MINERALS FOCUS ISSUE 2022

The Magazine for the Mining and Cement Industries

SIEMENS

How the digital transformation of minerals companies is improving processes across the value chain

Sustainability and digitalization are not only my passions, but two topics that weave their way through the pages of this issue of Minerals Focus."

Sven Demmig Executive Vice President Minerals Solutions Siemens AG





Dear readers,

For a year now, I've been responsible for Siemens Minerals. As many of you may not yet know me, I'd like to take this opportunity to talk about two topics that are very close to my heart. The first is sustainability. When I'm not at work, you can find me in the Alps with my family, each one of us atop a mountain bike. As a father and nature lover, I believe we have a responsibility to minimize the impacts of mining on the environment; we owe it to the generations to come. The other topic is digitalization. Like most of you, I'm still expanding my knowledge in this area. A big help for me has been my years of work with automation and electrical drives.

Sustainability and digitalization are not only my passions, but two topics that weave their way through the pages of this issue of Minerals Focus. A common element is how our customers are using digitalization to become more sustainable. In our cover story, we show a sampling of our digital solutions that cover the entire value chain – from the pit to the port, as we like to say. But how does this look in practice? In an interview on page 18, Ignacio Flores, Superintendent of Operational Excellence for the Doña Inés de Collahuasi Mining Company, talks about how digitalization is impacting his company. And on page 48, you can learn more about SICEMENT, our digitalization offering for the cement industry.

I hope you enjoy this issue - and I hope to meet many of you in person at bauma!

Best regards,

Sven ann

Sven Demmig Executive Vice President Minerals Solutions Siemens AG

Siemens sees itself as a strategic partner for digitalizing the entire mining value chain.





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PARTNER FOR THE MINING INDUSTRY

Digital to the core

Digitalization touches every aspect of the mining value chain – from excavation to transport to beneficiation to how minerals are stored and handled. As an end-to-end digitalization partner for the mining industry, Siemens Minerals offers a complete digital portfolio – some main elements of which are highlighted here. At each step of the way, individual processes are optimized. Yet the biggest effect is achieved when all the data generated in each area is brought together with our pit-to-port strategy. For some years now, digitalization has been gradually transforming the mining industry. Today, digital solutions are delivering substantial added value all over the world – for example, in the form of significant productivity gains, or sizeable reductions in downtime. Digitalization is improving utilization, which not only saves money but also helps to achieve sustainability goals.

Digitalization

can best be described as a journey that initially involves digitalizing individual subsystems. Siemens sees itself as a strategic partner for its customers in their efforts to bring digitalization to the entire mining value chain. The process is gradual – best compared to a journey – and involves initially digitalizing individual subsystems. Each successful digitalization project opens the door to yet another digitalization project. When enough systems have been digitalized, the next logical step is enterprise-wide solutions. That paves the way for further increases in efficiency for the entire value chain and reveals considerable hidden savings potential.

The following examples show how digitalization can improve individual areas, and how these technologies can be extended to entire mining operations.

Make the most of every shift

The journey begins with excavation and transportation. Before a shift starts, mine managers need to be informed of any critical constraints that may impact the ability to carry out operations. Support is available with the Short Interval Control (SIC) Platform. It evaluates the availability of personnel, material, and equipment at the beginning of every shift. If the SIC Platform detects any constraints, a decision support module evaluates recovery options and presents them to decision makers for consideration. No time is wasted in finding a solution.

After any necessary decisions have been made and managers have ensured themselves that everything is in place, the shift lineup is dispatched to the staff members. Information can also be transmitted to mobile devices configured to receive it.



Data can be used to identify and eliminate harmful externalities to make operations more sustainable.

> From pit to port: Siemens covers the entire mining value chain, for example with solutions for excavation.



Each successful digitalization project opens the door to yet another digitalization project.

End-to-end digitalization

Siemens is a strategic partner for the digitalization of the entire mining value chain.



It doesn't stop there: During the shift, the SIC Platform collects updates from the field via sensors and information entered in mobile devices. That enables real-time tracking of equipment and personnel, and evaluation of actual tasks. In the case of unexpected equipment downtime, SIC Platform's support module again plays an essential role by evaluating recovery options and presenting them to decision makers.

The most obvious benefit is the smooth operation of trucks, shovels, draglines, dump machines, and more. However, the SIC Platform has another advantage: Equipment utilization can be improved, and the information it provides makes it easier to meet sustainability goals. With these and many other features, companies get the most out of their investments.

Complete stockyard information

Before and after processing, materials are stored in stockyards. Siemens offers SIMINE Advanced Stockyard Management, which gives operators extensive knowledge about their stockyard inventory so that they can make the best decisions possible. This solution introduces autonomous machine operation and real-time inventory information based on the 3D stockpile model.

The model starts with material tracking from any take-in point, for example, from the mine directly, or from a ship or train. As material makes its way from the conveyor to the stacker, SIMINE Advanced Stockyard Management measures material quantity with belt scales and assigns quality data gained through laboratory systems, online analyzing systems, or other sources. The solution then determines Information provided by the SIC Platform makes it easier to meet sustainability goals.



the exact position of the stacker and thus calculates the stockpile. The same applies for the reclaiming process: SIMINE Advanced Stockyard Management determines the exact position of the reclaimer and calculates the stockpile as it is reclaimed. In short, the solution provides real-time information about the location of raw material within the stockyard, including related quantity and quality data.

To bridge the operational level with the planning level, SIMINE Advanced Stockyard Management also features a component for planning and scheduling. This scalable system automates and optimizes planning and scheduling based on operational objectives using real-time data integration. Production orders get broken down into feasible jobs and are sent to the Advanced Stockyard Management system for execution. The system also takes into consideration status information and machine availability when issuing commands. Intuitive user interfaces keep the planner permanently up to date and help improve the decision-making process.

SIMINE Advanced Stockyard Management has been helping manage bulk material stockyards for over 20 years – and not only at mines, but also at steel plants, thermal power plants, and more. Benefits of using SIMINE Advanced Stockyard Management include improved equipment and process efficiency, better space utilization in the stockyard, reduced machine wear and abrasion, and a safer and healthier working environment for personnel.



Comprehensive knowledge about the stockyard inventory enables operators to make the best possible decisions. SIMINE Advanced Stockyard Management provides real-time information about the location of raw material within the stockyard, including related quantity and quality data.



Know before it's too late

Mining equipment needs to operate reliably around the clock; unplanned downtime must be ruled out to the biggest extent possible. But before an outage occurs, machinery generally gives signs, such as through changes in temperature and vibration patterns. With SIMINE Asset Health Analytics (AHA), operators can avoid surprises with early information on deviations. Furthermore, the solution supports them in identifying root causes and helps them prepare with recommended to-dos. At the heart of SIMINE AHA is one or more simulation models that can be integrated upwards in a digital twin.

