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AXISHOUSE GROUP

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Axis House Group continues to make significant commitments to sustainability, by dedicating research and development efforts to the development of environmentally friendly reagents (pg 6).

COMMENT

Between a rock and a hard place

Nelendhre Moodley.

As the mining sector readies for the Mining Indaba in Cape Town – one of the largest mining events in the world devoted to the development of mining interests across the continent, which takes place from 5-8 February – it does so against the backdrop of much global turmoil, which sets the stage for some interesting conversations and discussions.

Added to this, the world's second largest economy and the region's second largest trading partner, – China, has posted sluggish GDP growth for 2023. In 2022, the value of China's trade with the continent stood at a whopping $282 billion. So, what does sluggish growth mean for China and how will it impact the rest of the world, especially the African continent and South Africa? Delegates to the Mining Indaba will have a front row seat to those answers, especially as the Indaba promises "an exciting lineup of influential speakers to engage in thought-provoking discussions".

Aside from its economic slowdown, China's population has been in decline for the second year running, which does not bode well for a country skewed towards an aged population. To grow a strong economy, a country needs a strong workforce and, if citizens are unwilling to up the ante and bear more children, the future is set to be all the more challenging, not only for the country itself, but for those that supply the raw materials and products to grow its economy. Given China's slowed growth, it is all the more reason for South Africa to be working harder to garner a greater share of that shrinking pie, yet we continue to underperform.

Aside from gaining insight into the impact of global factors on African economies, delegates can also look forward to understanding the factors currently challenging the local mining sector, especially port and rail freight, and clarity on progress related to the awarding of mining licences. Minister Gwede Mantashe recently conceded that of the more than 2 500 mining applications received in FY 2023/24, none had been finalised – which begs the question, how exactly are we to attract investment to an already struggling mining sector if government continues with its lackadaisical attitude? Mining Indaba event organisers tell us that Reviving Africa's untapped exploration pipelines will be a key topic at the event, which is sure to elicit some healthy discussions on how industry is expected to advance the agenda if government is tardy about issuing mining licences. Moreover, we are itching to find out when the long-promised new mining cadastral system will be launched – a system that has been years in the making, and which has seen little progress to date. These and other challenges underpin the retrenchment bloodbath underway in the mining sector.

On a more positive note, in this edition of *Modern Mining* we provide our readers with insight into key commodities – Battery Metals (pg 8) and Critical Metals with Wits University's Professor Glen Nwaila, director of the Wits Mining Institute providing a progress report on the institution's advances in developing its Critical Minerals Catalogue (pg 10). Rebecca Gordon, CEO of CRU Consulting, also shares insight into the importance of critical metals in line with the world economy navigating the path to 1.5°C (pg 14). For our Energy solutions feature, our lead story – WEG Africa – flags its bespoke solutions which deliver energy security and efficiency to mines (pg 24). For our Underground Mining feature Murray & Roberts Cementation flags its new 'mock-up' facility situated at its Bentley Park training complex, which is "offering a quantum leap for mechanised mine training" (pg 30), while equipment supplier, Komatsu, advises us that it has entered the fray with the recent launch of underground hard rock equipment to Africa (pg 35). ■

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George Bennet, CEO of Rainbow Rare Earths.

Rare Earth Oxide separation work commences in Florida, US

LSE-listed Rainbow Rare Earths has announced the progression of the Phalaborwa pilot plant process, with the rare earth oxide separation process now underway at the facilities of Rainbow's technical partner K-Technologies, Inc. (K-Tech) in Florida. The back-end plant process uses continuous ion exchange (CIX) and continuous ion chromatography (CIC) to produce separated rare earth oxides. The innovative application of this established technology has been pioneered by K-Tech in the rare earth space and replaces traditional solvent extraction, which uses toxic and flammable solvents and diluents and requires more than 100 separate stages. The process will produce all four of the critical rare earths used within permanent magnets, being neodymium and praseodymium (together NdPr), dysprosium (Dy) and terbium (Tb). Bench scale test work carried out by K-Tech is already showing positive rare earth oxide separation in line with expectations. The continuous run of the CIX / CIC pilot plant has also now commenced. The first separated oxides to be delivered will be the NdPr, expected within the coming weeks, while the Dy and Tb will follow thereafter due to their presence in smaller volumes within the rare earth basket, the company said.

The front-end pilot plant, which is situated at the Johannesburg facilities of the Council for Mineral Technology (Mintek) has successfully completed the first two of three planned campaigns, from which ca. 5.75 kg of mixed rare earth carbonate have been shipped to K-Tech in five batches to date. The front-end will start running on a continuous basis from the week commencing 15 January 2024. This integrated, whole-circuit campaign will produce increasing volumes of mixed rare earth carbonate to ship to K-Tech over the course of Q1 2024.

George Bennett, CEO of Rainbow, commented: "Whilst we have experienced some delays from the original timetable due firstly, to the further beneficiation of the mixed rare earth sulphate to produce a cerium-depleted mixed rare earth carbonate as the optimal feedstock for the K-Tech CIX and CIC circuits, plus two key mechanical issues at K-Tech, which took longer to resolve than anticipated due to the Christmas period, this has in no way affected the integrity of the process flowsheet which is progressing as planned. During this time, we have continued with front-end plant optimisation work to deliver the most efficient final flowsheet for commercial operations, as well as ongoing shipments of mixed rare earth carbonate to K-Tech." ■

Permanent magnet alternator used to generate electricity in wind turbines, converting the kinetic energy of the wind into electrical energy.

Akobo Minerals targets funding for Segele Mine

Scandinavian-based Ethiopian gold exploration and boutique mining company, Akobo Minerals, plans to call for an Extraordinary General Meeting (EGM) to be held on 2 February January 2024, in Gothenburg, Sweden, to secure authorisation to issue new shares.

This resolution, if approved, will provide the company with the flexibility needed to raise the required funds efficiently. The Board of Directors has appointed SpareBank 1 Markets as financial adviser to facilitate the upcoming funding process and to assist with further strategic considerations. The company believes that this step is crucial to raising sufficient funds from both existing and new shareholders, ensuring the successful progression of the Segele mine project. The decision to call for an EGM reflects the commitment of Akobo Minerals to responsible and strategic financial management, the company said. ■

Akobo Minerals Segele project.

Altona receives approval to increase Monte Muambe holding

LSE-listed Altona Rare Earths, a resource exploration and development company focused on Rare Earths in Africa, recently received regulatory approval from the Minister of Mineral Resources and Energy regarding the increase of its holding in Monte Muambe Mining to 51%. The application follows the successful completion of Phase 2 of the Monte Muambe Rare Earths project. The requested duration of the Mining Licence is 25 years. Monte Muambe Mining is the Mozambican subsidiary holding the prospecting license encompassing the Monte Muambe Project. Cedric Simonet, CEO of Altona, commented: "We are very pleased with this promising progress. The speed with which approval was granted by the Ministry shows the level of support our Monte Muambe project has." ■

An aerial view of the Monte Muambe project.

Sibanye-Stillwater appoints a new Chief Sustainability Officer

Diversified miner, Sibanye-Stillwater, has appointed Melanie Naidoo-Vermaak as Chief Sustainability Officer, effective 1 January 2024. Naidoo-Vermaak has over 20 years' experience in sustainable development in both the private mining and public sectors in South Africa and globally. Naidoo-Vermaak holds a Bachelor of Sciences (BSc) (Hons), a Master of Sciences (MSc) in Sustainable development and a Master of Business Administration (MBA). Before joining Sibanye-Stillwater, she worked at various international mining companies, including Harmony Gold Mining Company, De Beers Consolidated Mines, BHP Billiton and Anglo American. Sibanye-Stillwater CEO, Neal Froneman, said: "As the Group has grown and evolved, we have continued to attract exceptional talent externally while retaining our top talent internally to ensure efficient delivery of our strategic priorities. Naidoo-Vermaak's appointment will further diversify and strengthen our senior leadership team. Sustainability/ESG is a strategic imperative for the Group, and we look forward to Naidoo-Vermaak making a positive contribution in our journey to be a Force for good." ■

Axis House Group provides green solutions in mineral processing

Axis House Group, a leading reagent manufacturer and supplier to the mineral processing sector, has made a significant commitment to sustainability by dedicating research and development efforts to the development of environmentally friendly reagents. Concrete initiatives, including gold leaching without cyanide and a range of non-hazardous frothers, allow the Axis House Research and Development team to reduce the environmental impact of its products, plus showcase and drive positive change within the industry.

Axis House Group's chemist, delves into the world of precision with ICP Analysis.

Mining has long been a critical industry for global development, providing essential resources for various sectors. The escalating demand for battery metals, driven primarily by the rise of EVs and renewable energy technologies, has positioned countries with significant reserves of these metals at the forefront of economic opportunities. The surge in demand presents challenges and opportunities, emphasising the importance of holistic solutions that balance economic benefits with environmental and social responsibility.

This urgent need for developing sustainable and responsible supply chains for mining and processing these metals underscores the urgency of investing in research and development (R&D) for alternative technologies. This involves reducing reliance on hazardous chemicals, finding greener solutions, and exploring innovative approaches to mineral processing. Axis House, with its dedicated R&D team, is at the forefront of these efforts, actively working to reduce the environmental footprint of its products and contribute to the industry's sustainable future.

One major initiative by Axis House involves the development of non-hazardous alternatives for cyanide salts, specifically in polymetallic flotation. Revadep 150 and Revadep 226 are both cyanide-free and non-hazardous depressants. The elimination of cyanide from the process promises a substantial impact on logistics, storage, and the environment. It also ensures improved health and safety, and a significant reduction in operating costs.

Another groundbreaking initiative by Axis House is the introduction of D20-M3, a non/low-hazardous alternative to cyanide in gold leaching applications. This innovative leaching agent boasts similar leach kinetics as cyanide while producing effluent that requires minimal to no treatment.

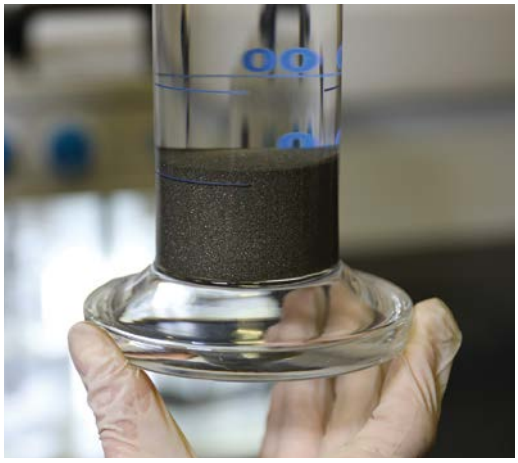
Also on the green agenda for responsible mineral process is Axis House's focus on promoting safety in sulphide collectors, advocating for the use of liquid sulphide collectors with lower hazards when compared to traditional options such as xanthates. In addition, sustainable initiatives also encompass organic polymer depressants widely used for talc, carbon, pyrite, and other floatable gangue. These depressants are safe to use and environmentally friendly and sustainably produced.

The company's commitment to sustainability extends to its innovative frothers range. The high flash point Hydrofroth frother range ensures operational safety while aligning with responsible mineral processing practices. On-site customisation of frothers further reduces hazards and improves process efficiency.

Finally, Axis House recognises the critical role of water treatment in enhancing the overall sustainability of mineral processing operations. Implementing advanced water treatment processes not only minimises the environmental impact but also contributes to improved water conservation and reduced demand on local water sources. Treating water with the Bronte flocculants and dewatering range facilitates efficient recycling within processing plants.

With a focus on the entire mining value chain,

Axis House is a leading reagent manufacturer and supplier for the mineral processing sector.



Customisation is a key aspect of Axis House's approach when working with clients.

Axis House showcases a commitment to green solutions that improve operational efficiencies and contribute to a safer, healthier, and more environmentally friendly future.

Above: The Froth Column - A pivotal innovation in industrial separation and mineral processing.

Left: The metallurgical processing team creates tailor-made solutions in its Cape Town laboratory.

Axis House's specialist teams offer tailored solutions, modifying reagent suites and dosages to optimise specific plants or situations. Beyond chemical solutions, the company provides a full supply chain service, including off-balance sheet stock holding, new routes to market, and innovative storage solutions.

As pressure on metal prices intensifies, Axis House recognises the importance of improving processes to save money for clients. Its strategy to reduce the quantity of chemicals in mineral processing aligns with a holistic view of the entire value chain. By emphasising the importance of optimised dosages, the company aims to lower its carbon footprint and that of its clients. With an increasing number of clients seeking ways to improve processes and save money, Axis House is experiencing growth in demand for technical support, both locally and in the territories in which it operates.

Customisation is a key aspect of Axis House's approach when working with clients. The company obtains ore samples, and the metallurgical processing team creates tailor-made solutions in its Cape Town laboratory. Recognising the ever-changing nature of ore bodies, Axis House adapts its reagent suite for each unique situation, ensuring maximum economic efficiency for clients.

Looking ahead; the years leading up to 2030 represent a critical period in which the demand for battery metals will reach unprecedented levels. The industry must navigate this surge with a holistic approach, addressing not only the economic opportunities but also the environmental and social responsibilities associated with increased mining activities.

The surge in demand for battery metals highlights the urgency of investing in research and development for alternative technologies, and Axis House showcases a commitment to green solutions that improves operational efficiencies and contributes to a safer, healthier, and more environmentally friendly future for mineral processing paving the way for a sustainable tomorrow. ■

Markets turn bearish across the major lithium-ion

By Martin Jackson: Head of Battery Raw Materials at CRU

Industry research firm CRU lays out the short-term supply-demand fundamentals of the major lithium-ion battery metals.

