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MINING IN CENTRAL AFRICA THE DRC'S MOVERS AND THE SHAKERS





↑ FRONT COVER

A keen understanding of customer needs, a strong focus on research and development (R&D) and an ongoing drive to create better reagent solutions. These are the tenets that have seen **Axis House** cement its position as a leading reagent specialist for the past 20 years. **P4**

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DRC Always and forever evolving

elcome, ladies and gentlemen – *Mining Review Africa* is proud to present our third edition of 2021.

Here's what you can expect from this issue: A 'killer' DRC edition that ranges from finance and investment, through projects at the forefront of excellence, to on-trend topics such as the evolution of the artisanal mining sector and the steps being undertaken to formalise it. All as the global world looks to the DRC for responsibly sourced cobalt for the EV boom.

But wait – there's more. You will also find the latest on commodity pricing and forecasting for base metals and a very in-depth analysis of the mining industry's relationship with water.

I'm taking the opportunity now however to explore the DRC in a little more depth: this country is undeniably in the spotlight – again – and this time for two reasons.

The first reason follows a cabinet reshuffle and the appointment of a new, female mining minister – Madame Antoinette N'Samba Kalambayi. Known as a civil society activist, and a French novelist on the topic, little else is known about her. Could a woman bring a different style to working with the local industry? What are her political views on the mining industry at large and will she bring stability to the sector? What will her views be on the Mining Code? The industry will be looking to their new minister for guidance, let's hope she is ready.

The second reason, which is of particular interest to me, is the DRC's formalisation of the artisanal mining sector. I wrote about this last year when Chemaf and Trafigura aligned to do just this at the Mutoshi mine site. More than a year down the line, the project has been successful, lessons have been learnt and a government-owned organisation called *Entreprise Générale* Cobalt (EGC) has been established to oversee the expansion of the initiative that was effectively introduced at Mutoshi.

Why is this so important? The world needs cobalt to drive its green economy ambitions and this metal holds one of the vital keys to achieving this. The DRC is home to the largest cobalt resources, of significant grade, and security of supply from electric vehicle manufacturers for example has become key. But, and this is a big but, the global world wants responsibly sourced cobalt. The DRC has responded – positively. Let's hope EGC delivers on this front. It would be fantastic if the country – recognised as being extremely difficult to operate in – could show the rest of Africa what is truly possible.

Madame Antoinette N'Samba Kalambayi, *Entreprise Générale du Cobalt* – it's time to step up to the plate! MRA



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Roads & Motorways

Axis House Reagent expert celebrates 20 years

A keen understanding of customer needs, a strong focus on research and development (R&D) and an ongoing drive to create better reagent solutions. These are the tenets that have seen **Axis House** cement its position as a leading reagent specialist for the past 20 years. Now, the company is set to increase its global footprint. **GERARD PETER** finds out more from **BERNARD OOSTENDORP**, technical and laboratory manager, and **GARETH HEYNES**, sales manager: Africa.

ostendorp starts by saying that the primary reason for the company's immense success is its customercentric approach with a keen focus on addressing specific customer needs. It is with this in mind that Axis House places a lot of emphasis on R&D to deal with the issues that the global mining sector is facing. "We deal with customers on a one-on-one basis, asking questions such as: What are the processing issues you are facing? How can we solve your problem? Are you making the targeted product quality? How can we be more economical in what we offer?"

Meanwhile, on the commercial side, Heynes avers that the success of the company over the past 20 years is the ability to adapt to any situation. "We have always been an agile organisation where decisions are made quickly and implemented just as quickly. We are able to adapt our service delivery to ensure that our customers' requirements are serviced and their expectations are exceeded," he says.

Over the years, Axis House has developed a footprint throughout Australia and Africa with the southern and central regions of the African continent being key focus areas where it has built an established route to market. Moreover, the company is currently also expanding its global footprint and has established offices in Turkey, which provides access to markets in Europe and the Middle East.

While the company is keen to expand its international presence further,

Heynes points out that Africa remains an integral part of the company's future aspirations. "A lot of the technologies used by Axis House were developed on African ore and implemented in African mines. We are growing our global footprint on the back of exceptional service to our multinational companies in Africa who now want to use our technology in other regions," he states.

Looking ahead

While the company places a lot of emphasis on developing new reagent technologies, Oostendorp points out that the adaptation of new technology is a process that is perfected in the laboratory before it can be implemented on site. "It all comes down to how it was developed and tested, how convincing the data is and whether it can be upscaled to plant scale," he adds.

With two decades of success behind it, what does the future hold for Axis House? Oostendorp explains that 18 months ago, the company decided to focus its efforts on expanding its existing flocculant offering by establishing a dedicated division which specialises in solid-liquid separation. The flocculant and coagulant range now covers most mineral processes, ranging from flotation, hydrometallurgical processes and the alumina process. "We have also expanded our range to cover everything related to solid liquid separation. This is where we have seen a big spike in terms of success," he adds. "If you look at Africa, in the DRC and Zambia, we have done extensive testing in our labs and on site. We have

We want Axis House to be known as a provider of safer and better reagent alternatives,

BERNARD OOSTENDORP

axis

several plant trials scheduled for the remainder of the year. On the flocculant side, this is definitely a big success story for us."

mage: 123rf.com

Meanwhile, on the collector's side, Axis House has done a lot of copper flotation development work. "If you look at the more general issue that our customers have in terms of copper flotation, it is the sulphide gangue that is recovered with the copper. A lot of our focus has been on how we can selectively float copper from an iron sulphide. Our new collector range is currently being tested in Zambia and Turkey and is already seeing some success," states Oostendorp.

Another focus for Axis House is looking at separation techniques for polymetallic ores. Already, the company has made big strides in Turkey where it is currently running plant trials. It is also implementing this new technology in South Africa and South America. The final outcome product will be implemented across the spectrum.

Furthermore, Axis House is working towards creating safer alternatives for, amongst others, the depression of pyrite and the elimination of cyanide in the leaching and flotation processes. "We want Axis House to be known as a provider of safer and better reagent alternatives," says Oostendorp.

In addition, Oostendorp points out that the DRC remains a key area of focus for the company. "Historically, Axis House had a large footprint in terms of oxide flotation in the country. We would like to consider ourselves as the first point of contact when it comes to oxide flotation reagents. This is a big focus going forward and is part of our shortterm goal to implement oxide flotation reagents to aid mining in the rest of Africa as well as globally – be it copper, cobalt, zinc or lead oxides."

