





Foreword:



Dear reader,

Welcome to **Best of European Mining Solutions by VDMA**, our renamed brochure with a guide to technology, equipment and services offered by the members of VDMA Mining. For a few years now, the VDMA's Machinery and Equipment Manufacturers Association has consisted of machinery and equipment manufacturers from across Europe. To reflect this, we have decided to rename this brochure accordingly to "Best of European Mining Solutions by VDMA."

Raw materials are indispensable for solving the most important challenges of the future — the energy transition and climate protection. As such, in 2022, raw materials and mining came back stronger than ever, and the industry's poor reputation is starting to give way to increasing interest as stakeholders gain a greater understanding of the connections between mining and critical material supplies.

The EU Commission is currently working on a European law on critical raw materials and the VDMA is taking advantage of consultation opportunities to accompany the legislative process. But even the best laws are useless without committed suppliers and first-class technologies to support the sustainable extraction and processing of raw materials.

Successful and committed entrepreneurs can be found in the VDMA. The roughly 150 members of VDMA Mining offer a wide range of technologies that have been tested and proofed in mining operations across the globe. In the search for ever better solutions, be it in digitalization, automation or the integration of different machines and processes with the ultimate aim of autonomous operation, mechanical engineering companies are working closely with a network of customers, scientists and industry partners.

In this issue you will find examples of best-practices and the results of this cooperation. I hope that reading **Best of European Mining Solutions by VDMA** is useful to you.

Glückauf!

Dr. Michael Schulte Strathaus President VDMA Mining

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2022: A Show of Strength in European Mining

Despite trade challenges, European mining equipment, technology and service providers continued to push boundaries in innovation during 2022

By Klaus Stöckmann, deputy managing director, VDMA Mining



The VDMA Mining booth at the bauma 2022 tradeshow. This acted as the contact point for VDMA members, other exhibitors and as a central information point for trade fair visitors. (Photo: VDMA Mining)

2022 was a notable year full of events. Some were great, like the bauma 2022 tradeshow in Munich, while others, for instance, the Russian war against Ukraine, were depressing.

One thing is for sure, the need for raw materials is more obvious than ever. For many countries, the Russia-Ukraine war highlighted the issue of supply chain security, revealing the full extent of their dependencies on raw materials. A just energy transition and climate change mitigation require huge amounts of raw materials, and in many commodities, demand looks set to exceed supply in the medium term.

For mining companies and their partners, there are a number of growing pressures. First, the increasing requirements for the observance of environmental, social and governance (ESG) criteria — either by national German law or European legislation — or issues of corporate social responsibility (CSR). These demands from politicians and investors will continue to grow and must be met. Second, further legal regulations, e.g., on environmental protection or occupational health and safety, are also expected. And last, but not least, the wishes and requirements of communities and worldwide customers must also be met.

Digitization and Automation Shine at bauma

Mining equipment, technology and service providers are preparing to help mines meet these demands,

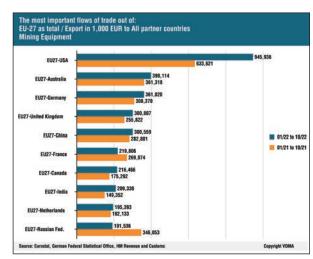
and their efforts could be seen at bauma. With a total exhibition area of 614,000 square meters, a total of 3,200 exhibitors and more than 495,000 visitors from over 200 countries, bauma was once again a superlative event. At the end of the week, the exhibitors headed home with great satisfaction.

VDMA Mining, who's booth was located in Hall C2, acted as the contact point for VDMA members, other exhibitors and as a central information point for trade fair visitors. As the conceptual sponsor and cooperation partner of Messe München, the VDMA was involved with numerous events.

Close by, at the OPC UA demonstration area, a wheel loader, excavator and conveyor belt showed how successful integrated autonomous operations can be achieved, despite the machines having different control systems and sensor technologies. In addition, at the bauma Forum (the event's conference stream), numerous presentations on the five leading themes of the trade fair were given by experts from industry, education and research as well as startups. On day three, various aspects of sustainable mining were highlighted and information given on state-of-the-art solutions and research projects.

What conclusions can be drawn from bauma? Technology is fast becoming a critical differentiator for mining companies. Automation and digitization continue to gain momentum to reduce the cost of extraction and maintenance, and support sustainability and decarbonization.

At the Mining Day in the bauma Forum, the keynote speech highlighted the importance of systems interop-



Mining Equipment - Flow of trade out of EU 27 to all partner countries. (Source: VDMA Mining)

erability, citing it as key to efficient mine automation. Further speeches centered on decentralized communication systems for the interconnection of mobile mining machinery and challenges in big data management.

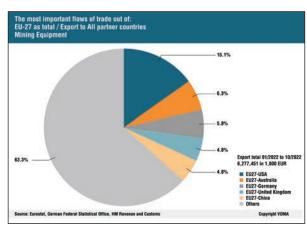
After years of research, trial and error in digitization, it is clear that a cooperative and collaborative approach is the only way forward if mines wish to reap the full benefit of their investments.

Collaborate for an Even More Competitive Future

Within VDMA Mining, various working groups consisting of equipment manufacturers, mine operators and academia continue to work on the 'OPC UA Companion Specification Mining.' At present, a working group focused on mineral processing and another on conveying are very active. In this respect, issues of communication must be discussed, and problems solved. For instance, which technology is most suitable for underground mining — WLAN, 5G or Bluetooth?

Alongside this issue, the topic of zero emissions is also a concern for the industry. Questions that need to be answered include: is a reliable, 100% electrical supply of power possible for mines? What is the ideal drive technology for battery-electric vehicles? How complex is the installation of modern power supply infrastructure? What are the respective legal framework conditions?

