turkish construction companies that does business in Turkmenistan.

Siemens Turkey supplied the complete range of the Sicement product portfolio for the cement works including electrical equipment and automation systems for the new line. The electrical equipment comprises the 110 kV switchgear units with the RTU communication system to the energy supplier; 25 MVA main, power distribution and drive-system transformers; the power factor compensation system; medium voltage Simoprime panels; Sivacon MDB, motor control centers (MCC), and lighting panels; the earthing and lightning protection system; the fire alarm system; the indoor and outdoor lighting



Since 2006, Siemens has been making a mark on Turkmenistan's cement industry. The country's third factory was successfully opened in February 2013 with the participation of the President of Turkmenistan and President of Ukraine.

system; medium voltage motors and starters; and 690 V motors and variable speed drives. To ensure that the operators always have everything in view, Siemens delivered a CCTV, telephone and data-facilities system.

Siemens Turkey was also responsible for the design and engineering, material supply and installation of all electrical packages listed above, the assembly of cables and cableways, the commissioning of all systems, project management and the complete site services of the process units.

The entire production line is controlled with the help of programmable logic controllers type Simatic S7-400, which are integrated in Cemat process control system based on Simatic PCS7. A management information system was set up for the long-term archiving of process variables and to store data for other external data processing systems. Process instrumentation including all measuring equipment was also part of delivery.

All along, the Siemens Turkey team endeavored to meet customer expectations of a timely start-up and adherence to all technical requirements. Furthermore, international measures and standards were introduced to ensure that the cement plant is as ecologically friendly as possible. The training of operational personnel was also very important to ensure continuity and optimal production figures.

Outlook

The successful completion and start-up of the Jebel cement factory opened the doors for an immediate further contract with Polimeks for the Koytendag cement factory. The Siemens teams that worked on the Jebel project were simply transferred to the Koytendag plant site to start work on Turkmenistan's third modern cement factory. Soon Turkmenistan will have a total of three modern cement facilities where Siemens Turkey is responsible for the complete electrical packages. Notably, back with the first project, Siemens Turkey set the national standard for a 110 kV switchyard, which is of course being implemented in the ongoing Koytendag cement project. ■

Authors:
Fatih Budak, **fatih.budak@siemens.com**
Dogan Gumeli, **dogan.gumeli@siemens.com**

Working with Siemens has provided the following benefits:

- Fast project implementation and problem-free operation
- Strong technological infrastructure to ensure service for years to come
- High energy efficiency and low operating costs
- Easy operation
- Product reliability
- Quality and speed of services

Siemens Turkey delivers

End users Polimeks and the Turkmenistan authorities are thoroughly satisfied with the quality and the technology that Siemens Turkey has delivered. There were many challenging issues during the implementation of the projects. Examples include the complexity due to information and data flow between various project interfaces like the main contractor, consultant, mechanical and process contactors, and end customer; as well as tough weather and natural conditions at the site.

International measures and standards have been introduced to ensure cement plants are as ecologically friendly as possible

State-of-the-art solutions to keep your plants in optimum condition

Continue saving electrical energy in cement plants

Siemens is continually searching for new ways to save energy.

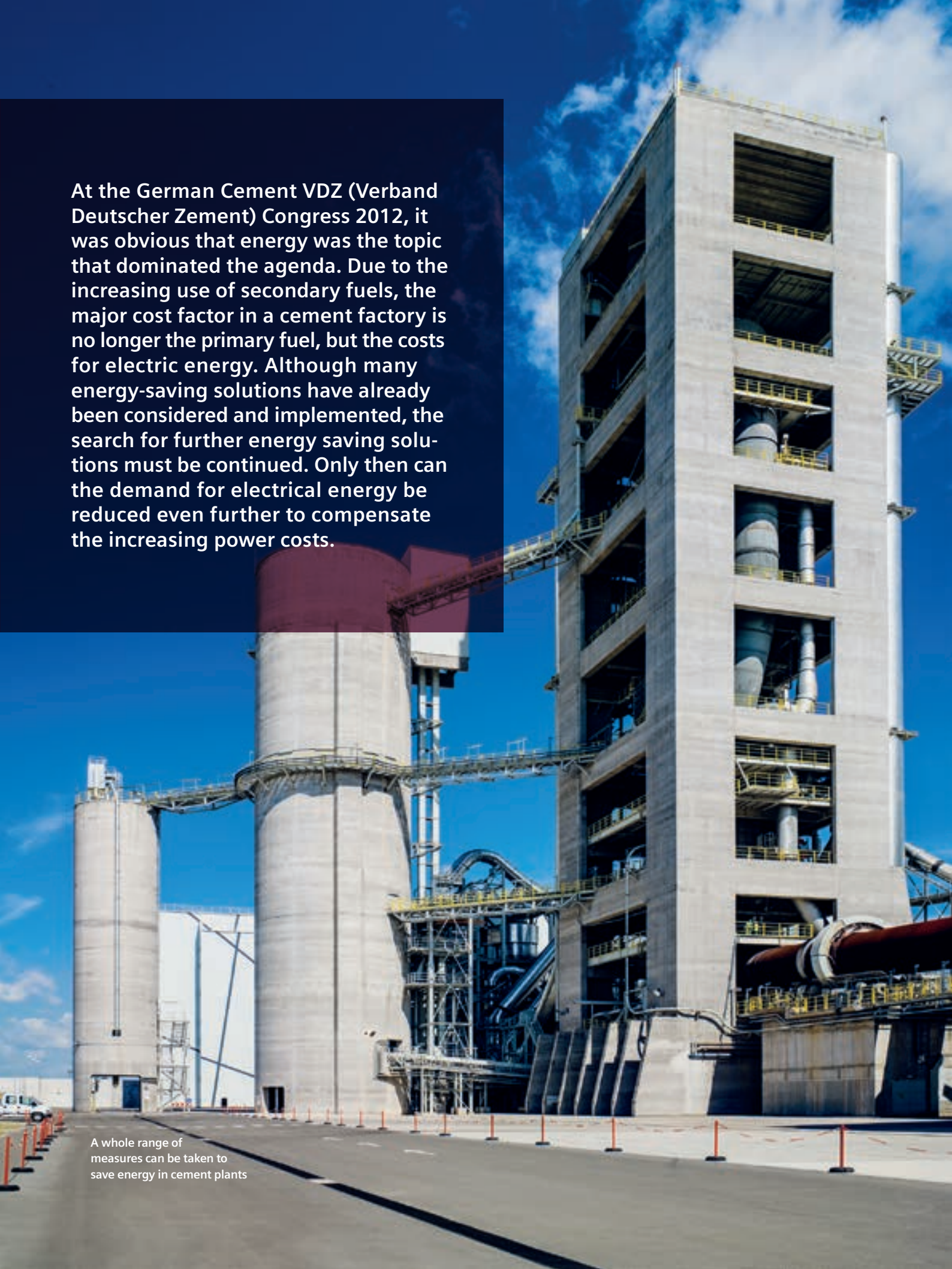
There are low-cost solutions, which can be financed from the OPEX budget, while the larger investments will require a CAPEX evaluation. Siemens is continually searching for new ways to save energy. As a cement producer, have you already considered or even taken steps to reduce electrical energy consumption in your plant? Below are areas that you can review in detail. The graphs on the foldout cover the topics of typical investment costs and the expected ROI period for variable-speed drives (VSD), IE2-IE3 motors instead of IE1-motors (IE), optimizing auxiliary equipment (AUX), continuous vibration monitoring (VIB), total harmonic distortion check (THD), management information system (MIS), secondary fuel management (FM), mill control optimization system (MCO) and waste heat recovery and power generation (WHR).