Company culture drives success

Furthermore, Heynes states that Axis House is keenly focussed on R&D in order that it can move away from commodities to develop specialised reagents for a wide range of ore types. "Moreover, we keep to global trends and in Africa water is a key issue and this is where we have focused the development of our reagents," he adds.

axishouse

decisions are made quickly and

implemented just as quickly,

We have always been an agile organisation where

GARETH HEYNES

Closer to home, Heynes adds that it is a culture of inclusivity that has borne success for the company. "We are implementing a culture where more people outside of the commercial and technical departments are starting to understand the products and applications and this goes a long way to developing internal skills and creating a shared skill set," he concludes. MRA

PARTNERSHIP TAKES MINERALS PROCESSING TO A NEW LEVEL

In February, Axis House announced a partnership with engineering firm Maelgwyn Mineral Services. According to Oostendorp, the partnership will benefit clients with Maelgywn on the engineering side offering new technology in terms of flotation cells and high-shear conditioners while Axis House will be bringing its chemical expertise to the partnership.

Each company has its own areas of expertise. Maelgywn is efficient in plant and equipment design and the mechanical aspect of minerals processing while Axis House will specialise in chemistry and reagents.

Both companies are already collaborating on projects with a focus on fines fraction particles flotation because a lot of minerals losses are incurred because they are sitting in the fines and are not recoverable by conventional flotation technologies. "Now, with the use of Maelgwyn's technology, it will be possible to recover these fines while Axis House will boost the efficiency of fines flotation. The partnership will cover all metal types from copper and gold to PGMs and chromites," explains Oostendorp.

In addition, the two companies will work on R&D to better understand why certain chemical reagents behave in a certain way and its effect on the hydrodynamics of the system. "Based on this information, we can develop better chemistry and improve on equipment design that can make the process more efficient," explains Oostendorp.

Artisanal cobalt mining in the DRC

Formalisation needs and the steps already in play

Never before in the history of the Democratic Republic of Congo (DRC) have the country's cobalt resources been as attractive as they are right now. The metal is required to feed the electric vehicle (EV) boom, and the 'fight' to secure resources – transparently, sustainably and responsibly – to feed this growing demand is gaining momentum, writes **LAURA CORNISH**.

ll eyes are on the DRC. The country already accounts for more than 63% of global cobalt production and the potential to increase this number is significant. Car manufacturers, metal traders and miners themselves all have an active interest in ensuring a longterm cobalt supply pipeline that will guarantee business sustainability and profitability.

Sustainability however is the theme that must be considered on a much larger scale. Today, mining companies across the globe are facing the reality of what building and operating sustainable operations truly means. For the DRC, and its future potential, this means dealing with the country's biggest issues – human rights, poverty and inequality. The world simply won't accept cobalt that compromises on any of these areas, which would be breaking the fundamental ESG (environment, social and governance) principles – principles that have quickly become part of the mining industry's core business drivers.

What does this mean in practice?

To a large extent, the DRC's sustainable future depends on the use, management and formalisation of the artisanal and small-scale mining (ASM) sector – which currently accounts for about 20%





of the country's total cobalt supply, and it could account for more.

"In light of the rising demand for cobalt, the DRC's unparalleled cobalt resources and its reliance on the cobalt mining industry, solutions to mitigate the human rights risks in the Congolese supply chain need to be developed," says Dorothée Baumann-Pauly, a professor at Geneva University's School of Economics and Management and director of the Geneva Center for Business and Human Rights, the first human rights centre at a business school in Europe.

Baumann-Pauly started to take an active interest in the DRC and its ASM cobalt sector back in 2019 and having visited the country produced a white paper in September, supported and copyrighted by the World Economic Forum, titled *Making Mining Safe and* *Fair: Artisanal cobalt extraction in the Democratic Republic of the Congo.*

Prepared in collaboration with the Geneva Center for Business and Human Rights at Geneva University's School of Economics and Management, and New York University's Stern Center for Business and Human Rights, this paper is an independent expert assessment based on the author's review of cobalt-producing mines in the DRC. The goal of the assessment was to identify actions that could eliminate violations of human rights and the use of child labour in sourcing cobalt in the DRC. These findings were intended to inform future dialogue on human rights and child labour issues associated with ASM in the DRC, including consultations being led by the Global Battery Alliance (a public-private collaboration platform of 70 organisations founded in 2017 to help establish a sustainable battery value chain).

The essence of Baumann-Pauly's research findings pinpointed that the formalisation of ASM practices is an essential step to address the widespread human rights problems that are prevalent today at Congolese mining sites. The jobs and income created on formalised ASM sites can also help to reduce extreme poverty, which is a root cause of child labour.

Formalisation of ASMs can produce a number of social and economic benefits for local communities, the author states, and these may include:

- creating stable employment for adults, which will reduce the need for extra income from child labour and provide funds for school fees;
- ensuring safer working conditions and reducing the number of accidents through capacity- and skills-building training for miners;



"

The standards must respond to industry needs and address the very specific human rights and environmental impacts of each different operational site,

DOROTHÉE BAUMANN-PAULY



"

EGC's production phase will cover the mining of cobalt ores by ASMs from artisanal mining areas, their transit to trading centres and their subsequent processing into cobalt hydroxide in local plants,

JEAN-DOMINIQUE TAKIS

- achieving higher productivity levels and generating higher income for miners as a result of better organised operations;
- 4) promoting female employment and respect for women across a range of mining tasks;
- 5) improving the health of miners and community members;
- 6) creating new business opportunities in response to higher output levels and higher demand for goods and services; and
- 7) ensuring effective and transparent representation of miners' labour rights through the formation of cooperatives that are empowered to negotiate prices.

"Of equal importance, formalisation will also require the development of industry standards, performance metrics and an implementation system that includes routine monitoring and evaluation of mining operations to ensure compliance with these standards. The standards must respond to industry needs and address the very specific human rights and environmental impacts of each different operational site. Regulatory agencies, industry associations and multinational companies have all publicly recognised the validity of the ASM sector as an important revenue generator for impoverished communities," Baumann-Pauly emphasises.

TWO KEY AREAS OF PROGRESS ALREADY ACHIEVED: 1. Mutoshi leads the way

The Mutoshi formalisation project was started in February 2018, initiated by metals trader Trafigura. Chemaf, the mining operating company, agreed to the project provided that Trafigura would support its implementation. Trafigura appointed Pact, a non-profit organisation, to help implement workplace standards and to work alongside SAEMAPE, the government's ASM supervision body.

