

SOLID

#2 2021

GROUND

A MAGAZINE FROM
SANDVIK MINING AND ROCK SOLUTIONS

Sandvik TH550B:
Next-gen
BEV truck

Mexico:
Rigged
for safety

Remote Monitoring Service:
From data
to action

Canada: Agnico Eagle

Automation pioneers

SANDVIK

Dear reader,

OUR FOCUS AT Sandvik Mining and Rock Solutions is on leading the way, always with safety as our No. 1 priority, in automation, digitalization and electrification. Our aim is to exceed our customers' expectations in terms of more productive and sustainable solutions. The recent acquisition of DSI Underground will help us further drive safety and productivity in underground mining and tunneling through ground support and reinforcement products, systems and solutions. Here, too, there will be a strong focus on digital development – for example, live monitoring of ground movements and convergence underground.

WE'RE PROUD TO be delivering the types of technology that one customer recently told us they've been dreaming about for the last 10 to 20 years (page 13). However, we don't sit back: we're always looking for ways to improve and expand our offering – such as the introduction of the latest equipment model featuring our third-generation battery-electric vehicle (BEV) technology, Sandvik TH550B truck, launched at MINExpo INTERNATIONAL 2021. The use of BEV technology means zero exhaust emissions and substantially lower heat generation, bringing mine ventilation advantages. Sandvik DD422iE mining and tunneling jumbo, Sandvik DL422iE longhole drill and Sandvik DS412iE rock bolter provide a strong battery-powered package for most underground drilling applications and most mining methods.

SANDVIK IS IN a unique position when it comes to aftermarket support: no one knows our equipment better than we do, and we have the whole ecosystem of services to support our customers' operations and keep equipment running efficiently throughout its entire life cycle.

We are committed to driving innovation in mining and helping our customers become more productive and more sustainable.



HENRIK AGER
PRESIDENT SANDVIK MINING
AND ROCK SOLUTIONS



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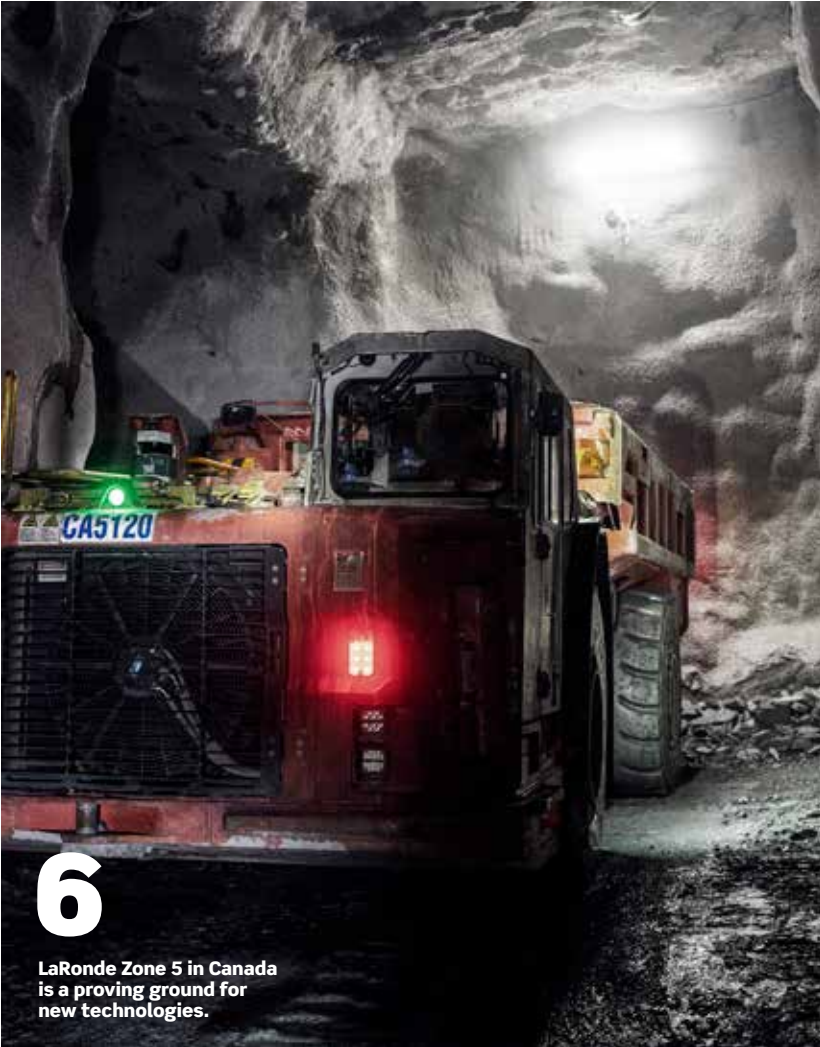
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THE SANDVIK SERVICE ECOSYSTEM

▶ Nobody knows their own equipment better than the OEMs that design and build it. Only they have the benefit of having been involved in the R&D process and knowing their equipment inside out. Sandvik is already there when its products are commissioned and continues to support its customers with inventory management, cost-efficient maintenance strategies, digital expertise and data insights. Overall, Sandvik Mining and Rock Solutions takes a holistic approach that includes a continuous feedback loop where findings from servicing and insights through data are used to make further improvements to

design and operational performance.

“We are in a unique position where we can not only provide equipment and parts, but also a whole ecosystem of services to support operations and to keep equipment running efficiently throughout its entire life cycle,” says Erik Lundén, president for parts and service, Sandvik Mining and Rock Solutions.

While local maintenance providers can offer highly qualified technicians on site, this is often the limit of their support. Sandvik, on the other hand, takes full commitment as the OEM throughout the entire life cycle of the equipment to give the customer peace of mind.

New tech center opens in Zimbabwe

▶ To support staff and customers in southern Africa in the shift to digitalization, Sandvik has launched a new technology center in Harare, Zimbabwe. Developed to improve customer productivity through tools such as My Sandvik, OptiMine and AutoMine, the facility is staffed by a team of engineers, analysts and technicians who will implement, train and monitor the use of these tools.

“There is a lot of information, data and dashboards available, and the critical mission for us is to turn this into mined tons,” says Ian Bagshaw, territory manager, Sandvik. “We believe this will be achieved when the use of these tools becomes second nature for staff at the mines.”

Hosea Molife, technology center manager, outlines the key focus for the next 12 months. “Firstly, we are installing hardware on the designated equipment as part of a OptiMine Monitoring and Location Tracking installation covering 76 Sandvik and non-Sandvik units,” he says. “Secondly, we have a My Sandvik project covering 100 units, where our challenge is to remove all manual data collection systems and have reliable, accurate and timely information for the right people at the right time. And finally, in our AutoMine project, we have received a Sandvik TH545i, which is the first automation-ready unit in the country and will form the starting point of an automated trucking loop at a customer’s site.”



In Sandvik's new tech center in Zimbabwe, a team of engineers, analysts and technicians monitor the use of tools such as My Sandvik, OptiMine and AutoMine.

**Erik Lundén.**

“Where we differ is that we have a lot more behind the organization,” Lundén says. “From the very start we have a machine design and life-cycle model that is suited to service, going all the way around to having supply chains that are dedicated to our products and can be integrated into maintenance management systems. On top of that, we can leverage a huge pool of data and have services like remote monitoring feeding into that ecosystem too, which is being used for preventive maintenance.”



Paving the way for underground collision avoidance systems.

New system to improve underground safety

▶ Newtrax, the IoT provider for underground mines, says its collision avoidance system (CAS) is the first and most advanced of its kind designed specifically for underground mining.

The CAS was inspired by the Earth Moving Equipment Safety Round Table and the International Council on Mining and Metals' Vehicle Intervention Roadmap. Newtrax's aim is to drive it toward level nine of the roadmap, which will virtually eliminate vehicle-to-personnel fatalities.

The CAS uses peer-to-peer communication technology and does not rely on continuous communication or positioning infrastructure. To ensure it does not disrupt mining productivity, it can be deployed in three stages. Initially, it can operate in passive monitoring mode, in which the IoT

hub analyzes interactions and where they take place so that mine management can change traffic patterns or train specific operators to reduce the risk of collisions. During the second stage, a notification system warns operators and pedestrians when they come too close to the equipment. The intervention control is only activated automatically during the third stage of deployment - for example, when an operator fails to act on an alarm.

“Not only is our CAS highly precise, it can also be integrated with any branded model of vehicle,” says Patrice Corneau, Newtrax product manager. “From data collection to controlling vehicles, it can be installed on any on-the-ground machines, large or small, including mixed fleets and autonomous equipment.”

Hose repairs reduced by two-thirds with unique kit

▶ To reduce downtime caused by hose failure in underground development drills, Sandvik is launching its hose swap kit. Typically such failures, which increase in frequency over a machine's lifetime, require a complete shutdown while each hose is removed and replaced. However, by preassembling and packaging the hoses in a smart design, installation can be made faster, safer and easier.