Volatility and complexity risks investments in the battery market

The energy transition is driving unprecedented demand for lithium-ion batteries and their constituent raw materials. In this decade, the largest end-use sector is battery-electric vehicles (BEV), although stationary energy storage is rapidly growing in line with the build out of renewable energy capacity.

However, the rate of growth in demand is slowing down in the short term, inventories are high across the supply chain, shifts in battery technology are enabling material thrifting, and mined supply of materials is surging from new sources. The combination of these is pushing prices lower, enabling cheaper electric vehicles and energy storage systems. This in turn will increase the risk that growing demand will overshoot supply again in the longer term.

Supply overshoots demand across the supply chain

Battery material prices were elevated in 2022 as demand overshot raw material supply, which subsequently led to a slowdown in early 2023. In China, the world's largest BEV and battery market, on this occasion the dip in demand was due to a combination of an early Spring Festival and the expiry of BEV purchase subsidies. At the same time, battery manufacturers built up burgeoning inventories of battery cells, and this rippled up the supply chain into much lower spot market activity for raw materials.

A seasonal lull in BEV sales is to be expected and should not be extrapolated into the long term, but the level of inventories in China will take time to draw down on, and consumers have reduced their spending due to macroeconomic factors. From a demand perspective, this contributes to the bearish outlook into 2024.

Shifts in battery technology are enabling thrifting and substitution of battery materials, softening the demand outlook

At the same time, improvements to the electrochemical performance of cathode materials and efficiency elsewhere in the battery and vehicle powertrain, are altogether making a positive effect on energy density. This in turn means less material is needed for the same battery capacity.

Growth in electric vehicle sales is steadily making a comeback.

This will continue for many years, but in the short term another trend is having a more profound effect on nickel and cobalt demand, namely the uptake of low-cost lithium-iron-phosphate (LFP) batteries.

Thanks to technical advancements, the traditional disadvantage of low energy density and EV driving range of LFP is now a thing of the past. Combined with a robust ramp-up of the supply chain, LFP now accounts for 60% of battery production in China. Batteries destined for energy storage in China are virtually all LFP.

The damage to nickel and cobalt battery demand in China will almost certainly last into 2024, although it will take longer for LFP to make an impact in other markets. Chinese NMC precursor producers have been aided by substantial orders from South Korean cathode producers, which in turn are exporting to Europe and North America. On the global level, NMC batteries will continue to maintain the dominant share in 2024.

Lithium-iron-phosphate batteries accounted for 60% of production in China last year, and do not contain nickel and cobalt.

Supply: Slower demand growth has combined with a supply surge as new developments in Indonesia, Zimbabwe, Brazil, and Canada come online.

- For lithium, as large mine investments continue to be announced despite a rapid fall in pricing, oversupply is increasingly a risk.
- For cobalt, thrifting and substitution has lowered intensity of use drastically. In parallel, growing supply from African miners and Indonesian laterite operations is pushing the market into oversupply.
- For nickel, production from laterite resources in Indonesia continues to grow more rapidly than nickel-based battery demand can absorb.

Lithium deficit rapidly narrows

Booming prices over the past couple of years have encouraged a large contribution of supply from high-cost sources.

battery metals

The tables are now turning and not in the favour of producers.

Forecast supply growth continues to exceed demand in the short term. Overall, the market is still tight, but operators in the supply chain are struggling to draw down on built up inventories.

In the short term, setbacks for Australian producers have been more than offset by miners in emerging jurisdictions – Brazil, Zimbabwe and Canada. Several key projects have accelerated their development schedules, and these mines are now already in production. For example, Chinese investment in southern Africa is adding meaningful volumes from mixed petalite and spodumene resources.

The result is that a supply surplus will become apparent in 2024. This will place downward pressure on prices and, beyond this time horizon, will test the feasibility of producers and projects.

Cobalt market surplus will weigh on prices as battery demand decelerates

Cobalt is almost solely sourced as a by-product, with less than 5% coming from primary mines. With weak prevailing market conditions, new primary cobalt producers are unlikely to come online in the medium term, edged out by copper and nickel miners. During this period, robust copper and nickel prices will incentivise producers, and hence ensure that an abundant supply of cobalt continues to flood the market.

Restocking requirements will bring buyers back to the market, but prices will remain under pressure into 2024. A sustained period of oversupply will mean that, in real terms, metal prices will persist at some of the lowest levels seen for the past 15 years.

The outcome of the looming presidential election in the DRC has the potential to swing the market into a deficit, but this is unlikely to be seen in the short term.

Nickel production from laterite resources in Indonesia continues to grow

Indonesian HPAL producers continue to ramp up production despite an oversupplied market. Their cost-competitive product, MHP, continues to see firm appetite from buyers in the Chinese market.

Nickel sulphate prices have dropped 18% this year to September. There has been a mild degree of restocking but, overall, there is ongoing weakness in demand from the battery sector. Although high-nickel cathodes are increasingly replacing low-nickel chemistries, intensity of use in Li-ion batteries has fallen 40% over the last three years due to the rise of nickel-free LFP batteries.

EV manufacturers outside China are equipping with high-nickel batteries, but BYD and Tesla, both of which make heavy use of LFP, will continue to lead the market in 2024.

Photo: CRU.

Copper-cobalt and nickel-cobalt miners are not deterred by low prices for cobalt.

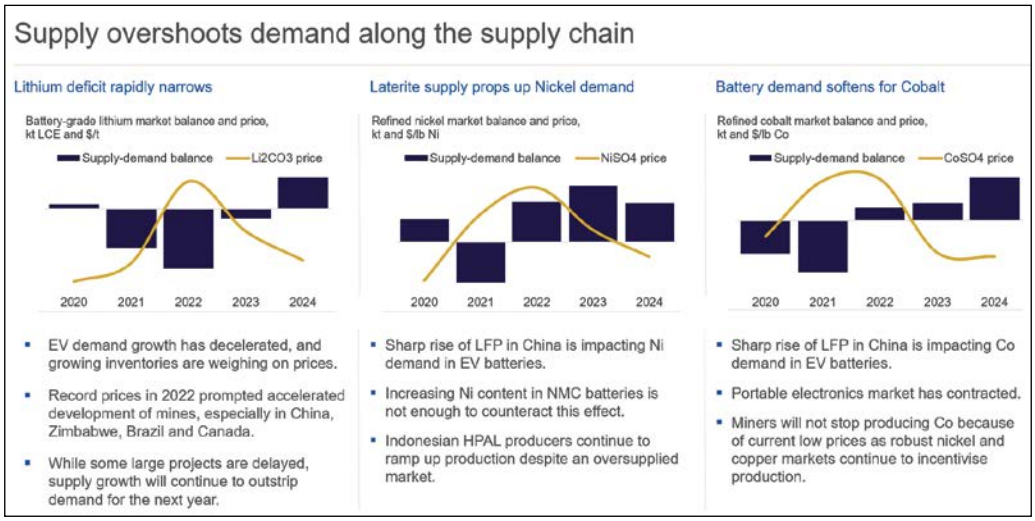
HPAL projects in Indonesia and Philippines continue to ramp up production despite an oversupplied market.

Battery metals will boom again

Large scale investments into the BEV and battery supply chain continue to be made in anticipation of further growth. Regulation and policy have always been the catalysts for this.

There will continue to be periods of short-term volatility in the next few years, but sustained low prices of raw materials will enable cheaper electric vehicles and energy storage systems. This in turn will accelerate demand and make it more likely that markets swing back into deficits in the long term.

This is not necessarily a good thing – volatility and extreme prices are not good for any investments – but as the battery industry grows, those periods should become less frequent and mined supply will be increasingly diversified. ■



Professor Glen Nwaila, director of the Wits Mining Institute.

WMI targets Critical Minerals Catalogue completion by December 2025

Underpinning the world's transition to a clean energy system is the need for critical metals, such as copper, lithium, nickel, cobalt and rare earth elements, to support clean energy technologies. *Modern Mining* recently spoke to Professor Glen Nwaila, director of the Wits Mining Institute (WMI) about the institution's progress in developing its Critical Minerals Catalogue. By *Nelendhre Moodley.*

According to Professor Nwaila, South Africa is establishing a Critical Minerals Framework for the country, with the WMI developing a Critical Minerals Catalogue.

Developing the Critical Minerals Framework involves collaboration between various government agencies, centres of excellence, mining firms and academic institutions. Key stakeholders include the Department of Minerals and Energy (DMRE), Council for Mineral Technology (Mintek), Council for Geoscience (CGS), Council for Scientific and Industrial Research (CSIR) and other alliance partners.

"At this stage," he says, "South Africa has a working draft related to policy formulation."

The national Critical Minerals Framework draft is currently in the commentary and consultative processes, while the WMI Critical Minerals Catalogue is targeting completion by December 2025.

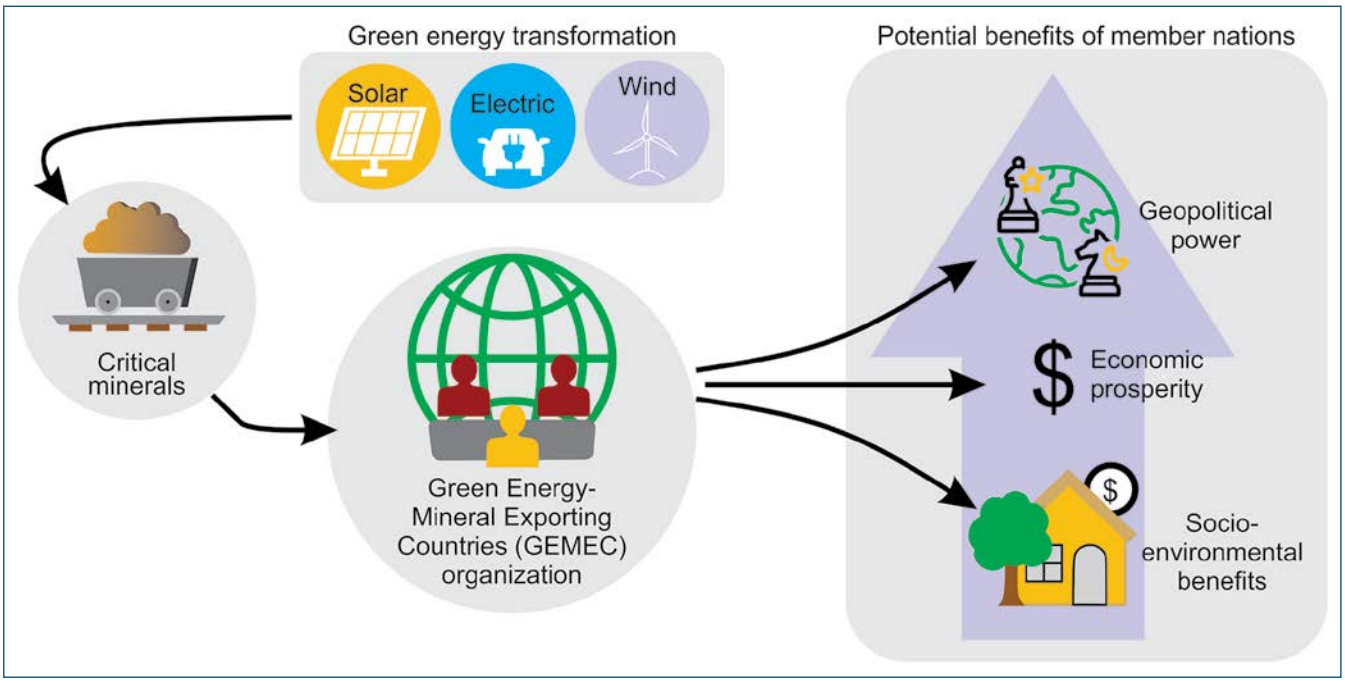
"The Wits Mining Institute (WMI)," says Prof. Nwaila, "through its Sibanye-Stillwater Digital Mining Laboratory (DigiMine) and associated research centres, initiated the establishment of a critical raw materials catalogue from the research principles of data compiled. We enriched the data layers with specific objectives that are aligned with the quantification and downstream applications of critical minerals. The research data will help inform evidence-based policy formulation."

South Africa will need to rely on the DRC for cobalt as it does not produce the mineral.

According to Prof. Nwaila, South Africa, like many other Global South countries, has a unique blend of economic, social, and environmental challenges.

"This is a significant consideration for many countries that must navigate international standards and pressures while ensuring that domestic needs and priorities are addressed. South Africa took time to establish its critical raw materials catalogue due to the complexities of its mining sector, historical legacies, and competing economic priorities. Establishing such a catalogue would provide clarity and guidance to the mining community regarding the nation's most essential mineral resources, thus helping streamline investments, operational decisions, and industrialisation plans."