Pact consulted with five local mining cooperatives that the government proposed for the Mutoshi site. The local cooperatives are vital to the success of these formalisation projects. In this largely informal context, they provide a consolidated institutional contact point for the mining companies and help to support the implementation of agreed standards.

COMIAKOL, the cooperative working at Mutoshi, is registered with regional and national government agencies. Having operated in the region for more than 30 years, it has strong links to the local community and, together with Chemaf, it has developed its own management structures.

Collectively, the companies registered more than 5 000 miners on site, provided them with the necessary PPE and

operating protocols and the site has since then performed exceptionally well.

Baumann-Pauly notes the existence of a second site intended to pilot test the formalisation of ASMs. "The Kasulo project started prior to Mutoshi in a concession controlled by CDM, a mining company and a subsidiary of Huayou Cobalt based in the DRC. While this site required some of the same procedures as Mutoshi, its implementation was different – for example, there is no enforced requirement for PPE and the site allows for tunnels up to 30m deep, which have much higher safety risks than open pits."

"Mutoshi however is an excellent demonstration indicative that ASM formalisation is a realistic achievement for the greater DRC," she continues.

2. Entreprise Générale du Cobalt officially launched

On 31 March 2021, the DRC government, through its wholly owned mining company Gécamines, announced the formal launch of Entreprise Générale du Cobalt (EGC).

Established in November 2019, hopefully influenced partly by Baumann-Pauly's report, EGC's mandate is to support the commercialisation of responsibly sourced artisanal cobalt. Further to this, the company has also published its *Responsible Sourcing Standards* [https://www.egcobalt-rdc.com/app/ uploads/2021/03/20210326-EGC-



EGC Responsible Sourcing Standard



Responsible-Sourcing-Standards-English.pdf) to define the operational principles that EGC will require to support the establishment of safe and strictly controlled artisanal cobalt mining zones. The essence of the organisation and its standards supports Baumann-Pauly's white paper objectives in full.

EGC will work alongside the DRC's Agency for Regulation and Control of Strategic Mineral Substance Markets (ARECOMS) to formalise the ASM cobalt supply chain with a primary focus to preserve and protect respect for human rights, safety, and environmental standards. The EGC Standard has been developed by an EGC Technical Committee, which states that it has been built upon global best practice and is concurrent with DRC legislation.

As part of EGC's formalisation strategy, it is responsible for purchasing

all domestically produced ASM cobalt ore, prior to processing and/or transformation and marketing. "EGC's production phase will cover the mining of cobalt ores by ASMs from artisanal mining areas, their transit to trading centres and their subsequent processing into cobalt hydroxide in local plants. This phase, which involves a large number of stakeholders, requires the execution of the contractual activities with the subcontractors in charge of operational support and the effective implementation of various activities on the sites," outlines Jean-Dominique Takis, the MD of EGC.

For additional support for the marketing, EGC has entered into a trading agreement with Trafigura, who will support EGC and its partners for the development of controls and traceability associated with ASM cobalt production. Trafigura will further help in identifying industrial

TRUE MOTIVATION

Through the institutions Baumann-Pauly works for, her aim is to advance human rights in corporate practice. Her applied research is focused on embedding human rights in organisations and developing business models that enable profits and human rights principles to coexist. She also teaches business and human rights and co-edited the first textbook on Business and Human Rights (Routledge 2016). In 2016, she co-founded a business school network to integrate human rights in business education as well as the BHR Young Researchers Summit for emerging scholars. She earned her PhD in Economics (summa cum laude) at the University of Zurich in 2010 while working for the Fair Labour Association, a multistakeholder initiative with the mission to improve labour rights in global supply chains.

Having done a lot of work in the clothing industry on child labour, Baumann-Pauly was eager to explore the DRC's cobalt sector. "Child labour issues in the clothing industry are quickly resolved, but the culprits often re-establish facilities elsewhere and so this problem just repeats itself. The DRC's cobalt resources however are fixed and so the problem only needs to be rectified once."

buyers for the cobalt sold by EGC. The partnership also includes financing for the creation of strictly controlled ASM mining zones, the financing of ore excavated by the artisanal miners and additional costs related to ensuring the transparent and traceable delivery of cobalt hydroxide.

Through its strong partnerships with several government institutions in more than 40 countries, PACT will also support continuous improvement against the EGC Responsible Sourcing Standard.

NICHOLSON QUOTES THE NUMBERS

- 15 million EVs are forecast to be produced in 2025 and as many as 24 million in 2030.
- The development of 5G handsets requires 20% more cobalt.

"70% of all new cobalt supply will originate from the DRC and ASM supply will and must form a significant part of this. With the right controls in place, volumes will recover for ASM activity and will fill the deficit."

EGC is currently making arrangements for the development of its first site at Kasulo, which Dominique Takis notes has been compromised in terms of existing standards. "We will be investing in the site to understand its geology and implement the correct mining approach for our ASM. With this work complete, we hope to start cobalt hydroxide production in the coming months."

The MD further notes that EGC has already identified its second site – the Tondo region – which is situated about 2 800 km north of Kinshasa.

Measuring success

Baumann-Pauly's report was produced independently, and without any bias – its objective is to inform and provide guidance on how to reconcile sustainability and human rights without compromising on profits. ctivity and "The journey to secure clean energy must be equally as clean as the end destination and this is my hope and ultimate objective and I hope that the EGC's standards will fulfil this requirement without compromise."

There are many stakeholders involved and a number of institutions and associations that were seeking clarity on this topic, including the Global Battery Alliance and its Cobalt Action Partnership, which is an initiative governed by an independent steering committee with balanced representation from the private sector, civil society, and governments. "Are these bodies all aligned in terms of the standards?" Baumann-Pauly questions. Considering the DRC ministry is a member of the partnership, it seems positive. James Nicholson, head of corporate responsibility at Trafigura,



notes that the EGC standards are "indeed complementary to the Global Battery Alliance".

"EGC's mission is to ensure that artisanal and small-scale cobalt production is undertaken in accordance with defined standards to increase the economic attractiveness of the DRC internationally, and to ensure that Congolese citizens benefit from the wealth of their environment. The goal of these standards is to ensure decent working conditions and to eliminate the major social, ethical, and environmental risks that have historically affected artisanal cobalt production in the DRC," notes His Excellency Mr Bene M'Poko, ambassador of the DRC to South Africa. MRA

DRC MINING WEEK ONLINE

Before gathering in Lubumbashi in October, and to reach a wider audience that may not be able to meet in person, the *DRC Mining Week* community will gather online on 14-15 June 2021 for a two-day online event, combining live-streamed and pre-recorded sessions, roundtable discussions and targeted networking through an innovative AI powered virtual platform.

