

The Siemens logo is positioned in the top right corner of the cover. It consists of the word "SIEMENS" in a bold, white, sans-serif typeface. The background of the entire cover is a photograph of a large industrial facility, likely a cement or mining plant, featuring massive circular structures and complex machinery. A vibrant rainbow is superimposed over the scene, arching across the middle of the image. The overall color palette is dominated by deep blues and purples, with a teal gradient overlaying the lower portion where the text is located. A vertical teal bar is placed to the left of the main title. The image is also decorated with a pattern of small, glowing green dots, particularly concentrated in the upper left and right areas.

SIEMENS

MINERALS FOCUS ISSUE 2021

The Magazine for the **Mining and Cement Industries**

How Siemens is addressing current challenges with more digitalization and remote work at minerals companies.

//

With our decades of expertise in digital technologies, we at Siemens have been able to address the call for more digitalization at minerals companies.”

Roland Ehrl

Executive Vice President
Minerals Solutions
Siemens AG





Dear readers,

For well over a year and a half, we have all been feeling the impacts of the COVID-19 pandemic in our daily lives and in business. We at Siemens Minerals sincerely hope that you and your families have managed to stay well during these tumultuous times.

Like you, we have seen some significant developments in the last 12 months. For us, the biggest change has been the rapid uptake in digitalization. We're not alone: According to a study published in October 2020 by McKinsey & Company, the COVID-19 crisis has accelerated the digitalization of most companies' customer and supply-chain interactions and of their internal operations by three to four years. And the share of digital or digitally enabled products in their portfolios has advanced by seven years.

With our decades of expertise in digital technologies, we at Siemens have been able to address the call for more digitalization at minerals companies. To give you an idea of what we are capable of, on the following pages you can read more about our technologies, such as the SIMATIC eaSie Digital Assistant (page 39). And you can also find out about recent projects, for example how we established secure remote connections to a mine in Chile (page 18).

I believe digitalization will continue to impact our business. While travel restrictions and safety concerns may eventually abate thanks to an influx of vaccines, the realization of new, more efficient ways of working are here to stay. If anything, that's the silver lining of everything we've been through in the last year.

Best regards,

A handwritten signature in black ink that reads "Roland Ehrl".

Roland Ehrl

Executive Vice President Minerals Solutions
Siemens AG

Digitalization requires commitment and strategy for mining companies to truly become part of Industry 4.0.



16



24





18

Contents

Editorial

News

Events

We are there for you

Now on video

Up-to-the-minute information on topics and trends

Cover Story

Material and quality management

COVID-19 prompts more interest in digitalization

3

Mining

K+S instrumental in vaccine success story

16

When only the purest will do

6

SINEMA Remote Connect

18

Safe and secure remote connections

41

Smart infrastructure

24

Digital also means sustainable and secure

Asset Health Analytics

28

Smarter tippler systems

8

Cement

Maintenance from afar

32

Switch to remote

Driven by data

36

On the road to digitalization

Credits

42

EVENTS

We are there for you

Despite the lockdowns to curb the spread of the coronavirus, Siemens Minerals has managed to stay in touch with customers, for example through online trade fairs and webinars. As soon as it is possible again, our experts look forward to meeting face to face, as they did at the China International Industry Fair in Shanghai. Here's a rundown of some recent events.



Chile Minerals Week 2020/2021

Everything on digitalizing mining

A three-day online conference at the end of July 2020 and 2021 brought together Siemens' mining experts, politicians, and researchers to examine trends in digitalizing mines. The event was organized and hosted by Siemens Chile in two consecutive years. The kickoffs were panel discussions on digitalizing mining operations, followed by presentations covering a wide range of topics



Digitalization figured prominently at online seminars from Siemens Minerals Turkey.

– from digital management of medium-voltage motors and drives to digital services and asset management for distribution systems. A highlight in both 2020 and 2021 was a focus session on gender diversity in digitalization and industry.

Siemens Minerals Turkey

Webinars for the cement industry

Turkey has one of world's largest, most advanced, and innovative cement industries. To ensure cement customers have access to the latest Siemens technologies, colleagues from Siemens Minerals in Turkey have, over many years, developed a very close cooperation with the Turkish Cement Manufacturers' Association (Türk Çimento). As part of the relationship with Türk Çimento, Siemens Minerals Turkey organized multiple technical online seminars for the association's members. The focus was among others on the latest developments in the areas of automation and digitalization.

16th Green Cementech

Sustainability in cement

Last year's Green Cementech conference came to participants on a virtual platform. The focus was squarely on innovative technologies and best practices for energy efficiency, productivity improvements, and sustainable development. Siemens experts contributed to the three-day event with presentations on the company's latest technologies and upgrades. Since 2004, Green Cementech has strived to bring the industry's best minds together to share insights and discuss the way forward for sustainable development.

Djakarta Mining Club

Experience with digitalization

Djakarta Mining Club – an organization of mining companies in Indonesia – promotes sustainable minerals production through education and ongoing dialogue among stakeholders in the country's mining industry. The club organizes a regular webinar series where members discuss the most pertinent topics and industry developments. For the meeting in September 2020, Siemens Minerals team members Bernardo Marinho, Greig Young, and Mada Herusy were invited to present their experience with digitalization. The more than 270 Djakarta Mining Club members who attended received first-hand information on how Siemens' digital solutions are addressing the current industry challenges.

China International Industry Fair Shanghai

Back to "normal"

International fairs and conferences are reopening in China. And needless to say, Siemens Minerals is there. From September 15 to 19, 2020, the company showcased its mining and cement portfolios during the China International Industry



At a Djakarta Mining Club event, a Siemens team spoke about their experience with digitalization.

Fair (CIIF) in Shanghai. Since CIIF's launch in 1999, it has become one of the most influential international industry exhibition brands in China. Last year, more than 2,200 exhibitors from 22 countries participated at the fair in Shanghai. Digital Mining Integrated Solutions were presented at the Siemens stand. Customers were particularly interested in Advanced Stockyard Management as well as the Production Management System (PMS).

Arab Mining Convention 2021

Siemens participates with two presentations

The Arab Mining Convention 2021 took place as an online conference and exhibition from February 24 to 26, 2021. The event accentuated the region's thriving mining sector with a primary focus on markets in Saudi Arabia, Oman, Morocco, Jordan, the United Arab Emirates, Sudan, and Egypt. Siemens Saudi Arabia and Siemens Minerals headquarters participated in the event with a booth and two presentations: Mark Yseboodt went over the company's capabilities, and Bernardo Marinho spoke about experience in automation and digitalization for mining.

MATERIAL AND QUALITY MANAGEMENT

COVID-19 prompts more **interest in digitalization**

As the COVID-19 pandemic has swept the world, increased attention has been put on the health, safety, and security of employees everywhere – and rightly so. Advanced material and quality technologies have always played a big part in keeping people safe. And they are good for the bottom line too.



