

# DRILLING INTO THE FUTURE

**Nellaiappan Subbiah, Sandvik Mining and Rock Solutions, USA**, explains why smart miners are saying goodbye to diesel and hello to electricity to revamp drilling, save costs, reduce maintenance interventions, and act more sustainably.

**M**ining, like every other sector, has a problem. Processes that have been well-grooved by decades of activity need to be re-engineered as mandates and ethics demand investments in sustainability and carbon emissions reductions. This demand does not brook negotiations. Without adherence to prevailing regulations, miners will lose their licences and permissions to operate. Therefore, whether they go into this willingly or unwillingly, miners have to change. And change is what is occurring everywhere across the big mining houses like BHP, Rio Tinto, and Glencore, but also at a panoply of smaller companies.

This need to change is seeing progressive miners of all sizes and specialisations make investments in automation, digitalisation, data analytics, and anything else that can aid their cause. However, where the rubber hits the road, or rather where the drill hits the seam, is the place to start. In drilling, the advent of a massive transition between diesel and electric is clear.

## **Why electric trumps diesel**

Why this change? The simple answer is that for a host of reasons and in a host of ways, electricity beats diesel hands down. These reasons range from lower maintenance thresholds and extended motor lifespans to cooler running, reduced energy demands, and a hugely significant improvement in total cost of ownership (TCO) levels.

Going electric means the wholesale elimination of standard diesel components, such as filters, cooling packages, exhaust systems, and fuel tanks – all of which

carry a significant maintenance burden. Losing them means a lengthier lifespan for drilling products.

Moreover, a diesel engine is only about 30 – 35% efficient in terms of converting chemical energy into mechanical energy, whereas a high-voltage electric motor typically delivers 90 – 95% efficiency.

Electricity also beats diesel when it comes to lifespan. A diesel lifespan will have an expected life of about 20 000 hr, but the same-class horsepower electric motor will have a life of 80 000 – 100 000 hr. This effectively means that an organisation could avoid changing the prime mover throughout the lifetime of the asset itself. This is a huge advantage, especially in harsh and remote locations with extremes of weather, limited accessibility, or high altitudes.

A related improvement is an ability to seamlessly integrate settings controls for automatic drilling and adaptive drill features that optimise energy usage. Electric drilling often goes hand in hand with smart drilling, as miners tap into ways to remotely control and monitor drilling activities. Results are even better if electric drilling is integrated with business infrastructure and workflows, as organisations deploy intelligent energy management systems, automated engine update alerts, and optimised drilling settings.

The motor control cabinet or transformer does not need a lot of maintenance, compared to the complexity of a diesel engine with its exhaust system, fuel system, radiator, charger cooler, and air-intake filters. These and other items typically have high levels of wear and tear, and must be maintained by periodical interventions every 500 – 1000 hr. With an electric-powered machine, these interventions largely go away for what is calculated to be a total maintenance time saving of about 68% compared to diesel.

Safety is another advantage in favour of going electric. Sensors can more easily be deployed to monitor the speed and direction of the rotation of cable reels and the force on the cable. This means that an operator no longer needs to leave their cabin and take remedial actions and

information can be relayed to a remote-control room. More broadly, automation can also be tapped to minimise manual human intervention and lower cycle times between operations, as well as in maintaining minimum distances between cable routings to avoid electromagnetic interference, thus ensuring the design's reliability and robustness.

Electrification also plays a role in the human factor: how are personnel in operations impacted by their work? Electric machines generate less noise, heat, vibration, and emissions than diesel machines, so operations not only become more environmentally-friendly, but they are also less exhausting for operators and maintenance personnel. The decreased service intervals of the aforementioned prime mover also mean less time is spent on maintenance, so stress and fatigue are reduced. The result is that drill and blast supervisors, or other personnel on the ground, can work in a less hazardous environment. Therefore, clearer thought processes and, ultimately, smarter decisions are evident.

## Think carefully when managing change

Swapping out diesel for electricity is highly effective, but it should not be considered as a 'slam dunk' or quick win. Change must be managed, and smart miners are making gradual, measured shifts towards electric power and cutting emissions.

First, there is hardware modularity. By designing drills to accept different fuel sources, companies can ensure that original equipment investment is not squandered and there is no 'rip and replace' strategy needed.

Second, infrastructure needs to be considered. Organisations (or their providers or service centre partners) can replace diesel engines with electric prime movers that are connected to the mine grid, usually via a substation and trailing cable.

However, introducing electrified components brings challenges too. Layouts and form factors in circuitry and hardware design when converting a machine from diesel

to electric are very different. It is also important to ensure that users are adequately trained and collect feedback to ascertain that they feel they are having a positive experience.

## Making the transition and using 'tailor-made' equipment

For organisations with unique operational needs, adaptations can be made. Electric motor and diesel power packs should be interchangeable without affecting the machine frame, cab, mast, or



Figure 1. Sandvik DR416iE electric rotary blasthole drill.

hydraulic system. Electrical power packs can replace diesel power packs, with changes only being needed for the cooler, plumbing, fans, etc.

In most transformations, it is not just the drill that is electrified, but also the shovel, dragline, or other equipment. However, many organisations will exist in a hybrid environment, combining diesel and electric equipment. Hence the importance of modularity – the ability to extract optimal usage from older equipment and integrate it with the modern aspects of the environment – is clear.

## The future is bright

The electrification of what were primarily diesel-powered machines is just one aspect of how the drilling process is changing. Looked at holistically and in the long term, it may best be considered as an interim step. At some point in the future, mining operations could be powered by a blend of alternative and sustainable fuel sources, including batteries, hydrogen, biodiesel, and biogas sources.

However, even today, demand for electric drills is going up and Sandvik's estimates suggest that these models will soon account for about a third of the total market with the scope to advance to perhaps half of the market in the mid-term. Sandvik's experience is that a mixture of emissions concerns and related tax benefits

for miners are seeing many take a proactive stance and that this trend is inexorable.

## Electric dreams

The advent of electrical drilling marks a radical transformation, but it is also important to have some patience and work through changes. Ground-based controls must still be maintained, because there are situations – such as the loading and unloading of cables, or dealing with some specific or unique obstacles in the field around the pattern – that require those controls.

And, as anyone who has experienced the operation of electric high-voltage electrified equipment will know, there is still a high potential for electromagnetic interference between different circuits. This means companies need to continue to put a lot of effort into making sure that the safety and reliability of the system are world-class.

However, any serious miner knows that radical steps need to be taken to stay relevant in a century that is being defined by attitudes towards power management. Drilling is just one example of how mining is moving away from old, dirty activities towards cleaner, smarter processes. It will be incumbent on everyone in the future of mining to work towards sustainability, reusability, and recycling. If those are watchwords, then the industry will be well-positioned to create a brighter future. **GMR**