The event will feature key players in the sector and is expected to host more than 1 500 attendees. It will use the opportunity to cover hot topics, including new mining technologies, commodity outlooks, infrastructure, law, and the wider implications of the global disruption caused by the COVID-19 pandemic.

One of the key themes to be discussed will be transparency of responsibly sourced materials in the DRC, particularly for the cobalt sector, and will include some key stakeholders speaking during the sessions.

Registration is now open on the Mine.it Africa Platform (on Swapcard) ahead of *DRC Mining Week* online.





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What impact has it had on emerging juniors in the country?

The Democratic Republic of Congo (DRC) is home to massive resource endowment yet the mining sector remains underdeveloped. To date, only a handful of mines have been developed and operated by large-scale miners. But are there still opportunities to grow this industry further and also encourage junior mining companies to operate in the country? **RICHARD JANSEN VAN VUUREN** reports.

RC Mining Week, in collaboration with Mining Review Africa and Africa Mining Forum, recently hosted a webinar titled: Emerging junior miners in the DRC - a new wave of investment needed. The panel comprised Boris Kamstra, Director: Pangea Group and Andrew Bell, Chairman: Red Rock Resources, both of whom have considerable experience when it comes to mining in the DRC.

Kamstra kicked off the discussion by providing a background to Pangea's interests in the country which began firstly through Metorex, then Alphamin Resources and now Pangea. "We have always believed in the DRC's mineral wealth and the economic potential this holds for the country."

However, the DRC's previous Mining Code ensured a safer entry point to the market for international investors. Since the adoption of the new Mining Code, Kamstra opined that the government has done little to assuage investor concern since the revisions were announced.

Bell highlighted the challenges faced by junior miners such as the interpretation of policy and legislation penned in French which when converted to English, is often open to interpretation. However, he added that limitations such as a language barrier are not unique to Francophone Africa. "This is evident by the number of established mining companies in English speaking regions of Canada for example," he added.

Bell also stated that the rise in copper, gold and cobalt royalties in the DRC bodes well for investment in the mining sector through effective communication with the government.

Exploration drilling at Red Rock Resources' three copper/cobalt exploration permits in Katanga is imminent and the company is aiming to examine drilling results in Q3 2021. "We have already established ventures with local companies in the country. One of which is the Luanshimba project," stated Bell.

The Luanshimba project is a permis de recherches (exploration permit), held 80% by Red Rock and 20% by a local partner. The region is located in the Copperbelt in the south of the DRC, 65 km from Lubumbashi and near the Zambian border.

The tenement is situated along a disrupted anticline with highly prospective undifferentiated Roan sediments draping off a nearby basement dome, similar to some other productive copper deposits in the immediate area.

An initial programme undertaken in 2018 identified two open-ended areas strongly anomalous for copper and cobalt. "We obtained very promising results from our initial exploration in a favourable geological setting, suggesting the presence of underlying copper and cobalt mineralisation," explained Bell. The second phase will include some geological mapping, pitting and trenching and geophysics. A controlled and modular programme will enable us to test hypotheses and step up activity quickly if justified."

Bell explained that the project has been self-funded but as the company progresses to more advanced stages of exploration, it will look to mobilise more money. "We will do this by either using some of our internal resources or by raising specific funding for the project, either by taking in partners, selling some of our projects or getting funding from the market. We are lucky in having existing income sources that support our basic costs.

"It is important that you have the right local partners. Yes, in any partnership, the expectations are different for each party but we need to manage it.

"Red Rock is in one of the world's most prospective environments for the minerals we seek, working with skilled and experienced local partners, and approach this new phase of our activity in the DRC with considerable excitement," he concluded. MRA

INVESTORS ARE STILL WARY

Earlier this year the Fraser Institute's Annual Survey of Mining Companies highlighted that the DRC is still one of one of the ten least attractive jurisdictions for investment based on the Producer Price Index rankings. However, the DRC's rating remained better than Venezuela, Argentina: Chubut, Zimbabwe, Bolivia, Argentina: Mendoza, Tanzania, Papua New Guinea.

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Energy efficiency technology South Africa takes the gold

The cost and supply of reliable electricity has become one of the mining industry's biggest headaches, particularly in South Africa. In April this year, the country's industrial electricity tariff rose above R1/kWh, taking the cost of energy to exorbitant new levels. How then do miners compensate for this challenge without 'breaking the bank'? The incorporation of **Zest WEG's** new **W22 IE4 motor** range is the perfect starting point, electric motors manager **FANIE STEYN** tells **LAURA CORNISH**.

he mining industry is an energy intensive user. Even smaller scale operations require large-scale equipment to beneficiate ore – all driven by motors, which collectively account for a significant portion of an operation's total energy requirements.

Zest WEG, a specialist motor supplier, and also an energy solutions provider, has been facilitating cost reductions on site through its energy efficient motor range, which it first launched to market many years ago. "We have undergone extensive improvements on this front over the years, moving from the older IE1 standard efficiency motor to our newly launched IE4 super premium efficiency motor," Steyn starts. This is an impressive step considering the use of energy efficiency motors in South Africa (and Africa) is not regulated. "This step shows our objective to partner with the industry, and the country, in alleviating their energy costs. The IE4 motor can add an additional 1 to 3% savings on energy consumption over and above those savings delivered by the IE3 motor," Steyn continues. "And importantly, in truly demonstrating our commitment to aid the industry in its cost savings, we have decided to offer our new IE4 motor at the same price as the premium efficiency IE3."

This is significant when considering the launch of the IE3 motor in 2015 – which Zest WEG offered to market at little or no additional cost relative to its IE2 motors, with the same goal in mind: Making both customers and the country more energy efficient.

Unpacking the IE4 savings and benefits

"The efficiency of 96.3% on an IE4rated 110 kW motor, when compared to 94.1% on an IE1-rated motor, can save users hundreds of thousands of rands in energy costs over a 10-year period," Steyn highlights. "Not only will these IE4 motors be more cost effective to run, but they have been designed with a number of new features that bring considerable benefits."

The WEG IE4 super-premium efficiency motors meet IEC efficiency levels when running on 50 to 100% of load. Efficiency is kept constant, which saves energy and ensures minimal losses through various loading points. The innovative frame design also allows maximum heat dissipation.