The professor explains that the critical raw



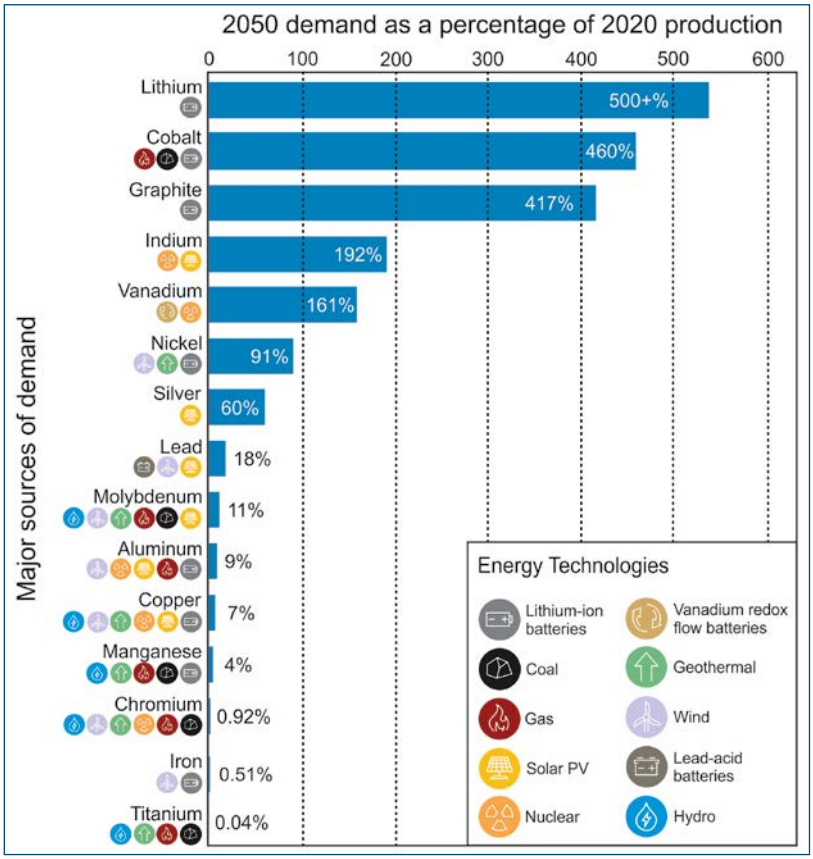
materials catalogue involves a multi-step process including:

- ❑ Assessment of current and future demand: "This required the examination of both domestic and global markets to forecast demand for various raw materials over the short and long-term.
- ❑ Geopolitical considerations: We analysed South Africa's position in the global supply chain and the geopolitical risks associated with sourcing/exporting each material, especially in politically unstable regions or where monopolies can dictate market conditions.
- ❑ Socio-economic considerations: Much time was spent on evaluating the socio-economic implications of critical raw material extraction, including potential for job creation, community development, and impacts on local economies. We are also assessing potential displacements or disruptions to local communities.
- ❑ Evaluation of supply vulnerabilities: We took the time to unpack and understand the vulnerabilities in the supply chain, from local disruptions to international trade tensions.
- ❑ Environmental Impact Studies: Each CRM (critical raw mineral) will require a thorough environmental assessment so we understand the ecological consequences of extraction and processing for each material.

For South Africa, the benefits of establishing a Critical Minerals Catalogue will be manifold:

- ❑ it will enhance economic opportunities for the country's vast mineral wealth;
- ❑ increase international trade opportunities by highlighting strategic materials; and
- ❑ the potential to leverage these resources in bilateral and multilateral negotiations, ensuring both economic growth and national security.

Aside from establishing a stakeholder consultation process, WMI put in place a regular review and update mechanism to review and update the catalogue periodically, to reflect changes in technology, market demands, geopolitical scenarios, and local socio-economic conditions.



Underpinning the world's transition to a clean energy system is the need for critical metals to support clean energy technologies.

The WMI initiated the establishment of a critical raw materials catalogue.

At this stage, the WMI has listed several elements and minerals considered critical based on their downstream application interest areas:

SA's progress in fostering the development of key materials for the JET?

South Africa is making concerted efforts to foster the development of key materials for the Just Energy Transition (JET) by balancing the need for economic growth, environmental sustainability, and social justice. "However, it is also essential to continually monitor, assess, and adjust these strategies in the dynamic landscape of global energy transitions," says Prof. Nwaila.

He goes on to explain that government has been updating its energy policies to reflect the importance of sustainability and justice:

The Integrated Resource Plan (IRP) is a key document that outlines the country's energy future, and recent versions have increased the allocation for renewable energy sources.

Secondly, promoting initiatives around Research & Development with institutions such as the Council for Scientific and Industrial Research (CSIR), which is at the forefront of researching new energy technologies and materials, including working on improving the efficiency of solar panels, energy storage technologies, and other renewable energy innovations.

Thirdly, there is a push towards Infrastructure development for renewable energy, including developing solar and wind farms and the necessary grid infrastructure to support them.

"In looking to support local industries," he says, "there is an emphasis on sourcing materials locally for the renewable energy sector, where feasible. This not only boosts local industries but also reduces the carbon footprint associated with transporting materials. And tying in with the aspect of education and training, JET recognises the need for skilled labour in the new energy sector, with initiatives in place to train workers. This includes re-skilling workers from the coal industry to ensure they are not left behind in the transition. Moreover, given the need to invest in the development of a pipeline of critical raw materials like lithium, vanadium, and rare earth elements for the energy transition, there has been a push to explore, develop, and mine these resources responsibly and sustainably."

Aside from international collaborations both for technology development and transfer, and to secure investments in the renewable energy sector, the country continues to collaborate with the private sector through initiatives like the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which encourages private investment in the renewable energy sector.

South Africa mines a vast majority of the metals and minerals on the critical minerals list.

Critical raw materials for the Just Energy Transition (JET)

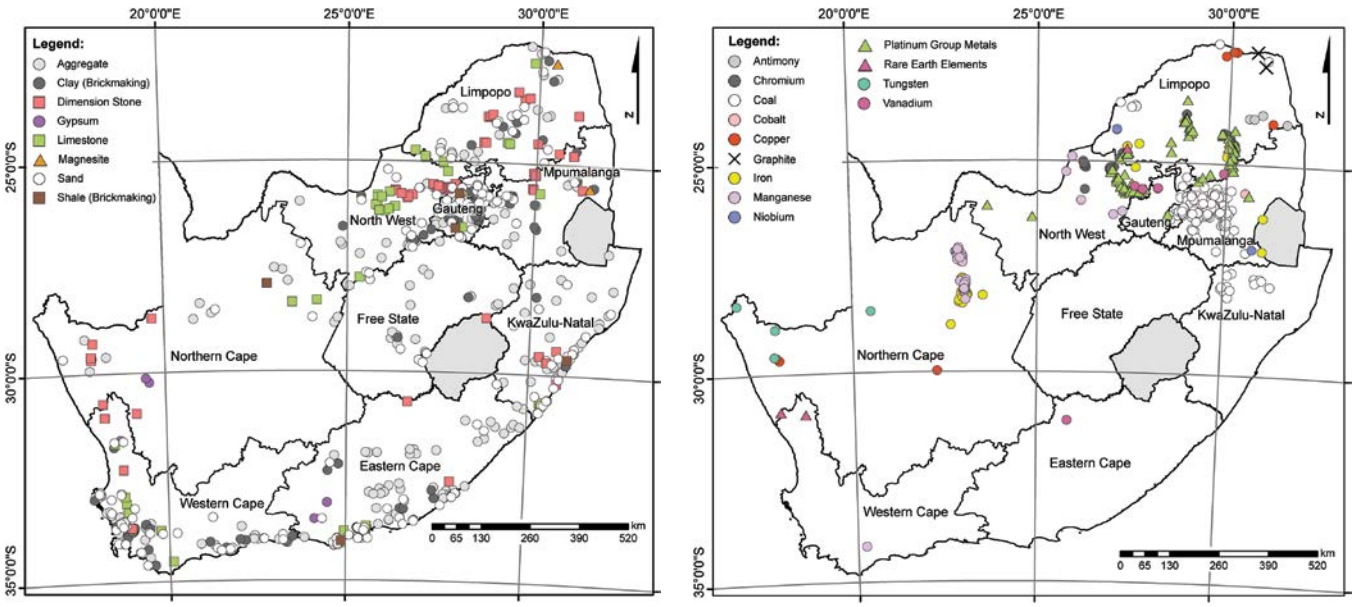
Materials that are regarded as critical for the Just Energy Transition (JET) considerably overlap with critical raw materials. The good news is that South Africa mines a vast majority of the metals and minerals on the list.

Discussing South Africa's capacity to produce the various key minerals for the JET, Prof. Nwaila says that while the country has several copper (Cu) mines, it is not a top global producer of the metal and might need to import copper from Zambia and the DRC to meet any significant demand.

For electrical steel (made primarily from iron-ore), South Africa is a significant producer of iron-ore and although it is not a leading global producer of nickel (Ni) it is, nevertheless, blessed with healthy nickel assets.

Resource rich South Africa is one of the top producers globally of vanadium (V) and zirconium (Zr), and a leading producer of Platinum Group Metals (PGMs) platinum (Pt), palladium (Pd), rhodium (Rd), as well as zinc (Zn), iron (Fe) aluminium (Al) and manganese (Mn).

However, for materials not produced in significant



quantities locally, South Africa would need to source from international markets, including Australia and China, as well as neighbouring African countries.

Materials will include uranium (U) as well as Rare Earth Elements (Nd, Pr, Dy) and, while South Africa does have uranium mines and has historically been involved in the nuclear fuel cycle, it also produces limited quantities of rare earth elements.

"South Africa doesn't produce significant germanium (Ge) except as a by-product in zinc ores (typically), which means that we will likely rely on imports. Moreover, there is no data available worldwide as to which country has significant germanium resources," explains Prof. Nwaila.

Even though South Africa produces magnesium (Mg), it is not in significant quantities – China currently dominates magnesium production, the country also has a few natural graphite mines near the border with Mozambique. However, South Africa will rely largely on other countries such as Mozambique and Tanzania to supplement its natural graphite needs.

Because it is not a primary producer of lithium (Li), boron (B) or cobalt (Co), the country will likely rely on imports from countries such as Zimbabwe and Namibia for lithium and the DRC for cobalt. Few nations mine and export boron.

Production of Gallium Nitride (GaN) – a synthetic material – will depend on processing capabilities, says Prof. Nwaila. The Just Energy Transition also relies on silicon (Si), which is produced locally, and silicon carbide (SiC), another synthetic material.

For its JET needs South Africa will require Sulphur (S), Phosphorus (P), Fluorine (F), by-products of other minerals and will rely on imports.

For minor metals Tellurium (Te), Gallium (Ga) and Indium (In), tellurium will be extracted from refining copper ores and gallium and indium from zinc ores.

"The WMI will provide bursaries to students through its DigiMine, to train and cultivate the next generation of CRM industry leaders. The bursaries will be sponsored by our key sponsor Sibanye-Stillwater in accordance with the Green Energy Minerals and Technologies theme of DigiMine," concludes Prof. Nwaila.

I. Downstream Application Interest Areas		
Categories	**Component/ Sub technology**	**Material/Mineral**
Transmission	Converters, transformers, breakers and switches	- Cu, Ge, Ni, electrical steel, SiC
Generation	Moderators, Solar, PVs, Off-shore & Land-based Windmill	- U, Zr, natural graphite, electrical steel, Si, Te, Ga, In, Cu, Nd, Pr, Dy, B
Energy storage	Stationary hydrogen to electricity conversion (Fuel Cells)	- Pt, graphite, La, Sr, Co, Ni, Y, Zr, Mn
	Lithium-ion batteries, zinc air, iron air, sodium air, flow batteries	- Li, Co, Ni, graphite, V, Zn, Fe, Al, Na, S, P, F
End Use	LED (Lighting)	- Ga
	Electric vehicles	- SiC, Mn, Mg, Al, Ni, Si, Nd, Pr, Dy, B, Fe, Li, Co, graphite, Al, P, electrical steel, Cu
	Power Electronics	- GaN, SiC
	Optoelectronics (Microchips)	- Ge
	Vehicles	- Mn, Mg, Al, Ni, Si, Pt, Pd, Rh Electrical steel, Cu, Graphite, La, Sr, Co, Y, Zr, Mn
	Hydrogen Electrolyers	- Pt, Ir, Ti, La, Sr, Co, Ni, Y, Zr, Mn

Rebecca Gordon, CEO of CRU Consulting.

Navigating the path to 1.5°C

The Paris Agreement's call to keep the global temperature rise this century to well below 2 degrees Celsius (°C) and pursue efforts to limit it to 1.5°C, is a key aspiration for most countries. *Modern Mining* recently spoke to Rebecca Gordon, CEO of CRU Consulting, to find out just how the world was faring in meeting the goals outlined by the Paris Agreement. By *Nelendhre Moodley*.

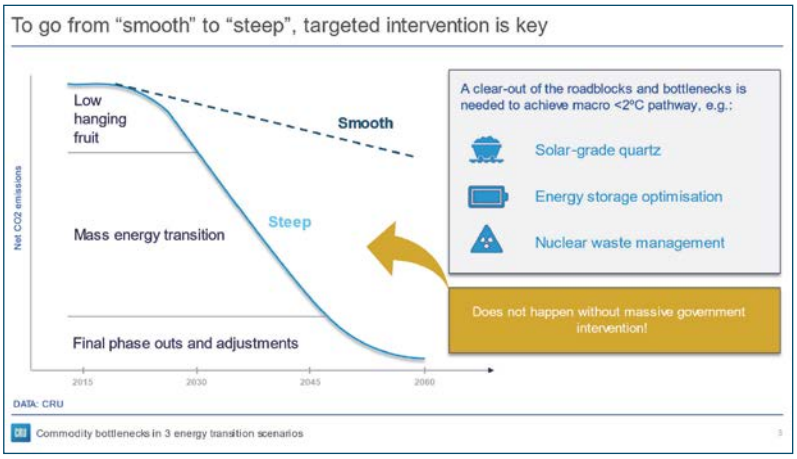
"In terms of overall decarbonisation of the world economy, one could say we are grading ever closer to a 'fair'," says Gordon. "Progress has been made, but not enough to stay on that 2°C path. For example, CRU's own emissions trend report shows that most commodities are on >3C path over the next decade. With regards to the energy transition specifically, we consider there to be three key phases and we are very much still in the first 'low-hanging fruit' phase."

(1) Low-hanging fruit – in this phase precedents are set by installing renewable energy where it is most welcome and most competitive: where the energy potential is high, the consumers nearby, and the jurisdiction enthusiastic. There are plenty of encouraging examples of this.

(2) Mass energy transition – refers to priority large-scale investment to replace and upgrade infrastructure instigated through governmental action including public / private partnerships and cooperation across borders.

(2) Final phase-outs and adjustments – these include reinforcements to the grid, and abating the sectors that are hardest to move across to low carbon.