For continuous transport technology, Siemens offers the specialized solution SIMINE Digital Twin Solution for Belt Conveyors. The web application is based on a modular and customizable approach, whereby standard modules such as User Management and Role-based Visualization are included. Other modules, like Online Simulation or Event Analysis, can be added as per customer requirements. The functionalities of SIMINE Digital Twin Solution for Belt Conveyors are many: operators are informed about the health status of a conveyor and its components, and they can automate workflows, analyze the root causes of downtime using historical data, and tap into a knowledge database with root-causes and countermeasures. SIMINE Digital Twin Solution for Belt Conveyors as well as belt conveyor systems and adjacent technology. The SIMINE Digital Twin Solution for Belt Conveyors contributes to more reliable operation of single belt conveyors as well as belt conveyor systems and adjacent technology.

SIMINE AHA

SIMINE Asset Health Analytics (AHA) is based on one or more simulation models that can be integrated upwards in a digital twin. AHA enables operators to avoid surprises by providing early information on deviations.



SIMINE Asset Health Analytics for Gearless Mill Drives supports early anomaly detection, giving operators time to initiate countermeasures.

SIMINE AHA for Gearless Mill Drives (GMD) follows a similar approach. It supports in early anomaly detection on gearless mill drives. For example, winding temperature increases coupled with other detected anomalies could be an indication of decreasing winding health status. Often referred to as predictive maintenance, these warnings give operators time to initiate countermeasures, because continuing operation without action could lead to an unplanned shutdown. The solution goes further: Aside from drawing attention to such dangers, SIMINE AHA for GMD has a prescriptive component with recommendations for ameliorative action. Furthermore, the solution features root-cause identification with artificial intelligence trained on real features. And it also aids in determining the best time for maintenance while taking operator experience into account.

A universal data manager

Data is being produced across all mining operations; the examples given here represent just a few key areas. To make the most of the data, it needs to be brought together at an enterprise level – from all mining sites, wherever they may be in the world. For this, Siemens offers the SIMINE Manufacturing Execution System (MES). Root cause detection with artificial intelligence trained on real features helps to avoid unplanned shutdowns.

The MES solutions provide comprehensive transparency along the entire value chain. On a granular level, it's possible to track mobile equipment and to learn more about usage time and routes within a mining operation. Or operators can view data on material properties and quantities with ease. Or they can get information on consumables, like fuel, water, and explosives, from a single site. However, the real value is attained when all of the data is brought together – such as with Vale Brazil's operations.

Vale Brazil is operating a system based on SIMINE MES to manage its operations at 38 sites, which include mines, pelletizing plants, railroads, ports, and blending and distribution centers. Since installation in 2017, Vale has saved upward of €70 million.

Overall, for distributed mining companies it becomes easier to benchmark and share best practices between sites. Activities can be better synchronized with SIMINE MES – for example, excavation can be coordinated with available processing capacities. The reliable and timely information from the MES improves decision-making processes. Finally, because data is collected and analyzed automatically, manual input errors can be kept to a minimum. The MES is flexible and scalable, so it can grow with requirements. The possibilities for the solution are wide and varied – and practically limitless.



The intelligent use of all available data enables comprehensive transparency along the entire value chain.

Complete pit-to-port solution

Just-in-time production was previously only possible to a limited extent in the mining industry, as mining production is typically decoupled from the purchase order. Stockyards hold millions of tons of ore that has yet to find the right buyer. The impact is billions in revenue loss due to poor price realization. What's preventing just-in-time production is the inability to assess the impact of planning decisions on downstream processes. What's more, volatile framework conditions lead to time-consuming daily replanning. Another hinderance is siloed management of the value chain. Currently, the only way to manage the mining value chain is with buffers – which is evident with overfilled stockyards. The newest digital innovation from Siemens is an end-to-end solution for the overall pit-to-port value chain – and it is set to change everything.

The solution is a simulation-based, enterprise-wide planning web app based on the real-time digital twin of the end-to-end material flow. Bottlenecks can be detected early on. Interactions between processes can be identified. And blending is also improved, because material stock across the complete value chain is taken into account.

What makes this and more possible is data handling. The solution simulates and considers the entire material value chain for optimized production and the best possible adaptation to the market situation. In doing so, it integrates vertical and horizontal data. The big picture in the mining value chain becomes visible. A higher level of optimization can be achieved, for example regarding sustainability. Or to improve the market price for ore and to ultimately achieve just-in-time production.

Just the tip of the iceberg

What is show here are just a few of the many ways in which Siemens digitalizes mining operations for its customers. Other portfolio elements, of course, are an integrated engineering platform, state-of-the-art automation, condition monitoring, and digital-ready hardware like drives, converters, and motors. With digitalization, one solution builds on the next. It is a journey in the classical sense but with one exception – you can basically start anywhere. The most important thing is to take action now. Among the benefits are savings, efficiency gains, and the ability to make an impact on sustainability goals.

Vale Brazil is operating a system based on the Siemens MES solution to manage its operations at 38 sites.

"The sooner the better"

In this interview, Ignacio Flores, Superintendent of Operational Excellence for the Doña Inés de Collahuasi Mining Company, talks about how he got involved with digitalization the role it plays at his company.



You have over 25 years of experience in the mining industry. Moreover, you are an expert in machine learning and artificial intelligence. How did this all come about?

The truth is that I always like this topic. In college I made my own algorithms and sold them to my classmates. That was the beginning of my passion



Ignacio Flores: "You have to start, and the sooner the better."

for digitalization and technology. For my master's degree in industrial engineering, I specialized in technology topics relating to management, circular economy, and also this whole world of algorithms. Over the years I've been improving my knowledge and skills so that my contributions can be of great value.

How is digitalization impacting Collahuasi Mining Company?

Our digital transformation strategy is all about adding value. Right now, our efforts are mainly focused on developing applications related to safety, processes, sustainability, monitoring, and learning. These activities are embedded in our vision called Master Algorithm, which we see as a large, highly intelligent, integrated operation that moves on multiple planes. Ultimately, it will have an impact on the entire production chain. Yet as an industry we are still far from this goal.





Our vision called Master Algorithm will have an impact on the entire production chain."

Ignacio Flores

Superintendent of Operational Excellence for the Doña Inés de Collahuasi Mining Company

When talking about digitalization, the term digital twin comes up. What role does this technology play at Collahuasi?

The way I see it, there are two technologies that are vital to our Master Algorithm and to enhancing artificial intelligence. One is machine learning and its ability to learn from the past and generate rules to optimize performance in the future. The other is the digital twin, which is basically a virtual replica of something. In the case of the mining production process, the digital twin enables us to model, replicate, anticipate, and define a series of operational scenarios. It points to the best way to optimize a function or achieve our objectives, like improved safety or a higher degree of sustainability. Coming back to machine learning, the digital twin is prerequisite for machine learning. Basically, you need them both.

What about the human aspects?

I believe that the human factor is as important or even more important than the world of algorithms. Reflecting on some of the projects that we have put into operation in recent years, 50 percent of the work was to make algorithms; the other 50 percent was to change mindsets in this very traditional industry. I have noticed that with the new generation it is much easier to convince people. In the end, the main challenge is not technological, but to dare to use these technologies to investigate, to explore new scenarios, and to build on what has already been achieved.