“The kit is essentially ready to plug and play in the field,” says Guillermo Blumenkron, global parts category specialist at Sandvik Mining and Rock Solutions. “It includes all the hoses, clamps and plugs packaged in layers in the precise order they should be installed. The customer just needs to follow the clear instructions and the logic of the layers.”

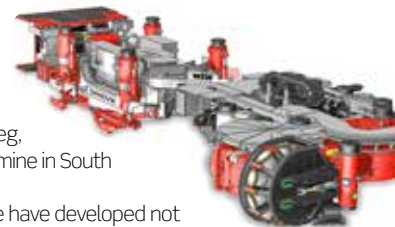
During pilot tests prior to its launch, the hose swap kit was able to reduce hose replacements from 18 hours down to just six. It also resulted in up to 75 percent fewer interventions caused by hose failure. By scheduling hose replacements during regular servicing, operators can avoid unplanned breakdowns or failures.

First order secured for innovative hard rock reef miner

▶ With its new and innovative Sandvik MN330 narrow reef production system, Sandvik Mining and Rock Solutions has succeeded in developing a method for continuous hard rock mining. Anglo American has placed the first order, which is currently being assembled in Zeltweg, Austria, and is due to be shipped to the Mototolo platinum mine in South Africa before the end of 2021.

“This is the result of a long-term collaboration, where we have developed not only a new system but a whole new method of mining,” says Arne Nicolaas Lewis, vice president, hard rock continuous mining, Sandvik Mining and Rock Solutions. “Even the mine's layout has been designed specifically for this system.”

The solution consists of the innovative hard rock cutter Sandvik MN330 and a Hencor system that extracts the cut material from the mine and sends it through a series of filters and separators. Since it can be operated remotely, it greatly reduces the need for personnel to be inside the mine and drastically reduces employee risk exposure. Compared with the traditional drill-and-blast method used by Anglo American, CO₂ emissions are reduced by half.



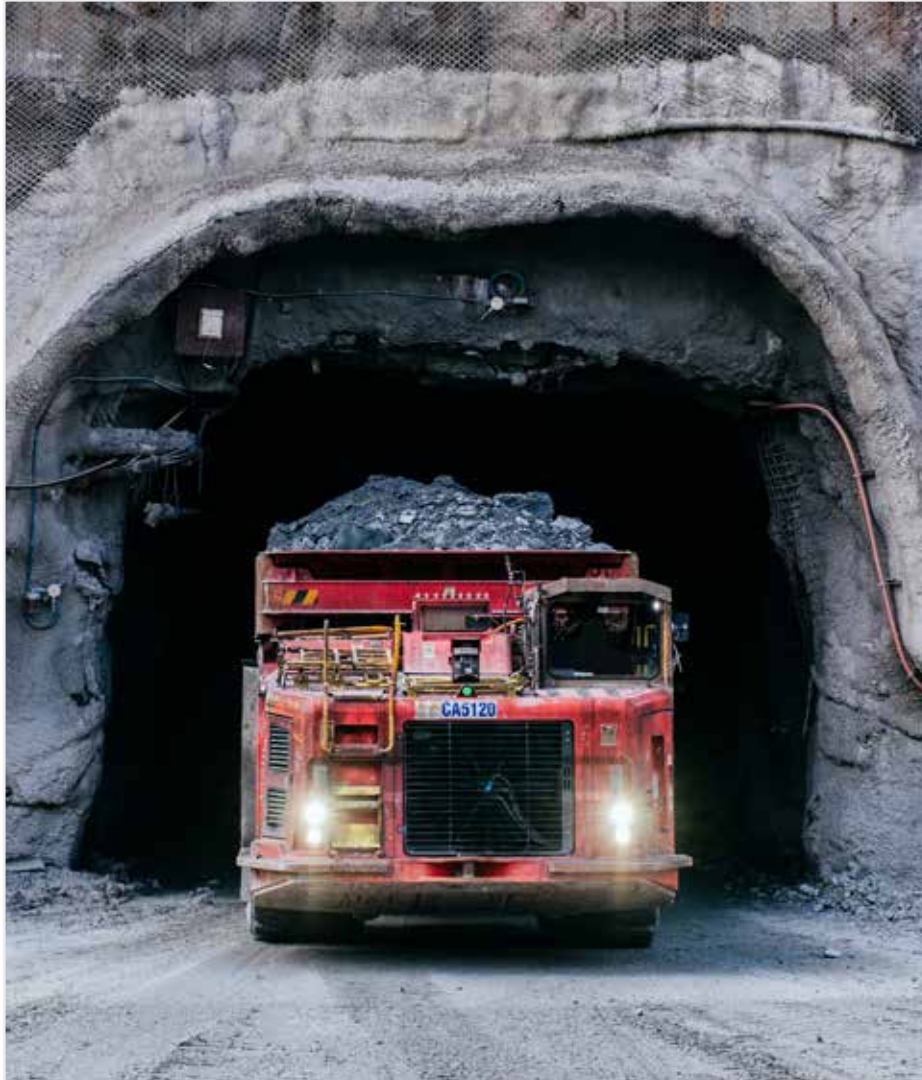
TECHNOLOGY TRENDSETTER

ABITIBI-TEMISCAMINGUE, QUEBEC. While the LaRonde Mining Complex is often regarded as the mine that created Agnico Eagle, LaRonde Zone 5 is the project that is turning heads today as the site of two firsts for North American mining automation. ▶

TEXT: KATE PARKINSON PHOTO: CHRISTIAN LEDUC



Agnico Eagle's LaRonde Zone 5 has become a proving ground for innovative, automated technologies.



Since 2018 LaRonde Zone 5 has been testing Sandvik's AutoMine system. Three years later, the mine's production has increased by 10 percent.

other mines around the world.

A 4G LTE cellular signal is present throughout the underground mine, a first in the Canadian mining industry, which streamlines the mine's communications abilities. Fifty one-ton driverless trucks loaded with rock emerge from the portal like clockwork every 30 minutes while there appear to be no workers on site.

ONE TECHNOLOGY THAT the mine has been focused on testing since 2018 is Sandvik's AutoMine platform. In three short years LaRonde Zone 5 has evolved its AutoMine system from a single loader working in an isolated stope to three Sandvik LH517i loaders and four Sandvik TH551i trucks, working extra autonomous shifts throughout the week to increase the mine's production by 10 percent. During 2021, Girard explains, the fleet will grow again to four Sandvik LH517i loaders and six Sandvik TH551i trucks.

"Within a month the operators at LaRonde Zone 5 were able to become familiar with the Sandvik system," says Devin Wilson, the superintendent of technical services. "It's not a very complicated system. Once you know what's going on it's really very easy to use."

Although learning the system may have been quick, LaRonde Zone 5's application of AutoMine is unique and brought challenges. Sandvik's AutoMine system at LaRonde Zone 5 was the first deployment in North America to autonomously haul ore from the

THREE HUNDRED MILES north of Montreal, the town of Val d'Or in the Abitibi region of northwestern Quebec is rich with mining history. Dubbed "Valley of Gold" in a gold rush in the early 1900s, Val d'Or has persevered through the many booms and busts that have occurred since and has been home to many major miners. Perhaps most famous among them is Agnico Eagle, which established its flagship underground gold mine, the LaRonde Mining Complex, in the area in 1988, initiating the start-up of a now widely recognized global gold miner.

Mining operations superintendent Luc Girard describes LaRonde Zone 5 as a small mining area within the larger LaRonde Mining Complex.

"The people who work at LaRonde Zone 5 have a strong interest in new technologies," Girard says. Agnico Eagle uses the site as a testing ground for new technologies, later to be implemented at the company's



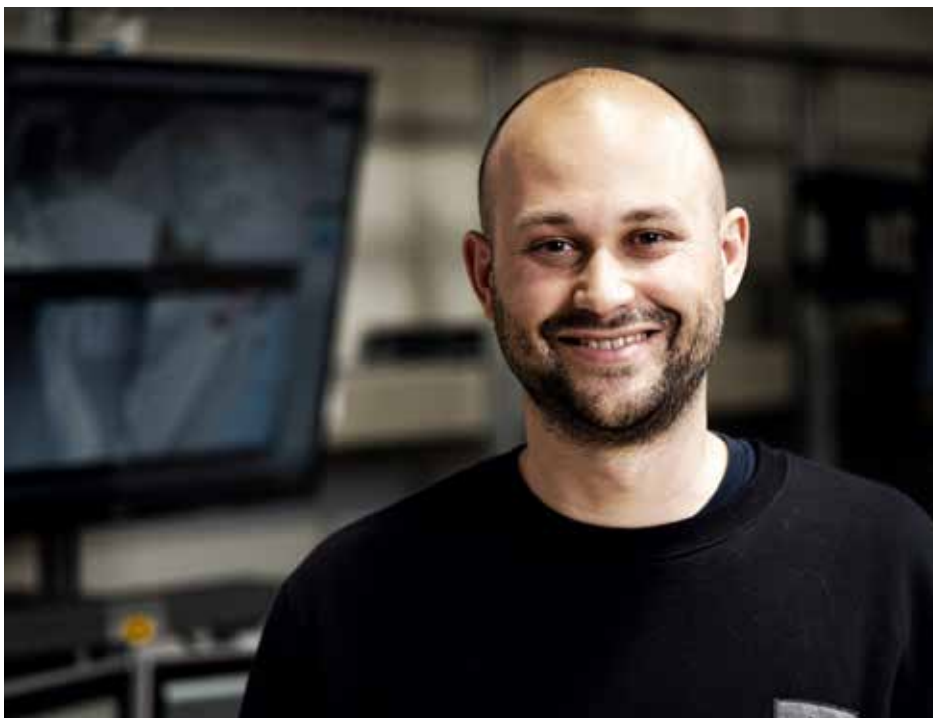
Luc Girard is the mining operations superintendent at LaRonde Zone 5.