Variable-speed control

If a flow of process air is presently being controlled using a damper, a variable-speed drive can save energy, because at lower speeds, less energy is drawn from the grid. Typically, this energy-saving method is already used for larger drives. However, since small frequency inverters are more affordable today, every attempt should be made to save energy in this power range. Also, many of the belt conveyors in a cement plant can run at lower speeds and still transport the material. Low motor speeds will also reduce the wear on the mechanical system.

It is important to make sure that the drive motor is suitable for frequency inverter operation. Normally, an insulated bearing in the motor is sufficient. ►

At the German Cement VDZ (Verband Deutscher Zement) Congress 2012, it was obvious that energy was the topic that dominated the agenda. Due to the increasing use of secondary fuels, the major cost factor in a cement factory is no longer the primary fuel, but the costs for electric energy. Although many energy-saving solutions have already been considered and implemented, the search for further energy saving solutions must be continued. Only then can the demand for electrical energy be reduced even further to compensate the increasing power costs.



A whole range of measures can be taken to save energy in cement plants

International Efficiency IE2_IE3 motors

Extensive legislation on energy efficiency has been passed in the European Union with the objective of reducing energy usage in the private and industrial sectors, and therefore reducing overall CO_2 emissions. The new IE2_IE3 motors have higher efficiencies than IE1 motors. Since the electric power costs are much higher than the capital investment costs for the motors, a typical ROI period is within two years. The EU directive for the new IE motors has been in place since June 2011, and the high quantities of small motors in a cement plant represent ideal potential for slashing energy consumption as motor efficiencies can be increased drastically in this area. As a consequence, it is more cost effective to replace a number of small motors instead of just one big motor.

If an existing motor is to be replaced, the higher efficiency class motor will have a payback time of between 1.5 and 3 years.

Optimizing auxiliary equipment

A complex cement plant often means that extensive auxiliary equipment is required, e.g. pressurized air supply, cooling water and process water, which could be linked together to increase availability. The capacity of these sections is normally oversized, since they are calculated for worst-case conditions. However, this equipment frequently operates in the idling mode. Therefore, the speed can be controlled to match the actual consumption. This reduces the power requirement, and therefore reduces the energy consumption for these high numbers of auxiliary units with a low power rating. If necessary, the next step is to evaluate reducing the total number of auxiliary units. When it comes to lighting process areas, LED floodlights can slash the power consumption by 80 percent. Further, all of the lighting systems should be intelligently controlled to reduce energy consumption even more.

A detailed on-site review of the complete cement plant will show all of the potential opportunities for saving energy.

Continuous vibration monitoring

Energy can also be saved by keeping the plant operational, because at the end of the day, the kW per produced ton of cement is the only value that is looked at. Therefore, all measures must be taken to guarantee continuous operation. Unplanned downtimes negatively impact the plant efficiency, as start-up procedures are unproductive and costly. Continuously monitoring the vibration of all units, especially the bearings of all machines, is an extremely important aspect. It is vital to ensure that all parts are replaced before the equipment actually fails, i.e. spare parts that are necessary must be available on site in the required time.

If part of the production facility is down due to damaged equipment, all efforts must be taken to get into operation as soon as possible. This is why it makes sense to invest in advance, and avoid unscheduled downtimes.

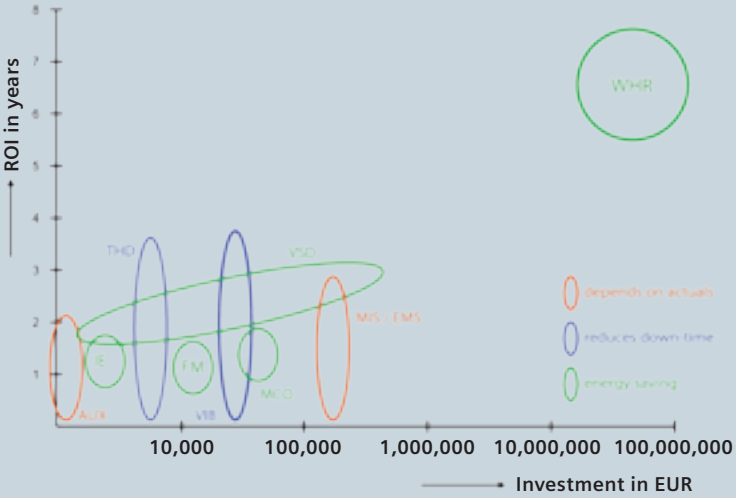
THD – total harmonic distortion check

The increased use of variable speed drives in the cement plant will save energy, but it also results in a higher harmonics in the electrical network. These harmonics in the network increase the losses in other connected loads, and in turn, more power is consumed. Furthermore, harmonics in the network also decrease the service life of many consumers. Power utility companies stipulate stringent limits on the harmonics generated by the electrical equipment in cement plants. As a consequence, periodically checking the THD level in your cement plant will identify whether the equipment is still working within its limits. If the value

If an existing motor is to be replaced, the higher efficiency class motor will have a payback time of between 1.5 and 3 years.