What misconceptions have you encountered regarding digitalization?

Hollywood has created a series of monsters derived from this technological transformation that we are now living in. I don't believe we'll see the day when machines take control of humanity. Instead, it will be more symbiotic. Technology complements human beings. If we look back in history, we developed the plow, but also weapons. Ultimately, human beings have to figure out what to do with the technological possibilities. But I am optimistic.

What would your recommendation be to an organization that has yet to start its digital transformation journey?

On the one hand, you have the hardware, the software and algorithms, the equipment in general. On the other hand, you have the human component, and by that I mean management. It is their responsibility to work on this topic, to define a strategy. Important questions have to be answered here: What am I going to use the technology for? How will it change the value chain? Once a strategy has been defined, you can start to implement it. One of the biggest challenges is a transformation of mentality, as I already touched on. With time though, it will become easier as digitalization becomes much more common. But you have to start, and the sooner the better.

CO2 REDUCTIONS IN MINING OPERATIONS

Winners all around with electric mining equipment

Decarbonization has become the watchword across industries – and mining is no exception. Huge contributions can be made with electric mining equipment.



The mining process is responsible for 2 percent to 3 percent of global CO₂ emissions. To contribute to global efforts to reduce emissions, the world's largest mining companies have set some aggressive goals: cut emissions in half by 2030 (base year 2019) and become carbon neutral by 2050. But where to start? For Daniel Robertson, Siemens Mobile Mining Marketing/Sales Manager, the answer is clear: "Eliminate the diesel engines powering mobile mining equipment, which are responsible for 40 percent to 50 percent of CO₂ emissions in a mine."

Electric rope shovels pave the way

Siemens has been electrifying mining equipment for over 45 years – starting with drive systems for electric rope shovels. Back then, Bucyrus, today Caterpillar, worked with Siemens on a custom design for electric rope shovels that could withstand harsh conditions in mines. In the years following the initial market launch in 1976, the all-electric rope shovel has been continuously improved. High productivity, reliability, low

Targeting net zero carbon emissions Over 72% by market cap of the 30 largest mining companies have committed to target net zero carbon emissions by 2050.

Source: S&P Global Market Intelligence, 2021

On uphill sections, trolley-assisted trucks connect to overhead trolley lines, which provide the trucks with electricity. The result: lower fuel consumption and higher speeds on ramps.





To cut emissions it is important to eliminate the diesel engines powering mobile mining equipment, which are responsible for 40 percent to 50 percent of CO₂ emissions in a mine."

Daniel Robertson

Siemens Mobile Mining Marketing/Sales Manager maintenance requirements, and low operating costs have made these shovels a favorite among mining owners.

Another big innovation in electric mining equipment is trolley-assisted trucks. Siemens joined the market in 1996 with its electric drives for haul trucks featuring innovative AC drive train technology. Compared to DC technology and mechanical engine transmissions, AC technology boasts reduced maintenance complexity and costs. A further differentiating factor of the Siemens approach is how the AC drive train is paired with specially developed DC trolley offboard/onboard infrastructure and equipment. In practice, trolley assist enables the best possible performance and efficiency. With hybrid electric trucks, regenerative power from electrical braking is stored in batteries.



Trolley assist helps mining trucks operate more cost effectively and is an important tool for cutting emissions.

Trucks go electric

Trolley-assisted trucks use diesel for general operations. However, on uphill sections, they connect to overhead trolley lines through a pantograph to draw additional electricity from the grid. Among the advantages is uphill loaded speeds that are up to twice as high. Furthermore, compared to dieselonly operation, this setup lowers fuel consumption by around half (depending on the mine profile) and is an important tool for cutting emissions by 50 percent by 2030. Alternatively, Siemens also offers technology for hybrid electric trucks. In this case, regenerative power from electrical braking is stored in batteries rather than heating up resistors, and later used to assist with uphill sections. No offboard/onboard trolley infrastructure and equipment is involved here. With both trolley assist and battery hybrid, fueling times and costs are lower, because the trucks are being partially driven with electrical energy.

Recently, Siemens developed a system for electric-only trucks to enable emission-free operation in open-pit mines. Electricity from overhead lines powers the trucks' wheels and charges onboard batteries. In addition, regenerative energy is captured and stored in the batteries. The batteries are then used to power the trucks in areas of the mine that are not equipped with overhead lines. Electric trucks overcome and eliminate the performance limitations and cost-intensive operations of diesel-engine power. Best of all, they can be in near constant service, as no time is needed for fueling.

Purely electric and trolley-assisted trucks are most economically and environmentally viable in those parts of the world where electrical power can be generated inexpensively and in connection with comparably low CO₂ emissions.

Everything from a single source

Siemens offers complete turnkey packages for electrical mining equipment, which the company continuously improves. Regarding trucks, for example, that means solutions for both hybrid and all-electric vehicles. Going electric in mining has only advantages: increased performance and speed, longer lifecycles, and no fueling times, to name just a few. And of course, electric mining equipment helps owners meet their CO₂ reduction goals. It's a win-win situation.



NEW MINE IN TURKEY

The right technology right from the start



Demir Export has chosen a complete package of Siemens technology for its new İspir Copper and Zinc Mine. Among the benefits are smoother operations from day one. One of the newest mining projects in Turkey is Demir Export's İspir Copper and Zinc Mine, which takes its name from the site location in the country's northeast. At an elevation of 2,500 meters above sea level, over the mine's lifetime the plant will process a total of 5.5 million tons of ore with an average of 1 percent copper and 3.5 percent zinc content. Production start is slated for the fourth quarter of 2022 and expected to extend over a seven-year period.

The products from the İspir mine will help to satisfy global demand for zinc and copper. At the same time, the project will create jobs for the local workforce and contribute to Turkey's economy. Demir Export's İspir copper and zinc mine is located in northeastern Turkey at an altitude of 2,500 meters above sea level. The fully integrated system is based on the complete Siemens product portfolio and offers above all smoother plant operations.



Siemens' extensive know-how in project management and engineering is having a significant impact on the project as it moves toward on-time completion.



Strong local and global expertise and technology

For this project, Demir Export wanted a supplier who could provide state-of-the-art technology to increase plant productivity. At the same time, the goal was to reduce interface problems between different suppliers. With this in mind, the decision was made to move forward with Siemens as a global supplier with a strong local presence. Proof of the latter is successfully completed projects in Turkey's mining industry in recent years. What also spoke for Siemens was the company's extensive know-how in regard to electrification, automation, and digitalization in mining.

Thus, the project was awarded in June 2021. The scope of supply is impressive and includes a long list of products and services. First and foremost is Siemens' SIMATIC PCS 7 process automation along with Minerals Automation Standard (MinAS), the PCS 7 library developed for the mining industry. Other aspects include medium- and low-voltage variable frequency drives, medium- and low-voltage switchgears, instrumentation, transformers, diesel generators, uninterruptible power supply, earthing and lightning protection systems,



The products from the Ispir mine will help satisfy global demand for zinc and copper.

lighting, weak-current systems (fire detection, CCTV), bulk materials (cable, cable tray), detail design engineering, project management, site management, and installation and commissioning activities.