AGNICO EAGLE

Agnico Eagle is a senior Canadian gold mining company that has produced precious metals since 1957. Its operating mines are located in Canada, Finland and Mexico, with exploration and development activities in each of these countries as well as in the United States, Sweden and Colombia.



With Sandvik's AutoMine system, loader operator Jessy Meideros no longer needs to sit in the cabin to operate the equipment.



“Once you know what’s going on it’s really very easy to use,” says Devin Wilson, superintendent of technical services, about Sandvik’s AutoMine system.

” Within a month the operators were familiar with the Sandvik system

production level up a haulage ramp to the stockpile, and it includes automated traffic control along the way.


Automation is typically considered for applications where routes are repetitive, such as the transfer level, but in an open stoping application the situation is quite different. At LaRonde Zone 5 there is no dedicated automation zone. On any given day the automation zone could be different.

“It’s really a dynamic process for us,” Wilson says. “In the past, AutoMine and automation has really been used to move muck from point A to point B. What we’ve done at LaRonde Zone 5 is try to make more of a dynamic process where on one day we might be in one spot and the next day in another spot.”

Mine automation specialist Marc St Pierre

checks the production plan daily and programs new routes that the trucks and loaders will drive. “The trucks go anywhere we ask them to go,” he says. “They will be going up to the surface in one assignment and then they are going to be assigned to another task at a different level.”

Wilson explains the mine’s LTE network has been critical in facilitating the constantly changing routes of the AutoMine fleet. “No matter what, we have communication with LTE and this is what has allowed us to have automation throughout our whole mine,” he says.

IN ADDITION TO utilizing the AutoMine system in this dynamic environment, LaRonde Zone 5 had a vision of automating a full mucking and hauling cycle, from the stope all 





LaRonde Zone 5 has no dedicated automation zone. On any given day the automation zone could be different.



Mine automation specialist Marc St Pierre checks the production plan daily to program new routes.



Automating the mucking and hauling cycle has provided LaRonde Zone 5 with 48 extra production hours per week.

Our figures show that we have increased our daily tonnage capacity by 10 percent

the way to the stockpile on surface, which meant autonomous trucking on the haulage ramp, a second North American-first in the same mine.

Equipment is operated manually during the mine's day and night shifts, but during shift changes and over weekends the entire mucking and hauling cycle is completed from a surface operations room. A Sandvik LH517i will start in a drawpoint where the AutoMine operator will engage tele-remotely to take a bucket from the stope. Then the loader will tram autonomously to a loading bay, automatically raising its bucket as it approaches a

Sandvik TH551i and an operator tele-remotely dumps it in the truck. Once the truck is loaded an AutoMine operator will send it to surface by route of the haulage ramp.

Automated traffic management permits multiple AutoMine-connected vehicles to use the haulage ramp at the same time, to prioritize loaded trucks over empty ones, and to manage the movement of the trucks safely.

Wilson explains that there are wait points along the haulage ramp for an empty truck to pull off the ramp to allow a full truck to pass.

"Sandvik has done a good job of putting in place good traffic logic," he says. "Everything

just happens by itself and it is a fluid movement of the vehicles. All we really have to do is send equipment from point A to point B and the traffic logic works everything else out."

Automating the mucking and hauling cycle has provided LaRonde Zone 5 with 48 extra production hours per week as the mine can now work autonomously through two night shifts on the weekends, and two shift changes per day.

"The key with automation at LaRonde Zone 5 is that we have been able to take advantage of those downtimes that we previously couldn't bring muck out of our mine with and now we can use them," Wilson says.

TYPICALLY, HE SAYS, the AutoMine operators can make four trips of a Sandvik TH551i truck over a shift change and 40 trips during a weekend night shift, amounting to an average of 136 extra trips per week.

"With the use of AutoMine, our figures show that we have increased our daily tonnage capacity by 10 percent," Girard says.

In 2020, tonnage mucked and hauled

Using automated technology has helped LaRonde Zone 5 increase its daily tonnage from 2,000 metric tons to 3,000 metric tons.



autonomously in otherwise unproductive time was 12 percent and the targets for 2021 are even greater.

“Our objective for 2021 is 17 percent but when the stars align and we have stopes in the right spot and the system is running well, we can move as much as 20 or 25 percent of our muck with automation,” Wilson says. “Some of the productivity gains have really surpassed what we originally expected. Without automation we could not have increased our tonnage from 2,000 metric tons per day a couple years ago to 3,000 metric tons per day today.”

THE BENEFITS THE mine has seen extend beyond increased daily tonnage. “By using AutoMine to muck development ramps or to transport the ore out of the site, you remove miners from these potentially more hazardous areas,” he says.

According to Wilson, one challenge the mine experienced was cultural. He said the best way to help employees overcome that challenge was by demonstrating how AutoMine could improve their health and

safety performances.

“Once they have seen how effective the system can be, they are quickly converted to supporters,” Wilson says. “Some of the operators have said to us that it’s going to extend their careers into the future, being able to operate from surface. There’s no way we would have been able to get where we are today if we didn’t believe in it, if we didn’t have the support from the management all the way to the muckers underground.”

Girard and Wilson agree that the collaboration between LaRonde Zone 5 and Sandvik has been crucial to the mine’s success.

“When we do business with a supplier of equipment or services, the first thing we look for is cooperation from that supplier, and then it’s service, service, service,” Girard says.

“Sandvik was always with us to accompany us and find a solution to one of our problems and it is for that reason that we are where we are today with automation,” Wilson agrees.

THE MINE PLANS to continue pushing the boundaries of what AutoMine is capable of, introducing new technologies into the mine

and blazing the trail for more mines to follow.

“Based on the situation and our needs, Sandvik is a great choice for automation,” Wilson says. “We have been dreaming about this technology for the last 10, 15 or 20 years but for the first time I think we can say it’s here, it’s ready, it’s mature.” ■

LARONDE ZONE 5

LaRonde Zone 5 lies adjacent to and west of Agnico Eagle’s famed LaRonde mine. LaRonde Zone 5 achieved commercial production as an underground operation in June 2018, with ore processed at the LaRonde mine’s processing facilities. It has proven and probable mineral reserves of 788,000 ounces of gold (11.8 million metric tons grading 2.08 grams per ton gold) as of December 31, 2020, and is expected to maintain a production rate of approximately 3,000 metric tons per day through 2029.

SANDVIK TH550B



Next level electric

The new Sandvik TH550B battery-electric truck provides an ideal match for the Sandvik LH518B battery-electric loader. Step by step, Sandvik Load and Haul Business Unit BHEV's innovations merge with proven Sandvik solutions for full maturity on the global market. ▶

TEXT: TURKKA KULMALA PHOTO: SANDVIK



24m

TECH SPECS

SANDVIK TH550B

Load capacity: 50 metric tons

Heading size: 16.4 feet

Climbing capacity: 7.1 mph/ 1:7
ramp/fully loaded

Top speed: 24 mph

Continuous power output: 540 kW
(tractive)

LiFePO4 batteries: 354 kW



This is the next step for Sandvik in our leading BEV offering

SANDVIK'S LOAD AND Haul Business Unit BHEV (Battery and Hybrid Electric Vehicles) has launched the latest equipment model featuring its third-generation battery-electric vehicle (BEV) technology. Essentially, this means that the vehicles are designed and built to be battery-driven from the ground up, instead of retrofitting battery-electric components into a vehicle initially designed as a diesel loader or truck. This core philosophy is also evident for the new Sandvik TH550B truck.

Launched at MINExpo INTERNATIONAL 2021 in Las Vegas, Sandvik TH550B is rated for 50 metric tons of load capacity and features the same battery technology as its loader sibling. Its predecessor, the Z50 BEV truck, was introduced in 2019 and has already achieved notable success in North American mines.

The second-generation Z50 was already a highly competitive package in several ways. The power capability exceeded comparable diesel trucks. Using BEV technology means zero exhaust emissions and substantially lower heat generation, bringing along all the related mine ventilation advantages. The Z50 could also independently swap its battery packs, minimizing the infrastructure necessary for battery swaps.

"This was the first machine we launched with this battery-swapping feature," says Brian Huff, vice president of technology, BU BHEV. "It has definitely been a big value for customers. It really helps enable early deployments in large mines because you can run these trucks without a big investment in infrastructure, which reduces risk. Then, of course, swapping batteries is much faster

than charging batteries, so it's a real benefit from a productivity standpoint as well.