State-of-the-art energy saving cement plant

Fold back for more information ►



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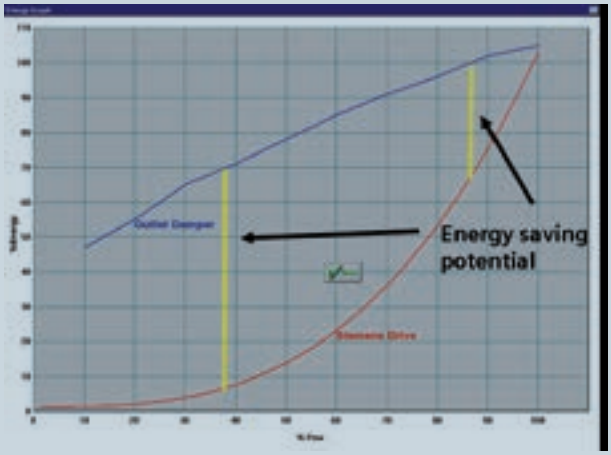

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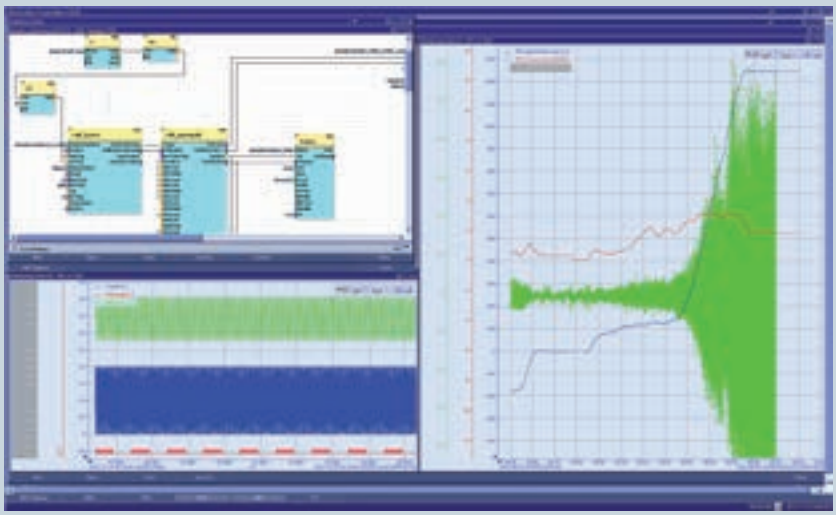

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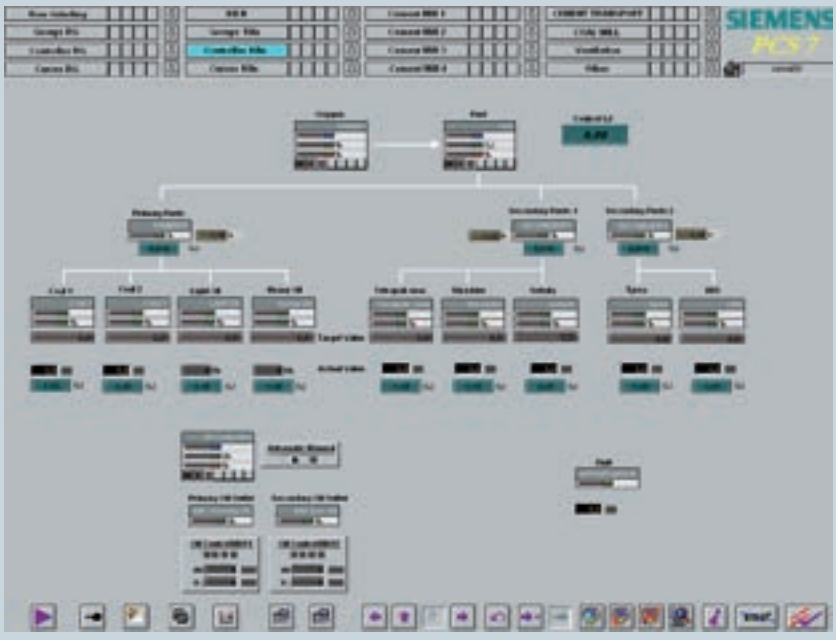
1 ROI versus investment cost

2 Energy-saving potential by reducing operation speed

3 Comparison of motor efficiencies IE1, IE2 and IE3

4 Graphic shows the ratios between capital investment, installation/service and energy cost

5 Screenshot showing continuous vibration monitoring



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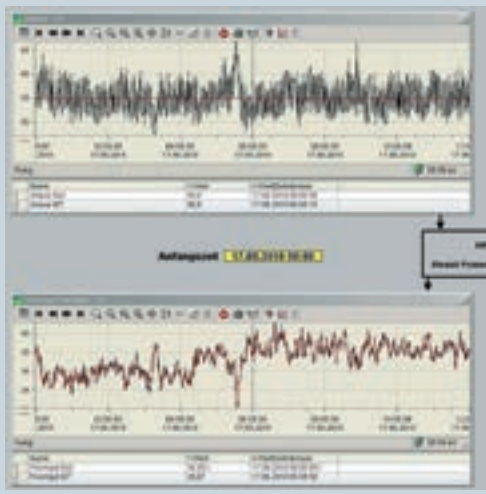

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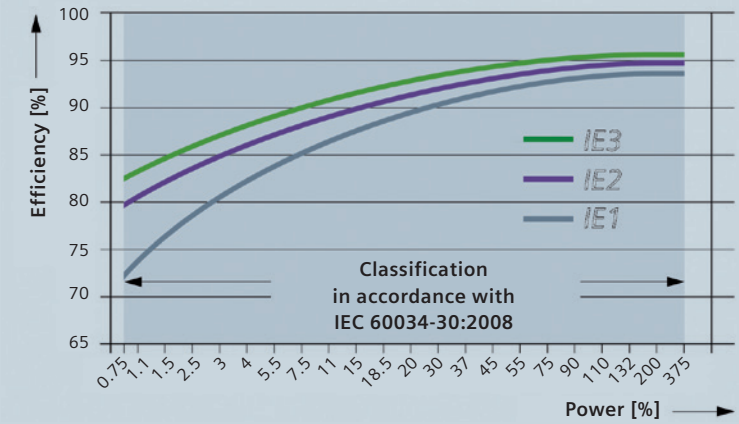

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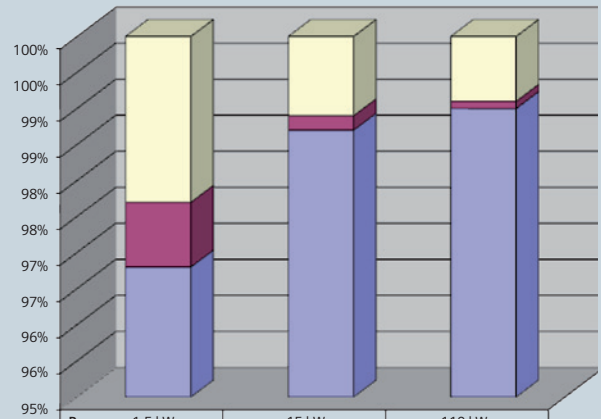

Power	1.5 kW	15 kW	110 kW
Investment	2.3	1.1	0.9
Installation and service	0.9	0.2	0.1
Energy costs	96.8	98.7	99

