Sandvik: the road to automation and electrification

The equipment giant explains how its surface mining offering is changing

By Beth McLoughlin

At MINExpo recently, Sandvik's battery-electric concept surface drill rig was on display for the first time outside of Finland, drawing plenty of interest from the crowds.

But when it comes to electrification, showstopping innovations of this kind are only one part of the story.

"On the rotary drill side, we are seeing a 30-35% percentage of the total demand for electric," Sandvik's global product manager for rotary drills Nellaiappan Subbiah told *Mining Magazine*.

The company, with bases in Finland and the United States, sells 400+ in global volume of rotary drills every year.

"Customers are shifting slowly towards electric drills," Subbiah said. "But I don't think the necessity for diesel will completely vanish."

One of the challenges for surface operations is powering the machinery – not only drills, but the diggers, excavators, shovels, trucks and other equipment – that make up an electric fleet.

"The power requirement for drills, shovels, drag lines and excavators is huge because they are stationary, while trucks can move," Subbiah said.

That means trucks have options that can reduce their dependence on the grid, while equipment that is stationary presents a bigger challenge.

"The mine has to invest a lot in bringing power to the site," he said. In cases where the grid is powered by coal, there is no net benefit of electrification in terms of reducing emissions.

An equipment provider like Sandvik has to be able to offer customers drills and other machinery that they can use today, whatever stage they are at on the electrification journey.

CONVERTING TO ELECTRIC

Mine sites using diesel today might wish to convert to an electric fleet in the future.

Sandvik's iSeries of machines, which include boom drills and large rotary drills, will be able to accommodate both electric and diesel power in the near future.

"Some mine sites don't have the infrastructure [for electric] and are running diesel, but in two, three, four years' time it might be different," Subbiah said.

"The life of our rotary drills can be anywhere between 10-20 years if they are maintained well. That's why we are building the next generation of iSeries drills on a modular platform that can have either a diesel or electric motor as a source of power on the equipment."

Sandvik will provide customers with a kit to convert the diesel rig into an electric rig. This should provide significant savings, Subbiah said.

"The main reasons customers buy our iSeries drills are safety, productivity and these future technology and automation capabilities," he said.

THE EVOLUTION OF AUTOMATION

The company's approach towards automation under the AutoMine banner is similar.

There are three levels of AutoMine: line-of-sight, control room, and fully autonomous.

Sandvik's iSeries of boom and rotary drills are equipped with onboard automation software that sends alerts to guide an operator through their tasks.

This 'automated assist' helps to automate certain basic procedures, such as levelling, or starting the drill process.

"The rigs are fully automation capable across the spectrum of automation that we offer," explained Rob Ewanow, marketing manager in Sandvik's rotary drilling division.

The technology is scalable – so drill rigs can also be operated from a nearby trailer or a control room offsite if customers want to upgrade from the assist feature.

"Depending on the customer's needs, they can start with the basic assist-type features and stay there if that is what they are comfortable with. If, down the road, they are

Sandvik's DR410i drill
Photo: Sandvik

looking to move to more automation, either for safety or productivity or both, then they have options – do they want to build a remote site where they can control one or more drills, or even take it a step further where they are fully autonomous," Ewanow added.

He said that advancements in Sandvik's drills are led by customer feedback and requests for new features.

"The technology is developed where there is a need," said Subbiah.

The need for greater automation in drilling came about after customers asked if there was a way to remove operators from dangerous environments, so they could operate the rigs safely from a distance.

Now, it is possible to operate drills from anywhere in the world, provided there is good network connectivity between the equipment and the mine network.

"When one operator can operate three machines, that helps increase productivity and availability," Subbiah said.

UNDERGROUND TO OVERGROUND

Many of Sandvik's autonomous capabilities were first developed in the underground environment.

"Underground mining is a little more dangerous than surface mining," Subbiah said. "We have got complete autonomous capabilities in underground mining, including drills, trucks and loaders.

"We have a good history of proven, installed fleets operating completely autonomously underground, but we are slowly getting there on the surface side."

Sandvik is the equipment provider for three sites operating with a completely autonomous surface fleet, including surface boom drills and rotary drills operating together from the same seat, operated from a remote control centre.

In these mines – one in Chile, one in Mexico, and another in Sweden – one person operates three rigs in this way in each location.