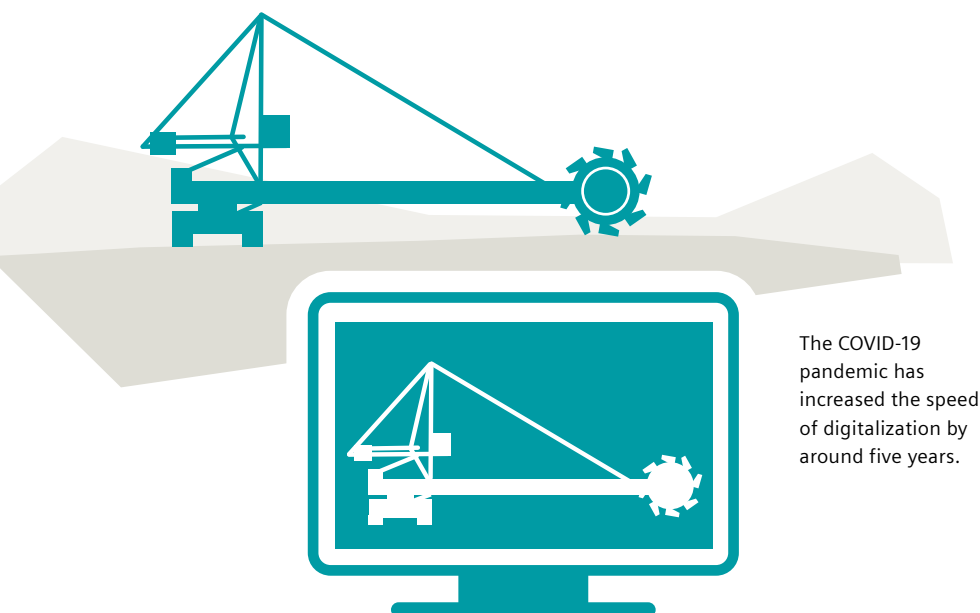
The situation is well known to everyone in the industry: In many parts of the world, the accessibility of ore, minerals, and coal is decreasing while labor costs rise. For mines to continue successfully, operational costs must be optimized. These challenges have led to the development of digital solutions to autonomously operate conveyors and stockyard machines, such as stackers and reclaimers. All along, a big advantage of these technologies has been that they limit the number of people in unsafe work environments, such as stockyards with their extremely high levels of dust.

For mines to continue successfully, operational costs must be optimized. Digitalization is promising in many regards.

With the COVID-19 pandemic, digital technologies have shown what they are really capable of. "In the last 12 months, we have faced COVID-19 challenges, like everyone else, but we achieved our targets nevertheless," says Christian Dirscherl, Vice President for Mining, Excavation, and Transportation at Siemens. "We did see impacts on plant setups, but we've been very successful with remote commissioning, for example, for autonomous stockyards and gearless mill drives. With a lot of these projects, we had planned commissioning pre-COVID and there was no way we could have foreseen that happening, so we had to adapt quickly. Most of our teams work remotely now, and commissioning and supervision services for all drives, electrification, and digitalization projects are carried out remotely."

Situations like those Dirscherl speaks about have prompted even more widespread acceptance of digital technologies. Dirscherl confirms: "In the last year, COVID-19 has probably increased the speed of digitalization by around five years. We believe that there's a huge demand coming, and in the future this will have a lot of impact on technologies."

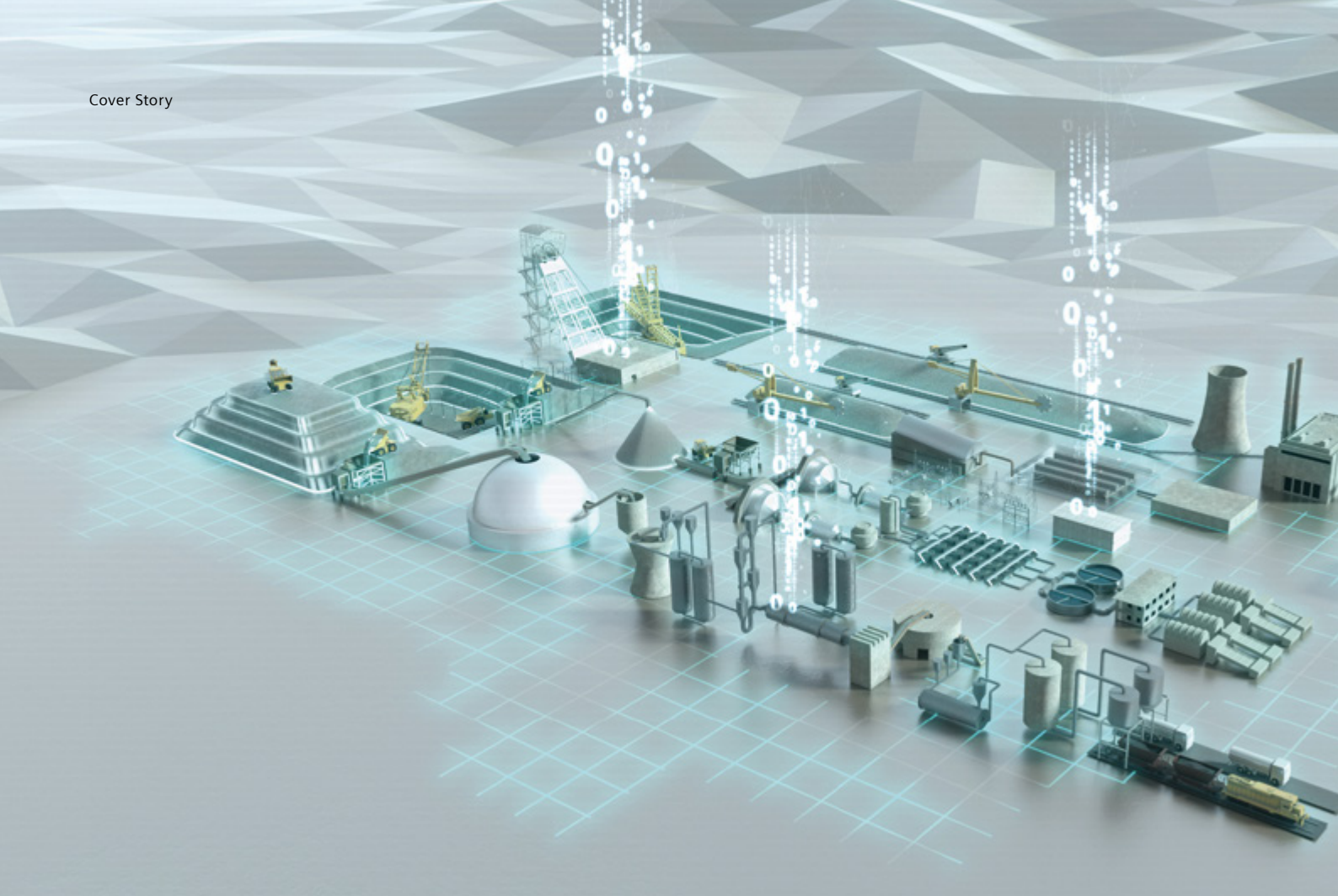
Here are some core Siemens technologies that are already making a difference, especially in conveying and stockyard management – and they are poised to have an even bigger impact in the years to come:



The COVID-19 pandemic has increased the speed of digitalization by around five years.



Today, many commissioning and supervision services for drives, electrification, and digitalization projects are being carried out remotely.