4

6 Screenshot of the management information system

7 Cemat/PCS7 system to manage secondary fuels

8 Cemat screenshot – start-up of a ball mill

9 Waste heat recovery on a cement kiln line

hours	Crusher		raw mill	kiln	Kiln inlet			Coal to primary burner	cooler	cement mill 1	packing	dispatch	TOTAL consumption
	Kwh	Runtime [min]	Kwh	Kwh	O2 average	O2 min	O2 max	t/h	Kwh	Kwh	Kwh	Kwh	kWh
1	245.54	49.76	49.76	59.12	49.76	49.76	49.76	49.76	49.76	49.76	49.76	49.76	553
2	240.84	50.03	50.62	58.58	50.03	50.03	50.03	50.03	50.03	50.03	50.03	50.03	550
3	251.27	50.28	49.74	50.62	50.28	50.28	50.28	50.28	50.28	50.28	50.28	50.28	452
4	253.67	50.28	50.33	49.71	50.28	50.28	50.28	50.28	50.28	50.28	50.28	50.28	455
5	251.76	49.71	49.71	49.74	49.71	49.71	49.71	49.71	49.71	49.71	49.71	49.71	451
6	245.53	49.74	49.71	50.33	49.74	49.74	49.74	49.74	49.74	49.74	49.74	49.74	444
7	247.93	50.33	49.74	49.74	50.33	50.33	50.33	50.33	50.33	50.33	50.33	50.33	449
8	250.59	50.51	50.33	49.74	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	453
9	245.54	49.76	49.76	59.12	49.76	49.76	49.76	49.76	49.76	49.76	49.76	49.76	553
10	240.84	50.03	50.62	58.58	50.03	50.03	50.03	50.03	50.03	50.03	50.03	50.03	550
11	251.27	50.28	49.71	58.58	50.28	50.28	50.28	50.28	50.28	50.28	50.28	50.28	452
12	253.67	50.28	49.74	58.58	50.28	50.28	50.28	50.28	50.28	50.28	50.28	50.28	455
13	251.76	49.71	50.33	49.71	49.71	49.71	49.71	49.71	49.71	49.71	49.71	49.71	451
14	245.53	49.74	49.74	49.74	49.74	49.74	49.74	49.74	49.74	49.74	49.74	49.74	444
15	247.93	50.33	49.71	50.33	50.33	50.33	50.33	50.33	50.33	50.33	50.33	50.33	449
16	250.59	50.51	49.74	49.74	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	453
17	245.54	49.76	50.33	59.12	49.76	49.76	49.76	49.76	49.76	49.76	49.76	49.76	553
18	240.84	50.03	50.62	58.58	50.03	50.03	50.03	50.03	50.03	50.03	50.03	50.03	550
19	251.27	50.28	50.28	49.71	50.28	50.28	50.28	50.28	50.28	50.28	50.28	50.28	452
20	253.67	50.28	49.71	49.74	50.28	50.28	50.28	50.28	50.28	50.28	50.28	50.28	455
21	251.76	49.71	49.71	50.33	49.71	49.71	49.71	49.71	49.71	49.71	49.71	49.71	451
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23	247.93	50.33	50.33	49.71	50.33	50.33	50.33	50.33	50.33	50.33	50.33	50.33	449
24	250.59	50.51	49.71	50.33	50.51	50.51	50.51	50.51	50.51	50.51	50.51	50.51	453
Total	5961.34	1201.91	1199.74	1269.18	1201.91	1201.91	1201.91	1201.91	1201.91	1201.91	1201.91	1201.91	11423.21

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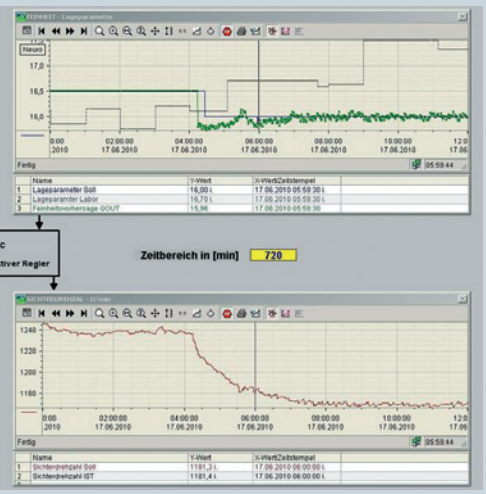

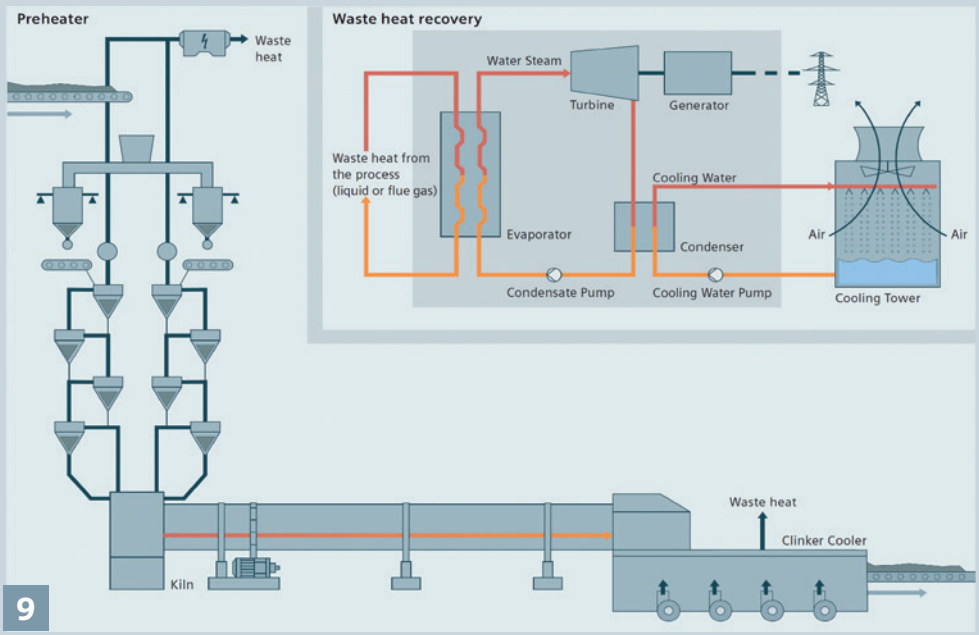

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is too high, a harmonic filter (i.e. a tuned power-factor-compensation unit) should be installed to reduce the THD value in the power supply.

A periodical check will show whether measures must be taken to keep the THD within its limits. We recommend a check every four years.