"Motor frame design plays a crucial role in thermal performance, as it is

The WEG W22 IE4 motor meets IEC efficiency levels when running on 50 to 100% of load

DID YOU KNOW?

- Regulations in Europe and China stipulate the use of IE3 motors
- Regulations in Brazil stipulate the use of IE3 motors
- Regulations in South Africa have NO stipulations for the use of energy efficiency motors

responsible for the outward transfer of heat generated inside the motor," says Steyn. "Running cooler means that our motors have increased life spans, allowing Zest WEG to offer a five-year guarantee on our WEG W22 electric motor range."

The motors' increased mechanical rigidity – achieved by integrating the front and rear feet sides – affords easier installation, higher mechanical stiffness and improved distribution of the mechanical thrust imposed by the load.

"As a first of its kind, our flexible terminal box mounting means reduced inventory and quicker modification," he says. "The terminal box can be rotated in 90° increments to facilitate supply cable connection orientated to the front, rear, top or either side of the motor."

IE4 gives South Africa the wow factor

South Africa may not be the fastest in executing or using new or first-world technologies but the country has the upper hand on energy efficiency through the IE4 motor. "Reinforcing our commitment to always offer technological advances which can truly benefit our customers, the IE4



motors range is now being deployed in South Africa as an off-the-shelf item," Steyn notes.

Available in the size range between 37 kW and 355 kW, their application into the mining sector is wide-ranging.

The IE4 motor is also equipped to benefit from Zest WEG's digitisation strategy – with the option of a motor scan sensor which enables condition monitoring in real time, and prevents failures by gathering information from the motor which is sent to the cloud. From there, that data is summarised, trends predicted and warnings delivered in an effective manner.

This again is the first step in a bigger Industry 4.0 plan for Zest WEG. "We are gradually introducing a Motor Scan Solution in South Africa that takes automation to the next level. This will entail providing clients with access to an exchange server which will allow our data



 Λ The WEG IE4 motor is also equipped to benefit from Zest WEG's digitisation strategy

to be integrated into our clients' existing SCADA systems. Integrating data onto a single platform has become a challenge for an industry working with so many different service providers. Through this solution, we will remove this customer barrier," Steyn concludes. **MRA**

THE IE4'S TOP 10 BENEFITS

- Inclusion of a C4 lamination core, meaning the motor can be repaired back to IE4 status after a failure in the field
- 2. It is very versatile
- 3. It has an extended grease pipe
- 4. It has removable gland plates
- 5. It is fully interchangeable with previous motors
- 6. It has more active components in terms of lamination steel and copper - less resistance and higher efficiency
- 7. More precise machining of the air gap
- 8. Better cooling and heat dissipation so therefore higher efficiency
- Carbon dioxide reduction reduced demand on the grid equates to less CO₂ emissions
- Energy savings 1 to 3% improvement in energy savings with every new range from IE1 to IE4

Alphamin Resources' tin journey

"We've only just begun"

The demand for green economies is rapidly gaining pace and those commodities that have a key role to play in contributing towards this evolutionary change stand to benefit significantly from increased demand and a consequential increase in pricing. Tin, amongst others, fits neatly into this scenario – and so does dual-listed tin miner **Alphamin Resources**, writes **LAURA CORNISH**.

rise in tin prices is no future forecast, but rather a current trend. It has risen significantly over the last year from its lowest point in 2020 – just below US\$14 000/t to an average (but still climbing and peaking) \$26 000/t. To a large extent, this is being driven by the electrification of economies around the world.

It is interesting then that Alphamin Resources stands to benefit so significantly from this healthy market dynamic – through the operation of its

The Bisie project is just the start of Alphamin Resources' tin

production strategy

Bisie tin mine's Mpama North deposit which has been operational since late 2019, but more so through the company's greater landholding which it intends to exploit with speed.

Alphamin today

A quick recap of the company's track record to date is important. Alphamin constructed the Bisie mine – in the very remote North Kivu province of the Democratic Republic of Congo (DRC) – and delivered it successfully, on time and on budget. Disbelievers of its ability

IN SHORT

It's exciting times for Alphamin Resources as it starts and fully commits to expanding its mine portfolio.

to bring its first mine into operation successfully were quieted as artisanal mining, potential conflict and zero infrastructure concerns were put to rest. At a rate of approximately 10 – 11 000 tpa, Bisie is now responsible for roughly 4% of the world's mined tin. Generally speaking, the mine has performed well since its start up and remains on track to deliver against its production and cost metrics for the foreseeable future.

Notably, the mine contains some of the highest grade tin to be found anywhere



↑ The new fine tin circuit will increase Bisie's production output

across the globe. At an average 4.5% tin, the equivalent of this in value is 12% copper and 14.6 g/t gold resource. No other tin mines can boast similar grades. This literally makes Mpama North the world's highest-grade tin resource – about four times higher than most other operating tin mines in the world.

Alphamin tomorrow

Bisie's Mpama North deposit, or as Alphamin executive director Boris Kamstra puts it, the 'starter project', represents the beginning of a much bigger and brighter future for Alphamin Resources, and it always has.

The company's licences in the region cover a total of 1 270 km² and at present comprise three exploration licences. This is the card in Alphamin's hand which it now intends to play.

"We find ourselves in a very strong position," says Maritz Smith, CEO of Alphamin. "We are clearly in the right commodity. We don't see any Greenfields tin mines coming on stream in the next seven to 10 years and the world's third largest tin producer Myanmar in Asia is suffering after a recent coup overthrew the government. Over and above this, the mines in this region have depleted their low-hanging open pit fruit reserves and must explore their lower grade underground potential to sustain their businesses in the longer run."

This leaves the company in a strong position to expand its mining footprint and in so doing, deliver on the world's

We are confident

of reaching our

with time, which

could double or

production,

MARITZ SMITH

even triple our tin

full potential

"

increased demand for tin while enjoying the financial benefits that come with that.

"The first of many projects to gain traction is the start-up of a new fine tin recovery plant at the Mpama North mine, which is quickly tracking to be commissioned in June this year and should increase the mine's total output by a further 5 – 10%. This in turn will see Alphamin increase its global supply of tin to closer to 5%," Smith outlines.

Beyond this, the company has its eye on the resource ball and is looking to bulk up its resources from its mining licence holding. The work to do so is underway, and it is being funded by internal cash flow. Smith outlines three key objectives in this regard, the first being to define the Mpama North resource extension at depth. "Historic drilling at Mpama North was terminated once a large enough resource was secured to justify the starter mine. We know this ore body is open at depth with one of our last holes intercepting 16 m, recording a grade of 22.5% tin." Smith states.