At this point we refer to the articles in this issue and to the fact that European mines and their suppliers are fast setting a global standard for low-carbon, autonomous



Mining Equipment - Flow of trade out of EU 27 to all partner countries. (Source: VDMA Mining)

and digital operations, not least because of the many framework conditions set out by the EU Commission. All mining equipment must now be compliant with exhaust emission directives, pollutant limits and others.

In 2022 (January to November), European mining equipment manufacturers delivered technology worth EUR 6.2 billion to their customers across the globe. Within the EU, the intra-community trade of mining technology amounted to EUR 1.8 billion. In order to continue their competition with overseas suppliers, it might be advisable to further expand the cooperation between machine manufacturers in Europe. And, in this respect, we hope that the new title of this brochure will further promote this idea.





Charging Ahead: Moving Toward the Net-zero Mine

To decarbonize the production of minerals and metals, collaborative efforts around mine electrification must extend beyond the big players to include smaller mine and quarry operators too

By Elisabeth Clausen and Aarti Sörensen, RWTH Aachen University

There is a growing sense of urgency around the need to decarbonize mining operations, and the conversation is now at the forefront of C-suite concerns.

According to McKinsey & Co., mining accounts for up to 7% of global scope 1 and 2 greenhouse gas (GHG) emissions and a reduction of 50% from 2010 levels until 2050 is necessary to stay on track for a global 2°C scenario. For a 1.5°C scenario, these levels need to be reduced by at least 85%¹. These targets are ambitious and require decisive and collaborative action across the industry and along the value chain.

With diesel-powered vehicles accounting for anywhere between 30% and 80% of direct emissions², varying with site geography, commodity, and mine design, switching to electric-powered mobile equipment constitutes an attractive option, and seemingly low-hanging fruit for decarbonisation.

It's not surprising then that a large focus for major mining companies has been and is to replace diesel-powered mobile machines with electric and battery-electric vehicles (BEVs). For example, BHP recently announced it will replace 160 haul trucks with those equipped with Caterpillar's new electric drive technology and other low/zero-emission powertrain trucks at its Escondida mine in Chile by 2023. Scandinavian mid-tier miner, Boliden, has installed trolley assist technology at two of its operations and is targeting the installation of 27 diesel-electric trolley-assisted haul trucks by 2023. In addition, initiatives such as the Blu-Vein project or Volvo's TARA solution are looking into advancing the efficiency of BEVs as well as overcoming the challenges around frequent battery charging.

While the public eye is often focused on the actions of large multinational mining companies and, while these companies do have a large share in the

global production of many critical minerals, the decarbonization of metals and minerals also requires solutions for medium and smaller sized operators, as well as those in the quarrying sector.

In Germany alone, 550 million tons (Mt) of sand, gravel and natural stones were extracted by around 2,700 medium-sized and small enterprises in 2018. Currently, a significant portion of the energy input is attributed to internal transport, mostly realized by diesel-powered vehicles. However, as is the case for larger operations, it's usually insufficient or impossible to simply replace these machines with electrified or battery electric models as the operational processes and infrastructure must be adapted as well.

Piloting Solutions for SMEs: The ELMAR Project

In order to support medium and small-sized operations with their transition towards electrification and decarbonization, the ELMAR project, bringing together a consortium of OEMs, mine operators, technology providers and academia and being funded by the German Federal Ministry of Economy and Climate Action, was launched in summer 2022.

The ELMAR consortium comprises two institutes of RWTH Aachen University - the Institute for Advanced Mining Technologies (AMT) and the Institute for Power Electronics and Electrical Drives (ISEA). Volvo Group Trucks Central Europe GmbH, Volvo Construction Equipment Germany GmbH, Volvo Autonomous Solutions AB (commissioned by VCE Germany GmbH) are providing their expertise as equipment and vehicle manufacturers and automation providers Meanwhile, Mineral Baustoffe GmbH and Knauf Gips KG represent mine operators, PSI Fuzzy Logik & Neuro Systeme GmbH, PSI Software AG as cloud solution providers, and TITUS Research GmbH as a developer of autonomous monitoring systems.

Taking a holistic approach, the project will not only include BEVs and the transformation of two very different SME operations, but also consider energy demand and energy supply as well as the optimization on both sides in combination with production constrains.

With respect to implementing BEVs, the consortium targets their autonomous operation, opening



ELMAR will not only consider the implementation of battery-electric vehicles and the transformation of two small-mid sized mining operations, but also energy demand, supply and optimization alongside production constraints. (Photo: Martin Braun Photography)

www.mckinsey.com/capabilities/sustainability/our-insights/climaterisk-and-decarbonization-what-every-mining-ceo-needs-to-know.

² www.icmm.com/en-gb/case-studies/2022/innovation/acceleratingimplementation-of-zero-emission-vehicles.



As part of ELMAR's scope of work, the mine plans will be optimized for energy utilization based on connecting an operation-specific deposit model with the energy demand forecast. (Photo: Martin Braun Photography)

the opportunity to use more, but smaller BEVs with a better ratio between the tare weight and payload to increase efficiency. Consequently, as part of the project, novel mobile machines that are smaller, lighter (and thus more energy efficient and better suited to electrification) will be integrated and demonstrated to improve the business case of electric vehicles.

As Dr. Tobias Hartmann of the AMT at RWTH Aachen University and coordinator of the ELMAR project, explains: "We will retrofit the transport approach at operations, rather than retrofitting batteries into existing machines."