Moving toward on-time completion

The fully integrated system based on the complete Siemens product portfolio offers significant benefits. Above all, it promises smoother plant operations. Integral here is SIMATIC PCS 7 and MinAS, which provide significant flexibility and scalability to monitor and operate equipment and processes across the plant. That makes it easier to meet the demanding operation schedule and site conditions – as well as to start operations on the right foot.

Siemens' extensive know-how in project management and engineering is having a positive impact on the project as it moves toward on-time completion. That's a good start to a relationship that will continue: Siemens Turkey is ready to support Demir Export throughout the lifecycle of the plant with its after-sales services for high plant availability and reliability.

About Demir Export

Founded in 1957, Demir Export has been operating mines to produce coal, iron, and gold for many years with facilities in different regions of Turkey.



LUMWANA MINE PROJECT COMPLETIONS

Demonstrating resilience during challenging times



Work was carried out during the global COVID-19 pandemic, which made the project logistically challenging.



Siemens managed to reduce costs with the reuse of of existing cabinets, cables, and chokes.

The Barrick Lumwana Mining Company in Zambia has been depending on Siemens technology since the Lumwana mine was opened in 2006. The latest orders were for upgrades on the two gearless mill drives and the installed SIMOVERT Masterdrives.

Siemens has been the primary electrical and control system supplier since the inception of the Lumwana mine in 2006. "With us as a trusted solution provider, the people at Lumwana can focus on their core business: mining," says John Jordaan, Siemens Account Manager. Business partners are especially important for the mine due to its remote location about 100 kilometers west of Solwezi in Zambia's Copperbelt. Even with the pandemic in full force, Siemens managed to deliver.

Gearless mill drives upgrade

In 2020, Siemens completed upgrades on the two existing Siemens gearless mill drives. Specifically, the old Simadyn D control system was replaced with a new Sinamics controller. Furthermore, the SIMATIC PCS 7 automation system was also upgraded. Work was carried out during the global COVID-19 lockdown, which made logistics quite challenging – particularly for the 25 people from Siemens and its subcontractors who had to travel to the site to carry out the job. They traveled from South Africa, Zambia, and Germany, and they worked day and night shifts.

The project was completed on time. Contributing factors were the in-depth know-how of the technical team and great support from Siemens Germany. Open communication between Siemens and Lumwana was important for selecting the correct equipment up front.

Equipment provided since 2006



Siemens has provided the following equipment for the Lumwana mine since its inception in 2006.

| Gearless mill drives | Medium-voltage switchgear | Medium- voltage variable speed drives | Low-voltage variable speed drives | | |
|--------------------------|--|---|---|--|--|
| Protection relays | Mobile substations | Containerized substations | Heavy-duty mining cables | | |
| Motor control centers | Mine automa- tion system (SIMATIC PCS 7) | 33 kV overhead lines | Energy metering system | | |
| Low-voltage motors | Medium-voltage transformers | Trolley line solution for haul trucks | | | |
| | | | | | |

Lumwana

Siemens

Lumwana mine in Zambia

Business partners are especially important for the mine due to its remote location about 100 kilometers west of Solwezi in Zambia's Copperbelt.





Lusaka

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The team that carried out the upgrade on the gearless mill drive in 2020.

We pride ourselves in building strong and agile partnerships."

Rousseau Jooste

Technical and Capital Projects Executive for Africa and Middle East at Barrick Gold As the OEM, Siemens has in-depth product knowledge, which enabled the company's engineers to offer an optimal technical solution.

Masterdrive upgrade

A year later, in 2021, Siemens completed another upgrade - this time for 36 existing SIMOVERT Masterdrives, which were powering conveyors, pumps, and more. The new drives are from the Siemens Sinamics family and range in size from 5 kW to 1,800 kW. Costs were kept low by reusing existing cabinets, cables, and chokes. Due to the limited shutdown time in which installations could be completed, technicians arrived days ahead to prepare the drive panels. The on-site installations were finally carried out during the planned shutdown in September 2021. The job was completed ahead of schedule. "That, of course, really pleased the client," John Proctor, Project Engineer, is happy to report. The project was officially completed in October 2021.

Here too, several factors led to a successful project course. As the OEM, Siemens has in-depth product knowledge, which enabled the company's engineers to offer an optimal technical solution. This knowledge also came to the fore during on-site works: The experienced commissioning personnel developed an efficient method to remove and install the new drives, which had the added advantage of not having to change the cables. By reusing existing equipment, Lumwana could reduce costs. Finally, having a single point of contact reduced coordination effort for the client as well as the risk of interface errors. "We pride ourselves in building strong and agile partnerships," says Rousseau Jooste, Technical and Capital Projects Executive for Africa and Middle East at Barrick Gold. "The site team created the urgency for modernizing our installations and Siemens stepped up to the challenge; even when global mobility was a cumbersome, we made use of technology to get connected and forge ahead."

Barrick Lumwana Mining Company now has a modernized gearless mill drive and conveyor system, equipped to serve the mine for another 30 plus years.



With us as a trusted solution provider, the people at Lumwana can focus on their core business: mining."

> John Jordaan Siemens Account Manager



ASSET HEALTH ANALYTICS

Smarter tippler systems

Mining equipment supplier TAKRAF has equipped its wagon tippler system in use at a mine in Karnataka, India, with SIMINE SmartMining Anomaly Detection. Among the benefits for the end customer is advanced warning of potential issues.

TAKRAF offers bespoke solutions, taking into account site conditions and the volume of materials to be transported.

Wagon mechanisms in mines have come a long way: The first wagons are thought to have made their debut in the 16th century, and until the beginning of the Industrial Revolution, the rails were usually made of wood. Today's wagon mechanisms are a far cry from those original systems.

A leading supplier in wagon unloading systems is TAKRAF, which designs, fabricates, and supplies a wide range of wagon unloading systems and equipment. Because each customer project is different, TAKRAF offers bespoke solutions according to the specific application, taking into account site conditions and the volume of materials to be transported. Furthermore, the company also takes steps to minimize the environmental impact of mining with its offering.

To ensure the highest degree of availability possible for its wagon tipplers, TAKRAF counts on elements from Siemens' SIMINE SmartMining portfolio. For a recent contract for a mine in Karnataka, India, TAKRAF chose Anomaly Detection. It monitors the health of the hydraulic system as well as the cycle time.

SIMINE SmartMining – A Siemens Modular Cloud-based Web Platform

Moving Towards Predictive & Prescriptive Maintenance

Predictive What will happen?

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Prescriptive What should be done?

- Anomaly Detection
- Fault Prediction

Operation Optimization

Maintenance Optimization

Real-time status monitoring of the assessed equipment

Better decisions using immediate practical recommendations and actions for anomalies

Better operational efficiency because operational improvements can be made immediately based on customized KPIs

Optimized production thanks to an integrated operation management system that among others improves the maintenance plan

SIMINE SmartMining

Close collaboration with mining customers over the years has helped Siemens create SmartMining. As a cloud-based or on-site platform, it hosts applications to detect operational changes or anomalies, and it also indicates early countermeasures. Applications are available for a range of mining applications, such as grinding mills, belt conveyors, mine hoists, and stockyard equipment. The valuable decision support for operation and maintenance teams is based on a unique combination of cutting-edge technologies, such as cloud computing, artificial intelligence, and simulation in line with the digital twin approach. Extensive mining operations know-how has gone into SmartMining.