"You can swap batteries in less than 10 minutes," he says. "Charging a battery in 10 minutes creates lots of heat and requires really high-power infrastructure in the charging system, plus all the strain on the underground electrical system. It's pretty intense."

ACCORDING TO HUFF, the new Sandvik TH550B is essentially a reinvented, third-generation Z50. Featuring the same 50-ton capacity, the proven driveline, frame structure and battery swapping system remain essentially unchanged. But the vehicle control system is entirely new. It runs on Sandvik control hardware, creating commonality with other Sandvik vehicles, including



Sandvik TH550B has a battery-swapping feature. When the battery is depleted it can be swapped with a fully charged one in less than 10 minutes.



Sandvik TH550B is rated for 50 metric tons of load capacity.

maintenance tools, data collection setups and compatibility with the My Sandvik customer portal.

SANDVIK TH550B NOT only matches the familiar Sandvik livery, but it also has the same modern, ergonomic low-noise cabin as the Sandvik TH545i truck, improving safety and reducing operator fatigue.

Merging the strengths from both pre-acquisition Artisan and Sandvik technologies creates two levels of commonality in Sandvik TH550B trucks. One is the battery-electric power system, including AutoSwap, a patented self-swapping system, and the other is AutoConnect, an automatic connection and disconnection function for the battery pack, which makes it possible for the operator to stay in the cab during a battery swap. The

functionalities are similar in all Sandvik vehicles with Artisan roots and in pre-acquisition Artisan vehicles. Any mine with an existing fleet of Sandvik LH518B loaders or Artisan trucks can easily integrate this new

truck into their operational practices.

Another level of commonality comes from the advancing integration of the parts infrastructure and support services with existing Sandvik designs and maintenance procedures. This, combined with new investments in Sandvik support services, also significantly increases the maturity of the machine for global markets.

“I’ve been privileged to lead the first Sandvik BEV truck project, combining the 50 years of expertise we have in Toro loaders and trucks with the third-generation BEV truck design by our innovative team in California,” says Sampo Peltola, project manager at Sandvik Mining and Rock Solutions. “We started by having a small engineering team from Finland on site in California to get to know the colleagues and familiarize themselves with the leading BEV products in the market. Then building on the strengths of our team and through cooperation, we have been able to continue the work remotely between the teams in Finland and California, despite the 10-hour time difference.

“We have actually been thinking of that as an opportunity, as we could say there has been engineering work done almost around the clock,” he says. “This is clearly the next step for Sandvik in our leading BEV offering, ultimately targeting and exceeding our customers’ expectations of more sustainable underground mining solutions.” ■

ADVANTAGES:

- **Excellent productivity:** high capacity and traction power
- **Smooth battery swaps:** fast and easy “refueling” without manual handling
- **Operational flexibility:** minimum mine infrastructure requirements as needs change
- **Zero local emissions:** substantial cost savings in mine ventilation and a boost to sustainability performance
- **Competitive total cost of ownership:** higher up-front cost vs. diesel equipment outweighed over time by significantly lower operational costs

SETTING UP FOR SAFETY

SONORA, MEXICO. At La Herradura, a large open-pit gold mine in northern Mexico, employing intelligent surface drill rigs has increased productivity while improving safety and sustainability. ▶

TEXT: ALICE DRIVER PHOTO: DE MILAGRO FILMS



Beyond covering large parts of northwestern Mexico, with its 100,400 square miles (260,000 sq km), the Sonoran Desert is also the hottest desert in the country.

What I love about Leopard is that every day I learn new things

IN THE MINERAL-RICH HILLS of the Sonoran Desert – Mexico’s hottest – Minera Penmont (Fresnillo Plc) operates one of the country’s largest open-pit gold mines. Situated about 12.4 miles (20 km) east of popular Gulf of California tourist destination Puerto Peñasco, La Herradura produces around 130,000 gold ounces per year – more than half of the Fresnillo Group’s total gold.

At the site, the hot sun is scorching the red sand, and small clouds of dust emit from Maritza López Riviera’s boots as she walks up to a Leopard DI650i drill rig. She began working at La Herradura in 2006 at the age of 19, driving trucks at the mine, later working her way up to become a surface drill rig operator.

The mining industry has traditionally been firmly male-dominated but diversity and inclusion are top priorities at the Fresnillo Group. López Riviera is one of several women who now operate the new Leopard DI650i at La Herradura.

The mine runs four Sandvik surface drills: two Leopard DI650i intelligent down-the-hole (DTH) drill rigs and two Leopard DI550 DTH drill rigs. López Riviera hoists herself into the air-conditioned cabin of Leopard DI650i.

“What I love about Leopard is that every day I learn new things,” she says. “I learn how to be more productive and how to take care of the machine. I’ve learned that there are issues I can fix myself.”

As dust storms spin up across the desert landscape, López Riviera confidently and precisely operates Leopard DI650i near the bottom of La Herradura – roughly 1,100 yards (1 km) from the top of the mine, which spans 1.7 miles (2.7 km) from north to south and 1.3 miles (2.2 km) east to west. Despite the mine’s challenging geology, López Riviera says that Leopard DI650i drill rig is easy to operate.

“There’s space for you, for your instructor, and the instructor can tell you step by step”

LA HERRADURA

La Herradura, one of Mexico’s largest open-pit gold mines, is owned by Minera Penmont (Fresnillo Plc). The mine, located in the state of Sonora some 50 miles northwest of the city of Caborca, produced more than 425,000 gold ounces in 2020 and has a treatment capacity of 364,500 metric tons per day. The mine has been operational since 1997 and employs around 1,600 workers and 1,800 contractors.



Two Leopard DI650i intelligent down-the-hole (DTH) drill rigs are put to work at the open-pit gold mine La Herradura. The site also employs two Leopard DI550 DTH drill rigs (above).



Drill rig operator Maritza López Riviera started working at La Herradura in 2006 at the age of 19.



“The challenge is essentially the stability of the site and guaranteeing the security of our employees and the stability of the mining operation,” says Carlos Fabián González Meza, the engineer in charge of the final mine designs.



For Carlos Alberto Torres Gámez, the mine drill and blast chief at La Herradura, safety is of utmost importance. Leopard DI650i has been instrumental in improving the overall safety at the open-pit mine.

what to do,” she says and is also quick to point out other benefits. For example, compared with a conventional DTH drill rig, Leopard DI650i can reduce fuel consumption by up to 15 percent, thanks to intelligent control technology. She also stresses the ease of working with TIM3D drill navigation with wireless data transfer.

LEOPARD DI650i DRILL rigs have proven a true asset to the operation at La Herradura. “One of our main goals at Fresnillo Plc is to safeguard the integrity of our employees and machines,” says Gustavo Adolfo Guzmán Loya, a geology specialist. “At first, we did our drilling at 90 degrees, and the material that remained generated a risk of landslides. But now, with Leopard DI650i, we can drill at the natural angle of the structure or modify the angle of the design to eliminate all those types of issues.”

The drill’s precision thus helps maintain the structure of the mine, increasing safety and productivity. “Thanks to Leopard DI650i, we can generate greater stability in the mine,” Guzmán Loya says. “We can modify the drilling at different angles that best suit the natural structure of the rock. We have been able to mitigate or eliminate landslides in areas where they were occurring.”

Previously, he says, the mine experienced the loss of tons of material, but thanks to

Leopard DI650i, the problem has been eliminated.

CARLOS FABIÁN GONZÁLEZ MEZA, the engineer in charge of the final mine designs, stands at the top of the pit and observes the equipment below. “The challenge is essentially the stability of the site and guaranteeing the security of our employees and the stability of the mining operation,” he says.

Among the major benefits of Leopard DTH rigs is their ability to help keep production safe. At La Herradura, this is especially true for the wall bench stability and control, which are the main task for Leopards in increasing safety based on the pit geology. There are four types of rock at the mine – two igneous, plus shale and sediment – which complicates drilling.

In the distance, the engineers drive slowly down into the mine, following behind a dump truck full of rock. “Given the constant changes in the geology of the mine, Leopard DI650i helps us with the required versatility of drilling,” González Meza says. “There is an unstable area, and with Leopard DI650i you can control the machine remotely. That is a very useful feature.”

When the engineers arrive, López Riviera greets them and climbs into the cabin to start drilling. González Meza, watching, brings up the importance of inclusion and supporting

women in mining. “In this group, we have Maritza, and we are also training more women,” he says.

INCREASED PRODUCTION MAXIMIZES the return on investment of Leopard DI650i. According to operator López Riviera, the automatic and remote drilling features make Leopard DI650i much faster and safer than other machines. “It is more productive than the previous machines,” she says. “We can drill more holes in a day.”

Carlos Alberto Torres Gámez, mine drill and blast chief, agrees with López Riviera that mine safety is a primary goal and is directly tied to productivity. “Leopard DI650i

FRESNILLO PLC

Fresnillo Plc, the owner of La Herradura gold mine, is the world’s leading silver producer and Mexico’s largest gold producer. Established in 2008, the FTSE precious metals group component operates seven mines and is committed to safety and a sustainable future. Given Mexico’s significant geological resources, Fresnillo Plc foresees a strong potential for continued growth.