MIS – Management Information System/Energy report in combination with an EMS (Energy Management System)

The system archives energy data from each department. It evaluates data to identify energy trends, time overlay trends and key performance indicators. The plant can reduce energy consumption based on analysis of the historical data. Further, the data allows a forecast to be made about future energy consumption, and at the same time consumption can be tracked and when necessary controlled. For instance, typically a mill section of the cement factory should not consume any energy when the mill is switched off. This can easily be checked using an MIS report. MIS continuously monitors the power consumption, and if the consumption is higher than normal, this could mean that a component has failed. The report will help you to identify a pending failure, and you can then take the necessary corrective measures in time.

A continuous evaluation of the MIS reports will help you to save energy and detect potential equipment failures.

Secondary fuel management

Due to decreasing resources and increasing market prices for primary fuels such as oil, gas or coal, cement manufacturers must search for alternative energy sources. Currently available secondary fuels include tires, plastics, waste paper, waste oil, industrial waste, Tetrapak, old carpets, foam plastics, animal waste, wood shred etc. All these secondary energy sources have different heat capacities. A kiln, which operates on a high percentage of secondary fuels, will be operated at higher temperatures. Energy management to handle up to ten different fuels is becoming more and more important, as secondary fuel costs have risen tremendously (these were previously free). Many secondary fuels result in changes in exhaust gas, clinker characteristics and kiln temperatures. A secondary fuel control management system to plan steady and continuous kiln operation can be realized based on Siemens standard Cemat/PCS7 function blocks in the DCS or as a standalone system.

High efficiency main kiln-drive

Mill control system

Mill Control Optimization (MCO) provides additional possibilities to improve grinding and mill efficiency. The system shortens the start-up phase and allows the mill to be operated stably at the maximum production level. In order to operate the plant with a low electrical energy tariff, the mills must be started and stopped. This means that it is necessary to ensure a smooth and efficient start-up, as this will reduce the energy consumption per ton of grinded material. The MCO can operate as a standalone system or fully integrated Cemat PCS7 application in PLCs. The system is especially helpful for night-shift operators when there are only a few operators staffing the central control room.

Waste-heat recovery power generation

Hot process gases produced from a kiln contain thermal energy, which is normally used for other process areas such as the raw mill or the coal mill. Although this allows energy to be saved, the utilization of excess thermal energy can still be optimized. The excess energy can be converted into electrical energy. The gases from the preheater tower and from the cooling area are used to generate high-pressure steam in boilers. A steam turbine drives a synchronous generator, which in turn feeds electrical energy back into the medium-voltage system of the cement plant. Optimum results can only be achieved based on a tailor-made system, which also takes into consideration any future cement plant modifications. Siemens provides ongoing assistance to cement manufacturers in identifying what their plants require. Only through continuous energy saving solutions can cement plants be optimized on a sustainable basis. ■

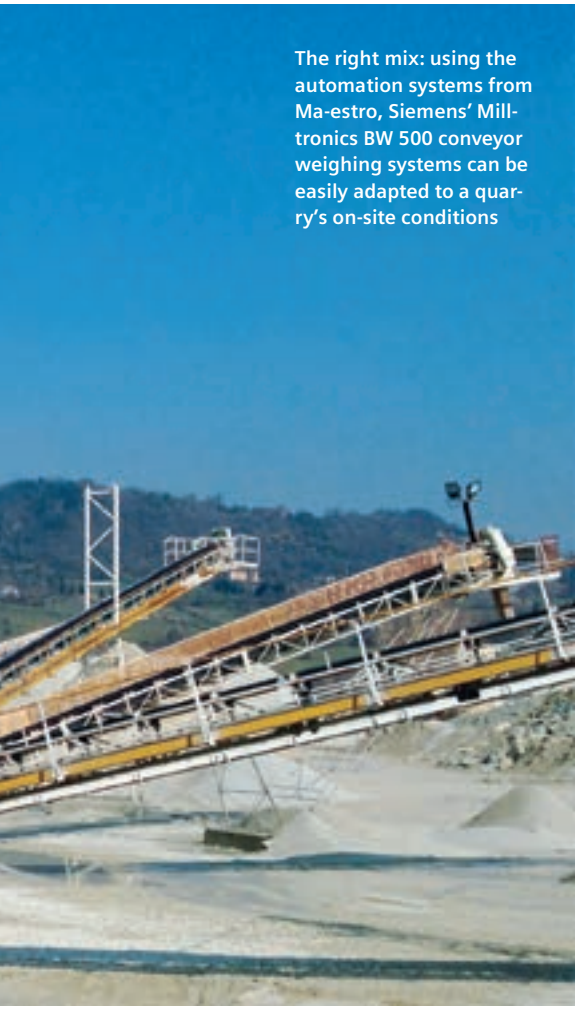
Authors:
Maarten Holland,
maarten.holland@siemens.com
Karen Chong,
karen.chong@siemens.com

Partnership between Ma-estro Srl and Siemens

Technology squared

In quarries it is necessary to have a good overview of energy use and costs. However, many areas are not yet automated. Thanks to a partnership between Siemens and Ma-estro, that is about to change.

The owner and founder of Ma-estro Srl, a technology company based in northern Italy, is Giorgio Manara. In fact, quarrying runs in his blood – his family owns a quarry in Pilcante di Ala, in the Trento province. So Manara knows the market mechanisms and constraints facing quarry owners first hand. An important aspect is to have a functioning system that monitors and optimizes all processes in a quarry. The goal is to get a grip on consumption costs and stillstands, and to eliminate idle periods. It is also important to know exactly what a ton of produced material in the desired quality costs – also with the associated costs calculated in. Ma-estro offers a suite of individual solutions with which a quarry can monitor, control and regulate its production. Q-Production, for example, provides an overview of production and energy use in a quarry and its auxiliary



The right mix: using the automation systems from Ma-estro, Siemens' Milltronics BW 500 conveyor weighing systems can be easily adapted to a quarry's on-site conditions

works; Q-Control helps control operations; Q-Maintenance provides assistance with managing maintenance; Q-Fuel observes and controls fuel use; and Q-Transport is a control system for the loading of material, which, along with the necessary transport and delivery documentation, also ensures material traceability. Via a dashboard, quarry operators have full control of all important data to calculate production costs in real time.