By providing timely countermeasures, Smart-Mining applications support effective maintenance to mitigate failures and avoid unexpected production downtimes. Altogether, the platform enhances the ability of mining companies to optimize their operations, improve asset utilization and reduce costs – all of which are imperative to maintain a competitive edge in today's highly uncertain and complex business ecosystem. Special dashboards display the current status of the tippler mechanisms, so operators always have an exact overview of the system health.

Enhanced availability

The customer benefits through early identification of anomalies in the hydraulics. Maintenance and service activities can then be better planned. And by monitoring the cycle time, the turnaround times could be improved so much so that four hours of energy are being saved per week.

A range of special dashboards displays the current status of the tippler mechanisms, individually and as a whole. That way, operators always have an exact overview of the system health. If an anomaly is recognized, a notification is issued right away to bring awareness to the situation and to give staff time to plan the appropriate steps.

Anomaly Detection also includes a know-how database that contains details on common faults and their root cause, plus instructions for corrective action. Furthermore, operators can find advice there on how to prevent anomalies from happening in the first place. All of these features together make SIMINE SmartMining Anomaly Detection into a comprehensive solution for special cases and for the everyday.

COLLABORATION WITH K+S

A partner for **the long term**

From fertilizer to salt products for a whole range of industries, K+S covers a wide selection of applications with the kalium and salt it excavates from mines in Germany.

The K+S plant in Borth, Germany, equipped with Siemens technology. With support from plant staff, Siemens developed the SIMINE Winder Asset Health Analytics electronic operating log for hoisting machines.

K+S has a mission of promoting health, growth, and quality of life for people all over the world. The company isn't alone in fulfilling this goal; it counts on support from Siemens. Over the years, the two companies have collaborated in a number of areas.

In addition to fertilizers and salts, K+S also produces high-purity salts in its plants for medical applications. Among other things, the pharmaceutical industry uses the salt solution for the dilution of vaccines.

SIMINE Winder Asset Health Analytics

This equipment monitoring module for winder systems triggers necessary safety audits depending on the current state of the winder equipment. The module allows the user to monitor the operating hours of the winder and its components, such as the hydraulic pump and fan. Additionally, the user can monitor the shift, daily, or weekly production figures.

Siemens has been a reliable partner in many major projects for the modernization of shaft hoisting systems at K+S mines. The orders often include new inverters for the traction motor, a new brake, and a complete shaft signaling and conveyor communication system, plus complete planning, project engineering, and implementation.

Traditionally, Siemens has been a trusted partner for hardware, like large motors and drives, and energy distribution technology. And lately, K+S has been turning to Siemens to become more digital. With support from staff at the K+S plant in Borth, Germany, Siemens developed the SIMINE Winder Asset Health Analytics electronic operating log for hoisting machines.

A sales and service team led by Michael Siebrecht and Michael Pfeil tends to all of K+S' needs. The positive feedback the team regularly receives and the continual incoming orders are good signs of a job well done.

SINEMA REMOTE CONNECT

Safe and secure remote connections

In times of social distancing and travel restrictions, having technology in place for remote plant connections can be a deciding factor between bankruptcy and survival. In this article: How standard web meeting software can be made more secure with the use of a virtual private network, and why it pays to consider cybersecurity, user management, and interaction logging.

A few years ago, scenarios like the one to the right sounded like science fiction. But today, they are part of everyday operations. What makes this possible is SINEMA Remote Connect, a management platform for remote networks from Siemens. The application is installed on a server at the user site and facilitates remote access to machines and plants around the world. The focus is on managing all requirements for easy and secure remote access.

A SINEMA Remote Connect platform can be hosted by customers themselves or by Siemens. If Siemens provides the hardware, installation, and maintenance, the user has all the benefits of a managed server without the hassle of ownership. The plant operator only needs to decide who should access the plant and allocate user rights accordingly.

No matter how SINEMA Remote Connect is configured and installed, users benefit first and foremost from a high level of security.

A new way of working

March 20, 2020, Santiago de Chile, 9:15 a.m.: From his home office, Pedro reviews the process data of the flotation cell in his company's copper mine hundreds of miles away in the central Chilean Andes. At a glance, he realizes that the froth's bubbles are too small and adjusts the froth speed accordingly. The concentrate's grade is quickly back in the ideal range.

12:30 p.m.: Pedro receives an alarm from the plant's condition monitoring system. The lubricant flow in the SAG mill is too low. The standby lubrication pump starts automatically. Pedro sends a request to the on-site maintenance manager José to replace the damaged pump.

2:23 p.m.: José puts on a set of VR glasses and connects to an expert from the pump manufacturer to receive audio and video instructions on removing and repairing the pump.

Safer data transfer

A core feature of SINEMA Remote Connect is the secure and comfortable administration of tunnel connections through virtual private networks (VPN) between the service center, the service engineers, and the installed equipment. This type of connection prevents direct access to the corporate network in which the equipment or machine is integrated. But how does this work in practice? Take remote online meetings as an example.

Remote support for a plant's personnel can be as simple as starting a web meeting. Standard programs such as Microsoft Teams[®] enable participants to control each other's computers. Similarly, with just a few mouse clicks a maintenance expert can take control of a plant computer to remedy issues.

02.07 💋 🌡 😱 +++ 🖾 👸 Request control 🧱

Remote control functionality in Microsoft Teams®

While standard web meeting programs do include various security features, it is better to use VPN technology, especially in situations where the corporate network security standards apply to all network users. A VPN uses the regular internet as a vehicle for data transfer but protects communication by means of a data tunnel. Tunnel endpoints must be authenticated before secure VPN tunnels can be established. User-created remote-access VPNs may use passwords or other cryptographic methods. This technology is employed for permanent connections to a company's network with a remote client and allows a plant to be operated outside its premises - as Pedro operates the plant high up in the Andes from his home in Santiago de Chile.

Remote technology:

- Increase safety
- Reduce costs
- Improve uptime
- Get a head start in the race for talent

VPN technology protects point-to-point communication. However, provisions are necessary to protect the plant against cyberthreats. This is where the so-called demilitarized zone (DMZ) comes into play.

Typically, a plant has multiple access points for the company's operators and for internal and external service technicians. These points all have different read/write rights in the plant's automation system. Consequently, the best access point for remote connections - whether a permanent connection for operations, or a non-permanent one for service – is the DMZ. It is shielded both from the internet and from the plant by a firewall, and it allows for all remote connections to be managed centrally. Other security measures in a plant dictate whether a packet-filter, stateful-inspection, or application-layer firewall should also be integrated. The value of the DMZ is most apparent when it comes to installing the latest operating system and antivirus software updates.