The second objective is to establish a maiden resource for Mpama South – a deposit only 750 m south of Mpama North, located along the same ridge as Mpama North. "Our work thus far indicates that this deposit is similar to Mpama North. It dips in the same direction and is showing similar



structural images and visual mineralogy." Thirdly, Alphamin is looking to uncover an entirely new ore body discovery further along the Mpama Ridge and two potential areas have already been revealed – Marouge and the 'V', which are located about 10 km from Mpama North.

Drilling required during 2021 to deliver on the exploration targets, Smith continues, are:

• Mpama South: Minimum 15 500 m required to define a maiden resource,

- and drilling to continue thereafter as infill and step-out extensions of the resource;
- Mpama North: Minimum 7 500 m to depth extents; and
- Marouge/'V': Minimum 10 000 m required to find new mineralisation – 3 – 4 000 m should be completed in 2021.

"We have celebrated phenomenal success on all of these fronts to date

which includes excellent visible tin intercepts," Smith continues.

"In the first quarter of 2021, \rightarrow 5 750 m of drilling has been completed on Mpama South with just two rigs on site. Another four are due to arrive between May and August. The structural study undertaken at Marouge and 'V' are showing high probabilities for new discoveries and drill targets have been set for H2, 2021.

Alphamin in five-years

"With a significantly sized tenement containing what we are confident contains thousands upon thousands of tons of tin, we took the 'smart approach' – we started small in order to prove our execution capabilities in a jurisdiction other miners have shied away from. Today, we have proven our worth and are now ready to exploit our greater potential, which as mentioned falls in line with market dynamics," Kamstra enthuses.

"We are confident of reaching our full potential with time, which could double or even triple our tin production and see us become responsible for 10 – 15% of the world's tin demand in coming years, making us one of the largest tin producers on the continent for the foreseeable future," Smith continues.

Within the company's immediate sights, as the next point along its journey, is the establishment of a second mine, up and running in a few years' time. MRA



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AVZ Minerals Charting the way forward for development of its DRC lithium project

With lithium supply expected to enter a deficit within the next few years owing to increased demand from the burgeoning electric vehicle sector, where lithium-ion batteries dominate, ASX-listed lithium developer **AVZ Minerals** is well placed to meet this growing demand for battery-grade lithium through the development of its Manono lithium and tin project in the Democratic Republic of Congo (DRC). **CHANTELLE KOTZE** speaks to MD **NIGEL FERGUSON** about the critical path toward construction.

Diamond drilling within the Roche Dure pit floor 'wedge'

IN SHORT

AVZ Minerals, the DRC's lithium front-runner, will enter the construction phase of its Manono project later this year, with an aim to produce first spodumene concentrate in 2023.

emand for spodumene concentrate – a feedstock material used in the production of lithium chemicals that go into batteries for electric vehicles (EVs) – improved significantly in the last

> quarter of 2020. This trend has resulted in an increase in lithium prices over the same period and is an early indicator that lithium prices should continue to rise exponentially on the back of tighter supply from around 2023/24 onward as the market enters a deficit.

In this regard, some analysts are predicting deficits of about 1 Mtpa over the next decade.

Despite slow EV manufacture and sale during the COVID-19 pandemic, there was a remarkable resurgence in EV sales in the last quarter of 2020, led by Europe and China, which is spurring demand for battery metals.

This positive turn in demand – which has resulted in an increase in lithium spodumene concentrate, lithium carbonate and lithium hydroxide prices – could see AVZ increase the proposed scale of the Manono project from the 4.5 Mtpa proposed in the DFS, says Ferguson.

The build-up towards construction

Having completed a 2 Mtpa and 5 Mtpa scoping study in May 2019 followed by a definitive feasibility study (DFS) in April 2020, which proved that the project would be both economically viable, and highly robust with strong financial metrics, the company is now completing an optimised DFS to understand how to best develop the Manono asset.

The optimised DFS will include the results of the front-end engineering design (FEED) study which was awarded to Melbourne-based engineering company Mincore in February this year. The FEED study – that will confirm the process flow sheet, confirm all bulk material quantities to verify pricing, confirm selected equipment pricing, finalise the execution schedule and provide early works drawings – will enable much tighter project costing



"

There are other groups currently in offtake negotiation for the remainder of Manono's anticipated SC6 production. Upon closing these offtakes, we expect to be oversold on our available SC6 production,

NIGEL FERGUSON

and layout plans for the project as it progresses, says Ferguson.

In addition to this, the optimised DFS will take into consideration the recently completed 1,650 m of diamond drilling within the Roche Dure pit floor 'wedge' – previously inaccessible and under water during earlier resource drilling programmes. The aim of this drilling campaign is to upgrade the estimated ~11 Mt of 'wedge' material currently classified as inferred resources into indicated resources for conversion to probable mineable reserves.

"Having previously been classified as waste, the 'wedge' material is now expected to be classified as mineable ore and will have a potential reduction in the ore-to-waste strip ratio as well as potentially increase revenue, increase the mine life, increase open pit volume, increase life of mine, lower the operating costs and reduce the payback period," explains Ferguson.

The company is in the process of collating this new data and will re-run the models to calculate both new geological resources and then upgraded mineable ore reserves to be fed into the optimised DFS, which should be released in June/July this year.

Ferguson explains that the next and final milestones to be met at the project include the eighth and final environmental and social impact assessment (ESIA) application to be submitted for approval, submitting a mining licence application to Cadastre Minier, or CAMI, in the DRC and making a final investment decision and progressing the processing plant and hydro-electric power plant EPC award during Q2, 2021.

Measuring up Manono

The 2020 DFS indicated that Manono could produce a product mix of 700 000 tpa of lithium spodumene concentrate, or SC6 concentrate (containing 6% lithium), and 45 000 tpa of highlyvaluable primary lithium sulphate, or PLS (containing 80% lithium), over a 20-year life of mine, based on a 4.5 Mtpa operation.

The addition of the PLS product will see 153 000 tpa of the 700 000 tpa of SC6 concentrate being used as feedstock to produce the 45 000 tpa of PLS.

Further upside treatment would potentially be developed in two stages: the first stage, as planned, entailing a dense-media separation (DMS) recovery producing SC6 concentrate, with an added calcining circuit to produce a lithium sulphate; and the second stage combining additional processing by adding a carbonate or hydroxide circuit, to produce lithium carbonate or hydroxide product. The company's aim is to increase PLS production through conversion of additional amounts of SC6 product as the project progresses.