While the global political, economic, and social ecosystem may not be receiving top grades for decarbonisation currently, significant progress is being made, concedes Gordon. Global cumulative solar photovoltaic (PV) installations will surpass 1 500 GW by the end of 2023, with 400 GW of this installed in 2023 alone – more than 50% growth vs 2022.



Copper is a critical commodity for advancing the decarbonisation agenda.

"Solar accounted for just 5% of global electricity production in 2023, but is growing rapidly," says Gordon. "China dominates global solar installations and energy production, but PV is being installed across the world at scale, in India, the Middle East, the US, Europe and elsewhere, accompanied by strong financial commitments to rolling out green electricity generation capacity. There remains considerable potential for further rollout of PV capacity, and this will need to be addressed rapidly to get close to the 2-degree scenario."

What is interesting, says Gordon, is that the regulatory commitment from governments to support renewable energy development and decarbonise industry has, to date, been mixed. Carbon pricing, for example, is becoming more common, as is the appetite in some consuming sections to pay premiums for green materials to meet consumer or financing requirements. However, carbon market developments are predominantly located in high income countries and carbon prices are still too low to incentivise the necessary shift to clean technologies. However, we expect further government action will see prices push higher over coming years.

"It is widely accepted that to decarbonise energy and industry fully and incentivise the final phase-outs and adjustments phase, a carbon price must be present. Carbon pricing is still limited in scale (in that the price does not accurately reflect the real

cost of emissions) and coverage (either sectorally or regionally).

The USA, for example, does not have a federal carbon tax whilst also being one of the world's largest emitters of CO_2. The result is an asymmetric system where businesses in regions like Europe face carbon costs on a much larger scale than elsewhere in the world. To challenge this asymmetry, regulatory levers are now being pulled to level the playing field, like the carbon border adjustment mechanism (CBAM). The signalling of CBAM coming into force has had a positive impact, encouraging other regions to consider and develop their own carbon markets.

CBAM in Europe and beyond will help to protect the goals of more climatologically ambitious regions to support their domestic industries, with its overall impact on global decarbonisation efforts ultimately depending on how the money is spent.

The appetite of industrial end users, like automakers and technology providers, to decarbonise their value chain is potentially growing at a faster rate than the regulatory environment, and is perhaps incentivised by the notable step up in government actions which has been seen

Metals and Minerals for the clean energy transition

As metals and minerals are integral to the decarbonisation agenda; governments and their institutions have identified lists of materials that are considered critical, however, the assessments for some of the minerals required vary. It is important to note that being designated "critical" is an indication of some form of failure in a market and that it should be the aspiration of participants in an industry to work together to keep commodities "core" rather than critical.

"The impact of a shortage of a particular commodity on an exporting country vs an importing country can lead to different focus and response– for instance, nickel is unlikely to be critical in Indonesia whereas it might be in Japan. CRU works with the World Materials Forum (WMF) each year to produce a criticality assessment for most of the key traded commodities."

"Market predictability is clearly the most challenging area for the critical commodities in the table. This is due to the difficulty of forecasting the rate of the energy transition and the quantity of metal that will be required in, for example, electric vehicles or energy storage facilities. This uncertainty means there is, and will continue to be, a wide spread of possible future demand scenarios."

At the moment copper, nickel, praseodymium, neodymium and tin are considered to be critical

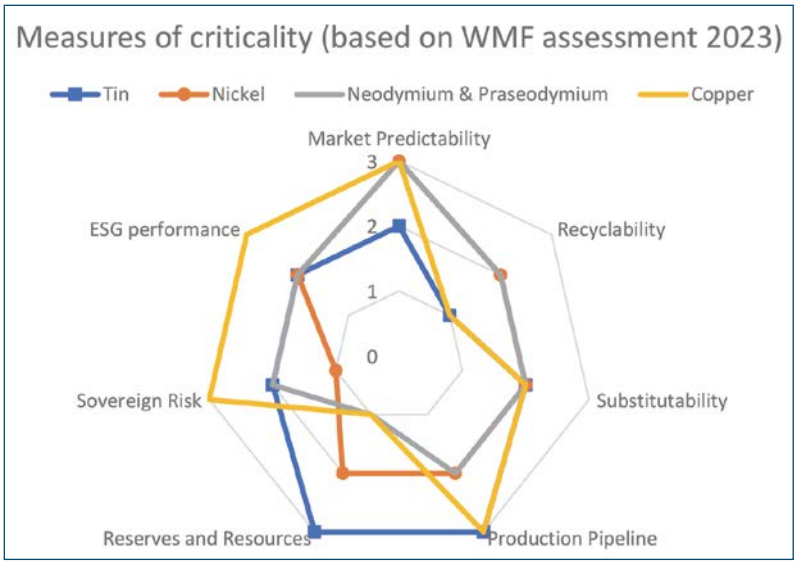
Global cumulative solar photovoltaic installations surpassed 1 500 GW at the end of 2023.

metals by WMF, with CRU noting actions on some of these commodities including:

Copper: According to Gordon, CRU has identified copper as a critical commodity for advancing the decarbonisation agenda with challenges both in forecasting demand and ramping up supply.

There is an extremely strong demand growth trajectory for copper due to the energy transition equating to roughly an addition 4.8 million tonne per year by 2033. According to Gordon, this could be moderated by thrifting and substitution (largely to Al e.g., wire and cable, radiator fins) and also by ever improved recycling. Conducting electricity requires very pure metals and recycled copper cannot yet be made sufficiently pure to be used for, if this becomes possible it would relieve some primary demand growth.

"From a supply side, we are looking at a supply gap of 8 million tonnes in 2033. To put that in perspective, that's up to 32 new world class copper



NB: Each of the different indicators is scored between 1 and 3. As such, each element has a cumulative score between 7 and 21. These 5 commodities each score >14 and are designated as "critical".

Demand in electric vehicles was accelerated by policy frameworks and social pressure incentivising EVs.

mines. Copper production in Chile, the world's largest copper producer, accounting for 27% of global output, has seen a significant decline in recent years, which was mainly attributed to lower ore grades, water restrictions and local protests."

Ore deposits gradually deplete over time. In the past 15 years, average copper grades have decreased from 0.70% to 0.58% – a 17% decline. Back in the early 1900s, global copper grades ranged between 1.5–4%, something that is now only seen in a handful of mines around the world, primarily in the Democratic Republic of Congo (DRC).

At the same time, global copper discoveries have been on the decline, with a total of 228 copper deposits discovered between 1990 and 2021, but only three new discoveries in the past five years. Between 2017 and 2021, only two major copper mines, namely the Kamoa Kakula mine in Congo and the Quellaveco mine in Peru, commenced operations.

Market predictability is clearly the most challenging area for critical commodities.

Metals and minerals are integral to the decarbonisation agenda.

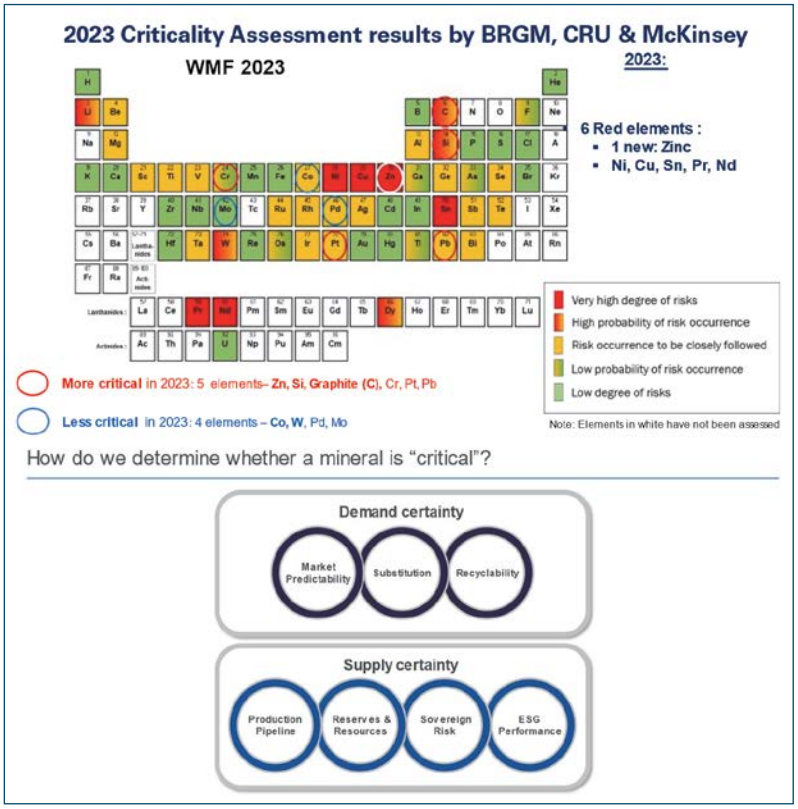
"A lack of high-quality, large-scale projects in the pipeline indicates that the rate of production growth may decelerate after 2024. Then on top of that, there are political and sovereign risks that may disrupt existing levels of supply. Moreover, there is political turmoil in Peru (protesting and blockades) which is the world's second-largest copper producer (contributing nearly 10% to global production). This disrupted approximately 20% of its copper supply in early 2023," says Gordon.

Meanwhile the world is becoming increasingly reliant on copper production from DRC and Zambia. Africa's contribution to global copper supply is expected to be 18% in 2027, up from 16% in 2023.

"Of the list of committed mine projects (8) with capacity over 100k t/y in CRU's project pipeline, South America (Chile) only contributes one. The African copper belt will have two large expansion projects in the next couple of years and Russia contributes the only greenfield mine project to reach production. We are becoming increasingly reliant on copper supply from countries that historically contain more sovereign risk," says Gordon.

Nickel and Cobalt: CRU has identified nickel as critical, but mitigation efforts should enable the market to return towards core status as has been achieved over recent years in the cobalt market moving cobalt through critical and back towards core status

Diversification in the chemistries used in batteries is reducing demand for nickel and cobalt chemicals, with the focus being on reprocessing materials from



end of use batteries back into the supply chain. Increased stainless scrap recycling will also help. From a supply point of view, new production from Indonesia and Australia etc, has been brought on stream, thereby diversifying the supply base slightly. All these actions should start to facilitate the transition of nickel back away from critical.

"The arrival of high demand for both nickel and initially cobalt chemicals for batteries has been a shock to the market. 15 years ago, cobalt was predominantly a metal market, serving superalloys and other metal applications. There had been a steadily growing demand for cobalt chemicals in Sony's Walkman portable cassette players (remember those!), laptops and phones but the volume was tiny compared to the potential needs for cars."

According to Gordon, demand in electric vehicles was also accelerated by policy frameworks and social pressure incentivising EVs, which started in the larger jurisdictions.

"The largest threat to the nickel and cobalt chemical market is deceleration in battery demand as the EV battery landscape is constantly changing. So, there is very high uncertainty about long term volume requirements."

Cobalt is used as a stabiliser in the cathode, historically allowing for greater range and durability in EVs. However, cobalt is one of the most expensive components in the cathode, which, combined with the negative publicity surrounding sourcing of cobalt from artisanal mines in the DRC, played a role in researchers developing cathode materials containing little or no cobalt content.

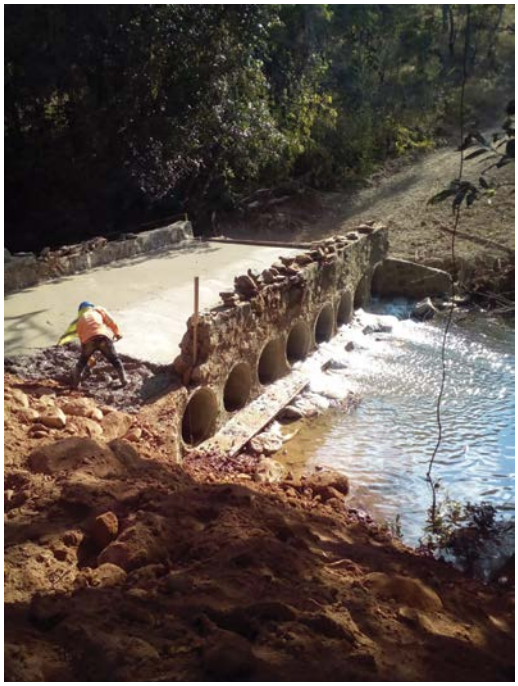
"In China, where EVs comprise ~20% of the market, cobalt-containing batteries are no longer the dominant chemistry, following the rise of LFP cathode chemistries," explains Gordon. ■

CRU's overall message:

- ❑ Criticality should be a transitory state and should focus on industry's attention on a market with a view to bringing it back to balance (core) with as little demand destruction as possible;
- ❑ Progress to a 2-degree global warming scenario will make very strong demands on many commodities and we need to plan to have the materials available if we are going to succeed;
- ❑ Future technology solutions will need to be found to manage demand, enable recycling and bring on more supply and they will likely diversify the commodity base needed. Markets will have to pay attention because some of the metals markets are very small indeed;
- ❑ Good quality data needs to flow up and down the industry value chains so that the huge investments are made in the right places at the right time.

Critical Metals on an aggressive growth path

LSE-listed Critical Metals has lofty ambitions that include an aggressive growth strategy targeting the acquisition of five brownfields mines in five different jurisdictions in the next two years. The junior miner expects to be producing a minimum of 10 000 tpm of copper ore from its flagship Molulu Project, bedding down on its drilling programme, CEO Russell Fryer tells *Modern Mining*.



Further to this, Critical Metals, which was established to acquire opportunities in the strategic metals sector, is hungry to secure a second acquisition.

Listed on the LSE on 28 September 2020 during the Covid pandemic with the odds stacked against it, the newcomer to the resources sector believes that its strategy, being cash generative soon after an acquisition in the key critical metals segment, will see it climb up the mining ranks sooner rather than later.