SIMINE Material and Quality Management

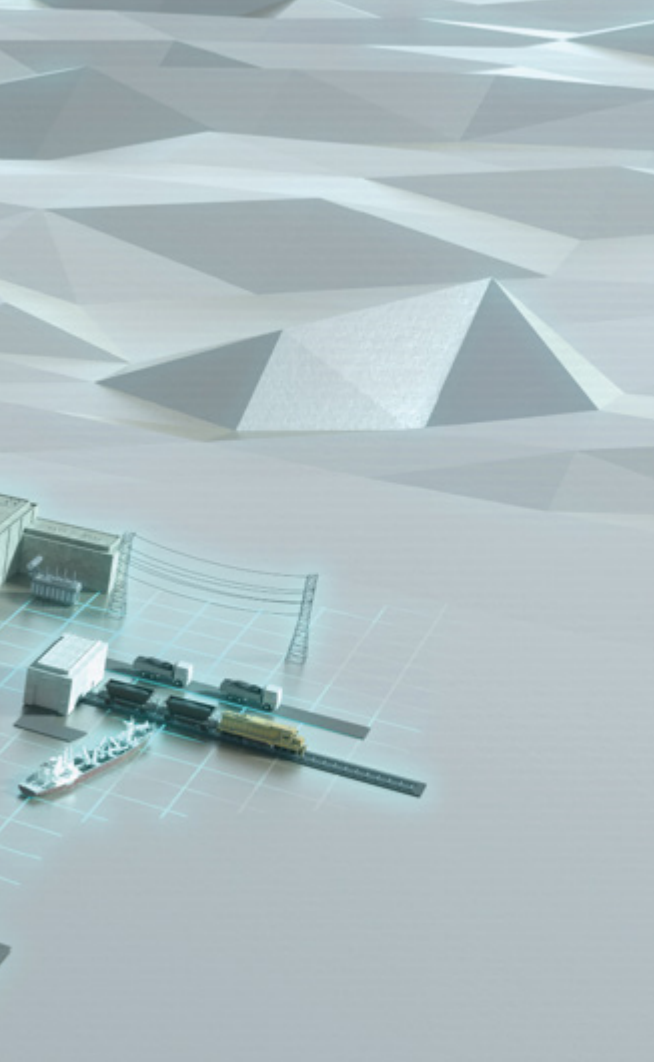
Siemens' SIMINE Material and Quality Management (MAQ) solution is a digitally enhanced advanced bulk material handling system for mines, ports, and other bulk material sites. It includes material and quality tracking, real-time material inventory, precise blend control, autonomous machinery operation, and high-resolution 3D stockpile imaging. In particular, the 3D model is a digital twin of the stockyard; without it, machines cannot be operated autonomously. "Basically we track material along the conveyors, we automate the machines in the stockyard, and we also have mathematical models to simulate the stockyards," explains Dirscherl.

Among the benefits of MAQ are steady and consistent machinery operation, which reduces machine wear and abrasion, and thereby lowers maintenance costs. Furthermore, MAQ improves equipment and process efficiency by increasing utilization and allowing better knowledge of the process data. Finally, MAQ contributes to personnel safety, because operators can drive processes from just about anywhere thanks to remote capabilities.

Real-Time Ore Measurement – a further step for MAQ

In November 2018, Siemens and Vancouver-headquartered MineSense formed an exclusive cooperation for the real-time measurement of ore grade and ore characteristics for conveyors. The joint solution is called Real-Time Ore Measurement (ROM). It combines Siemens' SIMINE MAQ with MineSense's BeltSense technology, which uses X-ray fluorescence (XRF) to scan and analyze the material on a conveyor belt.

ROM is a system for optimizing the processing plant and mine to increase productivity, and its components can be installed without interrupting production. The



Siemens' SIMINE Material and Quality Management (MAQ) solution is a digitally enhanced advanced bulk material handling system for mines, ports, and other bulk material sites.

ROM housing, which is approximately 8.3 meters long, contains XRF sensors; it is placed over an existing belt conveyor. Automation and computer software is also installed next to the ROM housing. "Our system is basically a software solution which is also capable of tracking material, and we have mathematical models to simulate the stockyards and stockpiles," says Dirscherl. "In combination with MineSense we can measure ore and material quality in real time on the conveyor, and also provide this information to the customer."

The solution is currently at the feasibility stage with installations at several copper mines in the Americas. Experience there has shown that ROM can improve copper recovery up to 1 percent; reduce water and energy consumption by up to 5 percent; and lower waste being misallocated to ore by between 3 percent and 5 percent, which also liberates mill capacity.

Gearless conveyors

A gearless drive solution for conveyors 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, which eliminates the necessity to install multi-motor drives. Additionally, the electricity required to power 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 between 3 percent and 4 percent. Using gearless drives instead of standard motor reducer packages eliminates approximately 40 bearings and eight couplings per conveyor. The

A gearless drive solution for conveyors increases the reliability and efficiency of the overall system by between 3 percent and 4 percent.

4%



Digitalization requires commitment and strategy, and what we've seen recently is more mining companies making that investment to truly become part of Industry 4.0."

Christian Dirscherl

Vice President for Mining, Excavation,
and Transportation
Siemens AG

Maintenance is lower for gearless drive technology, and there is also no need for lubrication and gearbox cooling systems.



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 for each year. Lubrication and gearbox cooling systems, together with their maintenance, are also obsolete for this solution. Several gearless conveyors are in operation in Chile and Peru, and in Mongolia and China.

SIMINE Asset Health Analytics

Asset Health Analytics (AHA) is an advanced condition monitoring system whose purpose is to recognize long-term changes in the general condition of mission-critical pieces of equipment, like grinding mills, conveyors, and mine hoists. The next step is to derive specific recommendations for conducting maintenance tasks in time to avoid unexpected equipment failures or losses in performance.

At the same time the AHA solution contributes to a better overall system understanding of equipment, thus facilitating continuous design improvement measures as part of product lifecycle management. In addition, AHA includes long-term data archiving of plant operational modes and measurement data as a means to document operational history.

Commitment and strategy drive digitalization

The list of digital technologies described here is by no means exhaustive. For example, the COVID-19 pandemic also saw a rise in remote commissioning and maintenance, and customers have also shown interest in manufacturing execution systems (MES).

For companies wishing to become more digital, Dirscherl has advice: "Digitalization has been key in all industries over the past five years, but it requires more than just IT and automation," he says. "It also requires commitment and strategy, and what we've seen recently is more mining companies making that investment to truly become part of Industry 4.0."

www.siemens.com/mining
christian.dirscherl@siemens.com

Gearless drive systems allow the size of the electrical room to be reduced, thus saving space and weight.

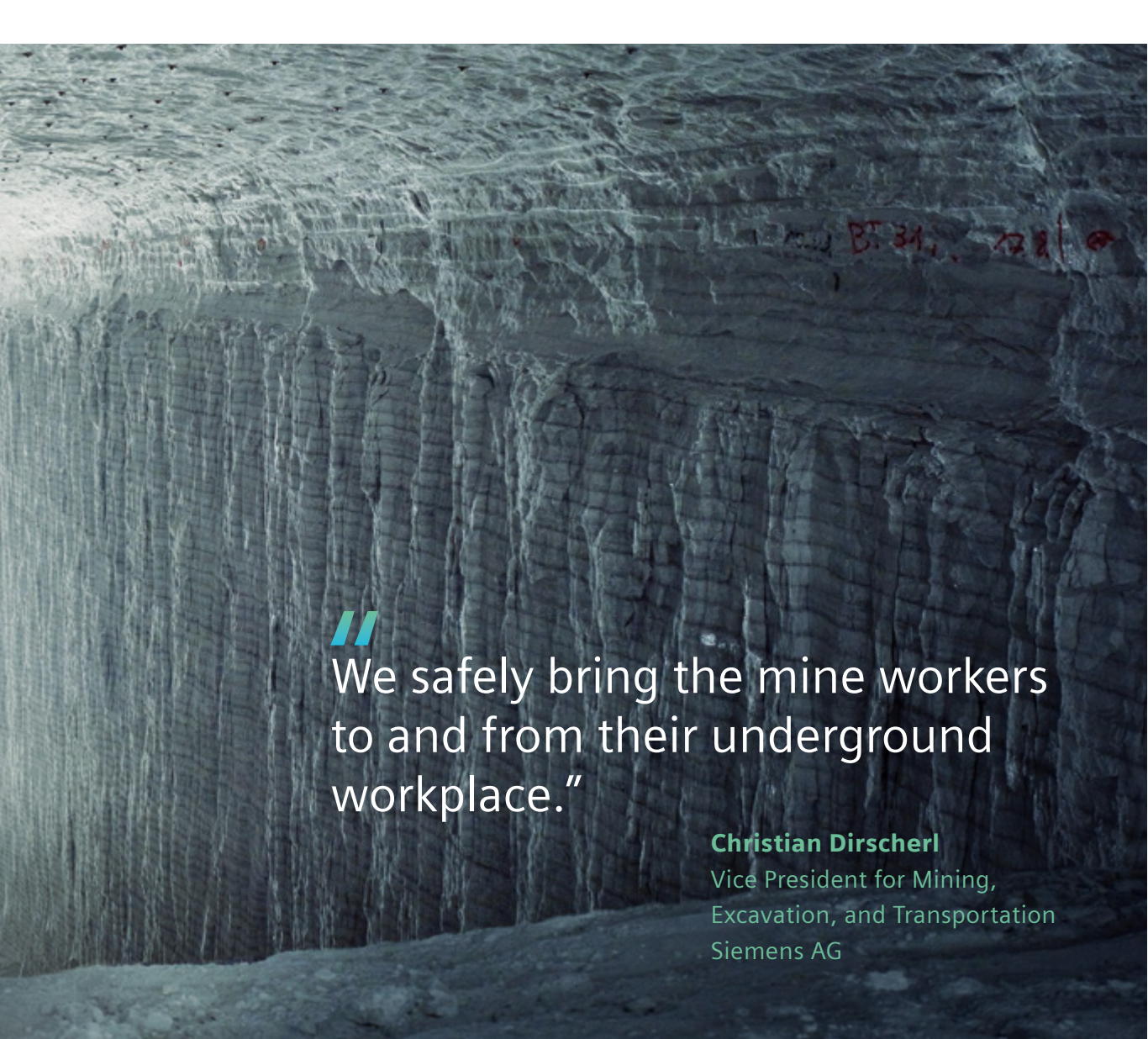
The main purpose of Asset Health Analytics (AHA) is to recognize long-term changes in the general condition of mission-critical equipment.