Electronic devices usually install software patches and update antivirus programs automatically, often without the owner's awareness. These updates help ensure that devices

External network connection with VPN technology

can be used safely. Similarly, a Distributed Control System's (DCS) operating system and antivirus program should also be continuously updated, even in a plant that is not connected to the internet. However, in production plants DCS systems require the operator's intervention to schedule and install software patches to avoid any negative impact on production itself. Updates can be downloaded from the manufacturer's website and installed on the DCS's servers. Update servers can automate this activity in such a way that the relevant updates are made available locally and the operator receives a respective notice via email. The operator can then schedule the installation of the software patch.

SINEMA Remote Connect has been a lifesaver for operating plants remotely in the COVID-19 pandemic.

No chance for attack

But how to install updates? A memory stick in the USB port of a DCS server can infect a complete automation system. Therefore, to protect against cyberattacks, update servers are commonly located in a DMZ. For utmost security, operators will also want to know who has logged in to the DMZ. For this, SINEMA Remote Connect provides central user administration with the user management component (UMC) and activedirectory connection. Additionally, it centrally logs various activities, including secure transmission to overlaid management systems.

Central user administration is also valuable for granting external equipment suppliers access to a plant. Generally, they should only see data from their equipment. If external companies need more access to a plant's automation system, then advanced user rights can be provided for a limited time. Typically, the owner's personnel supervises activities of external companies. Sessions can be logged for quality and liability reasons.

Head start in the race for talent

SINEMA Remote Connect has been a lifesaver for operating plants remotely in the face of social distancing and travel restrictions due to the COVID-19 pandemic. But there are further benefits when people work remotely. Plant safety increases, because fewer people are at a given site. Costs are reduced when external equipment manufacturers continuously monitor the condition of their equipment remotely. Plant uptime improves when issues are immediately remedied. And finally, technology for remote and secure connections allows people to work independent from place and time - which is what especially the new generation in the industry wants. By using SINEMA Remote Connect, plant owners get a head start in the race for the best talent.

Connect the DCS to the Internet

Vpdates

00100101100100

4.15 p.m.: Karl from Siemens' global Distributed Control System (DCS) support team in Germany logs on to Pedro's DCS client to assist him with installing the latest Windows[®] patches on the plant's DCS in the central Chilean Andes.

SICEMENT OPERATIONS

10.00

The future of digitalization is now

With digital transformation now part of the cement industry, Siemens has developed a new digitalization platform specifically geared to the requirements of cement producers.

We live in very exciting times. The digital transformation in the cement industry is happening as we speak, and all cement producers are progressing along the digitalization path, each at their own pace. The cradle of digitalization is in the IT world, and that is where most companies have already taken steps to implement digitalization solutions to improve the transparency of their operations, mainly at corporate, logistics, and financial levels.

However, the bread and butter of cement producers remains in their production facilities, and this is where the use of digitalization is starting to ramp up. The main purpose is to support the existing automation to improve the production process, and to bring more transparency in areas such as alarm management, asset management, and maintenance. New technologies such as machine learning (ML), artificial intelligence (AI), and digital twins (DT) are being developed at an incredible speed. To avoid a proliferation of stand-alone solutions, it is becoming increasingly clear that all this must be brought together into one central platform.

A digitalization platform for the cement industry

With this objective in mind, Siemens has developed a modular software platform – SICEMENT Operations – with a large choice of applications specially developed for the cement industry. SICEMENT Operations is a cloud-based web platform that hosts applications to improve activities in cement plants. It uses the relevant data available in real-time wherever necessary from various sources, such as condition monitoring, process control, and other systems. The bread and butter of cement producers remains in their production facilities, and this is where the use of digitalization is starting to ramp up.

New technologies such as machine learning, artificial intelligence, and digital twins must be brought together in one central platform.

In essence, the system works like a smartphone. Once SICEMENT Operations is installed, users can select which applications they want to use from an extensive catalogue. The platform is very flexible and is continuously being updated based on the feedback and requirement requests Siemens receives from end customers. New ideas and developments can be implemented in an agile and efficient manner.

Zooming in on cement production itself, a lot of process data is already available in the existing distributed control system (DCS) and process historian systems. Therefore, it is very important that the automation system has an architecture that allows highly available real-time, deterministic, and transparent transmission of this data, even at very high communication rates. For that reason, it is strongly recommended to upgrade to an industrial ethernet network, such as Profinet, if this is not already the case.

SICEMENT Operations

is a cloud-based web platform that hosts applications to improve activities in cement plants.

SICEMENT Operations Front End

SICEMENT Operations Back End

Mobile App

In essence, the system works like a smartphone. The platform is very flexible and is continuously being updated. New ideas and developments can be implemented in an agile and efficient manner. Numerous applications – such as alarm analysis, workflow management, asset management, and process monitoring – are already available, and new applications are being developed continuously. In this article, two specific applications will be explained in more detail: smart anomaly detection and AI for the kiln.

Smart anomaly detection

The essence of digitalization is to generate, use, and analyze data to contribute to the improvement of business activities by having the relevant information available in real time, whenever and wherever it is needed. The combination of process data together with condition monitoring signals and machine learning technology results in so-called smart anomaly detection for all assets in the field.

In a cement mill, measurements such as temperature, pressure, and flow are used to keep the grinding process under control and are available in the process control system, while condition monitoring sensors are used to monitor the health of motors and bearings. Very often, this information is only available in a separate stand-alone system, independent of the control system.

SICEMENT Operations gathers the relevant signals from different sources and smart anomaly detection looks at all these signals simultaneously and for various process conditions of the mill. Fingerprint evaluations are created and added to an extensive database for reference and evaluation. If one or more signals move out of the defined normal range and no match is recognized with the fingerprints from the database, it is tagged as an anomaly and the operator gets a warning.

When an anomaly occurs for the first time, an expert can have a look at all the signals and make a root-cause analysis. With this knowledge, the expert suggests countermeasures to solve the

Fingerprint evaluations

If one or more signals move out of the defined normal range and no match is recognized with the fingerprints from the database, it is tagged as an anomaly and the operator gets a warning. issue. All the anomalies together with their respective fingerprint, root-cause analyses, and countermeasures are entered into the same database that gets bigger and smarter over time. When a known anomaly occurs, the system recognizes this and makes recommendations to the operator on how to fix it. Fingerprints are taken regularly, thus allowing the system to create new patterns and to compare patterns to detect and predict anomalies. When informed about a potential failure before anything actually breaks down, operators can take corrective actions to mitigate the failure and unexpected production downtimes.

Al-assisted autopilot for the kiln

The kiln is the heart of a cement plant and its operation, together with the preheater and cooler, is often difficult to handle. Traditional advanced process control (APC) systems usually struggle to maintain stable control due to unknown variables, such as alternative fuel types. As a result, most of the APC systems could not even be operated or require intensive fine-tuning. such as alarm analysis, workflow management, asset management, and process monitoring – are already available, and new applications are being developed continuously.