"Our company is focused on those metals that are required by economies for growth. If access to these minerals or metals were to be severed, the western economies would struggle. Moreover, given that Africa contains the minerals our company is looking to invest in, we remain focused on the continent. In fact, Africa compares well with Australia and North America in terms of potential value and, importantly, the ability to permit a mine is much quicker in Africa than anywhere else in the world," notes Fryer.

He adds: "Our investment criterion for a potential asset is that the asset must be cash generative within 12 months following its purchase. We are clear that we are project developers and operators, not explorers or speculators. What this means is that the financial community can estimate cash flows and profitability within 12 months of an acquisition."

According to Fryer, an operating asset or one that has been in care and maintenance, is "easy to get up and running as it requires minimum investment and effort to become operational".

Although there are "plenty of opportunities" in the critical metals market because there are several previously operated mines on sale and large mining houses remain keen to dispose of non-core assets, the challenge, concedes Fryer, is that as the minerals and metals being pursued are also on the US and Europe's critical metals list, they are also being courted by a number of industry players.

"The whole world has cottoned onto critical metals and there are an increasing number of players bidding for assets. We are seeing several news faces, in particular, companies from the Middle East entering the fray. Typically, in this space we compete

Below: Team inspecting the Molulu Project core samples.

Bridge development underway at the Molulu Project.

largely against the Chinese and Indians and, to a lesser extent, the Russians, but now, there are many more nationalities chasing the assets in the critical metals space."

Molulu Project

The cash generative Molulu Project, a medium scale copper/cobalt asset, is located in the Democratic Republic of Congo's highly prospective Katangan Copperbelt.

Critical Metals holds a 70% stake in the Molulu Project, which was mined by artisans prior to 2018 with the ore sold into the local market.

Fryer's appetite to be cash generative sees the miner "doing things a bit differently, i.e., mining while simultaneously firming up the resource."

Situated on a tenement of just 16 acres, the Molulu project, located some 98 kilometres north of Lubumbashi in the Katanga territory, about 30 kilometres northwest from the village of Malambwe, is currently being mined concurrently with the company firming up the resource. Critical Metals has two diamond drill rigs operating onsite and is waiting on the results of the drilling programme.

"In May, June and July, of 2023, we conducted IP induced polarisation and geophysics which delivered outstanding results, including identifying anomalies that were 100 metres deep and 200 metres wide. What is interesting is that the geophysics identified ore body outcrops on-surface in several areas. As such, we have an intensive drilling programme planned to verify the initial results," says Fryer, who

Team inspecting and weighing soil samples from the Molulu Project.

Site clearing and infrastructure development underway.

believes that the strike length is a minimum of three kilometres.

To better understand the size and scale of its Molulu asset Critical Metals is currently undertaking diamond drilling of the oxide and the sulphide zones.

Fryer remains upbeat, stating that the grades from the Molulu project trend between one and a half and two per cent copper, "with grades of up to 33% Cu in super high-grade sulphide ore".

Drilling taking place at the Molulu Project.

"Even though we have undertaken a limited amount of drilling, we have garnered immense interest from the market with several plant operators keen to purchase our ore. These are exceptional grades when compared to the average grades coming out of Chilean, Peruvian, or Arizona copper mines, which is around 0,8% Cu."

The company recently signalled that it is in the market to acquire a processing plant in order to process the Molulu ore into copper cathode and potentially cobalt hydroxide. Talks with several plant owners are underway and further news on the potential plant acquisition is to be announced shortly.

"This allows Critical Metals to increase its margins on the ore from the Molulu Project by being able to sell the higher value-add products that owning a processing plant produces and provides finished goods to a wider global market."

"We believe that the best way to increase shareholder value is to be in control of our own destiny. The acquisition of a processing plant will mean that we get full value for processing Molulu copper and cobalt ores, thereby ensuring superior margins."

Market outlook for copper and cobalt

Given that copper is critical to the electrification process, Fryer anticipates a steady increase in demand for copper and cobalt going forward.

However, the supply of copper remains constrained as copper mines in South and North America face declining copper head grades and higher costs of production.

"Cobalt is a mineral used in high temperature applications. If more nuclear power plants are required to help the world move away from burning coal to generate electricity, much more cobalt will be needed as cobalt is a key metal used in

the building of nuclear power plants. Although cobalt demand/supply is close to equilibrium and even possibly in surplus supply at the moment, we believe that cobalt prices will return to their higher price levels by 2025 due to the greater global demand."

Critical Metals portfolio

With its eye on an array of critical metals, the company, which has adopted an aggressive acquisition strategy in the next two years, is focused on acquiring antimony, caesium, copper, cobalt, fluorspar, niobium, tin, tungsten, tantalum, titanium and vanadium assets.

The sectors that require critical metals include aerospace/aircraft, telecommunications, computing, defence, hand held communication devices, infrastructure, and the space industry (satellites). According to Fryer, without a consistent supply of critical metals, these sectors would suffer.

"Ideally, we are seeking polymetallic deposits. However, we understand that some metals, such as vanadium, are prevalent only in particular areas, such as in South Africa and Zimbabwe. In fact, there are only a handful of countries that have the minerals we are seeking."

According to Fryer, investing in a range of minerals and metals talks to its risk diversification strategy as its variety of assets targets de-risking the company geopolitically and geographically.

"This mineral risk diversification strategy means we will be able to rely on several product lines, which will enable us to smooth out the EBITA over time, such that we don't experience spikes and troughs. This is an issue when one is a single mineral company," explains Fryer.

In fact, Critical Metals continues its search for key assets and, according to Fryer, is in discussions with owners of mines that produce tantalum, tungsten, niobium, more cobalt, and rare earths.

"These talks continue apace, and we hope to make an announcement in the near future on one of the minerals."

With Critical Minerals keen to play across several commodities, does the miner have the right skills set to manage such a broad portfolio?

According to Fryer, the Critical Minerals team is equipped with highly skilled, well experienced miners and engineers some of whom have worked in key destinations in Africa operating mines in Central African Republic, Ghana, Guinea, Republic of Congo, DRC, Rwanda, Zimbabwe, South Africa and Namibia.

"Aside from key personnel, we employ 49 local Congolese, many of whom are graduates from the University of Lubumbashi with qualifications in engineering and geology. Moreover, when we acquire a brownfields operation, we invariably inherit an existing experienced team and, while our mantra is to hire locals, we also seek experienced personnel to bring in fresh ideas on how to improve our operations and processes."

Team viewing a presentation onsite.

ESG

Underpinned by its focus of uplifting its host community, Critical Metals has engaged the local community in several initiatives, including a brick-making endeavour. The company subsequently purchased the bricks produced for the development of its campsite, and for use in the development of a local school.

"We have built a school for the local community, which had an initial intake of between 30-40 students. In time we will expand the school, adding more classrooms."

The company has also engaged villagers in a gardening project, providing seeds for a vegetable garden. Critical Metals purchases the vegetables to feed workers at its operation – the initiative advances the establishment of a micro economic zone in the area.

"In September 2022, we had no employees and today, we employ 51 people. We will employ more people as we expand the mine."

Speaking of operating in the DRC, Fryer notes that the DRC has, based on the practices of corruption and child labour, been given a bad rap. However, he is adamant that as more Western companies endeavour to enforce best practice mining methods and take care of host community needs, this perception of mining practices in the DRC will change over time.

"Critical Metals' way of operation follows in the footsteps of mining leaders such as Barrick Gold's Mark Bristow and Ivanhoe's Robert Friedland, and we aim to prove that a company from the Western world can be successful in implementing good corporate and ESG practices," concludes Fryer. ■

How Power Metal Resources is crystallising value

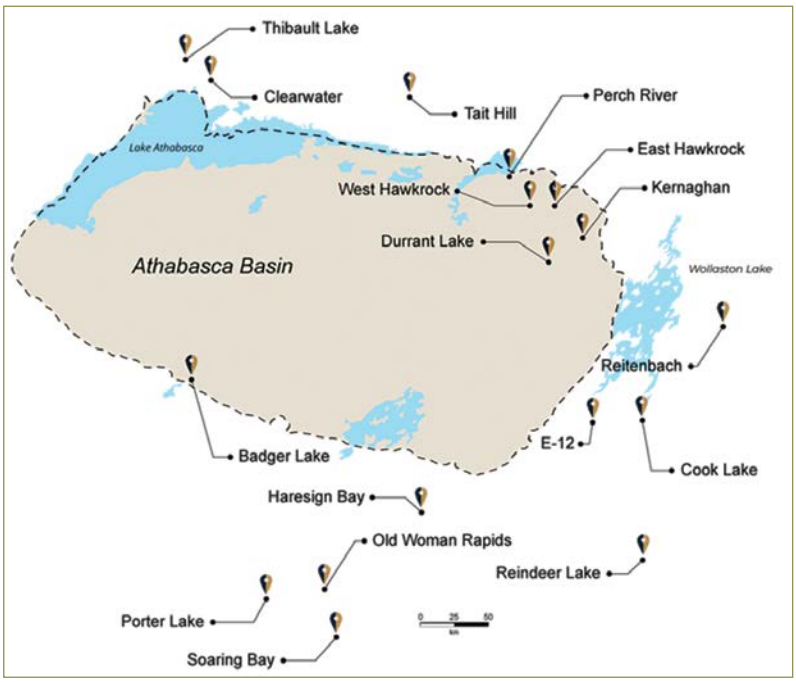
Although well-understood in North America, the project incubator approach to mining investment is still quite new to the UK. With almost all London-listed mining companies planning to generate value through the exploration, development, and production routes, the obvious downside is that it leaves investors in each company exposed to one management team and, often, one asset. Project incubator companies take a different approach. Investors in a project incubation company have their risk reduced and their chances of returns increased as the incubator builds its portfolio of assets, each with the potential to deliver significant value for shareholders.

The project incubator approach seeks to monetise value at the development stage. In this model, early-stage mining assets in jurisdictions with areas of proven mineralisation are identified by skilled teams and, if they are believed to have value, are acquired at a cost that reflects their underdeveloped status.

In this way, the project incubator company builds a portfolio of assets. Investment can then be highly targeted, with the company undertaking methodical and cost-effective exploration studies to prove, and subsequently increase, each asset's value.

Once high-quality drill results have been established, the project incubator has three options; spin the asset out into an IPO, with the parent company retaining a stake in the listed business; put it into a joint venture partnership to help carry it through production; or sell it outright.

Compared to the traditional approach of junior mining companies, these early-stage exploration projects provide an attractive entry point for investors while presenting long-term returns as value is built through the development of the asset – and ultimately sustained following their disposal – as shareholders retain a stake without bearing the entirety of the costs.



Power Metal Resources has the largest London listed uranium focused asset.

Fieldwork on the Tait Hill Project, Northern Saskatchewan.

AIM-listed Power Metal Resources, an energy, precious and strategic metals exploration company with assets in North America, Africa, and Australia, is one of the few London-listed companies to employ this business model, and benefits from its largely underutilised potential.

The current mining trend follows investment into minerals that power the green energy transition, particularly uranium, lithium, nickel, and copper. Power Metal's commodity portfolio covers the breadth of these, as well as other well-valued minerals, such as gold, whose price usually rises at times of high inflation or global turmoil.

The incubator model is implemented across the Power Metal portfolio, and, through it, the company offers diversified investment opportunities for assets with promising or proven value. This strategy compelled financial expert Charles Archer to identify POW as one of his top long-term FTSE AIM picks. It is also why Rick Rule, one of the most prominent resources investors in North America, has bought a significant stake in the company, becoming a 4.5 per cent shareholder.

POW's asset portfolio

A successful uranium bull, Rick Rule's investment into Power Metal demonstrates his confidence in the incubator model's propensity for generating value from the company's uranium portfolio. Uranium is currently the subject of huge market interest; it has experienced a recent price rise, driven by predictions of a supply deficit as early as 2024-2026 as governments shift their focus towards nuclear energy in a bid to achieve net zero targets.

Crucially, Power Metal's uranium projects are located in and around the Athabasca Basin in Saskatchewan, Canada; the company wholly-owns 17 properties across more than 1000 square kilometres of the basin, which ranks as the second most attractive area in the world for mining, according to

across its portfolio

the Fraser Institute. With excellent infrastructure in an extremely safe jurisdiction, the basin is home to the two largest high-grade uranium deposits in the world, and mining giants Cameco and Denison have had huge success nearby. Archer states that 'even without POW's other projects covering nine other metals, the company is undervalued based on its uranium assets alone'.

Initial exploration at a number of portfolio projects has demonstrated their value; trenching at Thibault Lake, for example, returned results of 1.09 per cent of U_3O_8 (uranite – uranium ore) over 10.7 metres, with grab samples up to 3.54 per cent U_3O_8 at Cook Lake, and soil samples up to 13 200 ppb of uranium at Tait Hill. In addition, hyperspectral analysis conducted at Perch River has identified several helium anomalies, which could be indicative of significant buried uranium mineralisation.

The company is planning a partial spin-out of this portfolio via a planned IPO, Uranium Energy Exploration (or UEE). This transaction is advancing, and a further market update is expected shortly.

In addition to uranium, Power Metal has access to other critical minerals, notably nickel, as part of its diversified portfolio. As a transition metal, nickel possesses properties that ensure it will play a pivotal role in the journey to a greener future. Nickel is now subject to a rising demand that mirrors the growth in demand for EVs and energy storage applications – both of which require nickel-containing lithium-ion batteries.

Power Metal's Molopo Farms Complex, located in Botswana and covering a vast 1 500 square kilometres, is well-placed to capitalise on this demand. Exploration at the project has revealed highly promising results, confirming geological attributes that strongly indicate a significant nickel deposit as found in other ultramafic belts across the world. The company is looking to commence drilling to confirm the large-scale deposit and crystallise this value for shareholders.