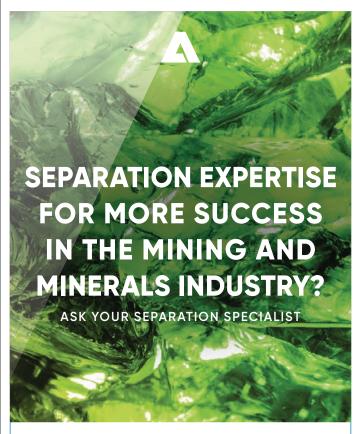
Furthermore, the mine plan will then be optimized for energy utilization based on connecting an operation-specific deposit model with the energy demand forecast. Options for integrating renewable energy sources will be evaluated and included in the mine redesign. The development of appropriate modelling approaches constitutes an important part of the project. These models will be data driven and include a cloud solution for data processing and storage as well as an interface to plan and run production based on the optimization.

It's this coupling of energy and data and its integration into the process, which makes the ELMAR project unique and a potential landmark in pushing electrification and decarbonisation in the SME mining sector.

Over the course of the project, demonstrations of automated BEVs are envisioned at brownfield operations across Germany. Lessons learned will result in a transformational concept for decisions around the transition to BEVs, along with recommendations for small to medium-sized mine sites which will also be adapted to a greenfield project.

There is a clear ambition across the industry to realize the zero-emission mine. Multinational mining corporations are focusing on the implementation of BEVs as a first and important step. While the technology challenges are still being addressed and solutions tested and piloted, the need for a holistic approach to energy sourcing and management is becoming center stage in decarbonization efforts.

To learn more visit: www.amt.rwth-aachen.de/en/elmar.html.



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Sustainability at bauma and Beyond

While the bauma 2022 tradeshow showcased the strength of German manufacturers and their solutions to help mining companies achieve net-zero operations, the innovations didn't stop there...

Despite the uncertain economic environment that has prevailed over the past three years, German mining equipment, technology and service suppliers have generally fared well. For many, a highlight was the bauma tradeshow which took place in Munich, Germany, in October 2022.

The Liebherr Group's exhibit was a particular stand out. Dr. Jörg Lukowski, vice president at Liebherr Mining, said: "bauma represents the opportunity for Liebherr Group to showcase its latest and greatest products and technology from the entire group, which encompasses 13 product segments. Our combined exhibition space in 2022 covered 14,000 m², and demonstrated our innovative capacity and high investment in research and development."

bauma also represented the first real opportunity for personal contact and dialogue with customers, partners, and business associates from around the world following the COVID-19 pandemic.

"After bauma, even though the forecasts of economic research institutes are less positive than they were some time ago and we are operating in a challenging environment, we at Liebherr are confident of the path ahead," said Lukowski.

"Zero-emission commitments have gathered global momentum across all industries recently, and the energy transition has been dominating all of our mining customer conversations. As an OEM, it's our responsibility to develop the technologies that customers need to help their transition along this sustainability journey."



The new Liebherr R 9300 excavator and T 274 mining truck with Trolley Assist at bauma. (Photo: Liebherr)

Liebherr: Decarbonizing Heavy Haulage

Liebherr already offers various solutions to lower the carbon footprint of mining activities, including its Trolley Assist System, electric excavators and the Liebherr Power Efficiency system.

The existing global fleet of Liebherr trucks with the Trolley Assist System consists of 50 T 284 trucks across two sites, and seven T 236 trucks in Austria. The system uses an overhead pantograph to connect the electric-drive system to a mine site's electrical network, powered by the customer's energy source of choice.

When it comes to electric excavator technologies Liebherr has over 30 years of experience, and recently introduced the Liebherr cable reeler option. This enables management of the excavator's electric cable during operation, provides better mobility of the machine, optimizes safety, and reduces the number of crew required for cable handling.

Liebherr Power Efficiency is a proprietary management system for the engine and hydraulic system controls which substantially reduces fuel consumption without compromising the overall productivity of the machine, providing a low-emission solution.

"Importantly, Liebherr Mining's design philosophy for equipment is modular and drivetrain agonistic, meaning the equipment purchased today can be retrofitted to the latest zero-emission options once available," said Lukowski.

As Without, so Within

In addition to helping its clients boost their sustainability, Liebherr is also focused on its own activities and corporate social responsibility. The company recently released a Corporate Responsibility Policy which summarizes the Liebherr Group's responsibility towards people and the environment.

"Within Liebherr Mining our three key focus areas are: the health and safety of our employees, our impact on climate change, and diversity and inclusion," said Lukowski. "We have several initiatives to support these focus areas. The most notable is our commitment to reduce greenhouse gas emissions from the use of our products — these represent approximately 90% of our Scope 1, 2 and 3 emissions.

"Our inhouse developments into the use of alternative fuels in internal combustion engines, along with our low-emission solutions for equipment, and of course our recent partnership with Fortescue Mining Group to integrate zero-emission drivetrains into the T 264 mining truck all play a big role in this commitment."

This partnership, which was announced in June 2022, will see the development and integration of zero-emission power system technologies being development.



An R 9350 E electric excavator with the Liebherr cable reeler solution. (Photo: Liebherr)

oped by Fortescue Future Industries (FFI) and WAE into Liebherr's T 264 mining truck. The phased supply of 120 zero-emission trucks haul trucks is anticipated to commence following a two-year joint development and validation period.

To support this project, which involves Liebherr teams from across the globe, Liebherr-Australia has expanded its Perth mining complex. The newly acquired office and workshop buildings will now form a central hub for Liebherr's zero-emission, autonomy, and other mining technology development and implementation projects in Australia.

To learn more visit: www.liebherr.com/en/gbr/products/mining-equipment/mining-equipment.html.

Rolls-Royce, Green Power Systems for Mines

Demand for Rolls-Royce's mtu products and solutions remained strong in 2022; the Power Systems business unit saw a record order intake in the first half of the year.