A major benefit of Leopard DI650i, according to drill rig operator Maritza López Riviera, is that it can reduce fuel consumption by up to 15 percent thanks to intelligent control technology.

LEOPARD DI650i

With Leopard DI650i, Sandvik Mining and Rock Solutions has delivered a high-pressure DTH drill rig designed for larger hole sizes. Leopard DI650i operators report that it is easy to run and has improved safety via the range of intelligent control technology. The drill offers innovative new components, excellent fuel efficiency, improved safety and higher productivity in challenging rock conditions such as those at La Herradura gold mine. In terms of intelligent technology, the latest onboard options include TIM3D drill navigation with wireless data transfer, My Sandvik fleet monitoring system and full-cycle drilling automatics.

is cutting-edge and can drill at angles,” he says. “Before using this machine, we drilled the three slopes vertically. It is tremendously important to be able to drill at an angle. The technology Sandvik offered with this tool met our needs.”

Having instructed everyone to prepare to clear the site because of a scheduled blast, Torres Gámez continues, stressing the importance of Sandvik’s technology, training and support. “Because of the incline of the drilling, the best option for us is Sandvik,” he says. “They have the latest technology and provide technical support and personnel who are specialists in these machines. They even

provide remote support from Finland. This is an added value which makes Sandvik the best option for drilling.”

FRESNILLO PLC DERIVES significant peace of mind from Sandvik’s comprehensive maintenance contract. “Because we place such importance on the stability of the mine,” engineer González Meza says, “we decided to contract the maintenance experts, in this case, Sandvik employees. We do this to prevent accidents and ensure operative continuity.”

Sandvik’s on-site specialists provide the technical support necessary to ensure that Fresnillo Plc can run its operations continu-

ously in a productive, safer and more sustainable manner.

At the end of the day, improving safety at La Herradura is the best way to ensure increased productivity at the mine going forward.

“We would like to reach 100 percent stability at the mine to stop dispersion and to have a 4 percent margin of error,” geology specialist Guzmán Loya says. “I think the innovation Sandvik offers will help us reach our objectives. They are a pioneering company that is betting on technology and innovation, on automation that will increase the maneuverability of operations.” ■

REMOTE MONITORING SERVICE



Mining equipment serves as a crucial source of information. With Remote Monitoring Service this information can be harnessed and put to use.

Converting data into action

Remote Monitoring Service is a new set of advanced digital services. The system can translate vast amounts of data acquired from underground mining equipment into actionable recommendations, thus reducing operating costs and boosting productivity and sustainability.

TEXT: **TURKKA KULMALA** PHOTO: **SANDVIK**

AVAILABILITY, PRODUCTIVITY AND safety are key factors in any mining operation's profitability. They are broad concepts made up of innumerable small details, such as whether equipment is available whenever needed or if there is unplanned downtime. Did the spare part last as long as planned, and can the operators work safely and meet the productivity target and schedules?

The constant flow of urgent tasks to complete and problems to tackle makes it difficult to gain sufficient "breathing space" to continuously improve operations, even if everyone recognizes how vital this is in the long term. Operator A consistently achieves better productivity than operator B, but there are no apparent reasons to account for this. A specific loader suffers from unplanned downtime due to problems in the hydraulic system. How do you find the root cause of the issue while you're under the relentless




Remote Monitoring Service converts information masses into concrete action points, making it easier to continuously improve operations.

pressure of daily production tasks?

Mining equipment serves as a crucial source of information, as these units have effectively become powerful telemetry and data acquisition platforms. But large amounts of raw data have little value without proper

analysis. Using hundreds of data points for troubleshooting a specific problem, such as a transmission breakdown, can be a daunting task – like looking for a needle in a haystack.

Sandvik now responds to these challenges with its Remote Monitoring Service. In a nutshell, it means using the telemetry data acquired from the mine equipment fleet and merging it with Sandvik's digital and OEM technical expertise, vast global pool of reference data and in-depth analytical skills to produce actionable recommendations for continuous improvement of mining operations. Another way to put it is that Remote Monitoring Service utilizes a data-driven study of abnormal behavior, in terms of both vehicle usage and health, to generate tangible remedial actions based on data.

In practical terms, this means that Sandvik data scientists continuously monitor and analyze the data points acquired from 

Sandvik's team of engineers trace and analyze the data acquired from the customers' underground production equipment around the clock.

customers' production equipment. They identify root causes for abnormalities and develop predictive solutions to increase the mean time between failures in a customer's fleet. The significant advantage is the intrinsic knowledge and experience that only the OEM can have of its equipment. Sandvik knows its equipment and their features through and through and is consequently uniquely positioned to maximize their productivity.

"Many customers have asked us to provide support in the process of translating their data into actionable items," says Ricus Terblanche, business line manager with Sandvik Mining and Rock Solutions. "This customer request was the main motivational factor to establish a remote monitoring service. Remote Monitoring Service does not require heavy investments in terms of IT infrastructure or associated resources from a customer perspective. This service provides the customer with a high return on the initial investment along with short lead times and low risks."

REMOTE MONITORING SERVICE is primarily designed for underground mining, suitable for both large and small operations and all types of underground production equipment.

One practical example of the possibilities that Remote Monitoring Service offers is to avoid improper gear selection, which can easily damage power train components. Remote Monitoring Service can identify incorrect gear selection when driving uphill and downhill, utilizing algorithms tailored to the conditions at the customer's mine.

Another scenario where Remote Monitoring Service can help is identifying premature engine failure by using a neural network to observe operational signals from the engine. The possible defect can then be determined before it escalates to power loss and engine breakdown.

All this adds up to an attractive value proposition for mine owners and mining contractors. Sandvik can say, for example, "We will increase the mean time between failures by X%." The actual delivery of the target is followed up by continuous monitoring, active



support and recommended actions from Sandvik reliability and maintenance experts. Remote Monitoring Service can ultimately slash the cost per hour of production equipment, increase its total usable lifetime and implement significant operational improvements, such as improved operator safety.

There is also the bigger picture of stakeholder expectations: the emerging social investors and other stakeholders not only pay attention to the profitability of a mining operation, but they also expect results and

transparency in matters such as decarbonization, value creation and sustainability beyond compliance.

Miners are expected to have meaningful sustainability goals and show results in achieving them.

CLEAR-CUT FIGURES SPEAK plain language, and Remote Monitoring Service will probably bring about statements such as: "Remote Monitoring Service helped us to train our operators and reduce our fuel



Remote Monitoring Service

Continuous remote monitoring: Sandvik traces the data acquired from underground production equipment 24/7, so there is no need for massive investments in resources and infrastructure.

Predictive and preventive maintenance recommendations: harness the expertise of Sandvik data scientists and engineers to prevent premature failures and unplanned downtime.

Visibility of equipment operations: identify operator-specific challenges for individualized feedback and training plans.

Fact-based insight reporting on measured data: pre-failure component behavior gives clues to maintenance and training needs to prevent recurring problems.

Tracking fleet performance: continuous feedback loop with Sandvik experts helps leverage your equipment's full potential.



improved equipment uptime is a positive effect you can expect when using Remote Monitoring Service.

consumption by X%, which also slashed our climate emissions.” “The service reduced our collisions by Y%, which also cuts back scrap metal impact of the operation by Z tons.” “It helped us to de-bottleneck our process, significantly reducing the idling times of our machines, which directly cuts fuel consumption and CO₂ emissions.”

“It is fair to say that with Sandvik’s Remote Monitoring Service you can now truly convert data into action and improve your equipment uptime,” Terblanche says. ■

REMOTE MONITORING SERVICE BENEFITS

- **Increased efficiency:** continuous analysis of real-time data year round helps get the most out of the equipment, minimizing downtime and maximizing uptime.
- **Lower emissions:** clear insights into fuel consumption and excessive idling times can drastically reduce underground emissions. Optimized component life cuts back on scrap metal.
- **Better operator safety:** alerts on speeding, brake violations, freewheeling in neutral and more.

Q&A

A FAIR CHANCE FOR EVERYONE

Rebecca Roper is mine manager for Glencore’s George Fisher Mine, an underground zinc, lead and silver mine in Queensland, Australia. She is passionate about ensuring that talented individuals are recognized in the operation, regardless of their gender.

Q: TELL US ABOUT GEORGE FISHER MINE.

A: George Fisher Mine (GFM) has a long and rich history. It is one of the largest zinc, lead and silver mines in the world. The Hilton zinc-lead-silver ore bodies, located 20 kilometers (12 miles) north of Mount Isa, were discovered in 1947. After 40 years of on-and-off development, Hilton finally began production in 1989.

Renamed GFM after Sir George Fisher, the former chairman of Mount Isa Mines, the mine was officially opened in 2000.

2020 marked the 50-year anniversary of the sinking of the Hilton Shaft, the 30-year anniversary of the official opening of Hilton Mine and 20 years of operation at GFM.

Q: WHAT IS YOUR ROLE WITH GFM?