K+S INSTRUMENTAL IN VACCINE SUCCESS STORY

When only **the purest** will do

Sodium chloride from a K+S site in Germany is playing a crucial role in the use of a leading COVID-19 vaccine.



// We safely bring the mine workers to and from their underground workplace.”

Christian Dirscherl
Vice President for Mining,
Excavation, and Transportation
Siemens AG

Some COVID-19 vaccines cannot be simply injected in pure form, but must first be diluted with a saline solution; the human body requires this in order to absorb them. From its Borth facility on the Lower Rhine, German company K+S is supplying sodium chloride (NaCl) – better known as table salt – for the saline solution.

Siemens part of the product lifecycle

As a general contractor, Siemens was involved with the modernization of the mine hoist and delivery of a complete automation and control system for the underground mine in Borth. Additional deliverables included a new converter and brake. “We safely bring the mine workers to and from their underground workplace,” explains Christian Dirscherl, Vice President for Mining, Excavation, and Transportation at Siemens. K+S also counts on a range of services from Siemens “to ensure that production operations run smoothly,” says Dirscherl.

Above: Hundreds of meters underground: K+S operates several rock salt mines in Europe and North America.

Right: High-purity salts from K+S are used in infusion and dialysis solutions.



Aside from being the primary ingredient for saline solution, for example for infusions and dialysis, NaCl has multiple and diverse uses: It supports penicillin production and generating blood plasma, and it is an active substance for different medical products. Furthermore, NaCl is essential in the foodstuff and plastics industries.

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.

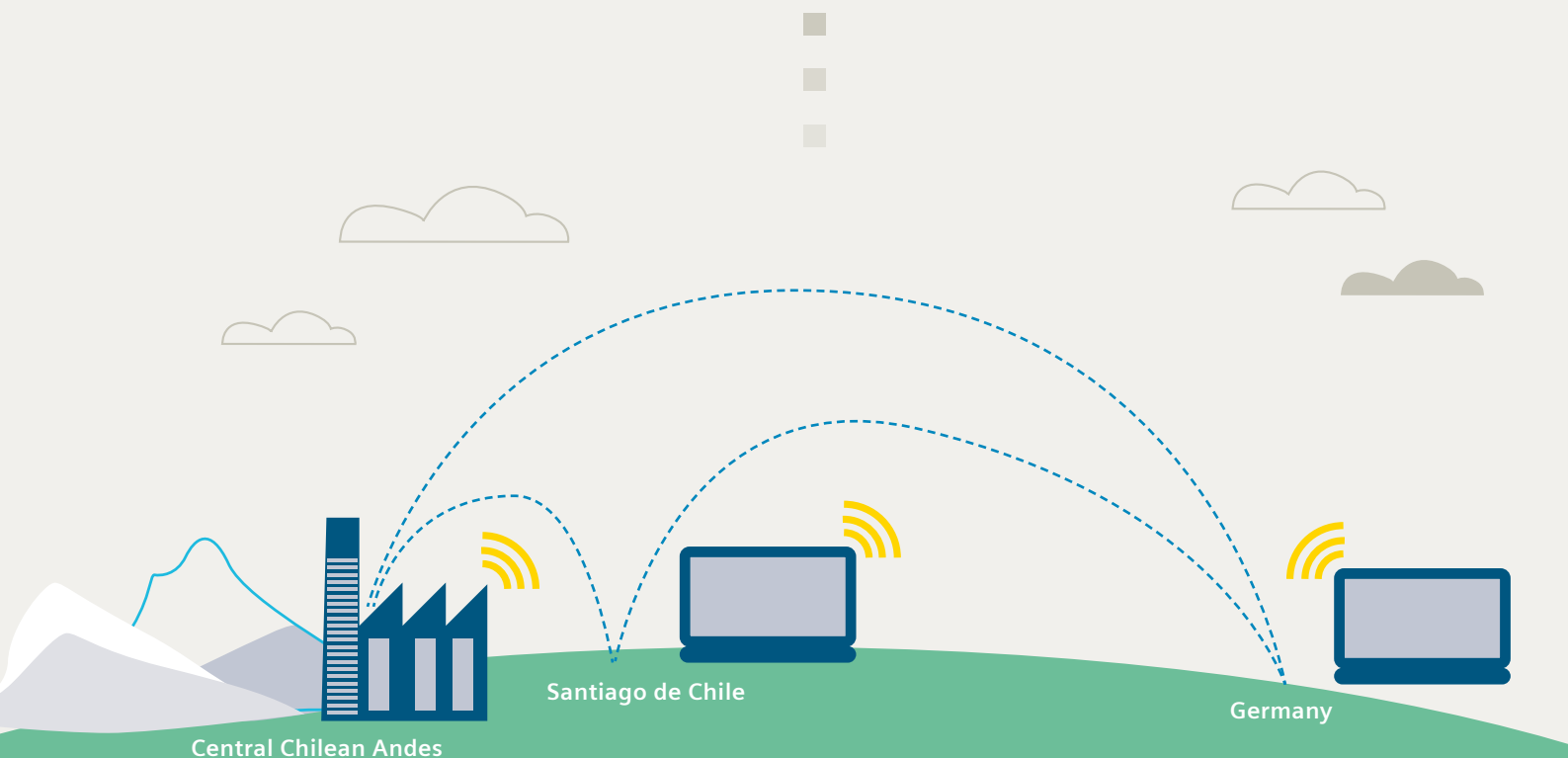
A SINEMA Remote Connect platform can be hosted by customers themselves or by Siemens. If Siemens provides the hardware, installation, and maintenance, the user has all the benefits of a managed server without the hassle of ownership. The plant operator only needs to decide who should access the plant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