"The past 12 months have been particularly successful for our mining business," said Cobus van Schalkwyk, Director Global Mining at Rolls-Royce business unit Power Systems. "Demand from mining customers has increased rapidly, and our renewed focus on mining at the start of 2022 has really paid off. The success of our new team in a short space of time has been a real highlight and success story for the business."

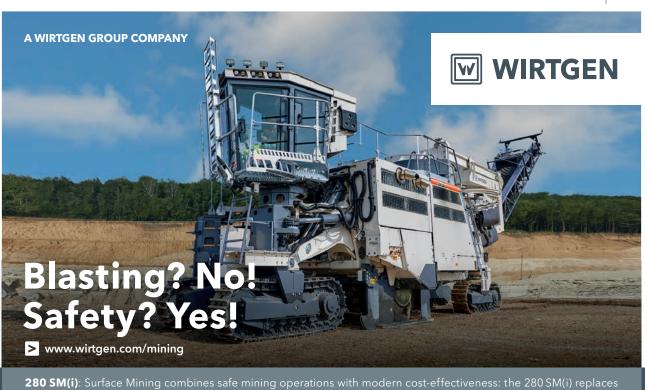
As part of Rolls-Royce's sustainability program, the company is realigning the Power Systems product portfolio to reduce GHG emissions with new fuels and mtu technologies. The aim is to help the group achieve net-zero emissions by 2050 at the latest. Decarbonizing haul trucks for open-pit mining is a particular concern for Rolls-Royce's mining customers.

van Schalkwyk explained: "Currently, there aren't solutions available that reduce emissions at an affordable cost. We are already assisting with solutions that reduce the stationary (power generation) side of our customer's needs, but the infrastructure to support the mobile side is not available just yet. We are, however, investing to be part of the solution for the future."

An important milestone was the release of the mtu series 1600 and 4000 power generation engines for sustainable and synthetic fuels in October 2022. By







280 SM(i): Surface Mining combines safe mining operations with modern cost-effectiveness: the 280 SM(i) replaces the entire equipment otherwise needed for blasting, drilling and pre-crushing. It cuts costs, delivers mined raw materials of higher quality, and ensures more efficient exploitation of the deposits. Take advantage of innovative solutions from the technology leader.

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the end of 2023, a large proportion of the mtu engines offering will have been approved for use with EN15940 paraffinic diesel fuels in order to reduce customers' GHG footprint.

"Rolls-Royce is taking an important step towards a more climate-friendly future in construction equipment, industrial applications, agriculture and mining with the approval of mtu Series 1000, 1100, 1300, 1500 and 4000 engines for sustainable fuels," said van Schalkwyk. "The entire Rolls-Royce product portfolio has already been approved for use with EN15940 paraffinic diesel fuels following successful bench testing. Many mtu engines for mining applications of the Series 4000 will also be released for the sustainable fuels. Engines for emissions regulations EU Stage V will follow. Some of our mining customers already use hydrotreated vegetable oil (HVO) in their trucks."

He added: "Rolls-Royce Power Systems is currently transforming from an engine manufacturer into a provider of integrated sustainable solutions with a strong focus on climate-friendly and climate-neutral technologies. Across all applications that we serve we are working on different innovative solutions, including hybrid systems, fuel cells and engines that run on alternative fuels such as hydrogen and methanol. For our customers in the mining industry, we are developing a roadmap to efficient, dependable and economical sustainable solutions for the transition to climate-neutral energy supply and mobility. We look forward to giving more details about these developments soon."

In 2022, Rolls-Royce Power Systems also established a central sustainability team to consolidate environmental and social sustainability issues.

Dr. Daniel Chatterjee, Director of Sustainability, Technology Strategy & Regulatory Affairs at Rolls-Royce business unit Power Systems, explained: "As part of the so-called Net Zero at Power Systems program, Rolls-Royce has committed to setting short- and long-term climate protection targets in line with the Science Based Targets initiative and submitted the targets developed in the program for validation by the organization in 2022. We received a Global Transition Award as a special prize winner awarded by Handelsblatt for this work."

Furthermore, Power Systems is strengthening its compliance monitoring with human and environmental rights along its supply chain to comply with the German Supply Chain Due Diligence Act. The business unit is also taking steps to decarbonize its facilities. For instance, in 2022, the Power Systems began purchasing 4 million kilowatt hours of electrical energy annually from a new solar farm in Tengen, southern Germany, saving 1,300 tonnes of CO₂ annually compared to the German electricity mix.

To learn more visit: www.mtu-solutions.com/na/en/applications/mining.html.

Wirtgen, Sustainability Through Surface Mining

The past 12 months have also been very successful for Wirtgen.

"Our highlight was the bauma presentation of the new 280 SM(i) surface miner which is environmentally friendly, resource-efficient and can be operated very economically," said Dr. Erik Zimmermann, Sales Director for Surface Mining at Wirtgen GmbH. "The 280 SM(i) surface miner's innovative technologies enable high machine utilization rates for maximum productivity."

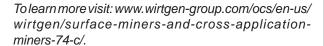
The 280 SM(i) is the successor to the highly successful 2500 SM surface miner. With the 280 SM(i), raw materials are obtained in a single procedure without drilling or blasting. This means they are produced in an environmentally friendly manner with the purest quality and are crushed directly for maximum efficiency.

As part of its sustainability strategy, Wirtgen's new surface miner also provides the mining sector with the technologies to minimize its environmental footprint and conserve natural resources; by reducing CO₂ emissions thanks to low specific fuel consumption, an efficient water management system and effective solutions to minimize dust emissions, the 280 SM(i) demonstrates that ecology and economy are compatible.

"Sustainability is firmly enshrined in our corporate principles and is part of our entire value creation process," Zimmermann explained. "We view sustainability as a social responsibility and a business opportunity. We help our customers move forward so that they can shape the world of tomorrow in a sustainable way."