New developments and applications are finding their way to SICEMENT Operations at an incredible pace. This is where AI becomes a real game changer. When the AI module is added to the platform, it starts to look for patterns in the historical data of relevant kiln values. Based on these patterns, the AI module can predict the behavior of the kiln in the future. In the blink of an eye, the operator can see if the kiln will continue to perform within its permitted limits and then adjust the set points to keep the kiln within its optimal operational boundaries.

With sufficient historical data, AI can even advise operators about the ideal kiln setpoints. When the system is trusted by the plant operators, it autonomously operates the kiln without the need for human intervention.

Many cement plants have at least one very experienced kiln operator who is close to retirement. This person understands the kiln and always knows exactly what the optimum set points are. This is something that is only possible with decades of experience. However, AI makes it possible to train the system with the know-how of the most experienced operators and guarantees that decades of experience are never lost.

The journey continues

This is only the beginning. New developments and applications are finding their way to SICEMENT Operations at an incredible pace. Siemens works together with its customers to find solutions for their pain points. With ML and Al, a new world of possibilities opens up and problems that did not previously have a solution can now be solved. An autopilot for the kiln is only the first example, and the next new thing could be, for example, a reliable prediction of cyclone clogging in the preheater tower. Digitalization comprises a very broad range of concepts and its applications in the cement industry are countless. The journey to digitalization has started and will unquestionably continue.

MINERAL PROCESS ANALYZER

Indian cement works goes digital

Cement plants generate data around the clock. But if there is no system in place to capture it, calculate KPIs, and analyze the generated data, it basically has no meaning. As part of an electrification and automation project at Chettinad Cement's site in Dachpalli, India, Siemens installed Mineral Process Analyzer.

When it came time to renew the electrification and automation, Chettinad Cement's operators were open to new ideas. The new equipment they were about to receive would produce more data than ever. With this in mind, Siemens' engineers introduced them to Minerals Process Analyzer.

This solution calculates and stores all performance-related data, and reports are generated without any manual intervention. The system also opens the door to horizontal and vertical integration, that is, connectivity to labs, SAP, and more. Furthermore, the data can be transferred to the cloud and third-party reporting systems. The solution makes it possible to quickly and effectively measure plant efficiency. Users can also see where their plant stands in regard to stringent environmental regulations. To be able to benefit from the data for the long term, Minerals Process Analyzer has a dependable archiving system and a documentation storage feature for maintenance manuals, pictures, and certificates.

The right information to the right person Minerals Process Analyzer manages data intelligently and gets the relevant information to the right person. For example, to the employees responsible for improving efficiency and meeting strict environmental requirements. In addition, the tool captures and processes data from all areas of a plant to generate KPIs for operators, engineers, and production, plant, maintenance, and electrical managers – as well as for headquarter management. For companies with more than one site, Mineral Process Analyzer allows the same information from various plants in different locations to be gathered for comparing performance.

Minerals Process Analyzer captures data from across the plant to generate KPIs – and it can even compare performance from various plants in different locations.

At Chettinad Cement's site in Dachpalli, India, Minerals Process Analyzer has been in use since the beginning of 2022.

At Chettinad Cement, data is communicated directly from the standard SIMATIC PCS 7 process control system. However, Minerals Process Analyzer can receive information from other sources via OPC. Information can be manually added too.

Thanks to its long-term archive of process values and alarms, Minerals Process Analyzer provides process information and analysis, production tracking, and quality assurance. Other features include straightforward handling and open, flexible user modules, and transparent presentation of information. If at some point in time operators at Chettinad Cement would like to take advantage of cloud solutions, no problem: Minerals Process Analyzer has standard cloud connectivity. It can also be equipped with a web server for remote connections.

Always an eye on what's going on

Minerals Process Analyzer has been in use at Chettinad Cement since the beginning of 2022. Monitoring energy use has become much more thorough. Power-consumption reports can be generated in 15-minute, hourly, and daily intervals. Furthermore, at either fixed intervals or when certain triggers are registered, Minerals Process Analyzer generates reports automatically as an email or in Excel or PDF.

KPIs are now being calculated in the PM server. A range of areas is covered here, including total production considering material moisture, or calculations for material factors, clinker factors, and cement factors. The different reports along with dashboards make it easier than ever to track ongoing operations. This information is the basis for optimizing operations. Moreover, problem areas can be identified easily – and rectified before they have a chance to become a major issue.

New electrification and automation – coupled with Minerals Process Analyzer – lets operators at Chettinad Cement benefit from the potential of digitalization. It shows that it pays off to be open to new ideas.

Minerals Process Analyzer visualizes production and process information and turns it into personalized reports.

ARTIFICIAL INTELLIGENCE

Making the most of existing data

What can I expect from my kiln? Are instabilities probable? Or is it smooth sailing for the weeks and months ahead? No, you don't need a crystal ball to get answers to these questions. Prediction applications based on artificial intelligence get the job done dependably.

When operators from a leading cement manufacturer approached Siemens, they had a clear goal in mind: they wanted to reduce fuel consumption and increase the reliability of their kiln. The solution from Siemens was to apply artificial intelligence to the troves of data the plant was already producing every second through SICEMENT. Since 2020, cement plant has been linking automation, drive, and power supply systems using SICEMENT. The result is one overall solution for primary tasks like extracting, transporting, and processing raw materials – as well as for secondary processes like supplying power for plant servicing and maintenance.

A stepwise approach

Siemens' initial goal was to create a proof of concept to display the potential of artificial intelligence on day-to-day operations. The first step was to take historical data and perform exploratory analysis on it and to inform the customer about the observations. Next was live data connectivity.

Overview of savings

Artificial intelligence ensures significant CO₂ emissions reductions and cost savings

Savings per day

Potential savings per year

What crystalized were 19 parameters to examine more closely. The Siemens team then got to work on inspecting business process logic to identify events and activities that occur within a workflow, and the subsequent decision points from those workflows. What they settled on were burning zone temperature, the inlet temperature, O₂ inlet, and NO_x inlet, which are impacted by the kiln speed, fuel rate, and ID fan speed.

These factors are now analyzed in real time, and the AI makes suggestions to operating staff to keep the kilns running at an optimum. The AI can accomplish this task because it "learned" from the experts. An example is with the kiln fuel rate. It first observed how the experts manage the fuel rate. Algorithms were then written so that the AI can independently recommend the optimal values for saving fuel. And when fuel is used more economically, CO₂ and NO_x emissions are reduced. But there's more to it than that. The data also provides indications about the future behavior of the kiln process.

Forecasting to avoid downtime

Here too, the AI uses algorithms to forecast kiln signals. What operators get are indications about the future trend of the kiln process for 15- and 30-minute time windows, which gives valuable early warnings about process instabilities with the kiln inlet temperature, the kiln inlet pressure, the kiln main drive current, the sintering zone temperature, and the tertiary air temperature.

The results of the PoC are impressive: On a daily basis, the customer can cut its daily coal consumption by 2.8 tons, which leads to CO₂ emissions reductions of 5.04 metric tons. Over a year's time, the solution offers potential savings of just over €200,000 per line. Perhaps most impressive here is that these savings could be had with data that was already being generated in the kiln.