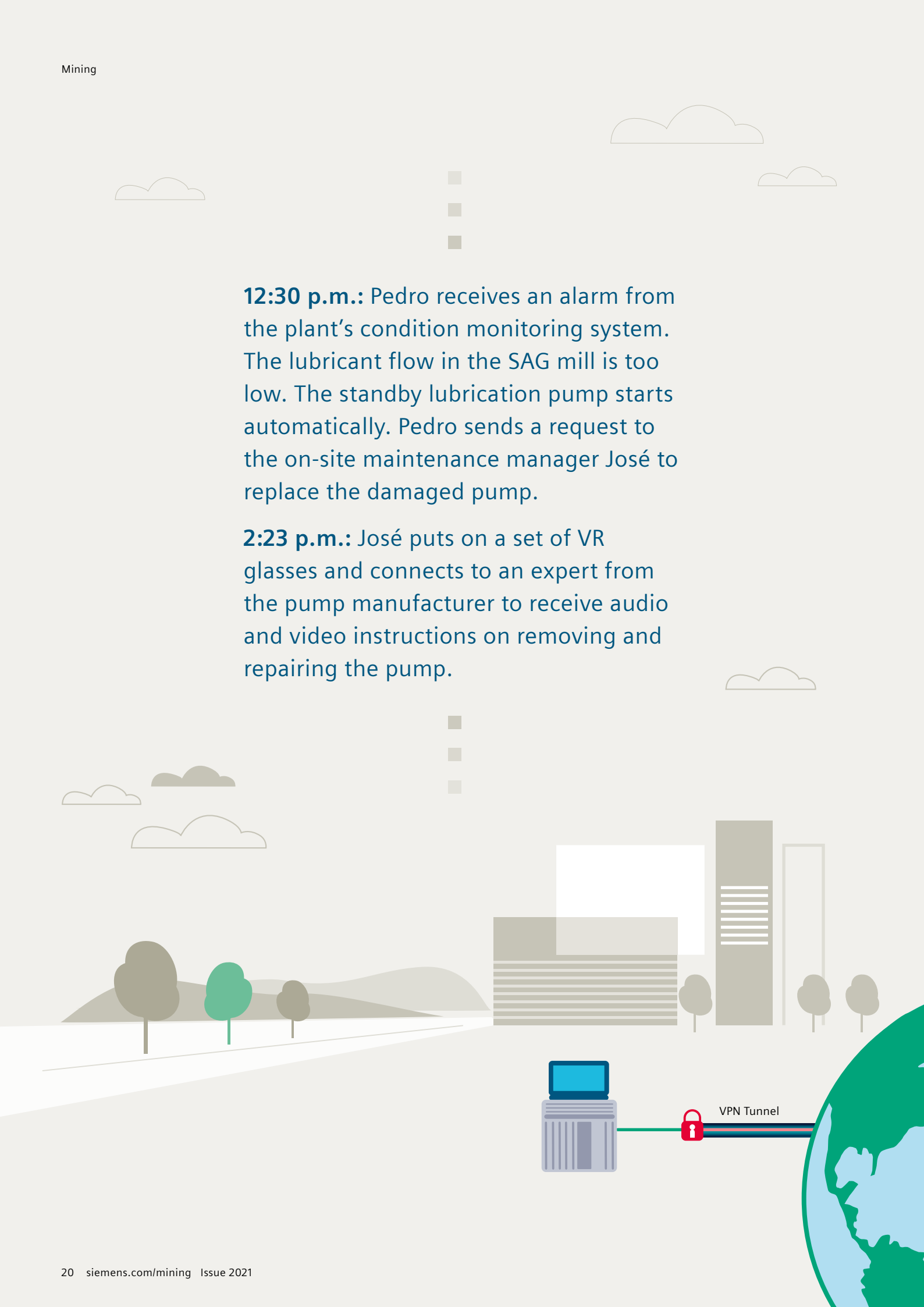
No matter how SINEMA Remote Connect is configured and installed, users benefit first and foremost from a high level of security.

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.



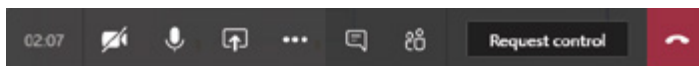
VPN Tunnel



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.



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 cyber-threats. 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.

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 active-directory 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.

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

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 allow 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.

www.siemens.com/mining

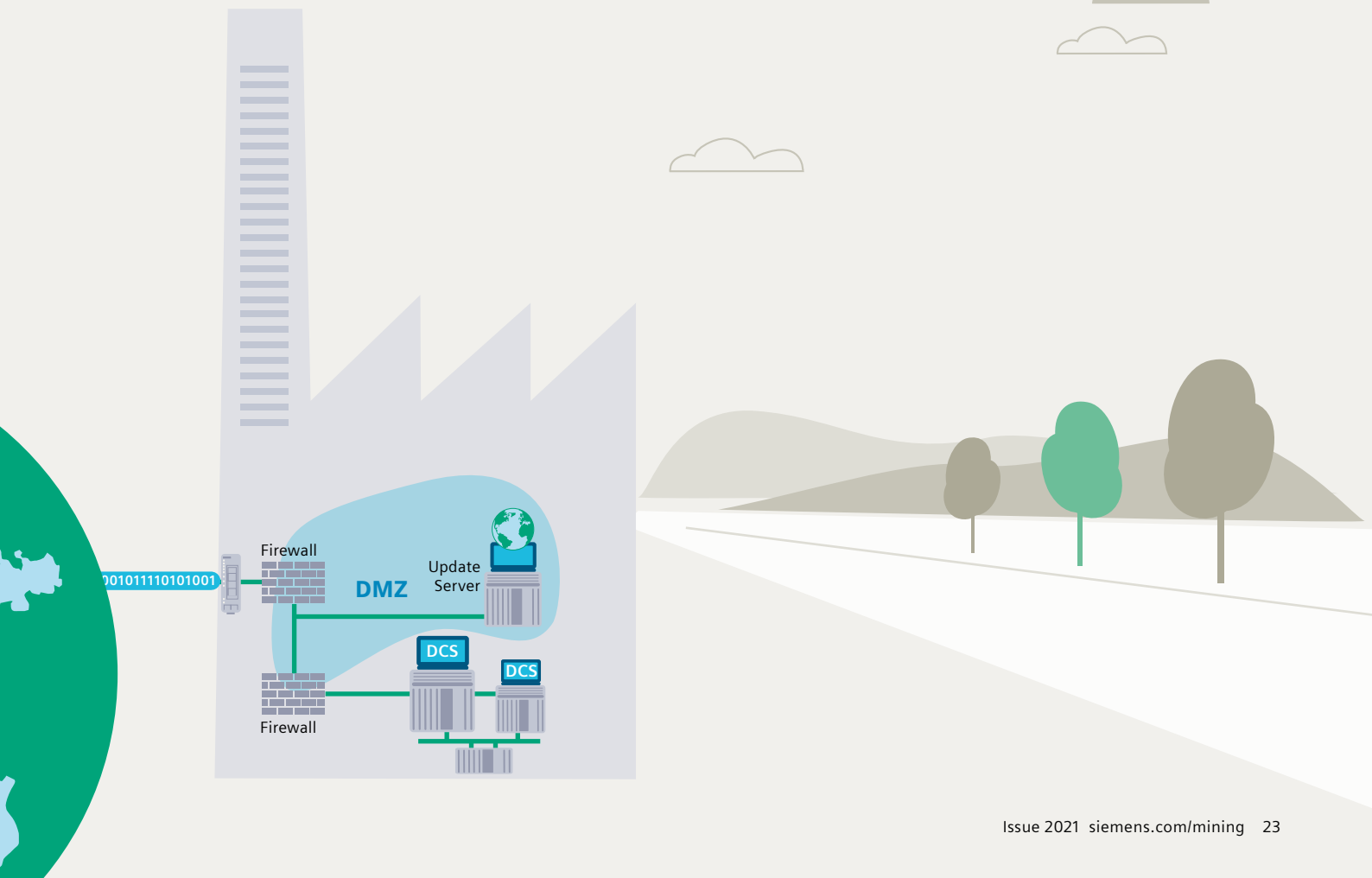
Author: Alexander Scholl

alexander.scholl@siemens.com

Connect the DCS
to the Internet



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.