Wirtgen also introduced the new 260 SX(i) at bauma. This is the company's first Cross Application Miner for infrastructure projects.

"With the 260 SX(i), we further enable the realization of challenging infrastructure projects without the need for drilling and blasting," said Zimmermann. "In contrast to the use of explosives, the 260 SX(i) removes rock and stone using Wirtgen's field-proven cutting technology. The drum has a width of 2.75 m and can cut to a depth of 650 mm. The process is almost vibration-free and generates very little dust and noise pollution, providing an environmentally friendly workplace for both people and nature."









bauma 2022 saw the presentation of Wirtgen's new 280 SM(i) surface miner. (Photo: Wirtgen)







Electrifying the Underground

Technologies that help create cleaner, safer and more productive operations are in demand as mines strive for the highest standards in environmental and social performance

From zero-emissions transport solutions to smart ventilation and new communication and automation offerings, electrification provides a host of possibilities for more efficient mining activities underground. VDMA Mining members are at the forefront of this movement, providing services and solutions that support the move to safer, more sustainable operations.

Becker Mining: New Technologies, New Partnerships

Becker Mining Systems has been very active over the past 12 months, both with in terms of new orders, and new solutions and partnerships.

Jonas Maximilian Becker, CEO of Becker Mining Europe, said: "Most markets performed well which, in turn, reflected in a lot of projects and orders for mining technologies and equipment. Two highlights for us were our partnerships with Swedish communications firm, Ericsson, and with Komatsu in the field of long walls."

In June 2022, Komatsu and Becker-Warkop Sp. z o.o. (Becker Mining's Polish arm) joined forces to produce a set of Joy custom-designed longwall powered roof supports for Warrior Met Coal in the U.S. market. The supports also included Joy Faceboss RS20s roof support controls.

Later, in October, Becker Mining announced an agreement with Ericsson under which the companies will work together to provide Ericsson's Private 5G (EP5G) network solution along with Becker Mining's communication, automation and electrification offerings.



CFT launched its E-Generator in 2022. The system can be retrofitted into all steam-process networks. (Photo: CFT)

The holistic solution extends the technological capability of mines by using wireless connectivity to enable the automation of ventilation systems, gas monitoring, real-time vehicle and personnel tracking, telemetry of production equipment and remote control of production equipment. This, in turn, improves operational efficiency, generates economic savings, and increases workplace health and safety and sustainability practices.

The framework covers countries including Canada, US, Mexico, Chile, France, Germany and Poland, and there are plans to expand this remit going forward.

According to Becker, power consumption is a key area of concern for Becker Mining's customers today. In their bid to be more energy efficient, mine operators customers want to know how power and load they use and where they use it.

"One of our goals is to make this information more readily available to customers via our centralized software solution, Smartflow," said Becker. "After our successful installations in Latin America, "We have the first Smartflow installations coming during 2023 for customers in other regions."

"We're also seeing strong interest in our battery electric Minetrans monorail transportation system. In about 40-50% of cases, enquiries are based on miner's commitments to meeting their sustainability goals. Eliminating diesel emissions from mines is a big concern, as are noise reduction and reducing ventilation requirements."

Looking ahead, Becker Mining recently launched its new proximity detection system, PDS4.0. The PDS4.0 is a smart proximity detection system that enables workers to communicate their status with each other. The system has been designed to be EMESRT Level 9 compliant and is very easy to install and maintain.

The Becker Mining Group is also committed to reducing its internal ecological footprint and is investigating various ways to reduce its CO2 emissions. For example, in 2021, Becker Warkop invested in the expansion of a photovoltaic system (originally installed in 2020) in order to reduce the purchase of additional energy required to run its Polish manufacturing facilities. The project has been so successful that the group is has begun to extend the initiative to its other global facilities as well.

To learn more visit: www.becker-mining.com.

CFT: A Breath of Fresh Air

Mining and tunnelling ventilation specialist, CFT's (part of the CFH Group) products are designed with sustainability in mind, ensuring low-maintenance and long-term use. The company supports customers to return their equipment and machinery at the end of its service

life which can, in some cases, span 30 years or more. Used equipment is reconditioned and resold or recycled where possible to ensure minimal environmental impact. Additionally, CFT allows customers to rent certain systems and machines, making them economically feasible for use over shorter time periods.

Executive Vice President, Corinna Both-Kreiser, said: "It's important to customers that our equipment is durable, low-maintenance and energy-efficient.

"The past 12 months have been a very exciting time for us. Among other things, we closed our head-quarters in Gladbeck (NRW, Germany) and moved to our new nearby building in Marl. We are pleased to be able to concentrate our competences in dedusting and ventilation technology even better on more than 7,500 m² of production and storage space with an innovative fan-test stand."

The topic of sustainability is also reflected in CFT's new building which is compliant with the German KfW 55 standard and has excellent energy properties. For heat generation, 4,200 m of geothermal boreholes were drilled and two brine-to-water heat pumps were installed. These heat pumps can also be used for cooling in the summer. A photovoltaic system was also installed on the hall roof (217.5 kW peak), and charging points added for electric and hybrid vehicles.

"Our mining customers are concerned about occupational safety, health and environmental protection, when they are interested in our products," Both-Kreiser explained. "Our contribution is to make the activities of underground employees more pleasant and healthier. Our technology also ensures compliance with all statutory national and international limits, including those for inhalable and alveolar dust."