Moreover, the processing flow sheet also allows for the recovery of an estimated 828 tpa of tin as well as additional tantalum and niobium from hard rock ore; plus an additional estimated 600 tpa of alluvial tin and tantalum, which will be secured from alluvial and tailings sources.

Offtake takes off

AVZ Minerals has already secured binding offtake agreements for over 80% of the intended annual SC6 saleable product from Manono. In December 2020, the company signed an offtake agreement with China's largest lithium compound producer Ganfeng Lithium for 160 000 tpa of SC6 for an initial five-year term and with an option to extend for a further five years.

In March 2021, it signed its second and third SC6 offtake agreements. The second offtake agreement was inked with global battery materials producer Shenzhen Chengxin Lithium Group for 180 000 tpa of SC6, for an initial threeyear term and the third offtake was with lithium-ion battery maker Yibin Tianyi for 200 000 tpa of SC6 for an initial threeyear term, with an option to extend for an additional two years.

Also in March, AVZ successfully secured its first tin offtake agreement with commodity trader Kalon Resources – a 100% subsidiary of Noble Group – for



↑ Drilling campaign at the Roche Dure pit floor 'wedge'



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↑ Drilling at the Roche Dure pegmatite



↑ The Roche Dure pit floor – previously inaccessible and under water during earlier resource drilling programmes

600 tpa of tin concentrate for three years – equating to approximately 43% of the total tin concentrate available for sale.

"There are other groups currently in offtake negotiations with us for the remainder of Manono's anticipated SC6 production. Upon closing these offtakes, we expect to be oversold on our available SC6 production," Ferguson enthuses.

Meanwhile, in terms of PLS offtakes, there are four groups currently interested in signing offtake agreements for the product. The groups have requested laboratory scale test work results, which AVZ has delivered, proving that it is able to produce a PLS with a minimum 76% lithium. Further laboratory scale test work has proven that PLS with greater than 80% lithium can also be readily produced.

The lithium and tin offtake agreements will assist the company in meeting certain conditions precedent which are required from the company's prospective financiers – the last step in ensuring Manono enters construction before year end.

"Now that we have received binding offtake agreements for 80% of our product and once we have our mining licence in hand, seven of the eight development finance institutes with which we have signed non-binding letters of intent, will re-engage with us on the funding agreement. Among them, they have committed to funding between US\$430 million and \$450 million of the required \$545 million in funding that we require. We are engaging with potential Chinese and European funders for the outstanding equity portion of the financing, which we hope to finalise during the second half of the year," says Ferguson.

Going for green

Owing to the fact that lithium (among other battery metals such as tin, cobalt, copper, nickel and graphite) is at the centre of the clean energy and transportation transition, lithium producers are increasingly required to ensure that their carbon footprints are kept to a minimum and that their projects are as carbon neutral as possible. The aim of this being to not exacerbate carbon emissions and risk the climate change that the mining of their raw materials is trying to mitigate.

As a result of this, Manono will be primarily powered from green energy sources including hydro-electric power from the Mpiana-Mwanga hydro-electric power plant, which, once refurbished, is anticipated to provide all of the Manono project's electricity requirements. The company is also studying the potential use of solar power and battery energy storage in future should the operation require additional electricity.

Moreover, AVZ is investigating and planning substantial greenhouse gas mitigation measures, which include the purchase of an electric mining fleet once commercially-viable equipment is available; the generation of hydrogen from excess renewable electricity to enable the use of fuel cell electric vehicles: and the establishment of a 5 000 ha sequestration plantation. The company is also considering harvesting power from the steam produced at its proposed sulphuric acid plant through a steam turbine as an additional form of green energy if it goes ahead with the establishment of an on-site sulphuric acid plant (currently under investigation).

The company, which is striving to be as close to a 'zero emissions' operation as possible, has completed an independent greenhouse gas study that has shown Manono to be in the lowest quartile of lithium mines – an estimated 30 – 40% lower than all other hard rock lithium miners. MRA

MANONO MAKES THE GRADE

The Roche Dure mineral resource stands at 400 Mt, grading at 1.65% lithium oxide (Li_2O) , 715 ppm tin and 34 ppm tantalum as reported in May 2019. In addition to Roche Dure, the Carrière de L'Este deposit has the potential to be a separate resource of equivalent or larger size and at least equivalent grade, as at Roche Dure.



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Ivanhoe Mines' Western Foreland project

Home to the DRC's next major copper discovery?

Canadian mining company **Ivanhoe Mines' Western Foreland** exploration licences, located to the west of the tier-one Kamoa-Kakula copper project, is a key pipeline asset for the company, which it believes can yield additional high-grade copper discoveries within the Democratic Republic of Congo (DRC). Despite being focused on executing construction and development activities at the Kamoa-Kakula, Platreef and Kipushi projects, the company has exploration in its DNA and company founder and executive co-chair **ROBERT FRIEDLAND** is always in search of the next world-scale discovery, writes **CHANTELLE KOTZE**.

aving amassed a wealth of geological and related technical

information about the Western Foreland region during the discovery and advancement of the nearby Kamoa-Kakula project, Ivanhoe Mines has spent the past two years securing the various exploration licences that now make up

the Western Foreland exploration project.

Drilling at the Kiala Discovery in early 2020

IN SHORT Ivanhoe Mines believes

that its Western Foreland exploration licences, which share the same geological setting as the prolific Kamoa-Kakula project, have the potential to host the DRC's next major copper discovery.

According to Ivanhoe Mines VP for resources George Gilchrist, the Western Foreland exploration project consists of 17 licences to the north, south and west of Kamoa-Kakula. These licences were identified based on

the exciting potential for the extension of the geological terrain that hosts the high-grade mineralisation at Kamoa-Kakula. The 17 licences cover a combined area of approximately 2 550 km² of ground which the company's geological team has prioritised as the most promising for further high-grade copper discoveries.

"Because the region has seen virtually no modern exploration, we will be building out the infrastructure necessary to access and explore the broader land package, mapping the region and leveraging our proprietary database to prioritise the discovery targets that contain Kamoa-Kakula-style copper mineralisation," says Gilchrist.