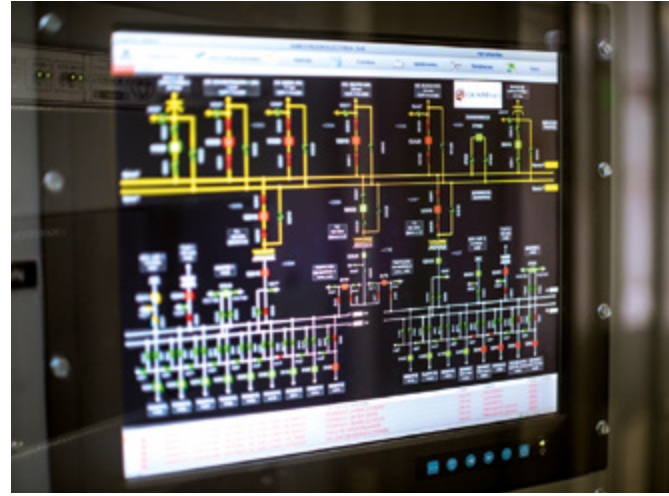
SMART INFRASTRUCTURE

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-to-solve 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.

www.siemens.com/mining

Author: Chris Pretorius

christiaan.pretorius@siemens.com

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.



ASSET HEALTH ANALYTICS

Smarter tippler systems

Mining equipment supplier TAKRAF has equipped its wagon tripler system in use at a mine in Karnataka, India, with a SIMINE® SmartMining Anomaly Detection solution. 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.

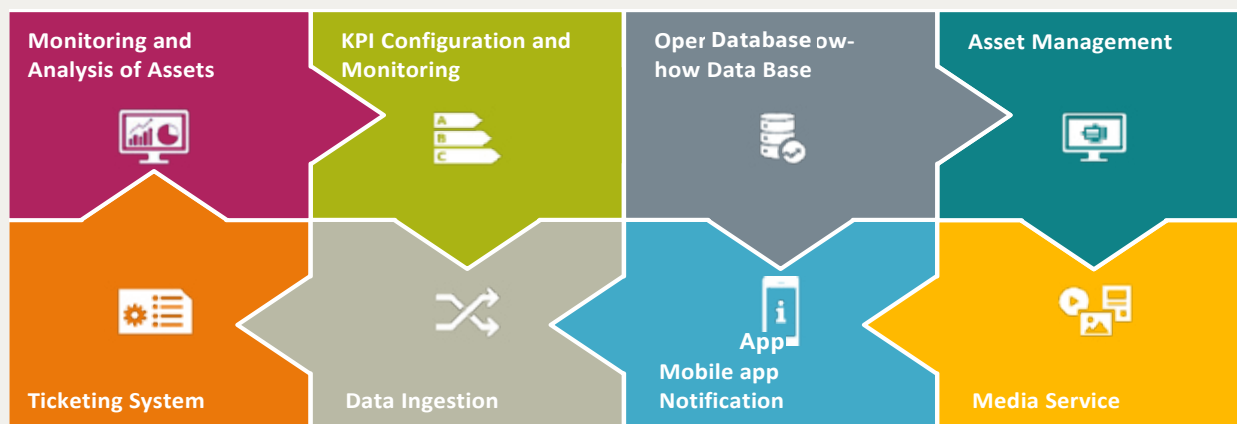
Wagon mechanisms in mines have come a long way: The first wagons are thought to have made their debut in the 16th century, and until the beginning of the Industrial Revolution, the rails were usually made of wood. Today's wagon mechanisms are a far cry from those original systems.

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 tippers, 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?

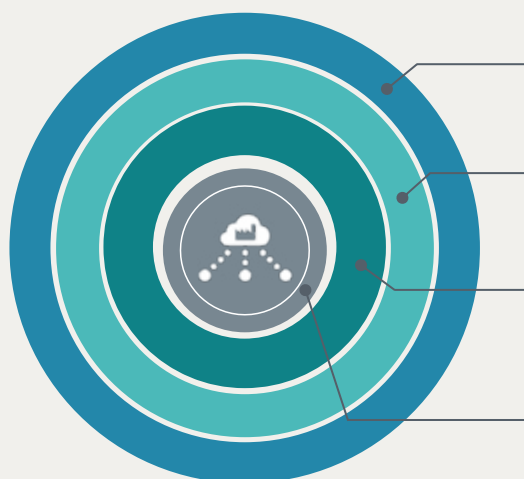
- Anomaly Detection
- Fault Prediction



Prescriptive

What should be done?

- Operation Optimization
- Maintenance Optimization



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, SmartMining 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 SmartMining Anomaly Detection into a comprehensive solution for special cases and for the everyday.



MAINTENANCE FROM AFAR

Switch to remote

Annual maintenance: A fixed date in the cement industry, which in North America generally falls sometime in February and March. Typically, 30 days are set aside for this annual activity. These dates are rarely flexible and usually planned a year in advance. The 2020 maintenance outage season was to be no different. But then came COVID-19 lockdowns and travel restrictions.



The COVID-19 pandemic halted both national and international travel. But with remote tools, annual maintenance could still be carried out.

“The show must go on.” While this saying has its origins in the entertainment sector, it’s certainly fitting to describe the attitude Siemens experts took during the yearly maintenance scheduled in March 2020 at the Lehigh Hanson site in Tehachapi, California, and at a cement facility in Michigan. Unfortunately, the CEMAT experts who were scheduled to travel from Europe to the United States were grounded by travel restrictions to combat the first COVID-19 wave. Fortunately though, Siemens had a way to access their knowledge and keep the annual maintenance shutdown on schedule.

The solution was remote connections, something which Siemens had already widely used to support customers in emergency situations. Siemens experts provide support verbally and, if need be, they employ live video chat. However, until March 2020, these possibilities had not yet been used for remote automation commissioning and controls system upgrades. That all changed in a matter of days.

A continuation of work already started

The project for Lehigh Hanson involved migrating the plant’s CEMAT control system from V6.1 to V9.0. Prior to the shutdown in March 2020, a total of seven controllers had already gone through factory acceptance tests (FAT), and three of the seven controllers were commissioned in January. Alex Bartzik, who is based in Germany, was the mastermind behind the CEMAT migration engineering. Originally, Alex planned to travel back to California in March to commission the remaining four controllers. When travel to the US from Europe was banned, a plan B was developed.

It involved sending Shahzar Durrani, Siemens CEMAT Application Engineer, from Alpharetta, Georgia, to California to work side by side with Jaromir Vojtech, Lehigh Hanson Tehachapi plant Controls Engineer, to act as the eyes, hands, and ears for Alex while he worked from his home office in Germany. Shahzar was the obvious choice, as he had previously supported the FAT and initial commissioning. Collectively, Siemens and Lehigh Hanson connected with remote technologies to carry out a very successful commissioning. An enabler here was the fact that Lehigh Hanson was already using a remote access solution, so no time was lost, and the team could get to work immediately. To accommodate the nine-hour time difference, Alex shifted his workday to the late afternoon and evening hours.

Best of all, there were no delays to the plant outage schedule. Alex, Shahzar, and Jaromir worked seamlessly together. “As far as the results go, we’re pleased with everything. It was almost like having Alex here with us in California,” comments Jaromir.

