



AN ELECTRIC ATMOSPHERE

Chantal Hortop, on behalf of Global Mining Guidelines Group, Canada,
takes a look at the current mining trends in Europe and Africa.



Despite it being one of the oldest industries on earth, there is no shortage of innovation and creative use of technology at the moment in the mining industry. Artificial intelligence, autonomous mining and increasing digitisation throughout mining operations are constant themes across industry. However, one technology that is undeniably at the forefront of innovation investment in mining is the electrification of the vehicles used both on opencast and underground mines.

Battery electric vehicles (BEVs) were a major highlight of *bauma* 2019, held in April in Munich (Germany). European original equipment manufacturers (OEMs) and mining operations were very strongly represented, and they are generally regarded as leading the charge in terms of innovation, but the increasing interest in new technologies in African nations, combined with the abundance of natural resources across that continent, make them a market to watch in terms of technological trends.

Tim Skinner, President of SMART Systems Group and Vice-Chair of International Standards for Global Mining

Guidelines Group (GMG), says that although *bauma* is mainly focused on the construction industry, there are interesting parallels between construction technology and that used in the mining industry. He says he was interested by the “similarity of innovation and technology subject matter in construction as in mining: digitalisation, automation and autonomy, battery electric equipment, data analytics, the Internet of Things (IoT), and the need for standards [...] the amount of development and evolution of digital capability [in the construction industry] will be a big source, influence and driver for mining.”

Differences in bureaucracy, resources and the workforce in Europe and Africa mean that new technology is implemented at different rates and for different reasons, but a common ground remains in the needs of mining operations on the two continents.

Don King, Vice-President of Global Strategic Customers for Epiroc Drilling Solutions, says: “In general, they follow the same trends, but it seems that the European operations usually are more accepting to new technology.

In Africa, the ambition is quite high, however in some cases the infrastructure is not implemented yet, which leads to delays in adaptation.”

The benefits of using BEVs are clear, no matter the location of the mining operation. As Darren Carter, Global Portfolio Manager of the Underground Rock Excavation Division of Epiroc Rock Drills, says: “Electrification means the reduction of diesel particle matter. This will immediately improve air quality in the underground mines, leading to healthier miners, much lower energy consumption for ventilation when using ‘on demand’ smart controls.”

The reduction of greenhouse gas emissions is also an important motivating factor for electrification, particularly in opencast mining.

Europe

Improved efficiency, productivity, cost-effectiveness and safety all come into play with the implementation of BEVs. These vehicles not only reduce greenhouse gas emissions, but may also facilitate other aspects of automation.

Many operations already have a considerable presence of electrification in their mines and are continuing to forge



Figure 1. bauma 2019 featured a wide variety of exciting innovations for construction machinery. BEVs in particular created a buzz among mining stakeholders. Copyright: Messe München.



Figure 2. King says that the range of BEVs available is rapidly increasing, partly due to steady demand for this kind of innovation from mining stakeholders. Photo courtesy of Epiroc.

ahead with new advances as they become available. For example, Boliden Group – which has mines across Scandinavia and Ireland – began its implementation of electric power in 2018. Arne Renström, Senior Project Manager of Mining at Boliden, says at that time the company began using some battery-operated light vehicles and tunnel drills, and began opencast testing of trolleys for ultra-class haul trucks at the Aitik opencast mine in Northern Sweden in late 2018. This initiative is expected to save approximately 830 m³/yr of diesel and reduce greenhouse gas emissions by as much as 80% for the routes where trolleys are being used. Initial discussions are also underway for the testing of trucks and loaders to be used underground, with trials expected to begin later this year.

There was no shortage of announcements about new battery-operated machinery at bauma. One notable development was Volvo CE’s introduction of the first of its range of electric compact excavators and wheel loaders following the company’s announcement in January this year, which would cease new diesel engine-based development of these models. In a press release from the company at the time, it said that while the company “stresses that diesel combustion currently remains the most appropriate power source for its larger machines, electric propulsion and battery technology is proving particularly suited to Volvo’s smaller equipment.”

They are not alone in their ambitions to phase out fossil fuels wherever possible. Michel Serres, Vice-President of Mining Solutions for North America for ABB, notes that “converting existing mines from fossil fuel to electric is our target,” and the Swiss-based company is doing so in collaboration with other OEMs.