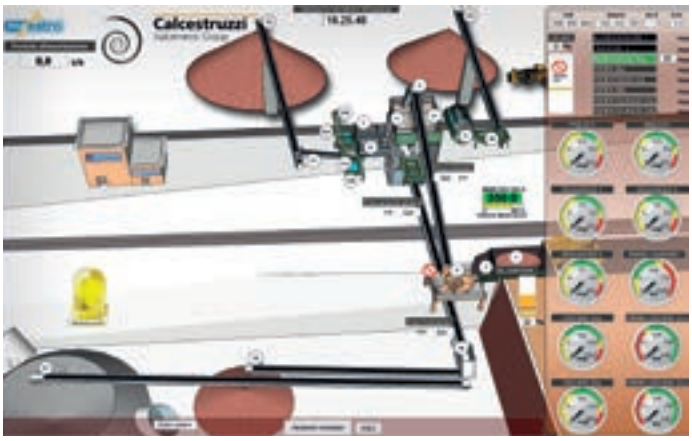
Ma-estro was founded seven years ago. The company sees itself as a provider of products as well as solutions. "The permanent monitoring of plants, coupled with the ability to access at any time respective documentation and inventory information, simplifies the organization of construction sites and quarries," says Giorgio Manara. "Measurable cost savings are possible with our products. Most important is information about the actual costs of each ton of produced stone," adds Ma-estro's owner and founder. "Our system pays for itself within a year, which is particularly important for many companies in these times of financial and economic crises."

In connection with Siemens' devices and systems, the Ma-estro systems have also been used for processing plants. Automation technology and belt weighing from Siemens play a special role here. With Milltronics BW 500, Siemens has a broad range of conveyor weighing systems in its portfolio. Using the automation systems from Ma-estro, they can be easily adapted to a quarry's on-site conditions. Totally Integrated Automation (TIA) is a comprehensive collection of products and systems for mining and processing aggregates, cement, limestone and asphalt. TIA extends from special automation solutions for mining and quarry companies, via decentralized periphery with actuators/sensors, all the way to MES systems and the PCS7 process control system. These systems are adapted on location to customer-specific conditions using certified system integrators such as Ma-estro.

"Repeatedly our customers have described the solutions from Ma-estro as pragmatic and user-friendly. The great flexibility and scalability of the solutions are especially appreciated," says Dr. Alessandro Passeggi from Siemens Italy, "which gives us a clear target for the future for our partnership." Manara adds: "This agreement benefits our products as well as Siemens' products, and it brings our customers technical and economical benefits. It enables us to improve products and services to such an extent that they are also successful in non-European markets. We are therefore working on unifying and standardizing our products and systems."

The use of these systems at Sipeg Srl, an Industria Cementi Giovanni Rossi SpA subsidiary that counts among one of the most important manufacturers of inert material, is proof that the partnership is working. For the automation of Sipeg's processing plant, Ma-estro used typical SPS architecture based on Simatic S7 – CPU 315 for routine motion-control applications. Together with the I/O modules, it controls via a Profibus network 4 crushers, 30 belt drives and 5 sieves, as well as sand filters to purify water and to dry sewage sludge. The material is dosed and mixed with the help of the Milltronics BW500/L measuring transducer for belt scales. Q-Control monitors and controls the facility. Since the introduction of the system, productivity has risen 10 percent, refuse has been reduced by 30 percent and process safety has been increased significantly. The composting plant is operated by a single operator who can access all information via a handheld PC or smartphone. In connection with the automation system, Q-Control was also installed in the production area. It allows processes to be controlled remotely using Internet technology. Production, energy use and costs are shown in real time. ■

Author:
Alessandro Passeggi,
alessandro.passeggi@siemens.com



Ma-estro offers a suite of individual solutions with which a quarry can monitor, control and regulate its production: Q-Production

Process instrumentation in the cement industry

Efficient down to the last detail

Cement manufacturing is an energy-intensive process. In addition to the high consumption of fuel for cement clinker calcination, electric energy is needed to process the raw materials, cool the clinker and grind the cement. The use of advanced technology has optimized the calcination process to such an extent that on the process side no further reduction in energy consumption can be expected.

For years, strategies have been pursued in the cement industry to improve energy efficiency and reduce the carbon footprint. One approach is to replace the primary fuels, mainly hard coal, with refuse-derived fuels such as car tires, meat and bone meals, animal fats, sewage sludge, or fractions from industrial and trade waste. The biggest challenge is posed by the different fuel properties such as moisture content,

reactivity and calorific value. They influence the flame and the temperature profile of the rotary kiln and require permanent adjustment of the burner to achieve constant product quality and low pollutant emissions with different fuel inputs. This requires a modern burner control system.

Another option to improve energy balance and reduce the carbon footprint is the production of cements with lower contents of cement clinker, because the calcination of the clinker in particular consumes a great amount of energy. The substitutes used are industrial by-products such as slag sand and fly ash. Although the energy balance of these substitutes is better, they cannot be added in just any amount, as this would significantly impair the quality of the cement. Hence, intelligent measuring methods and professional field devices are absolutely necessary for the apportioning of these substitute substances and the subsequent homogenization processes.

In recent years, research has focused more and more on the use of alternative binding agents with lower requirements of lime and energy. Apart from so-called belite cements, geopolymers and sulphoaluminate cements, Celitement is to be mentioned here, which is based on hitherto unknown calcium hydrosilicates. The future will show which approaches can provide a sustained improvement of the energy balance and the carbon footprint of cement.

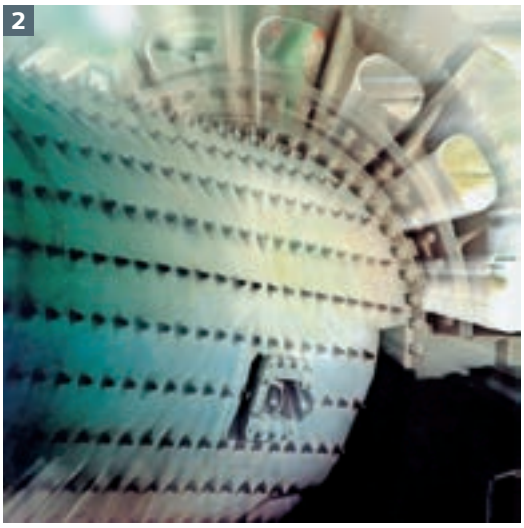
Success factor: process stability

Aside from capital-intensive measures such as the installation of heat recovery systems and new motors, the use of refuse-derived fuels or the development of new binding agents, one aspect should not be forgotten when we consider energy optimization, namely maintaining a stable and trouble-free production process. To enable cement works to produce cement around the clock, all sub-processes – from crushing the limestone to calcination of the clinker, all the way to storing the finished cement in silos – need to function without fault and interact perfectly. Up-to-date control systems tailored to the requirements of the cement industry such as Cemat, which is based on the Siemens process control system Simatic PCS7, make sure that the perfect condition is achieved and maintained. They enable optimal use of thermal and electric energy. However, the procedure requires that appropriate field data are provided, which needs to be acquired first by means of suitable measuring methods. Choosing the ideal measuring procedures has a decisive influence on the efficiency of the overall process and requires industry-specific know-how and extensive knowledge of the physical and technological challenges. The examples given below show how the combination of measuring methods and suitable field devices can make cement manufacturing more efficient.

For cement works to produce cement around the clock, all sub-processes need to function without fault and interact perfectly.