Benefits

of combining real-time data with predictive intelligence

- Improve production with easy-to-interpret data comparison
- Analyze plant operations with trend visualization and plan inventory and maintenance accordingly
- Achieve transparency through production tracking and quick access to relevant information
- Identify issues across the plant through alarm analysis
- Reduce breakdowns and increase durability with real-time monitoring of assets and their maintenance

SMART INFRASTRUCTURE

Digital also means sustainable and secure

A steady focus on process efficiency doesn't have to be at the expense of sustainability and security. Proof can be found in recent projects Siemens has completed for mining operators across the globe. Automation and digitalization keep power supply reliable.

When outages are detected, the grid ring automatically reconfigures itself in under 300 milliseconds.

Siemens offers solutions for entire mining infrastructure installations – from power supply, microgrids, and security to fire detection and prevention. When these technologies are combined with digitalization, the results bring additional sustainability and security to mines. Here are some examples of what this means:

For a steady supply of energy

A major concern in mining is the reliability of the power supply, especially when using renewable energy. The answer lies with automation and digitalization, for example to enable self-healing grids: When outages are detected, the grid ring automatically reconfigures itself. All of this happens in under 300 milliseconds to ensure absolute minimum process downtime.

Another trend is rising energy costs, particularly at peak times. Here too, digitalization and automation of the electrical supply provide a remedy. In one particular case, innovative and intelligent power management allowed operators at a major iron ore terminal to slash in half electricity consumption at peak times. The result is significant cost improvements and CO₂ savings of 2,400 tons annually.

In a further case, Grupo Mexico achieved major efficiency improvements at its Buenavista del Cobre Mine – namely a 60 percent reduction in electrical grid downtime and a 50 percent cut in energy costs. Close interaction between Siemens engineers and mine staff ensures that the solution best matches the needs of the mine, including functions like consumption and power-factor monitoring, load shedding, and black-start capabilities. These utility-grade offerings ensure that all the requirements and standards of the electrical utilities are met - also when using renewable energy. An added benefit of this holistic approach has been a significant improvement in employee satisfaction, as registered during the latest employee survey at Buenavista del Cobre Mine. The modern infrastructure and reduced

Modern technology assists with monitoring facilities and providing additional situational awareness.

downtimes have minimized employee workload and resulted in simpler, cleaner, and easier-tosolve tasks. The same methodology has also been used for the implementation of similar measures at numerous mines worldwide. Proven switchgear, protection, and supply automation systems provide the backbone for all these solutions.

Protecting infrastructure

Modern technology assists with monitoring facilities and providing additional situational awareness. A welcome side effect of this is the significant savings in operational expenditures that can be achieved. For example, in the case of an on-site emergency, an integrated command and control system enables a highly efficient response through automatic, event-dependent dispatch of the closest, most suitable staff member or first responder.

Additionally, infrastructure is protected with fire extinguishing systems. Early detection features issue danger alerts before a developing situation can get out of hand. When possible, systems are equipped with natural and clean agents to lower the impact an extinguishing event can have on the environment. A further aspect to ensure security is electronic access control systems. They regulate who has access to a site. And once a person is within a site, they govern access rights to specific machinery, substations, and buildings. These systems come together in e-houses at the Eti Bakır Adıyaman copper mine in Turkey.

For an extended service life

The Smart Infrastructure portfolio is rounded off with digitally supported customer service. Service packages cover hardware, such as switchgear and fire detectors, and software for among others grid control and monitoring. The software offering also extends to cybersecurity, a critical element considering the high degree of digital assets in a modern mine and the threat a breach can have on operations.

Service packages are tailored to customer needs to assure optimal components for the site in question, and they are carried out by a local team that can respond immediately, if need be. The service team makes full use of digital technologies, such as remote operations and diagnostics. In addition, they can tap into Siemens'global technical know-how to receive support in particularly sensitive cases. Ultimately, this service approach leads to higher efficiency and, of course, more sustainability because well-maintained assets have a longer lifetime.

The examples listed above are just a few of the many that Siemens has to its name. Best of all, the Digital Mine offering is based on international standards, such as IEC 61850 and Profinet. This provides a high level of redundancy and supports an agnostic approach and investment security, which just goes to show that efficiency need not be at the expense of sustainability and security.

> Buenavista del Cobre in Mexico has achieved a 60 percent reduction in electrical grid downtime and a 50 percent cut in energy costs.

Service packages are tailored to customers' needs to assure the optimal components for the site in question are selected.

Minerals and **mining up close**

Keeping the connection to Siemens has never been easier – whether through a new online portal, trade fairs, or webinars.

Siemens Large Drives Applications Portal A one-stop hub

The new Siemens Large Drives Applications Portal is a one-stop hub for everything in the business's portfolio: high-voltage motors, mid-size generators, medium-voltage converters, as well as digital services for drive system applications in the megawatt range, and much more. Users can find the latest product and portfolio information there, quickly find the right product for their industry application, and get fast support and service from Siemens experts around the clock. With just a few clicks, you can set up a profile and request an offer or support. Visit the Siemens Large Drives Applications Portal to experience it for yourself. You can also subscribe to the newsletter at the site to stay up to date on the latest products, services, and more.

Large Drives Applications Podcast Listen in for ideas and inspiration

A new podcast series from Siemens explores topics surrounding large drives applications. Listeners can expect among others the latest information on product and service innovations, red-hot tips from experts, and insights into practical applications.

Hall C2, booth 325

Focus on efficiency and sustainability

The latest innovations in the construction, building materials, and mining machinery industry will be on display at bauma 2022, which is taking place in Munich from October 24 to 30. As always, Siemens will be there - this time in hall C2, booth 325. The focus of the Siemens booth will be on digital solutions for optimal efficiency and enhanced sustainability of mining operations. Future-facing minerals operations are increasingly turning to digital solutions that emphasize integration, linking processes and data for everything from discrete procedures to entire mining operations. This is precisely where Siemens shines, combining technologies and expertise for optimum outcomes and providing high-efficiency solutions. The staff at the Siemens booth are looking forward to showing visitors how digitalization and automation can make mining more integrated, efficient, sustainable, and competitive.

Online sessions Get ready to be inspired

Siemens regularly holds free-of-charge webinars on a variety of topics. Two recent sessions dealt with mining. Click on the boxes below to see recordings of the sessions.

What makes mining and raw materials processing more sustainable?

The Nelson Mandela Bridge: a Johannesburg landmark.

Electra Mining Africa 2022

At the forefront of sustainability

At the beginning of September, Siemens showed its solutions for the mining industry at Electra Mining 2022 in Johannesburg, South Africa. Displays focused on how visitors can strike a balance between people, planet, and profit with the right solutions. In addition, speakers from the company gave presentations on current topics impacting the industry, for example, on drive technology applications to support weak grids, or on the impact of technology in mining.

Siemens Minerals Week Chile

A compendium of industry trends

Speakers and panelists from government and industry reviewed the big topics facing the industry at Siemens Minerals Week Chile. Videos from the event are now available at CNN Chile's YouTube channel.

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