Power Metal's technical team reviewing recent drilled core at the Molopo Farms Complex Project.

Golden Metal Resources' Pilot Mountain Project hosts what is believed to be the largest undeveloped tungsten deposit on U.S. soil.

Power Metal operates a second asset in Botswana – the 100 per cent-owned Tati Greenstone Belt project. Principally a gold asset, it also has a potential for nickel, with geochemical soil sampling assay results confirming two significant gold-in-soil geochemical anomalies and continuity along an 8 km gold trend.

Proof of the model via succesful ipos

AIM-listed Golden Metal Resources has gold and tungsten exploration assets in Nevada that were formerly wholly owned by Power Metal Resources. Power Metal now holds a 62.01 per cent shareholding in Golden Metal Resources following its successful IPO on London's AIM market in May 2023. Power Metal's retained stake in its former projects allows it to continue to generate value and reap the benefits of future exploration, development, and production without bearing the full risk or costs, enabling POW shareholders access to upside with significantly lower risk exposure.

First Development Resources, an early-stage copper, gold, and transition metal exploration company based in Western Australia and the Northern Territory, has been fully prepared for an IPO listing which, subject to a return to normalised market conditions and final regulatory approvals, can be undertaken at short notice, further validating the efficacy of the model.

The project generator strategy, by its very nature, enables Power Metal to be highly flexible with a diverse commodity portfolio, crystallising the value of each asset when market conditions are optimal, and ensuring that the company's success isn't wholly tied to the market performance of one particular metal. As the mining industry finds itself in the new role of purveyor and driver of the energy transition, the fast-paced nature of global innovation perhaps invites the necessity for new approaches. For Power Metal Resources, it has been an approach worth taking. ■

WEG Africa's bespoke solutions deliver energy

While the mining sector pursues ambitious goals on its journey to a lower carbon future, energy security remains an indispensable pillar of project viability – from concept and planning stages through to operational success.

Alastair Gerrard, WEG Africa's Energy Systems Executive.

Joe Martins, WEG Africa's Sector Specialist in Mining and Industrial Business Development.

Electrical reticulation platforms with motors in operation.

"Without a secure and reliable supply of energy, any mining operation will find it difficult to prosper," says Alastair Gerrard, WEG Africa's Energy Systems Executive. "Right from the outset, whether a new mine or an expansion or optimisation project, mining companies need a high level of confidence in the security of energy supply to accurately assess project viability and return on investment."

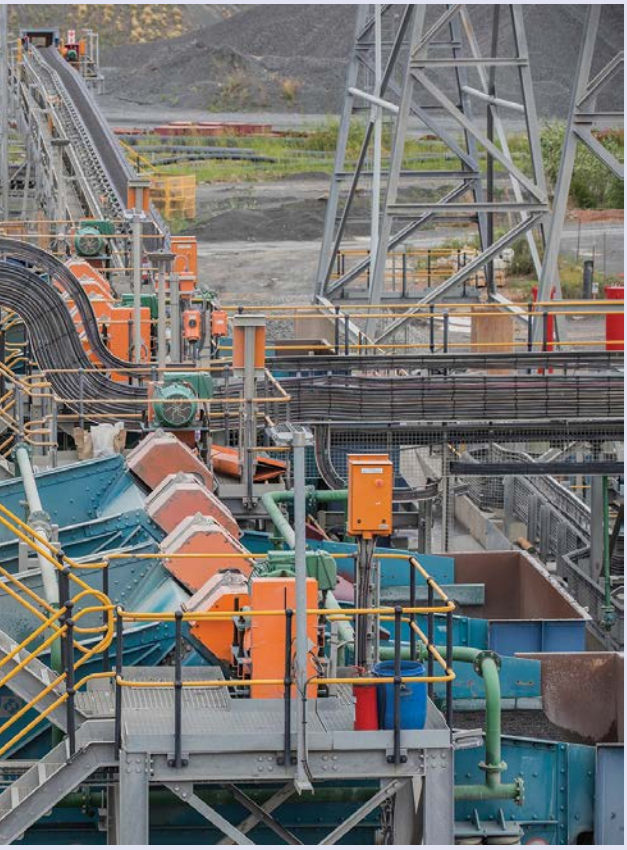
Gerrard argues that it is not just a question of sourcing or generating the necessary power, but also the efficient utilisation of the available supply to ensure cost effectiveness over the longer term. Mining operations can be compromised if energy usage is not optimised throughout their lifecycles, due to the risk of exceeding available supply constraints or budgets.

"With rising energy costs in many regions of Africa as well as often unreliable grid systems, mines are increasingly needing to take a holistic view of how they source and use their energy," he explains. "This is made easier when they collaborate with a partner who has a depth of electrical and energy project experience combined with a wide spectrum of technical solutions and products."

Low voltage variable speed drives in a motor control centre.

He points to the value of bespoke power solutions in mining, where mines source energy from a centralised plant using one energy source or a combination of sources in the form of a hybrid energy system. Where the local utility is providing a base load of supply, for instance, it may be necessary to integrate standby solutions to facilitate continuous operations. The power distribution on site, he emphasises, needs to be carefully planned to serve the specific needs of each aspect of the operation.

security plus efficiency for mines



WEG medium voltage variable speed drives operating in a mine.

"There is also a significant drive towards renewable energy, as mining companies work to reduce their carbon footprint in line with global sustainability targets," he says. "Mines are making more use of solar energy and battery storage technologies to reduce their dependence on national utilities."

There is even strong interest in wind energy, a space in which WEG Africa participates through its wind turbine technology. Strategies to source energy from wind power projects are usually associated with wheeling arrangements, as the windy locations where wind farms are viable are seldom close to mines.

"We can already see instances in the market today where mines purchase renewable energy from independent power producers, benefiting from the cost per kilowatt hour and the carbon credits derived from that source," he says.

He emphasises that the variability of renewable energy – with sunshine and wind not being constant – makes it vital that every mine develops a solution that suits its specific needs and conditions. Battery storage is also being considered as this technology evolves.

WEG substation distributing power.

WEG transformer distributing power into a mine's operations.

"Every solution must be developed to balance the capital cost with achieving long term savings," says Gerrard. "While energy can now be provided from a growing range of options – from diesel generation to batteries – every additional source of energy added to the system will demand more investment."

Joe Martins, WEG Africa's Sector Specialist in Mining and Industrial Business Development, highlights the advantage of WEG Africa's wide range of state-of-the-art solutions. From standby generator solutions to variable speed drives (VSDs) and electric motors, the company works with mining customers and project houses to find a cost-effective balance for energy security and lower carbon emissions.

"As much as there is a focus in most African countries on generating sufficient energy for mining operations, we also help customers consider the demand side of their business," says Martins. "This process requires in-depth measurement and understanding of where and how energy costs can be reduced."

Overhead cables running power into a mine.

There is a capital cost to every new technology, but an accurate prediction of power consumption over time paves the way for more informed decisions. The result is that mines can control their expenditure in line with their strategic objectives in terms of operating costs and sustainable performance.

"Our high efficiency WEG electric motors and VSDs, for instance, can have a direct impact on the diesel consumption of a remote mine that relies on gensets," he explains. "By managing energy demand optimally, a mine may be able to reduce the number of on-site genset units required – saving on the capital cost as well as the maintenance and diesel volumes required."

Where a single large processing plant at a mining operation might include 500 electric motors, significant energy can be saved by applying the right technology. Payback periods when upgrading to WEG premium efficiency motors can be less than a year, while the addition of WEG VSDs can improve the payback period to as little as two to three months.

For existing energy operations, WEG Africa also conducts energy audits that help customers transition to lower running costs. This is achieved by gradually replacing older technology motors and drives with more efficient modern products and solutions.

"WEG Africa is one of the few companies with such a wide and diverse range of products and solutions – to offer customers a one-stop shop," says Martins. "With our Value-Added Resellers strategically located in mining areas around Africa, we ensure customers achieve a cost-effective solution that prioritises both energy security and efficiency." ■

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SA mine gets world-first planetary gearbox customisation from SEW-EURODRIVE

When a mining operation in South Africa's Mpumalanga province found that one of its planetary gearboxes on a high-torque conveyor was failing, it called SEW-EURODRIVE for a solution. Leveraging the latest intelligent technology, the solution is a pioneering innovation providing a cost-effective replacement that will ensure reliable performance. Greg Lewis, Business Development Manager Projects for SEW-EURODRIVE, says the application at the mine demanded a customised and carefully considered approach.

Greg Lewis, Business Development Manager Projects for SEW-EURODRIVE.

"The application itself was in the plant where a steel-belt transfer conveyor moves extremely slowly – with the 4 metre diameter head pulley turning just one revolution every 25 minutes," says Lewis. "Two planetary gearboxes drive the pulley, with one on each side, and the mine had been facing the pending failure of one of these, which needed to be replaced."

With the original installer of that gearbox unavailable, the mine came directly to SEW EURODRIVE, he explains. The drive specialist already has a good relationship with the mine and has provided most of the power transmission items on the site.

"One of the key challenges was that the mine required only the one gearbox to be replaced at that stage," Lewis says. "It is important to understand that in this application the two gearboxes must run together at the same speed and torque. Any variation in the speeds is not an option."

SEW-EURODRIVE was able to match one of its units very closely with the unit being replaced, but there was still a very slight difference in the ratios. This led to a 0,001 difference in the revolutions per minute.

"While this may sound insignificant, it makes a difference when the gearbox torque is a couple of hundred thousand Nm's," he says. "At this high torque level, any misalignment or desynchronisation can affect the foundation and potentially cause catastrophic failure."

With the expert input of one of SEW-EURODRIVE's in-house mechatronics engineers, the solution uses the company's MOVI-C technology in a way that has never been done before. The new planetary gearbox supplied by the company will match the torque of the original gearbox – ensuring that they turn at precisely the same speed. The solution involves removing the existing base plate and providing a new, drop-in solution with an SEW-EURODRIVE planetary gearbox – designed to match the current infrastructure in the plant.

SEW-EURODRIVE leveraged its extensive experience to provide a world first planetary gearbox customisation to a local mine.

"The technology on our planetary gearbox constantly changes the torque to match the existing equipment," he said. To prove this intelligent design, SEW-EURODRIVE built a small-scale working mock-up for the customer to witness. Together with its own customised base-plate, the 'model' arrangement was taken to site and demonstrated to the customer's satisfaction.

The mock-up was so successful that SEW-EURODRIVE colleagues around the world asked to see it, so they could learn from the achievement. It was also a showpiece at the company's exhibition stand at the 2022 Electra Mining Africa event just outside Johannesburg.

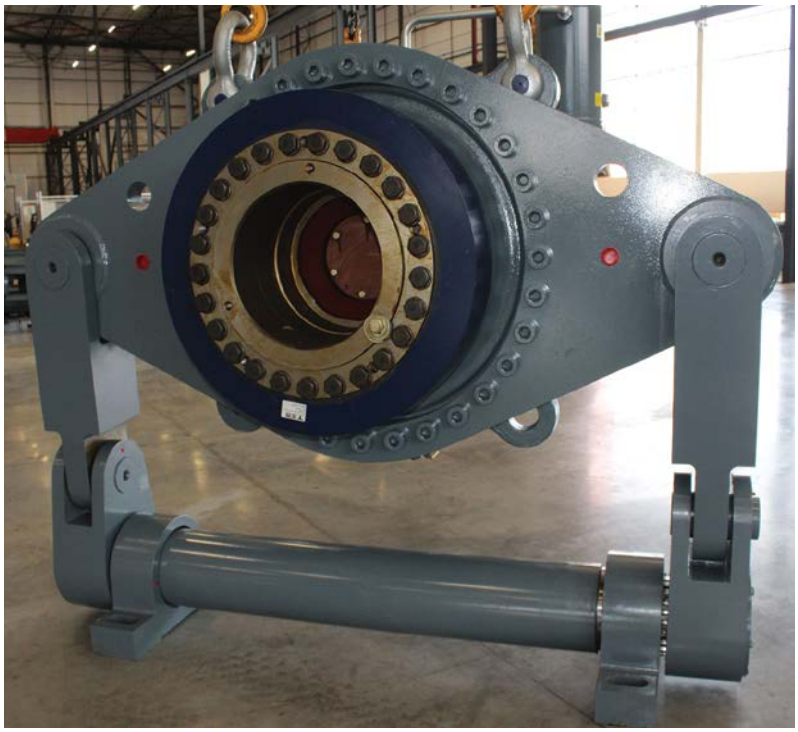
Lewis explains that the project was

designed and delivered by SEW-EURODRIVE as a complete solution – from the fully customisable panels to the electronics and the installation of the gearbox. The installed unit is an XP planetary gearbox with shrink disk, with a primary X-series gearbox as a further reduction unit to achieve the required ratio.

"We engineered the steel base to fit onto the existing concrete foundation without any modifications required from the customer's side," he says. The significance of the project is enhanced by the considerable scale of its elements. At about 1,7 m in height – and measuring 2,1 m wide and long – the gearbox itself is sizeable, weighing about 6 t. Moving at 0,07 rpm, it moves the steel belt that carries a fine cake of raw chrome material.

"There are not many companies who can produce a solution to meet these very slow revolutions," Lewis says. "Being among those who can is a source of great pride for us. This project has been particularly rewarding as it demonstrates our capability in matching another footprint, eliminating the need for the customer to break down existing structures and build new ones."

Lewis highlights the assurance that SEW-EURODRIVE can give the mine in terms of support, as the company has long been an established presence in the sector and the country. The customer was so happy with this creative solution that its other plants may well be looking at similar replacements in the coming years. ■



A South African mine has received a world first planetary gearbox customisation from SEW-EURODRIVE.