Plan B turns to plan C

The cement plant in Michigan was also set to rely on support from Europe, but for a different reason. A CEMAT V8.2 controls system was commissioned in 2018 but hadn’t been functioning properly. In December 2019, Siemens CEMAT expert Burak Civanoglu traveled to Michigan from Turkey to perform a detailed audit of the plant’s control system. The audit included a plan to rectify the issues and concerns during the March 2020 outage. Civanoglu outlined a schedule by which he would spend half of the time required for the project making changes offline from his office in Turkey; the other half of the work would be carried out during a site visit in March. Then came the last-minute trip cancellation. In essence, his plan B strongly resembled that of Alex Bartzik’s.



Despite travel cancellations due to the COVID-19 pandemic, remote technologies kept the annual plant shutdown on schedule.

Remote support: A portfolio for today and tomorrow

The Siemens global operation headquarters in Germany teams up with local experts to provide support and services – also remotely. An overview:



More than 2,000 service experts

Our worldwide network of specially trained personnel provides you with a high-quality service. We provide direct remote access to our experts via web link communications or help-desk service stations.



We are close to you – also via remote

With service centers in more than 44 countries worldwide, we are always close to your location. But especially in these challenging times when social distancing measures are enforced across countries, we focus on providing our services remotely.



You are our first priority

You as our customers are our first priority, 24 hours a day, 365 days a year. Service is our attitude, and even in hard times, our goal is it to support you in your daily challenges so you can focus on what is important to you.

Umer Tanvir, a Siemens Application Engineer who is stationed in Harleysville, Pennsylvania, was selected to be Civanoglu's on-site counterpart. Tanvir was well suited for the task, as he had spent time in the past at the plant to resolve issues and was therefore familiar with the customer and the site. But the plan was foiled while he was in route to Michigan and received word that the governor of Michigan closed the state's borders and he had to return home. Time for plan C.

Without skipping a beat, Burak spoke to the site's Controls Engineer, and the two decided to work together on the plan. Civanoglu connected with the customer from his home office in Turkey. Most of the issues were resolved prior to bringing the kiln back online, and for those that remained the duo continued to collaborate as the plant came up to full production. "When Burak and I finished our work, the plant control system was working better than ever," says the Controls Engineer. Here too, remote technologies kept the annual plant shutdown on schedule.

Easier access to even more Siemens experts

In both cases, remote support proved to be a viable solution. Initially, the customers voiced their concerns about safety and network security. "But collectively we were able to resolve all concerns quickly," says Joe Holmes from the Siemens Alpharetta Large Drives Applications Minerals solutions team. "Of course, it does require a lot of coordination," he continues. But with his 20 years of Siemens experience and his deep familiarity with the US cement industry, Joe and his team were able to organize the technical, commercial, and logistical details between Siemens and the customers.

In the end, the provided support proves that remote isn't just for resolving emergencies, but for basically any issue – and even for annual maintenance. Perhaps even more valuable is that remote technologies extend the reach of Siemens experts and make their know-how available to an even wider audience.

www.siemens.com/cement

Author: Joe Holmes

joe.holmes@siemens.com

DRIVEN BY DATA

On the road to digitalization

Intelligent dashboards. Extensive data exchange along the entire value chain. Transparent financial figures for better resource allocation. All of this is possible thanks to digitalization. But the bread and butter of cement and mining companies still remains in production – and here the use of digitalization is ramping up rapidly.



Data fuels digitalization, which has a positive effect on day-to-day operations.



New technologies such as machine learning, artificial Intelligence, and digital twin are mentioned in the same breath as raw mills, kilns, conveyors, and drives. Digitalization is a very broad concept and its applications in the cement, and mining industries are countless. There is a constant, though: digitalization starts with automation.

The essence of digitalization is to generate and analyze data to improve a company's activities. Zooming in on cement production, great amounts of process data is already available in the existing distributed control and process historian systems. To make the most of this data, it is very important that it be transmitted in real time at very high communication rates. Ideal here is the industrial ethernet standard Profinet. Depending on a plant's size and requirements, Siemens offers several Profinet architecture blueprints. Security is an important aspect in automation, and the blueprints take this into account to avoid any unwanted access to a plant's network. While Profinet is common in new installations, plants that were constructed several decades ago need

to be modernized to continue production for the decades ahead. Siemens can take care of that too.

With a properly designed automation network, the first step to digitalization is completed. Plant data can now be collected, transferred, and stored in a way that makes it available when and where it is required. The new architecture also supports the integration of additional data collection points from the field. Generating more data in itself is not so difficult, as it often involves simply adding another sensor.

However, there is often a limit to the amount of data that can be added to an existing control system. Because a lot of the data from the sensors is not necessarily required to control the process itself, CPUs shouldn't be overloaded with irrelevant data. The trend today is to create an additional channel with smart switches routing the signals through the CPU and/or through the additional channel. In this way, a plant can generate more data without interfering with the existing automation system. The additional data channel is fully secure.

With issues surrounding the transportation and collection of data solved, what to do with the troves of data? What follows are three examples of how data is fueling digitalization with a positive effect on day-to-day operations.



The digital twin shortens commissioning time and keeps plant data always up to date.

Only the operator can tell them apart

The majority of plants in operation today have very limited up-to-date documentation. In fact, most documentation dates back to the construction of the plant, and the changes that were done in the meantime are only stored in employees' minds. A current plan of a plant is essential for creating a digital twin, which is the starting point for digitalization.

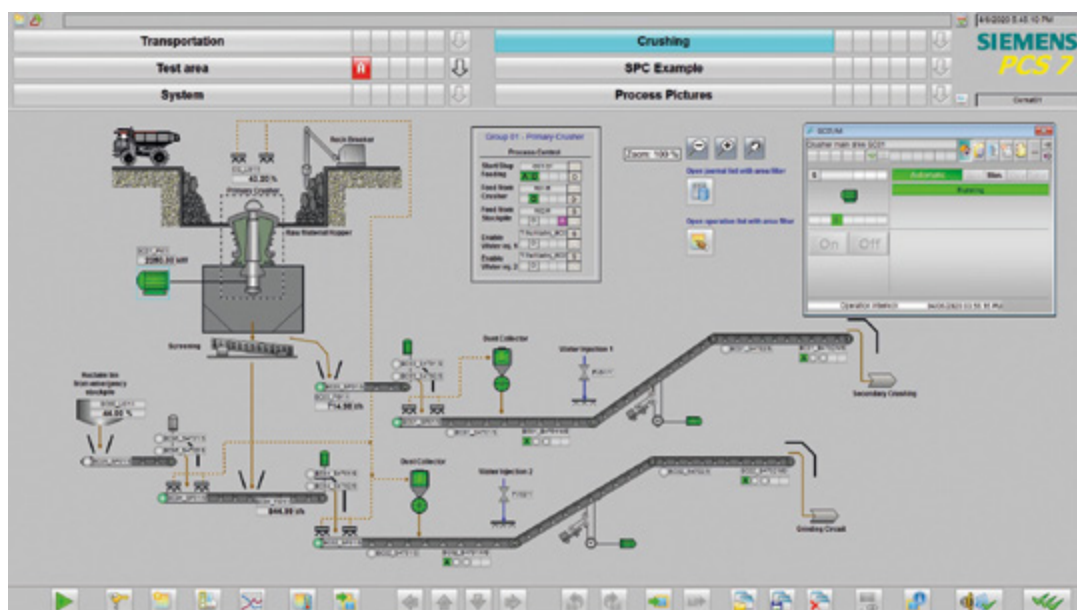
Siemens offers a tool to modernize a plant's outdated process control system and create a digital twin in the process with the engineering platform COMOS. The software solution for the integrated management of plant projects covers engineering and operations all the way to modernization and even dismantling.

All necessary information about a plant's automation system – such as signal lists, functional descriptions, and interlocks – is collected from the

existing system and used to populate the tool. COMOS features a comprehensive product database as well as a customer-specific database with individual templates and standards. This allows the digital twin of the plant to be automatically generated in COMOS. From there, SIMATIC PCS 7 or CEMAT code (for mining or cement plants, respectively) is generated to create an automation project according to the customer's standards and without human error. Every project is customer specific yet always has the same structure, which is a big step toward standardization.