Level measurement at the crusher

The crushers play the most important role during the preparation of the raw materials. They crush the limestone, which is the main component of many types of cement. As they are one of the biggest energy consumers, it is important that the workflow is optimized. Although there are different types of construction of crushers, they all have in common that they work most efficiently when the stones break each other due to an ideal filling level. If the level is low, the stones are not crushed to the desired size and have to pass through the crusher again. This means double the energy consumption at this point already. At the same time, the mechanical parts of the crusher are stressed more than necessary and the plates or rollers wear out much more. If, on the other hand, the filling level is too high, feeding must be interrupted and the process comes to a halt. Continuous measurements are indispensable to keep the crusher at the optimal filling level. Under the prevailing conditions, this is a challenge. Dust, extreme vibration and stones flying about do not permit the use of any measuring equipment with sensitive electronics inside, such as radar or laser technology. However, operators can reply on ultrasonic level instruments such as the Siemens Echomax ultrasonic sensors. They are hermetically sealed, very compact and emit their acoustic pulses in a narrow beam. Suitable for operation in the crusher are the Echomax XPS transducers that cooperate with the Sitrans LUT400 series controllers, such as the Sitrans LUT430. The controller precisely mea- ▶



1. Sitrans LR560 is designed for the high temperatures and extreme dust levels in a clinker cooler **2.** Heidelberger Zement Germany, grinding ball mill **3.** Sitrans LUT400 ensures crushers run most efficiently by maintaining an ideal filling level **4.** Echomax transducers can withstand dust, extreme vibration and stones **5.** The crushers play the most important role during the preparation of the raw materials

► sures the time between the transducer's pulse and receipt of the echo, and within seconds it calculates the distance between the sensor and the limestone. Filling-level monitoring ensures optimal feeding in the crushers and energy-efficient crushing of the limestone.

Gas analysis in the kiln

The rotary cement kiln is the heart of clinker production and the biggest consumer of thermal energy. Continuous, reliable and precise analysis of the flue gases is decisive for an efficient use of the fuels. Moreover, for clinker quality monitoring and emission protection is indispensable. The concentrations of oxygen, carbon monoxide and nitrogen oxides form the basis for an optimization of burner operation, use of fuels and product quality. The more stably the kiln operates and the better the combustion is itself, the more efficient the combustion process is, with higher raw-material savings. Taking samples is no easy task at temperatures of more than 1,400°C, with high dust load in the gas sample and high concentrations of aggressive substances such as alkaline compounds, sulfates and chlorides. In conventional, water-cooled fluegas sampling probes, these substances clog the gas pipes due to condensation processes. Siemens has developed the Set FLK to considerably reduce the expenditure for maintenance of the gas sampling installation. The probe does not use water for cooling but a heat transfer fluid with a boiling point higher than 300°C. This enables a gas sampling temperature of more than 200°C, that is, above the acid dew point of the flue gas. In this way, condensation of the flue gas is prevented and substantially less condensate is formed, which results in less expenditure for cleaning.

The subsequent gas analysis then provides information on the combustion processes. The results form the data basis for automated burner opera-

The rotary cement kiln is the heart of clinker production and the biggest consumer of thermal energy.

tion. This ensures optimal fuel usage by regulating primary air flow, divergence and rotation of the flame. Potential savings are enormous, as only 1 percent excess oxygen means an unnecessary extra consumption of about 15 kcal per kilogram of clinker produced.

Level measurement in the clinker cooler

To determine the filling level in the clinker cooler, contactless measurement, as for the crusher filling level, is preferred at any rate because it requires much less maintenance. However, ultrasonic sensors are ruled out here due to the high temperatures and the extremely dusty atmosphere, as the strong damping characteristics of the swirling clinker do not allow reliable measurements. Therefore, in some places cement works make do with pressure gauges that at least give hints as to the clinker filling level and thus the compressed air volume and throughput speed necessary for cooling. However, this method does not take account of the clinker density, which may vary and then distort the results. To counteract this, many cement works use camera systems. The operator uses the camera images as a basis to manually regulate the travelling speed of the clinker through the cooler – a personnel-intensive approach. Radar technology is well suited for the implementation of an automatic control system for the clinker cooler. To solve this task precisely, Siemens is now also using 78 GHz frequencies in addition to 25 GHz radar level measurement devices. The Sitrans LR560, a two-wire radar transmitter with FMCW (frequency modulated continuous wave) technology, uses a frequency of 78 GHz. This transmitter delivers highly accurate measurements and features a small lens antenna for versatile installation. The short wavelength yields excellent reflections even for bulk goods with high angles of repose. Although this is not decisive for the filling level measurement in the clinker cooler, it makes the device also ideal for precise continuous level measurement in the clinker and cement silos.

The precise determination of the clinker filling level in the cooler not only forms the basis for automation of this process step and the optimal use of compressed air, but also allows an even removal of the clinker without manual intervention and without interruption, which means a stable and therefore efficient process in the kiln.

Flow measurement for grinding aids

Depending on the required degree of fineness, the infeed grain size, the moisture content, etc., various grinding methods are used or combined in the final step of cement manufacturing. The addition of grinding aids has become standard practice and has several aims. Additives increase the throughput, improve the energy efficiency or influence the quality of the cement. This is achieved by the specific physical properties of the additives, most of which are liquid. They counteract the agglomeration of the cement particles by neutralising electric surface charges and in this way prevent, for example, cement deposits in the mill. The additives are mixed in amounts of between 0.01 percent and 0.2 percent by weight, and this has to be measured very precisely. As many grinding aids (e.g., glycols or glucose syrup) are not conductive, conventional magneto-inductive flowmeters cannot be used for the task. Therefore, Siemens uses mass flowmeters such as the Sitrans FC430, which functions based on the Coriolis principle and offers an unrivalled measuring accuracy of 0.1 percent of the flow rate over a wide measuring range. The Sitrans FC430 enables exact dosing with high availability rates. The devices have no moving parts and therefore require almost no maintenance. The precise measurement of the grinding aids allows sparing use, which is decisive for the quality of the product. ■

Author:
Mark Yseboodt, **mark.yseboodt@siemens.com**

Salon International des Mines et Carrières 2012 provided a number of opportunities to network: (from right to left) Slim Kchouk, CEO of Siemens Morocco, greets Aziz Rabbah, Morocco's Minister of Equipment and Transport

Conference kick-off in Morocco

The first-ever Salon International des Mines et Carrières (SIMC) took place from December 5 to 8, 2012 in Casablanca. The event was held under the patronage of Morocco's Ministry of Energy and Mining and the Ministry of Equipment and Transport, and organized by the publication "Energie & Mines" in partnership with Office Chérifien des Phosphates (OCP), the world's largest supplier of phosphates. The target audience of SIMC consists of mining operators from all over North Africa as well as the French-speaking Sub-Saharan countries. A delegation of African ministers and representatives from Niger, Mali, Guinea-Bissau, the Central African Republic and Benin was present.