A: I’m the GFM manager. I am responsible for the Mine Operations team, which incorporates the production, development, and fill and services departments, employing close to 400 people, including underground operators and technical staff.

In February 2020, after spending 12 months as mine manager at Glencore’s Lady Loretta Mine 140 kilometers (90 miles) northwest of Mount Isa, I moved to GFM. This was just before the COVID-19 pandemic turned the world upside down. My first 100 days turned

out very differently to how I had initially mapped them out.

Q: WHAT ARE YOUR DAY-TO-DAY RESPONSIBILITIES?

A: I’m responsible for ensuring the safe execution of the mine plan, from diamond drilling, raise boring, development, production through to backfilling the waste voids created underground.

Q: WHY DID YOU ENTER THE MINING INDUSTRY?

A: I grew up on a farm in outback New South Wales and although I loved it, the droughts, floods, bushfires and being at the mercy of commodity prices meant at times it was soul-destroying. This taught me resilience, the ability to plan and problem-solve, and instilled within me a strong work ethic to see a task through to the end. These proved invaluable skills when I was introduced to the day to day of the mining industry.

As a child, we used to go fossicking near the farm in an area that was mined for copper during the early 20th century. I was fortunate to see the evolution of a new open-cut copper mine on the site. My older siblings worked holiday jobs on the exploration drill rigs, and I was always jealous I wasn’t old enough.



REBECCA ROPER

Age: 42

Home: Mount Isa, Queensland, Australia

Title: Mine manager

Family: Husband Michael and two school-age sons, Matt and Ben



Geology was on my career list, however. I investigated it further by attending the careers open day at university. The talks by the civil and environmental engineers were very formal, held in a large theater with hundreds of people. In contrast, the mining engineers were having a barbecue outside their building and it was very relaxed and informal. I felt at home.

Q: WERE MANY WOMEN GOING INTO MINING WHEN YOU STARTED?

A: I started university in 1998, as the mining industry was taking off. My year had an intake of 70 students, and only 12 of those were women. By the time we graduated, there were six women left. This was still more than any previous year. The six of us have remained friends and keep in touch regularly. We are all still in the mining industry.

Q: WHAT ARE THE CHALLENGES YOU CURRENTLY FACE IN YOUR JOB?

A: The challenge is always around the people – how to lead a culture of safety and change. A lot of the workforce at GFM have a generational connection to the mine. Part of my role is changing and driving the culture and explaining why we no longer do some of the things that we used to do, that there's now a safer and more efficient way to do the same task. That continuous drive for improvement and to change mind-sets is the hardest challenge.

Q: WHAT IS THE MOST REWARDING PART OF YOUR JOB?

A: The most rewarding part is interacting with people and providing guidance and assistance to empower them. I'm a collaborative leader, so I'm always looking to ensure that everyone

Roper's focus is on diversity, inclusion and, importantly, excellence.



The challenge is always around the people – how to lead a culture of safety and change

feels valued, has a voice and is heard.

It's also rewarding to be an advocate for the women in mining. In the past, I've felt like I'm just doing my job. I now realize that other women see me in the role and think, "I can do that too." That's really significant, and if I can make their path any easier, then we all win.

I have a focus on diversity, inclusion and, importantly, excellence. I encourage a culture where we choose the best person for the role, ensure that our eyes are open to everyone, and that all voices have a seat at the table. I encourage my superintendents to keep their minds open to different possibilities, and suggest different options.

Q: HOW WOULD YOU SAY MINING HAS CHANGED SINCE YOU STARTED?

A: There are things that I did in mining 20 years ago that we just don't do anymore. There are even things that we did five years ago that we don't do anymore. In mining, we have that quest for safety and striving for

excellence all the time. We have removed people from the line of fire.

Likewise, technology is evolving. As a graduate completing time on crew, we used to fill out our daily activity sheets which required the employment of six administration people to complete the data entry, with the results of the shift available hours later. Now, it's done electronically, direct from jumbos over Wi-Fi, with data available instantly on dashboards accessible on your phone.

The other exciting change is the variety of careers now available in mining. Apart from the usual suspects, we now have data scientists, linear programmers, drone pilots, and we've got an operational technology team. These careers didn't exist when I started.

Q: DO YOU FORESEE MORE WOMEN WORKING IN MINING?

A: If you're a data scientist, health profes-

sional, chemist or IT specialist, the opportuni-

ties are boundless in mining. I still don't think we always do a good job of marketing ourselves to other women in both the traditional mining roles (trades, operators) and nontraditional roles.

We need to tap into the sustainability of mining and the roles required for sustainable mining practices – electric cars, mobile phones and solar panels all need minerals.

Here at GFM, I have started Women in Mining (WIM) Wednesdays. Once a month on Wednesdays, many of the women at the mine meet for lunch and discuss different topics – things like confidence, having courageous conversations and resilience. It's a great networking opportunity and a "safe place" to discuss specific issues, ask for guidance and

2020 marked the 50-year anniversary of the sinking of the Hilton Shaft, the 30-year anniversary of the official opening of Hilton Mine and 20 years of operation at George Fisher Mine.



gain confidence with public speaking. A lot of women end up taking a technical role because they think that's going to suit their family life better. But I say that if your passion is in operations, you can make it work. Find a supportive mentor and supportive leaders in the business. If you're not getting that, don't stay in the job. Find a mine, a company, a leader that is supportive, because they are out there. Find your passion and find a mentor or someone in your business who will listen to you.

I've been fortunate enough in my career to have some senior leaders that have actively encouraged me and "had my back" to whom I'll be forever grateful. But if I also hadn't stepped out of my comfort zone, I wouldn't

be in this chair now.

Q: GOING FORWARD, DESCRIBE YOUR APPROACH TO SUSTAINABILITY.

A: We aim to achieve and maintain the highest standards of health, safety and environmental performance at our Queensland Metals operations.

We take a continuous improvement approach to managing our operations and apply a variety of actions to measure and manage the potential impacts of our activities on our communities.

A major project has been rehabilitating two former waste rock facilities at GFM. The final stages of works are underway on capping 570 acres of land, with almost six million tons of

earth moved as part of the project.

We're committed to minimizing environmental impacts from our operations, with about 45 million dollars' worth of work being undertaken to restore mined land across our Queensland Metals operations between 2016 and 2022.

We will be looking at the success of this project to set the benchmark for other rehabilitation works across our Queensland Metals business.

At Queensland Metals we are committed to responsibly sourcing the commodities that advance everyday life in countries all over the world, as well as creating a sustainable metals business that is a source of pride and prosperity for the region. ■



SANDVIK DL422iE



Powering up the underground

With the launch of Sandvik DD422iE mining and tunneling jumbo, Sandvik DL422iE longhole drill and Sandvik DS412iE rock bolter, Sandvik has its first battery-powered offering available for all major drilling applications.

TEXT: TURKKA KULMALA PHOTO: SANDVIK



SANDVIK DD422iE



SANDVIK DS412iE

MINES NEED MORE productive and safer underground drilling with better control of drilling quality. And Sandvik is listening. The company's newest scalable drill rig range for drift sizes 4x4 metres (13x13 feet) and up offers a well-rounded package for most underground drilling tasks and features continuously evolving automation platforms. This is a constant focus in Sandvik's R&D efforts going forward and will be expanded to new drift sizes and applications.

But what are the essential features of the 400iE-series drill rigs? *Solid Ground* asked Johannes Väliavaara, Jukka Naapuri and Anssi Kouhia, the Sandvik Mining and Rock Solutions product managers responsible for this innovative equipment.

HOW CAN MINES IMPROVE THEIR PRODUCTIVITY AND SAFETY WITH SANDVIK 400iE-SERIES UNDERGROUND DRILL RIGS?

JUKKA: One clear common denominator is automation and tele-remote control. This is a common theme in these rigs, both today and in the future.

ANSSI: All these rigs run on a common i-Class control system, which enables advanced mine automation and tele-remote solutions. This is a key productivity asset compared with previous generations of control systems.

JOHANNES: In some applications, power compensation can be a valuable asset. In other words, the onboard battery can compensate for capacity limitations of the mine grid and boost drilling performance, while from the grid point of view, the rig still behaves like a constant load.

WHAT BENEFITS DOES SANDVIK DD422iE PRIMARILY OFFER TO MINING OPERATORS?

JOHANNES: We launched this mining jumbo in 2016, and the rigs have since then logged around 8 million feet of drilled holes and 4,700 miles of tramming. We were the first OEM to offer this type of jumbo, and now you can say this is already proven technology in wide use. We have upgraded it with a new automation package consisting of a boom

collision avoidance system, drill bit changer and tele-remote drilling capability. Our platform thinking means that upgrades become available as soon as they are mature enough.

Sandvik DD422iE eliminates underground emissions and offers excellent all-around safety and ergonomics with its new cabin, which is also used in the other two rigs. We believe it is the most ergonomic underground working environment on the market. The operators have widely embraced the ergonomics, and we have even heard comments that this cabin has helped improve the quality of their spare time due to less fatigue.

AUTOMATION IS A KEYWORD IN THE 400iE DRILL RIG RANGE. WHAT TARGETS CAN MINES EXPECT TO ACHIEVE WITH SANDVIK MINE AUTOMATION?