In 2022, CFT launched its E-Generator, a system that can be easily retrofitted into all steam-process networks. It can be used with any form of steam generation (gas, oil, hydrogen). The electricity generated is fed into the company's own network and reduces the need for external electricity supplies. The existing production pro-

cess is not disrupted by the system, and the E-Generator can be used with saturated steam, wet steam and superheated steam. The core technology has been tried and tested in other applications for more than 80 years and CFT said it has been proven to significantly reduce company's external energy requirements.

Read more at https://cft-gmbh.de/en.

PAUS, the Sustainable Mine Vehicle Specialist

The bauma tradeshow was a highlight of 2022 for Emsbüren-based Hermann Paus Maschinenfabrik (PAUS).

Executive Director, Franz Josef Paus, said: "bauma gave us a chance to meet many of our customers in person again, and the spirit was surprisingly good. For us, 2022 started well, but then the world changed drastically. Sales outside of Russia are still strong, but we have experienced supply chain disruptions."

In terms of equipment sustainability, PAUS has always strived to offer long-life, heavy-duty machines for underground mining. Even under tough service conditions, the company aims for its utility vehicles to have service lives of over 15 years or 30,000 operating hours.

"We see a growing interest for creating a safer and cleaner underground environment," explained Paus. "To achieve this, our clients ask for emission-free units (battery-electric vehicles), for scalers (roof support), graders (road maintenance) and remote controlled/automated solutions, to mention our most popular offerings."

Recent innovations include the PScale scaler series — the PScale 8T and PScale 10T — which were introduced in early 2021, followed by the PTM 100 Roadheader in mid-2021 and the 17-ton PMKM 8030 dump truck in 2022.

Paus added: "Currently, we are working on a successor for our flagship UNIVERSA 50 vehicle. The new unit will be named the 'UNIVERSA 55' with many improvements and enhancements, such as a suspended front axle. This model will be launched in Q3 2023.

"Then, in 2024, we will also introduce our redesigned Minca 18 utility vehicle which is best known in its personnel carrier configuration. All developments will feature low-emission, Stage V compliant engines or battery drive systems, and will be optimized for low fuel consumption by intelligent power flow systems."

Since the summer of 2022, PAUS produces almost 100% of the electrical energy needed to run its Emsbüren headquarters using solar panels. And, of course, the company uses some of this energy for charging its employees cars and the company's own battery-electric vehicles.

To learn more visit: www.paus.de/en/mining-and-tunneling.htm.



PAUS introduced its new PTM 100 Roadheader in mid-2021. (Photo: PAUS)









Adapting Mineral Extraction for a Changing Climate

From dry tailings stacking to dry beneficiation, water management and safety are driving innovation in mineral processing

Climate change is expected to cause significant disruptions to mine water supplies over the coming decades. While some operations will experience more frequent floods, others will be subject to prolonged periods of droughts. Recent research from McKinsey & Co has revealed that today, 30% to 50% of global copper, gold, iron ore, and zinc production is concentrated in areas of high water stress and these numbers will increase in the run up to 2040. For example, in Chile, 80% of copper production is already located in extremely water-stressed and arid areas and, by 2040, it will be 100%. Climate adaptability and, particularly, water preservation are therefore key concerns in mineral processing.

allmineral's New Waterless Beneficiation Plant

Accordingly, allmineral's aftermarket business has seen a surge in demand over the past 12 months. A highlight of 2022 was the delivery of a full after sales solution package to two coal washeries in Indonesia, including a vendor-managed spare parts stock as well as 365-day supervision of the plant.

Marco Steinberg, Managing Director – HAZEMAG allmineral Australia Pty Ltd., said: "Our clients in Australia are particularly concerned with tailings management. allmineral will launch a new dry beneficiation solution in 2023 which eliminates the use of water and hence tailing ponds are not required at all."

The dry separation plant is similar to a jig plant, but without the need for water. The plant will be avail-

allmineral Service of the service of

allmineral will launch a new dry beneficiation solution in 2023. The solution is semi mobile, allowing it to be moved into the pit where necessary. (Image: allmineral)

able as a containerized, semi-mobile solution which enables mines to move the beneficiation plant into the pit or as a close to mining activities as possible.

"This will fit perfectly in our product portfolio and, with our expertise, we can provide a full solution package as an OEM," said Steinberg. "Our allair dry jig is also now available as a modular and semi-mobile solution. This will drive efficiency in beneficiation, and industries such as coal will gain the most benefits due to the high capacities."

To learn more visit: www.allmineral.com/en.

ANDRITZ: Excellence in Solid-liquid Separation

For ANDRITZ, the issue of sustainability is of immense importance. It concerns all areas of the business and includes the most sustainable production of equipment worldwide. This encompasses sourcing raw materials and energy exclusively from reliable and certified partners and suppliers.

"We have long recognized the importance of this area," said Mario Gerards, Industry Director for Mining and Minerals at ANDRITZ Separation. "We are helping our customers and, ultimately, the environment, to make this world safer and more sustainable. In the past, the minerals and mining industry has not always been in harmony with the environment, but this no longer has to be the case. Especially in the field of solid-liquid separation, we specialize in the safe processing of mine tailings and are happy to pass this expertise on to our customers."

According to Gerards, ANDRITZ Separation performed well in the minerals and mining sector during 2022, despite difficult economic conditions and sanctions related to the Russia-Ukraine war.

"Our order intake has been very satisfactory," he said. "We continue to support single machine sales and are well on the way to becoming a complete solution provider for mineral processing lines too. A complete drying and packaging line, which we sold to a European customer in the battery recycling sector, can certainly be seen as a highlight."

Gerards added that ANDRITZ Separation's minerals and mining customers are placing ever more attention on environmental compatibility and the sustainable extraction of raw materials. The company recently supplied four state-of-the-art filter presses and a Metris addIQ control system for tailings dewatering to Brazilian iron-ore producer, Itaminas. All of the units are now commissioned and are consistently produc-

ing cakes with a moisture content of around 17% and a density of 2.5 t/ m³ which makes them ideal for dry stacking. Final performance was 34% higher than expected, and around 8,800 m³ of process water per day (approximately 80%) is now recovered and returned to the plant for reuse.