Murray & Roberts Cementation mock-up is a quantum leap for mechanised mine training

An extensive new 'mock-up' facility at Murray & Roberts Cementation's Bentley Park training complex now allows a realistic, but safe and cost-effective learning environment for operators and supervisors of mechanised mining equipment.

This addition to the Murray & Roberts Training Academy (MRTA) near Carletonville in Gauteng closely resembles a real underground, hard rock, mechanised bord-and-pillar mining workplace. It has been equipped with essential primary or first-line equipment such as drill rigs and bolters, as well as secondary equipment for loading, hauling and dumping blasted rock. Adding to the realistic environment are ventilation systems, support structures and blasting systems.

"With the look, feel and even the smells and sounds of an underground operation, this large 1,125 m^2 facility is as close to a real mine as you can get," explains Murray & Roberts Cementation's Education, Training and Development Executive, Tony Pretorius. "This is important, as it means all the learners' sensory perceptions are responding to the new work environment – so they can start developing the necessary muscle memory for safe and efficient performance."

Developed over a number of years, the facility represents an investment of over R35 million, according to Pretorius, including the range of dedicated mechanised mining equipment. He highlights that the mock-up facility forms an important part of MRTA's workplace integrated learning component of its extended reality training framework. Learners coming out of the academy's simulated and virtual environment need to transition into the actual workplace, and the mock-up facility fills this role.

"We built this facility to further improve the way we foster practical skills acquisition," he explains.

Murray & Roberts Cementation has unveiled an extensive new mock-up facility at its Bentley Park training complex. From left, Danie Van der Westhuizen, Roderick Swartbooi, Joseph Bahumi and Eugene Pienaar.

"Operators need to put their theoretical learning into practice, but the pressurised production environment is often not the ideal place to accomplish this."

The challenge with operators learning in a producing mine, he continues, is that this could have a cost impact if production is negatively affected. There are also safety issues to consider.

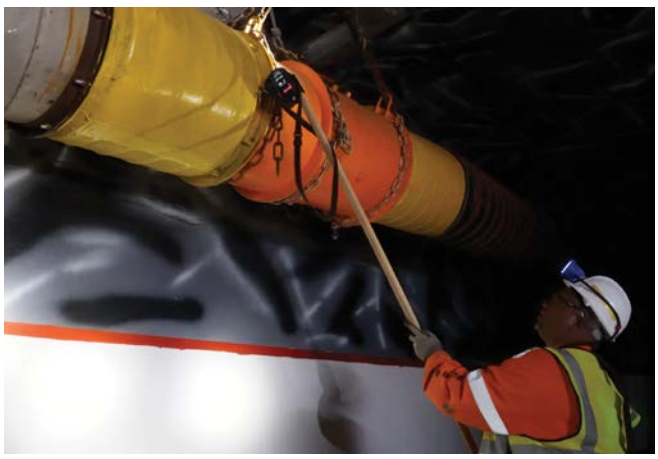
Lower cost learning

"In contrast, our new facility provides a safe and low-cost learning environment which still delivers the sensory experience that allows learners to develop the muscle memory they require for the real-life workplace," he says. "This can be done without hindering production while learning takes place."

He notes that the pressure of production often means that – even when a training initiative is created in an underground mine – the necessary

Right: Adding to the realistic environment are ventilation systems, support structures and blasting systems.

Below: The mock-up facility closely resembles a real underground hard rock mechanised bord-and-pillar mining workplace.



Above: The training process covers a range of key activities allowing learners to experience the waiting place and safe declaration.

Left: The new mock-up facility forms an important part of the company's workplace integrated learning component of its extended reality training framework.

equipment is not always available. Where the production side of the operation needs another machine due to a breakdown, for instance, it can disrupt the training effort.

To facilitate the learning process in the mock-up facility, a suite of infra-red cameras is installed to monitor the actions of learners in a 360-degree supervised environment. These and other communication systems are connected to a remote-control room from which trainers can observe and interact with learners. They can also record the training and assessment sessions, to be used later for review purposes.

"This ensures that the safety aspects of the exercises are closely controlled, through real-time interaction and guidance from supervisors and trainers," he says.

Key activities

The training process under these realistic conditions covers a range of key activities in the mechanised mining value chain. Learners experience the waiting places, the entry exam, safe declaration, support installation and cleaning of blasted rock. They conduct marking, drilling and indexing of the face wall, charging up with inert explosives and simulating the blast with a centralised blasting system.

"The services like water and ventilation must be installed by learners, as well as bolting," says Pretorius. "They go on to break rock, and to haul and dump this rock with the dedicated equipment."

With health and safety as a priority, there is a state-of-the-art emergency response application where MRTA simulates underground fires using light and smoke machines. This gives learners valuable insights into the practicalities of responding to underground hazards. They are required, for instance, to follow life-lines to a refuge chamber, as they would have to do in an actual emergency scenario.

Quantum leap

"The nature and scale of what we have developed here is really a quantum leap in achieving a true underground experience for learners in the mechanised mining field," he says.

For machine operators who have completed training in MRTA's simulators, the new facility exposes them to time-bound activities. This further tests their capability for production demands, and helps to evaluate their competence.

"In addition to preparing operators, it provides us with a valuable platform for supervisor training," he says.

Supervisors are required to plan, lead, organise and control people, equipment, material and services within a given time – and this facility gives them the opportunity to do this within a realistic cycle of work. They can engage, coach and give direction to others under the same conditions as would apply in the workplace.

Situational leadership

Referring back to the way that MRTA's extended reality framework follows the situational leadership model, Pretorius emphasises how the new facilities allow learners to participate further in developing their skill sets. This is vital to entrenching their areas of applied competence.

The facility was built to further improve practical skills acquisition.

"What is so valuable about this experience is that it sensitises learners not just to the conditions in which they must apply their skills, but also to the hazards and risks they must navigate in each activity," he says. "This drives home the safety precautions that they are taught, as they can sense the environment first-hand and understand why the measures are in place."

This 'reflexive competence' can often not be as well imparted through simulated or virtual reality conditions – which are not fully immersive.

"At some point in the training process, it is necessary to evaluate the learner's actual ability to operate a machine in an authentic environment," he says. "Here, you can accurately gauge whether they are capable of operating equipment safety and responsibly, with a proficiency that will meet the production targets of the mine."

He concludes that MRTA can now achieve this key objective, with a safe and well-resourced facility that is likely to lead the way in Africa. ■

Khomotso Duiker, Business Line Manager for Underground Drills at Sandvik Mining and Rock Solutions.

Future of drilling has arrived, from intelligent to battery electric

Underground drilling technology is moving apace to deliver not only greater accuracy and productivity but also more detailed operating data, alongside the opportunity for safer drilling practice by remote control.

With its wide range of underground drill rigs and bolters, Sandvik Mining and Rock Solutions is seeing customers moving steadily towards the concept of intelligent drilling – with some looking at the battery electric models for the future. According to Khomotso Duiker, Business Line Manager for Underground Drills at Sandvik Mining and Rock Solutions, the Sandvik 400 Series of larger drilling machines – as well as the Sandvik 300 Series – now includes models with intelligent features.

Sandvik's recycling initiative has been extracting over six tonnes of carbide material annually.

"Using our iSURE® Intelligent Sandvik Underground Rock Excavation software, users can run automated drilling cycles," says Duiker. "In Southern Africa, certain of our diamond mining customers are already using our DD422i development drill rigs, as well as our DL422i and DL432i top hammer longhole drill rigs."

He highlights that the integration of intelligent technology is an exciting but demanding phase in which Sandvik Mining and Rock Solutions works closely with customers to train operators and support the change management process. Making a key contribution here are Sandvik's Product Masters, who are experts in the equipment being rolled out.

"They are the 'best of the best', and we deploy them to facilitate the introduction of first-in-country machines, and to support commissioning of new machines," he says. "Our in-house training department is then able to conduct any orientation and training that the customer requires for itsoperators and maintenance teams."

iSURE® allows users to run automated drilling cycles.

He emphasises how important it is for operators to understand the full benefit of the automated functions, which include higher levels of safety and better productivity. The levels of automation can vary from one machine to the whole fleet and can extend to full automation that can complete an entire development end without operator intervention.

A valuable innovation in the intelligent machine models is their ability to download the mine's drill plan for the development ends, he points out, and to execute the drilling process exactly according to that plan. This improves the profile drilled, which enables a more effective blast that avoids any underbreak or overbreak.

"The tele-remote function allows the drill to be controlled from surface, as long as there is the required on-site network infrastructure," says Duiker.

Right: Sandvik's Digital Driller™ allows operators to learn anywhere, anytime.

Below: Data collected from the drill rig improves the work cycle and the drill and blast excavation process.

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Toro™ TH545i
Safer. Stronger. Smarter.

Experience the future of underground mining with Sandvik's Toro™ TH545i, a revolutionary intelligent mining truck designed to redefine efficiency and productivity. Engineered with cutting-edge technology, this powerhouse machine is poised to transform the way you extract resources from the depths of the Earth.

The Sandvik DD422iE drill offers intelligent, electric drilling.

"To ensure that customers are fully supported when they want to move in this direction, we have a Business Line Manager in charge of automation."

Monitoring how the equipment is performing has become critical to mines' efficiency. The Knowledge Box™ on Sandvik drill rigs collects a range of data such as advance speed, penetration rate, cycle times and other key performance indicators. He notes that iSURE® data collected from the drill rig can be used to improve the work cycle, and to enhance the drill and blast excavation process.

"This improves excavation, production operations and planning through targeted reports and analysis," he explains. "Part of the process of introducing and optimising our latest machines does, of course, rely on the mine's communication infrastructure – as data connectivity is crucial; however, most mines are already addressing and implementing this requirement."

The performance of the rig can be tracked from a control room, where any signs of under-performance or impending failures can be picked up in real time. Mines can use this data to tackle areas that could improve productivity and uptime, whether in relation to operator behaviour or the machine's condition.

At the cutting edge of drilling technology is Sandvik's battery electric option, which is already available in the DD422iE model. Duiker explains that this innovation responds directly to the growing focus in the mining sector on sustainability and decarbonisation.

"We know that our customers' sustainability plans are developing all the time, and they are looking for opportunities to drive this important strategic agenda," he says. The benefits are likely to be felt most keenly in greenfield operations that can be designed with battery technology in mind, but wherever battery electric options are applied there can be significant reductions in underground ventilation costs.

Through its own sustainability initiatives, Sandvik is passing on benefits to customers who are also committed to the principle of a circular economy. In South Africa, Sandvik Mining and Rock Solutions supports two SMMEs (Small Medium Micro Enterprises) to extract the carbide buttons on its drill bits while boosting entrepreneurship and creating jobs. After years of technological development on specialised equipment for automated recycling, the company has facilitated the removal of the tungsten carbide buttons from the drill bits before sending them abroad for recycling. Making tools from recycled carbide requires 70 percent less energy and emits 64 percent less carbon dioxide. ■

Komatsu launches underground hard rock equipment in Africa

According to a report by the International Energy Agency (IEA), reaching the clean energy goals of the Paris Agreement by 2040 will require a quadrupling of mineral resources. An even faster transition, to hit net zero globally by 2050, will require six times more mineral inputs in 2040 than today. *(The Role of Critical Minerals in Clean Energy Transition, SIEA, 2021).*

The move to a cleaner energy system requires an exponential increase in the scale of sustainable mining operations and the extraction of minerals, including copper, silver, nickel, manganese, cobalt, chromium, molybdenum, zinc, and rare earths.

This surge says Komatsu General Manager: Mining Operations, Herman Hollhummer, represents an opportunity for Africa and Komatsu.

"The journey to net zero by 2050 cannot be reached at the expense of other environmental, social and governance considerations, which means that when assessing new projects, mining companies will increasingly look towards underground methods to mitigate their impacts on the natural environment and host communities," comments Hollhummer.

Complete mining solution

Komatsu, traditionally a manufacturer of opencast mining equipment, expanded its portfolio to include underground soft rock mining with its acquisition of Joy Global in 2017, and is now introducing underground hard rock mining equipment to Africa. It views sub-surface hard rock extraction on the continent as an integral part of its sustainable strategy to offer customers a complete mining solution, in both the surface and underground mining environments.

"We're committed to playing our part in helping the world find solutions to achieve the energy transition it needs and look forward to bringing customers in the underground hard rock mining sector the same quality of equipment, service and support associated with surface mining equipment in the Komatsu range," says Hollhummer.

With its entry into hard rock mining on the continent, Komatsu will help the African mining industry contribute to the world's urgent demand for minerals and the global shift to renewables.

"We see Mining Indaba, the largest minerals event on the continent, as the ideal stage on which to introduce new and existing customers to products that have achieved success in other mining territories, but are yet to be debuted in Africa," he adds.

Komatsu WX07 loader.

The frontrunners in Komatsu's hard rock range

The first products to be introduced to the African market will debut at the African Mining Indaba 2024. They are the Komatsu WXO7 loader, the Komatsu single boom ZJ21 jumbo drill and the Komatsu ZB21 medium class bolter.

The innovative drill and bolter products share a common platform, extending from rear skirt to outer boom, and enable operators to easily convert drill to bolter and vice versa. This high degree of commonality extends to control systems and operator platforms.

The introduction of these Komatsu underground hard rock products will offer sustainable mining solutions in the future. ■

Komatsu ZJ21 jumbo drill and Komatsu ZB21 bolter.

Biodiversity focus in EIA demands specialist skill set

SRK Consulting applies its ecological and botanical expertise beyond EIAs, contributing to efforts in controlling alien plants and optimising biodiversity around the country.

Rob Gardiner, partner and principal environmental scientist at SRK Consulting.

With environmental impact assessment (EIA) regulations and protocols becoming increasingly prescriptive in terms of biodiversity protection, project developers need highly specialised scientific input to develop accurate proposals.