Siemens exhibited its Mining portfolio at a booth covering an area of 54m². Minister of Equipment and Transport Aziz Rabbah visited the booth during the inauguration and was impressed by all the solutions and technology Siemens has on offer. The exhibition of the technological innovations and equipment was only one aspect of SIMC. Organizers also arranged a forum for conferences and scientists' workshops as well as a dedicated space for B2B meetings between projects leaders, financers and investors. As such, there was plenty of opportunity for Siemens employees to enter into dialogue with potential partners and customers during the fair.

SIMC also served as an opportunity to gain a good understanding of the investment programs and the business objectives of key customers, for example OCP. It is imperative to have a clear vision on how we can help our mining customers to resolve their operational and technical issues.

During the conference Siemens employees were able to develop a number of ideas with partners and customers. Mining solutions were proposed that help them implement their strategic investment programs.

Morocco is especially attractive as a mining location, particularly for phosphates: Of the country's mining production of 28.3 million tons, 26.6 million tons are phosphates. The mining industry as a whole represents 6 percent of GDP and 27 percent of exports. In regard to cement, Morocco's yearly consumption is 12 million tons. ■

Trade fair

Strong showing at IMME 2012

Siemens employees (from left to right) Roland Grafe, Subrata Chatterjee and Joy Mazumdar during a discussion with a customer

The Confederation of Indian Industry (CII) held the 11th International Mining and Machinery Exhibition (IMME) from December 5 to 8, 2012. CII touts the event as the largest trade fair dedicated to the mining industry. IMME took place in Kolkata, India, and attracted 200 exhibitors and 9,000 visitors.

Siemens presented products and solutions for the mining industry with a particular focus on drive systems for bulk material handling and mobile mining, as well as automation systems for stockyard equipment. For Siemens, IMME was a success: over 200 visitors showed their interest in Siemens and asked for business contacts and cooperation opportunities.

India is a leading mineral producer. Globally, the country ranks second in chromite excavation; third in coal, lignite and bauxite; fourth in iron ore; and fifth in magnesium. As such, India's mining sector plays a pivotal role in the country's infrastructure and economy. In recent years the Indian government has made it easier for private entities to invest in the mining sector. The result has been considerable global interest, which was also reflected at IMME: The event's partner country was the United States, and the focus country was Australia. Furthermore, pavilions were set up for the United States and Australia as well as for the United Kingdom, China, the Czech Republic, Germany and Poland. ■

Trade fair

Siemens at bauma 2013

Siemens, broad technology portfolio will be on display at bauma 2013

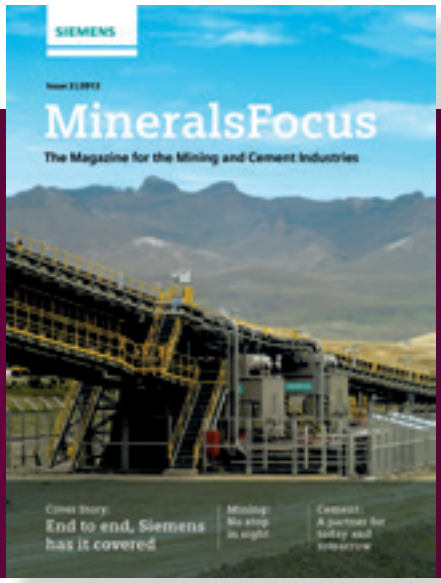
bauma is the largest and perhaps the most impressive trade fair in the world. This year's bauma – the 30th International Trade Fair for Construction Machinery, Building Material Machines, Mining Machines, Construction Vehicles and Construction Equipment – will take place from April 15 to 21, 2013, in Munich, Germany. The figures are impressive: giant machines on an exhibition space of 555,000 m², over 3,200 exhibitors, and an expected 420,000 visitors over the seven days.

The trade fair stands out due to its comprehensiveness – it features all sectors, all market leaders and a whole range of innovations. For bauma 2013 a key focus will be on drive technology for mobile construction machinery.

Naturally, bauma would not be complete without an exhibition from Siemens. Visitors can expect to be wowed at booth C2.206, which will have on display Siemens' broad technology portfolio. Highlights include automation and MES, mobile mining/eHighway and gearless drives for conveyors. Stop by to see the latest completely integrated products, solutions and systems for the mining and cement industries. ■

If you are interested in receiving a sample copy, or if you would like to order a free subscription of MineralsFocus, please send an e-mail to **mining@siemens.com**.

Our magazine is also available as an ePaper. The current version can be accessed at **www.siemens.com/mineralsfocus**. You may also order the print version at that link.



Siemens at bauma

bauma, which takes place in Munich, Germany, from April 15 to 21, features giant machines on an exhibition space covering 555,000 m². At booth C2.206 Siemens presents its broad technology portfolio. Highlights include gearless drive systems for conveyors, solutions for electrified mining transport, and the company's comprehensive automation and MES portfolio.

www.siemens.com/bauma

No details missing

New websites provide a comprehensive overview of Siemens' products and solutions for the mining and cement industries. Whether brochures, case studies or videos, everything can be found at the dedicated pages.

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SIEMENS

SIMINE gearless drive systems for conveyors

Overland conveyor with gearless drive system commissioned at copper mine in Peru

siemens.com/mining

E20001-F350-T195-X-7600

For the first time, a large-scale belt conveyor system with gearless drives has been installed outside of Germany: For an order from the Australian mining company Xstrata Copper, ThyssenKrupp supplied the conveyor system and Siemens the gearless drive system for the Antapaccay copper mine in Peru. With a conveyor speed of 6.2 meters per second on a belt 1,370 millimeters wide, approximately 5,260 tons per hour of copper ore can be transported over a distance of about 6.5 kilometers from the mine to the processing plant. The only comparable conveyor drive system in the world was installed in 1986 – also by Siemens and ThyssenKrupp (previously O&K) – in the Prosper-Haniel coal mine of Deutsche Steinkohle AG in Germany and is still in operation.

The drive system consists of two low-speed synchronous motors, each with a power rating of 3,800 kilowatts, and the associated Sinamics SL150 cycloconverters, converter transformers, a containerized E-house, and related electrical equipment. Compared to conventional high-speed motor and gear units, this gearless drive solution enables the installation of larger drives, increases reliability and efficiency, reduces maintenance effort – and delivers maximum availability.

Siemens' scope of supply also included the entire switchgear and gearless drive systems for a 40-foot SAG mill and two 26-foot ball mills with all associated power supply equipment.

Answers for industry.

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