With the digital twin in place, a range of options becomes available for plant engineers. For example, they can carry out simulation projects using SIMIT simulation software. This is a big advantage during commissioning, because it is possible to perform most of the testing in simulation mode and thereby significantly reduce commissioning time. Once the plant is in operation, SIMIT can be further used for operator training and for testing new ideas.

Thanks to COMOS, any subsequent changes in a plant are automatically reflected in the digital twin, since all communication is bidirectional. A plant's database and documentation are always fully synchronized and up to date. Incomplete documentation becomes a thing of the past.



With SIMATIC eaSie, communication between staff in the control station and service engineers is significantly improved.



Artificial Intelligence sheds new light on advanced process control for the kiln.

Introducing Siemens Digital Assistant

There are fewer maintenance people and operators in the control room today, which poses a challenge for cement plants and mining sites. When resources are not available, technology has to step in. Siemens has therefore created SIMATIC eaSie, the Siemens Digital Assistant. SIMATIC eaSie is an on-site support tool in the form of an app that runs on a smartphone or tablet and is integrated into the existing SIMATIC PCS7 or CEMAT project. It informs plant staff about important events and alarms, provides real-time data and status information on demand, and supports simple procedural workflows.

The intuitive user interface is designed like the popular messenger apps for mobile devices. Users can easily access data from the system, such as temperatures and preheater cyclone pressure, motor status, and detailed diagnostics on plant equipment. Interacting with SIMATIC eaSie is as easy as using natural language (chat or speech), or simply scanning QR codes.

SIMATIC eaSie is currently being piloted at sites in Germany and the United States. Service and maintenance people can now walk around their plants and get the information on the on-site assets without having to contact the control room. And when the control room needs to be involved, it is possible to open a faceplate on the operator station so that the operator and the maintenance engineer can be assured that they are referring to the same asset. SIMATIC eaSie contributes to more efficient communications among plant staff and supports a unified workflow for notification services, querying basic data, and guided operational sequences.

SIMATIC eaSie is the Siemens Digital Assistant that runs on a smartphone or tablet.



Profinet down to the field level is the right choice for digitalizing process control.

Paving the way for artificial intelligence

Data analytics is opening the door to artificial intelligence (AI), a new technology that is finding its way into industry. AI creates opportunities to solve issues that couldn't be solved in the past. By collecting and archiving relevant data, it becomes possible to recognize patterns and detect anomalies that previously remained invisible. With this information, plant operators can take corrective action before an actual problem occurs. Initial AI projects reveal how cement producers and mining operations can define new and improved optimization strategies and fresh approaches to maintenance concepts, such as predictive and prescriptive maintenance.

Artificial Intelligence changes the view of advanced process control (APC). Traditional APC

solutions look at actual measurements and try to find the optimal setpoints by making adjustments in very small increments. This works well for certain, well-defined processes, but a kiln is a different animal. Unknown variables, such as alternative fuel types, cause traditional model predictive controllers (MPC) to drift over time. The result is that most APC systems are out of service or require intensive finetuning. This is where AI makes a big difference, because it can also consider the history of the variables and recognize patterns in these trends. In mining operations, a similar development can be observed with a machine-learning solution for anomaly detection called SmartMining.

What advantage does this bring? Drawing on historical data, the AI module compares the actual trends with the trends from the past and predicts what will happen in the future if the equipment continues to run with the same setpoints. What seems to be operating flawlessly today can easily become faulty in the future and result in unwanted alarms or even shutdowns. AI can warn the operator in time and give indications of what can happen if no corrective actions are taken. When the AI module is well trained, it can even suggest corrective scenarios based on past experiences. The more data that is available, the better the suggested scenarios will be. For example, if the plant operator decides to use new types of alternative fuels, the AI module will learn about this automatically. Initial tests have shown that AI can significantly reduce – if not completely eliminate – equipment outages. AI solutions like these are still being developed and tested in collaboration with a customer. A market introduction is planned for the coming months. Before long, every plant will be able to profit from AI solutions. The financial impact will be big.

The scenarios described above are just some of the applications, ideas and concepts that fall under the digitalization umbrella. There are many more possibilities already available today, and there will be even more in the future. The journey continues – and it will probably never be over.

AI creates opportunities to solve issues that couldn't be solved in the past.

www.siemens.com/cement

Author: Mark Yseboodt

mark.yseboodt@siemens.com

NOW ON VIDEO

Up-to-the-minute information on topics and trends

In a new video series, Siemens Minerals' experts talk about current industry developments.

Initially, eight videos of about a minute in length are being published on trends and topics in the minerals industry. Each video features a Siemens Minerals' expert who covers the highlights on current developments in his or her area.

In a video on cement plant modernization, for example, Automation Sales Manager Mark Yseboodt goes over advantages of modernizing an existing DCS to the latest version of CEMAT. Among the benefits are better protection against cybercrime. In another video, Christian Dirscherl, Vice President for Mining, Excavation, and Transportation, talks about a digital solution from Siemens for stockyards. Customers can expect reduced operational costs, improved quality and process efficiency, and increased machine safety.

Other videos cover solutions for mine winders, or aspects to consider for developing a modern mine.

The videos are available at www.siemens.com/mining and www.siemens.com/cement, as well as on Siemens Minerals' social media channels and in the Minerals app.



Sales Manager Mark Yseboodt on the advantages of modernizing to the latest version of Cemat.



Minerals App

Please click on the app store button to download the Minerals app, where the videos and much more are waiting for you!



DRIVING THE CEMENT INDUSTRY FORWARD

Go digital. Gain momentum.

Cement will always be cement. But the role of digitalization in its production will increase – raising productivity to a new level. Leveraging industry specific solutions for advanced process control, process simulation, asset management, and lifecycle engineering, Siemens helps you integrate both engineering and operations. Generating a new competitive edge in your industry.

siemens.com/cement

SIEMENS

Published by:
Siemens AG

91052 Erlangen, Germany
siemens.com/mining
siemens.com/cement

For the U.S. published by:
Siemens Industry Inc.
Large Drives Applications
100 Technology Drive
Alpharetta, GA 30005
USA

Responsible for contents:
Roland Ehrl
Thomas Walther

Concept, coordination: Anna Stahlberger

Editorial committee:
Thomas Walther
Karen Chong

Concept, editing, design:
Agentur Feedback, Matthias Weiner,
Munich, Germany
www.agentur-feedback.de
Editorial staff: Alexander Chavez
Art direction: Monika Gollasch

Photographs: Getty Images p. 2 · Getty Images/
iStockphoto pp. 8-9 · Getty Images/Hoxton p. 11 ·
K+S Aktiengesellschaft pp. 16-17 · TAKRAF
GmbH pp. 28-29 · Getty Images p. 32

All other photos: Siemens AG

© 2021 by Siemens Aktiengesellschaft Munich
and Berlin.

All rights reserved.

Article number: VRMN-M10005-00-7600

The following products are registered
trademarks of Siemens AG:
CEMAT, COMOS, Real-Time Ore Measurement
(ROM), SIMATIC eaSie, SIMATIC PCS7, SIMINE
Asset Health Analytics, SIMINE Material and
Quality Management (MAQ), SIMIT, SINEMA
Remote Connect, SmartMining, Anomaly
Detection.

If there is no special mention of trademarks,
trade names, technical solutions, or similar
items, this does not mean that these items are
not protected.

The information in this magazine contains only
general descriptions and performance features
which do not always apply in the described
form in the actual application or which may
be subject to change in the course of further
development of the product. The specific
performance features are only binding if they
were agreed expressly in the contract.