"The transformation of land that occurs when projects are developed on greenfield sites invariably means the loss of natural vegetation," said Rob Gardiner, partner and principal environmental scientist at SRK Consulting. "As biodiversity becomes a greater focus, we have seen regulated requirements getting more complex and demanding."

Gardiner explained that there is particular concern from the regulator when the natural vegetation in question is located in a Critical Biodiversity Area (CBA). This has also raised the demand for specialists with both ecological and botanical expertise to accurately describe the prevailing conditions, and to recommend what actions must follow.

"The EIA protocols are compulsory and cover a number of themes including terrestrial (land-based) biodiversity or ecology, fauna and flora," said Clayton Weatherall-Thomas, a plant ecologist at SRK Consulting. "If an EIA report does not meet the exacting demands of these protocols, it can be rejected by the regulator; it is therefore important that the environmental assessment practitioner (EAP) and the investigating specialist are very familiar with what is required."

Expertise

The report must be clear on exactly what the impact of the development will be on any sensitive features of the area. The screening tool may also require that the EIA considers specific species, in which case the EAP may have to involve a dedicated specialist who has sufficient prior knowledge. In terms of the 2020 protocols, the specialist also has to be registered with the South African Council for Natural Scientific Professions (SACNASP).

"The assessment of biodiversity has become more detailed," said Weatherall-Thomas. "You can't just claim to be an expert in everything – the authorities will not accept that. It also means that scientists must spend considerable time on site to gather data by conducting a population census of the various species of plants and animal, he notes.

Weatherall-Thomas further notes that specialists must be able to identify the threatened species, understand the ecological requirements for its continuing persistence on the site, and determine the relevant mitigation measures that will allow the development to proceed without residual impacts on the species.

Due diligence

This volume of work on biodiversity inevitably raises the cost of EIAs, which can impact especially on smaller projects by less well-resourced companies or even farmers. The strict protocols can also mean that certain land is deemed unavailable for development; the specified buffer areas around a rare plant

species, for example, may leave insufficient space for a commercially viable application.

"It is therefore increasingly important for buyers to conduct thorough environmental due diligence studies before land is purchased for development, which saves them time and money," said Gardiner. "For consulting engineers, we need that expertise in-house or as part of our network of contracted specialists who can competently answer the critical questions on those species and ecosystems."

In terms of South Africa's regulatory landscape, CBAs are irreplaceable areas where there are threatened species or ecosystems that need to be kept in their natural or 'near natural' state. A related category is that of Ecological Support Areas, which are supporting zones whose ecological value lies in helping to prevent degradation of CBAs and formal Protected Areas.

The impact on natural vegetation in Critical Biodiversity Areas heightens regulatory concerns, leading to a surge in demand for specialists.

CBA zoning

Weatherall-Thomas highlighted that South Africa is a signatory to a range of international biodiversity protocols that bind government to certain conservation targets. This means that CBAs should be taken into consideration as seriously as any zoning regulations.

"It also deserves re-emphasising that any vegetation that has not been disturbed for more than 10 years is considered indigenous – and therefore triggers an EIA," he explained. "If an area is over 300 m2 then a CBA is likely to require a terrestrial biodiversity assessment."

He noted that enforcement might vary between provinces, but there is a strong focus in provinces like the Eastern Cape and Western Cape – and parts of KwaZulu-Natal and the Northern Cape – where biodiversity levels are particularly high. While it is mainly national and provincial departments that implement these regulations, CBAs have also been incorporated into Spatial Development Frameworks for municipalities – who also have an important role to play in preserving biodiversity.

Field work

The current scale at which CBAs are mapped may still be fairly coarse in some regions of SA, so he stressed that desktop studies were insufficient to determine whether projects could be considered in these areas.

"In our experience, on-site field work is necessary to identify exactly where threatened or endangered species are to be found within a CBA," he said. "CBAs often include areas that are less sensitive, and where development could be possible – but it does require detailed on-the-ground studies by a qualified person to establish this."

It is also valuable for the specialist to have experience as an EAP, he said, as they then understand what the project EAP requires and what management recommendations can be reasonably implemented.

Gardiner added that, in addition to EIAs with their demanding biodiversity elements, SRK Consulting has also applied its ecological and botanical skill set to efforts to control alien plants. The company has been involved in alien invasive management plans around the country, helping to create conducive conditions for optimising biodiversity.

Booyco Electronics helps SA lead the way in PDS technology

Following South Africa's implementation of the Mine Health and Safety regulation focused on trackless mobile machinery in December 2022, Booyco Electronics, an original equipment manufacturer specialising in mine safety equipment, has witnessed a surge in demand for its Proximity Detection Systems (PDS) and Collision Prevention Systems (CPS). These systems offer crucial vehicle-to-pedestrian and vehicle-to-vehicle detection capabilities.

Anton Lourens, CEO of Booyco Electronics, notes that South Africa's mining industry has been proactive in adopting technologies and innovative products to foster behavioural changes in pursuit of safety.

With stricter mine safety legislation, the company is focused on ensuring compliance with South African proximity detection and collision prevention systems requirements. Lourens says the Minerals Council South Africa played a pivotal role in understanding and mediating around this regulation and identified concerns related to equipment supply, installation, and maintenance. In addition to implementation of PDS systems, some mining houses are keen to take ownership of product maintenance, requiring comprehensive training for their personnel, and this creates further opportunities for Booyco Electronics to expand its workforce.

"Significantly, South Africa was the first country to regulate PDS deployment in mining, attracting interest and engagement not only locally but also internationally," Lourens says. Booyco Electronics, in business for over 17 years, has evolved its product line to meet diverse operational needs. ■

Proximity Detection Systems (PDS) and Collision Prevention Systems (CPS) offer crucial vehicle-to-pedestrian and vehicle-to-vehicle detection capabilities.

Booyco Electronics has witnessed a surge in demand for its PDS and CPS since the regulation's promulgation.

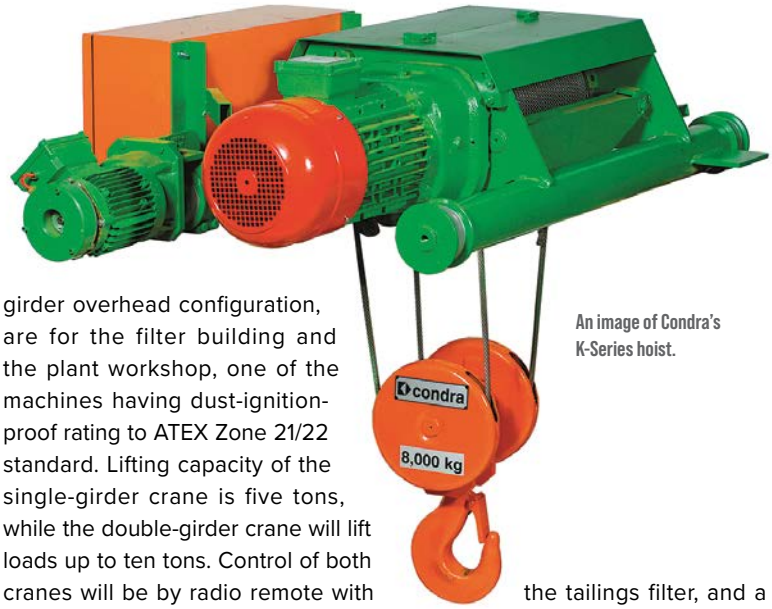
Condra Cranes supplies equipment to Platreef PGM

Crane manufacturer, Condra Cranes, recently delivered electric hoists, two overhead cranes and a number of chain blocks to Platreef Mine, part of the Platreef PGM project near Mokopane in Limpopo Province, South Africa. The lifting equipment will be used for machinery maintenance work at various points across the mine site. Under development since 2020 by Ivanplats (Canada-based Ivanhoe Mines' South African subsidiary), Platreef comprises two vertical production shafts, a ventilation shaft, a concentrator and associated supporting infrastructure.

Mine production, scheduled to begin this year, will tap a 26-metre-thick flat ore body extending over several kilometres to deliver 12 megatons per annum over a lifespan of three decades, positioning Platreef among the largest platinum group metals (PGM) mines in the world.

The mine's overhead cranes and hoists are currently being installed. Condra was selected by consulting engineers Dowding Reynard and Associates to manufacture the machines.

The electric cranes, of single-girder and double-girder overhead configuration, are for the filter building and the plant workshop, one of the machines having dust-ignition-proof rating to ATEX Zone 21/22 standard. Lifting capacity of the single-girder crane is five tons, while the double-girder crane will lift loads up to ten tons. Control of both cranes will be by radio remote with manual pendant back-up.



An image of Condra's K-Series hoist.

Two hoists accompanied delivery of the cranes: a short-headroom hoist for the tailings filter, and a K-Series hoist for the mill feed conveyor. Both will be used for maintenance work. ■

Kendal Ash Disposal Facility nears completion

Pierre van Vuuren, Concor Project Manager.

The expansion of the Kendal Ash Disposal Facility is more than 80% complete.

The Kendal Ash Disposal Facility expansion project, responsible for the storage of ash produced by Kendal Power Station until 2023, has successfully reached over 80% completion. With a projected completion date set for March 2024, this intricate venture is rapidly approaching its final stages.

Led by joint venture partners Concor and Lubocon Civils, the project accelerated its construction schedule over the winter, capitalising on the dry conditions. Concor's Project Manager, Pierre Jansen van Vuuren, highlights the stellar productivity in June and July when the teams committed to continuous 24-hour shifts to gain momentum before the onset of the rainy season.

Spanning a massive area of 2.5 km by 3 km, the project's components comprise the new 65-hectare Ash Disposal Facility (ADF), two dams each for both clean and polluted water storage, silt traps, an expansive 16 km V-drain system, a significant stream diversion and access road construction.

While the stream diversion and the majority of the 14 km access roads have been completed, the principal focus now revolves around the ADF and the basins.

The in-situ material is clay soil, which calls for a specific construction methodology. Selected stockpiled excavated materials are being used in a double-layered low permeability clay for base protection, topped with carefully selected river sand to prevent liner damage. Cutting-edge drainage and leachate collection systems are incorporated to manage water flow efficiently, emphasising sustainability with dirty water reuse for dust suppression and other ADF activities.

Concor's innovative approach in basin construction employs a patented PVC concrete formwork system, boosting efficiency by accelerating the casting panel process. This technique is not only time saving but also labour efficient. ■

HDGASA's Executive Director, Robin Clarke.

HDGASA says training pivotal to ensure project excellence and industry success

The Hot Dip Galvanizers Association Southern Africa (HDGASA), a not-for-profit trade association, plays a pivotal, lynchpin role in liaising across the entire value chain as it seeks to develop the market for hot dip galvanizing as the preferred and cost-effective corrosion control technology. In line with this key objective, training and skills development for the sector are among the most crucial aspects of the association's multi-focused strategy, according to Executive Director, Robin Clarke. "We wear many hats: industry advocate, custodian and champion, interacting with many different role players throughout the steel and galvanizing value chains, and acting as a lynchpin, linking different role players. A large degree of our success in doing so can be attributed to training," Clarke states.

Notwithstanding an excellent industry track record, the Association has faced substantial challenges in the past few years: for example, the struggles of the South African steel industry, coupled with the economic and industry-wide impacts of the global Covid-19 pandemic.

"We have seen tremendous contraction in the steel and steel-related industries during this time. Steel consumption has shrunk, which has impacted on hot dip galvanizing locally. Unfortunately, many marginal plants did not survive. However – now that the steel and galvanizing sectors have come through this period of contraction and consolidation – we are starting to see encouraging signs, including 'green shoots' of growth. One of the most important has been an increased demand for – and investment in – training," Clarke points out. ■

Metso to deliver key crushing equipment for Simandou iron ore mine

Metso's Nordberg cone crushers.

Equipment supplier, Metso has received an order from Winning Consortium Simandou (WCS) for the supply of key crushing equipment for its concentrator plant at Simandou Iron Ore Blocks 1 and 2 in the Republic of Guinea. The value of the order exceeds EUR 10 million.

Metso's scope of delivery consists of 16 Nordberg® HP900™ secondary and tertiary cone crushers. Metso's Nordberg® HP Series has over 10 000 installations worldwide in the aggregate and mining industries.

"We are pleased to have been chosen as the supplier of the state-of-the-art crushing equipment for the Simandou iron project by WCS. We will leverage our global knowledge and resources to support the success of this project," says Xun Fang, Head of Metso's Minerals Sales in Greater China.

Winning Consortium Simandou was set up by the founders of SMB Winning Consortium, namely Winning International Group from Singapore, China Hongqiao, and UMS Guinea. WCS won the public tender to develop Simandou Iron Ore Blocks 1 and 2 in November 2019 and signed a Base Convention agreement with the Guinean Government in June 2020. ■

Invincible Valves on a growth path

Established in 1982, Invincible Valves has since grown to become a medium-sized enterprise located in Knights, Germiston. The company prides itself on service excellence and flexibility as it strives to enhance its customers' bottom lines.

Its 6 500m^2 facility in Knights is made up of 4 500m^2 under roof, which includes stores and a workshop. The facility is fully equipped to offer a one-stop resource for valves and ancillary equipment, which the company transports globally.

As an approved supplier to all major industries within South Africa, Invincible Valves maintains expertise across a broad spectrum of industries and applications with a wide range of products. The company remains Africa's largest stockist of Saunders & Insamcor products and also offers a comprehensive range of local and imported valves and accessories for the mining, petrochemical, power generation, water, sewerage and general industries. Invincible Valves has agents in all major centres around the country and services all corners of the globe. It offers an in-house rubber lining service for valves, pipes, fittings and vessels which is used by many of the country's major valve manufacturers. In addition, the company offers complete service, repair and valve reconditioning services for all types of valves. ■

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