More than 100 sites globally use AutoMine, including underground mine sites.

"One of the advantages that Sandvik has is we have that strong heritage and background in underground mining, so we're able to take a lot of what's been proven over decades underground and bring it to the surface," Ewanow said.

DATA-DRIVEN DECISIONS

"If you have data you can quantify, you can analyse and you can come to a conclusion more quickly, because you have data to prove what you are saying," Subbiah said.

Sandvik's equipment, including the iSeries drills, give miners full visibility of machine performance, utilisation and health.

This data can be exported to any operating system, including those supplied by other companies, where it can be processed so companies can monitor equipment performance.

"This is important, because a lot of customers already have a fleet management system and we don't want to force them to buy our solutions, but we do want to help them," Subbiah said. "We have an open drill interface, via API, so all the data from the machine can be transmitted through the interface to their fleet management system.

"They can use it as they want, to measure performance, utilisation, machine health and productivity or fuel consumption."

Sandvik also provides its own data reporting solution, where customers can access dashboards with the relevant data already processed and visualised.

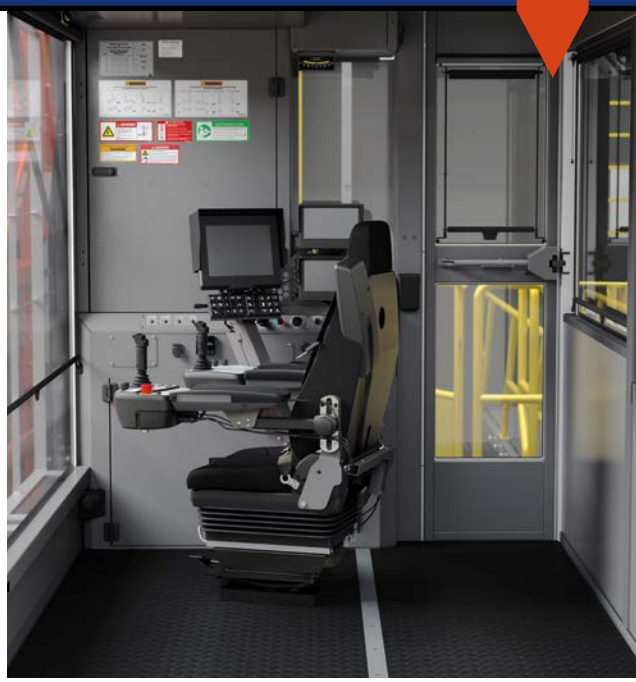
The data is shown in three categories: production management, operational efficiency and maintenance and availability.

"We measure the drill parameters as we drill every 50 mm," Subbiah said. "How much pressure it required to drill, how much speed it required to drill, how much engine load it required, how much fuel consumption it took, all the relevant data, and then we transmit it to the server."

Monitoring to this level of precision helps to avoid any material that could prove difficult at the fragmentation side going through unnoticed.

This digital file can be provided to a blasting company to help them create a profile of a particular hole and fill it with explosive accordingly, in a targeted way.

Sandvik has even created 'drill recipes', where an auto-drill algorithm takes over, adjusting the drill to the right setting for whatever it encounters, whether that is a void or an area of particularly hard or soft rock.



The new iCab has more space and a clearer view
Photo: Sandvik

The operator can pre-set these drill recipes based on the ground they are drilling, and work similar to adaptive cruise control in a car.

The next step is for the algorithm to dynamically adapt to the environment, adjusting the settings based on what it finds.

"We are continuously working on how to enhance drilling," Subbiah said.

"You're not always going to have your best driller or that one person who does an optimum job everywhere," Ewanow added. "But one of the advantages of the technology is that you can almost replicate that person through the use of recipes and automation."

Sandvik also recently launched improvements to some of its ancillary features, such as a more comfortable and roomier cabin for operators, something that attracted a lot of attention at MINExpo.

The auto-bit changing device is another innovation that can help make operations safer, as the operator can make the change from the cabin rather than risk being in a dangerous environment.

This can also bring significant efficiency gains, particularly on those mines where the bit is changed very frequently.

"With our automation capabilities, we are aiming to eliminate human intervention as much as possible from the drilling process," Subbiah said.

"The life of our rotary drills can be anywhere between 10-20 years if they are maintained well"

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