"The greatest challenge in the safe and efficient dewatering of larger tailings streams is economic efficiency and the attempt to generate further saleable products from tailings," Gerards explained. "With our magnificent filter press plant at Itaminas in Brazil, we won a sustainability award of which we are particularly proud."

ANDRITZ is currently developing solutions for the processing of critical battery elements, including lithium, graphite, cobalt, copper, nickel and aluminum.

"We see dynamic development of projects in this field and adapt our machines to the individual needs of our customers," Gerards explained. "Often it requires new construction materials or more efficient components in areas such as wear protection and corrosion resistance. For example, our new LiKOSET thickener was developed specifically for the processing of lithium, potash and various salts. Here we often deal with



ANDRITZ recently supplied four state-of-the-art filter presses and a Metris addIQ control system for tailings dewatering to Brazilian iron-ore producer, Itaminas. (Photo: ANDRITZ)

highly corrosive solutions that have to be processed at high temperatures. Our new development ensures the highest process reliability for our customers.

"The development of entire process lines is also not only on our agenda but is already being actively implemented. We are also a global leader in application control and the automation of entire plants. Ultimately, standstill means regression, and ANDRITZ does not rest on proven quality but tries to get a little better every day."

To learn more visit: www.andritz.com/separation-en.





Making Material Handling Ultra-efficient

Manufacturers and mining companies are leaning on digital insights to drive down the footprint and cost of material transport

To achieve their zero-emission targets, mining companies are looking for reliable partners to help them adapt their operations to new technologies and ways of working.

Nils Janssen, Head of Global Account Management at Siemens Minerals, explained: "At Siemens, we want to become a partner to all stakeholders to support the move towards a more sustainable economy by creating sustainable value. It's thereby our highest priority to take leadership towards decarbonization and responsible business practices as a company, but to also help our customers meet their individual sustainability goals with our eco-efficient portfolio of integrated products, services and solutions including hardware and software.

"Our focus is to invest in R&D and innovation to increase the resource efficiency of our offerings and decrease our customers' environmental footprint. For example, our gearless drivetrain systems are approximately 5% more energy efficient than the conventional set-up and process improvements derived from digital solutions can boost the mine output at constant energy consumption in the double-digit range."

Siemens, Supporting Mines to Reach Net Zero

Despite turbulent times during 2022, Siemens seized the opportunity to align itself and its processes more closely with its customers. Material shortages were a

Siemens' gearless drive technologies improve the energy and cost efficiency of drive trains on critical pieces of equipment, such as conveyors. (Image: Siemens)

particular challenge. While, in the past, the supply of large parts was a typical bottleneck for mining projects, today, even the smallest parts like switches or programmable logic controllers (PLCs) could put project delivery at risk.

"To satisfy our customers priorities we have established new internal guidelines for project management and establish a close cooperation with our partners to secure the supply chain." said Janssen.

"At the same time, we see a very active investment in the mining sector to secure critical minerals necessary for the energy transition. For example, with increasing orders for gearless mill drives (GMDs) and e-houses. A number of major digitalization projects are now in operation. It's exciting to see the visions that our customers created with us a few years back being realized and exceeding expectations."

Electrification is a key trend; Siemens' gearless drive technologies improve the energy and cost efficiency of drive trains on critical pieces of equipment, such as conveyors and mills, while also boosting safety and availability through fewer failures. Siemens Large Drives Applications also provides the most efficient electrical components including switchgears and variable frequency drives (VFDs) installed in e-houses to enable plants to connect to renewable energies.

Automation and digitalization are also important trends. While Automation projects extend further through the lifecycle of the plant from earliest planning & simulation phase until deep in the operation phase digital solutions utilizing artificial intelligence create greater transparency and allow operators to optimize their processes.

"Greater visibility enables mine operators to optimize the complete mine (or even several mines), rather than individual process steps," said Janssen. "Siemens also offers remote and autonomous operations of machines. This is achieved through modern automation and digitalization solutions."

Janssen added: "A recent development is the combination of SIMINE MAQ with digital technologies from MineSense. We recently integrated modules from our respective portfolios to create a complete solution for a copper mine in Canada. We also have some exciting GMD deliveries being prepared for clients in Southeast Asia and Africa, and plenty of e-houses with integrated VFDs for mines in South America.

To learn more visit: https://new.siemens.com/global/en/markets/mining-industry.html.

Voith Turbo, Digital Insights for Optimal Transport

Sustainability is a huge focus at Voith; the company's slogan is 'sustainable technologies for future generations,' and this ethos applies to both its products and internal operations. It's production site in Crailsheim, Germany has been operating carbon-neutrally since January 2022 thanks to 41 energy-efficiency initiatives resulting in a 30% reduction in the facility's power demand and green energy production through Voith's own photovoltaic parks.

2022 saw the successful commissioning of Voith Turbo's BeltGenius ERIC (Efficiency and Reliability Intelligence Control) system at a copper mine in Chile. The digital twin of the complete conveyor belt system allows mines to monitor, benchmark, and optimize various aspects of their conveyor operation.

For instance, it provides full transparency of energy efficiency in conveying systems. Identifying energy-intensive conveyors and areas within the conveyor with a high energy contribution, it's possible to develop strategies to optimize bulk material transport costs and lower the operation's environmental footprint. Digital simulations of the system during operation (the models calculate the relevant forces with an accuracy better than 99%) also allow mines to predict failures before they happen, cutting downtime to an absolute minimum and reducing the need for replacement parts.