JUKKA: Automation and also tele-remote control basically increase the number of productive hours during your shifts because they reduce the need for manual tasks. The drill rig can run more independently for

It is the most ergonomic underground working environment on the market

longer periods, over shifts and over breaks and during blasting.

ANSSI: There are some differences between applications, though. In rock reinforcement, automation poses more challenges and is practical so far on a single-hole level only. Next steps, such as automated cycles of several bolt holes and tele-remote control, will be introduced in future upgrades.

JOHANNES: What we call the Sandvik digital ecosystem is a clear focus in all of these drill rigs, including integration with systems such as My Sandvik and AutoMine. All three rigs share the common i-Class platform for compatibility with all these systems.

JUKKA: As for tele-remote control, the message we get from the front line is clear: the user interfaces of various machines must be as similar as possible, and this is something that the Sandvik i-Class platform provides an excellent basis for.

WHAT ARE THE KEY ASPECTS OF SANDVIK DL422iE LONGHOLE DRILL RIG?

JUKKA: Sandvik has a rich heritage of powerful longhole drill rigs. Automation entered the picture in the 1980s with single-hole automation, followed by automatic fan drilling around the turn of the millennium and tele-remote control some 15 years ago. Now Sandvik DL422iE is bringing all the strengths we have developed, reliable and efficient production drilling capability essentially, to a new platform that will get us far in the years to come and will open up unlimited possibilities for product offering development. It will shape the characteristics of the drill rig in the direction that the industry and our customers expect from us.

Hole straightness is a particular focus in this machine. Straighter holes are enabled by further improvements in boom stability, particularly in the support of the front end of the telescopic boom. The telescopic boom is a standard solution for all Sandvik longhole drill rigs, which is an excellent example of

component commonality within the Sandvik i-Class platform.

HOW DO THESE BATTERY-ELECTRIC UNDERGROUND DRILL RIGS HELP ENABLE MINES TO ACHIEVE THEIR SUSTAINABILITY AND COMPLIANCE GOALS?

JOHANNES: Mining companies constantly look for ways to cut back underground emissions, which is bound to boost battery-driven drill rigs as a technology trend. Particularly in new mine projects, there is significant potential in eliminating diesel engines from the ventilation capacity calculations. The cost saving potential brings in a double benefit.

ANSSI: We see a clear increase in demand for battery-electric drill rigs, and Sandvik will heavily invest R&D resources in these types of vehicles.

WHAT NEW ADVANTAGE DOES SANDVIK DS412iE OFFER FOR ROCK SUPPORT APPLICATIONS IN UNDERGROUND MINES?

ANSSI: The i-Class platform has improved our ability to offer various levels of automation for rock support drilling. What we call the Silver package is standard for all Sandvik bolters, while the upcoming Gold package will boost capabilities even higher.

Another improvement that Sandvik DS412iE brings to the table is a higher quality of rock reinforcement, thanks to the i-Class platform that enables a whole new level of data collection during bolting. We can know better how drifts and tunnels are supported and can also document it. This will in the future be complemented by our Intelligent Sandvik Underground Rock Excavation software – iSURE – to improve advance planning of bolt holes.

ARE ALL THE NEW 400iE DRILL RIGS ALREADY ON THE MARKET?

JOHANNES: Sandvik DD422iE jumbo was launched in 2016, and the experiences gained

from users around the world have been utilized to fine-tune the other two 400iE drill rigs.

JUKKA: Sandvik DL422iE was launched in early 2021. The Borden gold mine in Ontario, Canada, wants to run an electric-only fleet of mining equipment and has already acquired the prototype that was co-developed with the mine. It has become one of the mine's most crucial production machines.

ANSSI: Sandvik DS412iE's field tests were completed in early 2021 and it has just now launched. The first unit was tested in the New Afton mine in Canada, a forerunner in battery-electric vehicle technology. All three drill rigs have already been proven in real-life conditions. Overall, this range creates a strong battery-powered offering for all underground drilling applications and most mining methods. ■



SANDVIK DL422iE

Efficient, safer production drilling with zero underground emissions | Advanced fan automation and tele-remote control capabilities

Rock drill: Sandvik HF1560ST, 33 kW

Hole diameter: 89–127 mm (3.5–5 in)

Hole length: max 54 m (177 ft)

Electric engine power: 160 kW

Battery type and capacity: 100 kWh, sodium nickel chloride (SoNick) technology



SANDVIK DD422iE

Safe and ergonomic mining jumbo for efficient drift development with zero underground emissions | Strong and evolving automation capabilities

Rock drills: 2 x Sandvik RD525, 25 kW

Hole diameter: 43–64 mm (1.7–2.5 in)

Hole length: max 5.27 m (17.3 ft)

Electric engine power: 160 kW

Battery type and capacity: 100 kWh, sodium nickel chloride (SoNick) technology



SANDVIK DS412iE

Upgraded drill control and other improvements for more productive rock reinforcement drilling, combined with zero underground emissions | Strong and evolving automation packages

Rock drill: Sandvik RD314, 14 kW

Bolt length: 1.8–4.0 m (5.9–13.1 ft)

Hole diameter: 33–45 mm (1.3–1.8 in)

Electric engine power: 160 kW

Battery type and capacity: 100 kWh, sodium nickel chloride (SoNick) technology

For a safer underground

Working underground can pose a range of hazards. Sandvik's recent acquisition of DSI Underground will further drive safety in underground mining and tunneling.

TEXT: ULF WIMAN PHOTO: DSI UNDERGROUND

GIVEN THE INHERENTLY hazardous underground environment, keeping miners and tunneling workers safe has always been a top priority for the industry. Despite mining and construction companies implementing systems and processes to support a Zero Harm approach, incidents and injuries still occur.

A couple of megatrends drive the further development of underground safety. There is an accelerating shift from open-cut mining to underground mining. This is partly due to depleting deposits and because open-cut mining is coming under more scrutiny and finding less public acceptance. At the same time, existing underground mines need to go deeper to find new ores.

In tunneling, the construction of mega tunnels in major cities worldwide will continue to increase, and much tunneling will occur in challenging ground conditions.

Sandvik announced in December 2020 that it would acquire DSI Underground, a full-service provider to the underground excavation process with a focus on safety.


The company provides a wide range of



Derek Hird

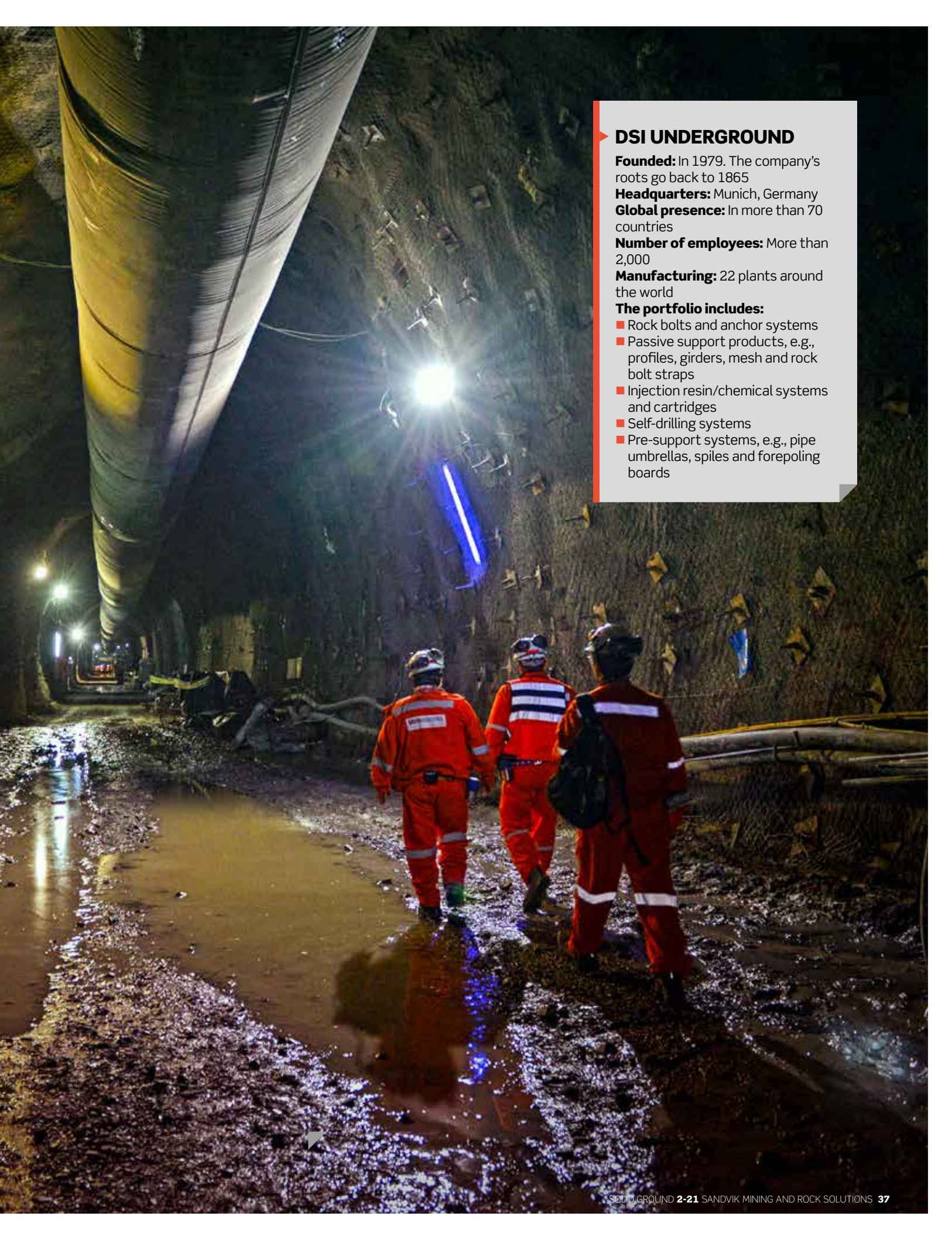
ground support and reinforcement products, systems and solutions. Working closely with customers is part of the strategy. DSI Underground's technical engineering design team assists customers with new or nonstandard products, and with 22 manufacturing plants around the world, the company can rapidly adapt products to individual needs.