He stated: “In Europe, we are supporting fleet OEMs with our technologies, mainly traction drives, motors and electric vehicle (EV) chargers. Short interval control and scheduling are also an important aspect. The combination of electrification constraints and proper scheduling is an industry need.”

Serres also explained that, more specifically, the company’s EVs are currently looking after a capacity of 1.2 MW – this compares to the 450 kW capacity achieved as of the publication of Version 1 of the Global Mining Guidelines Group’s *Recommended Practices for Battery Electric Vehicles in Underground Mining*. The BEVs guideline outlines the recommended practices for using BEVs in an underground mining environment. It is structured as a specification and can be included in mining companies’ tender documents to mining vehicle OEMs. It can also serve as a blueprint path forward for OEM research and development efforts. Version 2 was published in November 2018.

Although many of the BEVs currently available are those in the light vehicle category, King says that in Europe in particular, acceptance of the technology is rapidly increasing and the range of options available is keeping pace.

He explained: “The portfolio of equipment available in battery power is growing rapidly and no longer consists of just the smaller units. Today, battery-powered equipment



Figure 3. Boliden began trolley testing for ultra-class haul trucks at the Aitik opencast mine in Northern Sweden in late 2018. Photo courtesy of Boliden – photo by Mats Hillblom.

is available in all models of underground equipment and is expanding at a very rapid rate.”

King believes the implementation of equipment using renewable energy is a “high priority” for many mines in Europe, explaining that the goal is to get away from diesel emissions and to run equipment on renewable resources, either tethered electric or preferably battery electric.

According to King, this transition is eased by the fact that in mining operations in Europe, and specifically in Scandinavia, “operators are technologically suave and eager to embrace the highest level of automation that is available,” not only being open to this kind of innovation, but actively pursuing it.

The superior technology infrastructure in mining operations in Europe is also a contributing factor to their steady advance into electrification. A working environment that is carefully monitored and evaluated by the mines’ operators contributes to the prompt implementation of technology to increase workers’ comfort and safety.

“Ergonomics and the workplace environment must be at a very high level and this has led to many new technological advancements being implemented,” King explains.

He also notes that Europe has prioritised the elimination of diesel particulate in the working environment, and their leadership in the implementation

of electrification in underground mining can be partly attributed to this fact.

Africa

The approach to vehicle fleet electrification is slightly different in Africa, as the evolution of the mining industry has happened in a different way than it has in Europe. One motivating factor for the electrification and automation of mining operations in Africa is the need to increase the efficiency of the operations’ skilled labour, as opposed to the maximisation of output per man hour that drives many other global operations to implement these changes. Although these operations often begin implementing this kind of technology to solve a labour problem, mining operators do see gains in efficiency and other key areas as a consequence.

African mining operations also seek benefits of electrification related directly to the nature of mining itself, much as is seen elsewhere in the world. 60% of the mining in Africa is for gold, and since gold mining tends to be done at greater depths, these mines benefit greatly from the reduced heat emissions seen with battery-powered equipment compared to that using diesel fuel.

In the past, some reluctance has been seen on the part of operators of African mines due to a relative shortage of electricity, but the increased need for power to run the BEVs is offset by the substantial decrease in ventilation required with this machinery.

Moving forward

For the next five years, Serres predicts advances in several specific areas of the electrification of mining. “Haulage remains the main challenge,” he says. “First to come will be a hybrid model: trolley assist and batteries.”

He adds that in opencast mining, trucks with a payload of up to 100 t will be fully battery-equipped. “Our focus will switch from battery capacity to opportunity chargers, fleet cycle time and minimising battery pack cost. For opencast, fuel cell and hydrogen production may have a future too.”

Serres also highlights the fact that partnership is essential to advancement. “Collaboration is ‘the’ component of innovation. Today, companies able to cover innovation from A to Z no longer exist. We know what we know, the rest should come from other experts.”

Carter says that the very nature of the customer/supplier relationship is changing: “New mines are designing in the new technologies and are planning to gain the full advantages simultaneously. It requires a closer co-operation with the OEMs and other suppliers than in the past, more of a partner relationship than the traditional customer/supplier model.”

Regardless of the location of a mining operation or what type of technology it was first designed to accommodate, electrification is a prominent trend for good reason.

As King says: “Technology can play a major role in all markets regardless of the level of maturity, providing that the operations can adapt to the change management required to implement it successfully.” **GMR**