Stefan Hutzenlaub, Digital Product Manager at Voith Turbo, explained: "A huge segment of conveyor operators are seeking solutions that can reduce their operating expenditure (OPEX), allowing them to be more profitable with their existing equipment and to operate more sustainably. For example, through energy savings, longer equipment lifetime and less wear and tear on key components.

"This is where BeltGenius ERIC comes into play. This overarching monitoring solution for the conveyor delivers insights on how to tackle and improve upon aspects like overall OPEX, with its subsegments of higher equipment life, safer operation and increased energy efficiency."

The TurboGuide Mobile app for constant-fill fluid couplings is another breakthrough solution for sustainable mining. The app delivers all necessary operating information and training material for Voith couplings directly to operator's mobile devices.

Thomas Ohr, product manager for the TurboGuide Mobile app said: "Providing filling guidelines using a standard smartphone rather than huge paper documents leads to optimized operation and a major reduction of misuse, ensuring no operating fluids come into contact with the environment. Providing manuals and tutorials via the app ensures the best possible training of the workforce, especially in less developed countries or for mines in very remote regions. And digital equipment tracking ensures transparency and hence better maintenance planning, leading to a better OPEX structure."

To learn more visit: https://voith.com/corp-en/products-services/automation-digital-solutions/beltgenius.html.

Köppern



Grind down your maintenance costs



Köppern roller presses have been proven successful throughout the world in plants specializing in the cost-saving high pressure comminution of various ores like iron, copper, gold, diamond, molybdenum and lithium ore. The Köppern Hybridur® tires feature an extremely wear-resistant surface that provides enhanced roller protection when grinding abrasive ores.

Köppern – Quality made in Germany.

- » State of the art HPGRs and wear protection
- » Process technology know-how
- » High plant availability
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Pilot HPGR testing capabilities in Australia, Canada, Germany and Russia

For further information please contact sales@koeppern.com

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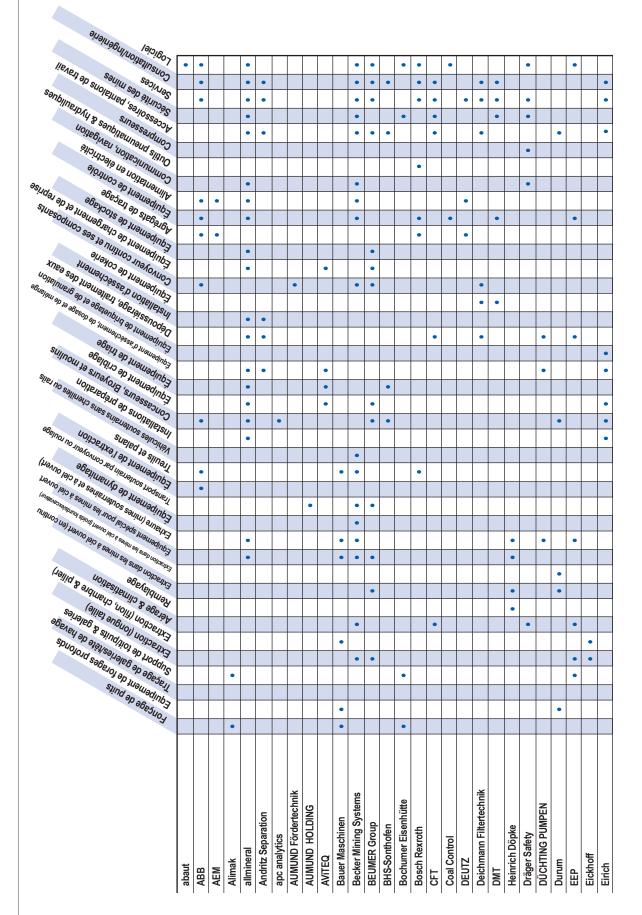


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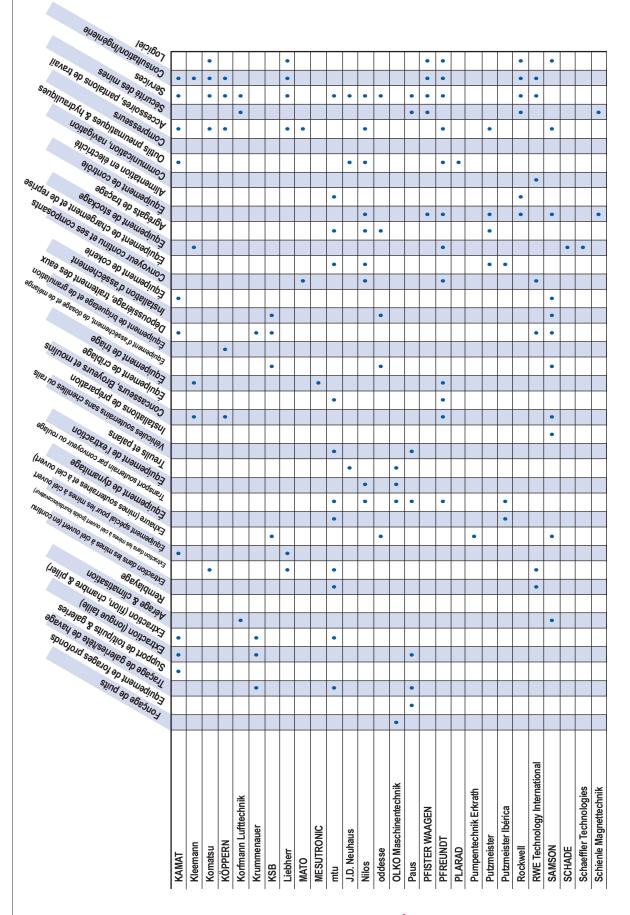
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