"SAFE AND RELIABLE ground support products and services are essential for the mining and tunneling industries," says Derek Hird, regional CEO for the APAC region. "DSI Underground's products are critical to productivity and a safe working environment by supporting the roof underground."

DSI Underground has a long history of focusing on technical innovation. "We have a long pipeline of technical developments, ranging from product enhancements through to next-generation products, such as self-drilling 

DSI Underground has a long history of improving underground safety with reliable ground support and reinforcement products.





DSI UNDERGROUND

Founded: In 1979. The company's roots go back to 1865

Headquarters: Munich, Germany

Global presence: In more than 70 countries

Number of employees: More than 2,000

Manufacturing: 22 plants around the world

The portfolio includes:

- Rock bolts and anchor systems
- Passive support products, e.g., profiles, girders, mesh and rock bolt straps
- Injection resin/chemical systems and cartridges
- Self-drilling systems
- Pre-support systems, e.g., pipe umbrellas, spiles and forepoling boards

As mines go deeper the need for higher capacity support increases

injectable bolts,” Hird says. “As mines go deeper and the need for higher capacity support increases, our R&D team can assist with the design and testing.”

As well as focusing on product developments, DSI Underground has focused on manufacturing improvement and capital investments in their factories to ensure they drive the internal efficiencies in manufacturing. The investment into a state-of-the-art injection chemical facility in Poland is a good example.

“Injection chemicals are products used for ground consolidation and cavity void filling in those extreme mining conditions,” Hird says.



Michael Reich

“Through this plant, we can supply these injection products globally.”

DSI Underground’s Fasloc resin capsules also improve safety and simplify handling and the injection process when installing mining anchors. Their ease of use, fast setting times and high bond strength have made them a popular choice in conventional and fully automated installations.

Digitalization and automation will be increasingly essential enablers to make

underground mining safer, more efficient and sustainable. However, ground support installation lags other processes in the underground excavation cycle in these areas.

“This is where DSI Underground becoming part of Sandvik will make a difference,” says Michael Reich, president of the new ground support division at Sandvik Mining and Rock Solutions. “Together, we will be a full-service provider to the underground excavation process. We will leverage a combination of equipment, drilling technology and ground support to improve safety and speed of ground support installation, unlocking value for our customers.”

DSI UNDERGROUND HAS formed a dedicated subsidiary, DSI Underground SMART, to fully participate in and lead digital development.

“We have started to engage with industry partners around the world to develop digital solutions, helping to overcome challenges in ground control,” Reich says.

The new company will, for instance, soon present solutions to live-monitor ground movements and convergence underground. This will support geotechnical engineers with critical data points to make the right decisions about ground support products.

In February 2021, DSI Underground SMART acquired Edvirt, a Swedish educational technology company that develops and delivers virtual reality and augmented reality tools to the underground mining and tunneling industry.

Simulators have become a standard tool for training miners to operate OEM equipment, but using them to train miners to install ground support in an underground environment is still relatively new. For example, Edvirt’s underground bolt simulator helps avoid costly mistakes involving major equipment repair or production downtime when installing ground support systems.

In the end, DSI Underground’s top priority is to provide customer value, which is true for safety as well as other areas.

“We pride ourselves on being responsive to our customers’ needs,” Hird says. “This might involve technical innovation, offering 24-hour emergency cover, on-time deliveries, guaranteed product quality, providing technical pre-sales support or after-sales services. And it doesn’t matter whether the customer is down the road or across the world.” ■

Improving underground safety together

In December 2020, Sandvik announced that it would acquire DSI Underground. The transaction closed in July 2021.

“Sandvik Mining and Rock Solutions and DSI Underground have complementary product offerings, with minimal overlaps,” says Henrik Ager, president of Sandvik Mining and Rock Solutions. “DSI Underground is a 100 percent aftermarket business and is the clear market leader in its segment. This strategic acquisition will enable Sandvik Mining and Rock Solutions to become the industry’s leading full-service provider of equipment and consumables to underground hard rock mining and tunneling, adding further value to our customers and driving the growth of the aftermarket business.”

DSI Underground will form a new division within Sandvik Mining and Rock Solutions. “Together, we will drive safety and productivity across the full underground cycle and support our customers in setting new standards,” says Michael Reich, president of the new ground support division at Sandvik Mining and Rock Solutions.

Being part of Sandvik will enable DSI Underground to accelerate its expansion into advanced ground support products and the opportunities of integration.

“Our presence in key markets worldwide will enable Sandvik Mining and Rock Solutions’ progress as a full-service provider within underground hard rock mining and tunneling,” Reich says. “Our ground support offering can also be marketed via Sandvik’s expansive global sales network. It will lead to more interaction with existing customers and will support the development of our sales in, for example, Africa and India.”

The Expert

Veena Sahajwalla is an accomplished engineer, scientist and inventor, and a passionate advocate of developing a circular economy.



Veena Sahajwalla believes sustainability is the key to improving the global economy for all.

A CIRCULAR ECONOMY is achieved when problematic waste products are recycled, reused and reformed rather than ending up in a landfill. Veena Sahajwalla, director of the Centre for Sustainable Materials Research and Technology (SMaRT) at Australia’s University of New South Wales, recently met with Sandvik staff and looked for waste reuse possibilities at the company’s workshop in Heatherbrae, near Sydney, Australia.

Q: TELL US ABOUT YOUR WORK.

A: SMaRT’s focus is on developing the fundamental science to allow us to transform waste into value-added materials and products. We’re looking at taking waste on a journey where it might come out the other end as a value-added material or as a completely new product. To do this, we’re pioneering

micro-recycling science and developing new technologies such as our MICROfactories for manufacturing.

Q: HOW CAN THE MINING INDUSTRY DEVELOP A CIRCULAR ECONOMY?

A: I think sustainability will be the foundation through which the global economy is transformed over the coming years into an economy that is fairer for everyone on the planet. To do this, we have to rethink how we go about doing business, managing our materials and waste challenges. That means bringing new opportunities to life, whether it be by reducing our carbon footprint or creating products that are made from recycled content, and developing new manufacturing opportunities as a result. For the mining sector, this might involve looking for new ways to respect

the materials used and the environment in ways beyond site remediation.

Q: WHICH CIRCULAR ECONOMY OPPORTUNITIES ARE AVAILABLE TO MINERS?

A: Many mine sites have mining trucks with massive tires. I would ask the question: what happens to all of those tires? There are technologies today like Green Steel where waste tires can be a useful feedstock for steel making. Then there’s the food packaging left over from people living in remote locations. There’s potential to set up a MICROfactory on site to process and reform that waste – in other words, turn it into a new product. The same goes for personal protective equipment that has reached the end of its life, things like safety glasses and high-visibility gear. It could be reformed into a product like green ceramics.

Q: WHAT PITFALLS SHOULD BE AVOIDED WHEN ADOPTING A CIRCULAR MODEL?

A: If you have a service provider taking away your waste for recycling, it’s important that you check that it’s being used in the way that they claim. Ask questions so that you have a full understanding of the material flows and supply chains. Get your provider to be fully transparent about where the material is ending up. We know a lot actually ends up in landfill.

Q: HOW CAN COMPANIES MERGE A CIRCULAR ECONOMY WITH THEIR CORE BUSINESS?

A: One key is changing mind-set. For the mining sector, rather than dividing what is produced by the mine into “waste” and “target material,” you can decide to take responsibility for both and treat them as co-products and as “renewable” resources. You might need to process the residue in a completely new way to create value. It might require a certain amount of investment and persistence until this becomes economically viable.

Q: WHAT ADVICE CAN YOU GIVE TO COMPANIES THAT WANT TO EXPLORE THIS FIELD?

A: Look for solutions for making better use of your waste. You may not have a solution yourself, but have a look at what other businesses in your field are doing. If a solution doesn’t already exist, then consider collaborating with researchers to develop one. ■



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