In pursuit of the next major copper discovery in the DRC

Having successfully extended the Kamoa copper deposit (first discovered in 2008) with the discovery of the Kakula deposit in January 2016, Ivanhoe embarked on exploration to the west of Kakula in 2017 to test the surrounding area along the Central African Copperbelt. This resulted in the company's third copper discovery – Makoko, which was discovered 20 km from Kakula, on the same prospective horizon as both Kamoa and Kakula.

Makoko shares characteristics with the Kamoa Far North Discovery and the recent Kiala Discovery – both of which join the northern boundary of the Kamoa-Kakula mining licence to the Western Foreland exploration licences, and which have the potential to host high-grade copper zones.

Makoko was initially drilled over an area measuring 4.5 km x 1.5 km, with new drilling intercepting significant copper mineralisation over an additional 7.5 km of strike south-west of the initial discovery area. The Makoko discovery hole, DD004, returned 3.94 m (true width) grading 5.46% copper starting from 306 m downhole. Other holes were equally high-grade, with DD010 intersecting 3.21 m (true width) of 6.78% copper, starting from 441 m; and DD017 cutting 3.19 m (true width) of 6.49% copper starting from 471.7 m. The initial discovery was



defined by over 50 diamond drillholes. The company's limited drilling to date on the Western Foreland exploration project has been focused at the Makoko and Kiala discoveries, where

permanent road access has been established.

FAST FACT

Ivanhoe Mines now holds 175 km of strike in the highly-prospective Western Foreland district been established. In addition to early 2020 drilling at the Kiala Discovery and drilling in the second half of 2020 at the Makoko Sud Discovery, Ivanhoe's exploration work in 2020 included stream-sediment sampling,

soil geochemical sampling, as well as outcrop and stream mapping on

the new tenements acquired in 2019. In total, 411 stream-sediment samples



↑ Drilling at one of the sites on Ivanhoe Mines' Western Foreland licences

and 958 soil samples were collected and processed for analysis.

According to Gilchrist, Ivanhoe's geologists first identified the prospectivity of the Kamoa-Kakula area in the mid-2000s using the same tools and techniques.

In Q4, 2020, a total of eight new diamond drill holes were also completed along strike of Makoko to the west. The drilling aimed to confirm the continuation of prospective lower Nguba stratigraphy westwards toward the new exploration permits. "Makoko West is extremely significant for the exploration potential of the new exploration permits as it demonstrates that both the target stratigraphy extends westward and that the copper mineralising system on the western edge of the basin is laterally extensive," explains Gilchrist.

A high-resolution electromagnetic and radiometric survey also commenced in Q4, 2020 and is ongoing. Once complete, the survey will help to better understand the stratigraphic and structural architecture of the new exploration areas,

DID YOU KNOW?

Western Foreland is extremely strategic given that the vast majority of it is fully-owned by Ivanhoe – thus offering additional discovery torque outside the current joint venture at Kamoa-Kakula



something that is key to generating early stage targets for ground surveys.

Expansion and acceleration of the Western Foreland exploration programme

Much of this year's exploration will focus on more than 1 700 km² of new, 100%-owned permits that were acquired in 2019 and received environmental certification in 2020.

"The target of the 2020 field season and the initial phase of the 2021 exploration programme is very much about accumulating data and working with our existing models to pinpoint the best targets for future exploration and drilling," Gilchrist explains, noting that the early stage exploration and data

DID YOU KNOW?

The Western Foreland exploration project is more than six times larger in area than the Kamoa-Kakula mining licence

collection is being used to deepen the company's understanding of the geology of the new licences for target generation.

This initial exploration programme, budgeted at US\$16 million (with optionality to increase the budget should results warrant) will include approximately 40 000 m of combined aircore and diamond drilling, airborne and ground-based geophysics, and soil sampling and will build on work completed in 2020.

Ivanhoe's exploration team is now working on a comprehensive, fasttracked exploration programme for the coming years.

"With the same team that discovered the world-scale resources at Kamoa-Kakula firmly driving exploration at Western Foreland, leveraging the same systematic techniques and data-rich processes, we believe we are in the midst of the next generation of great copper discoveries in the DRC," says Gilchrist.

"Given the strong resource base currently established at Kamoa-Kakula, and the great work being done by our development team, we can potentially expand the Kamoa-Kakula mining operation up to 19 Mtpa," he concludes. MRA



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Company Overview

- Operating in the DRC since 2007
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+243 82 850 4081 (DRC) +27 83 301 3112 (RSA) Slow but steady

Red Rock's Luanshimba – a new copper-cobalt discovery?

Patience and a clear understanding of the African mining environment is holding AIM-listed Red Rock Resources in good stead as it continues to further its exploration activities in the Democratic Republic of Congo (DRC). **GERARD PETER** finds out more from chairman **ANDREW BELL**.

stablished in 2004, Red Rock Resources (Red Rock) is a natural resource exploration and development company. The company manages a diverse portfolio of mining, oil and gas investments around the world. This includes the Migori gold project in Kenya and the Luanshimba copper-cobalt project in the DRC.

Red Rock owns 80% of the Luanshimba project, which is situated 65 km south-east of the provincial capital of Lubumbashi in Haut-Katanga, in a 420 ha prospecting licence in the Congolese Copperbelt. The tenement is situated along a disrupted anticline with highly prospective, undifferentiated Roan sediments draping off a nearby basement dome, similar to some other productive copper deposits in the immediate area.

As Red Rock advances its exploration efforts in the DRC, indications are that Luanshimba could be holding a significant cobalt resource

The company carried out initial exploration on the property in 2018 which

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identified two open-ended areas strongly anomalous for copper and cobalt. While Red Rock had intended to commence a geophysics programme at Luanshimba early in 2020, it was slightly delayed due to the onset of the COVID-19 pandemic. Bell explains that some of

delays arose because the team was not able to travel in and out of the country as freely as they had before. That said, despite the delay, the company was able to commence its geophysics programme in November.

In February 2021, the company announced that it had completed the first of two phases of the programme. Just over 70 line-kilometres of magnetic data was collected and three magnetically anomalous areas were observed, namely the north-west, the east, and the south-west. The south-west anomaly is considered the highest priority for a follow-up ground geophysics programme of induced polarisation (IP).

Thus far, Bell is pleased with the results of the second phase of exploration. "I think the results are sufficiently encouraging and we are going to start drilling shortly. I believe that we have a very significant amount of copper and cobalt," he adds.

IN SHORT Luanshimba is located

in the Katanga Segment of the Central African Copperbelt in the DRC, an area well-known for its lucrative copper and cobalt reserves. With the rainy season coming to an end, Bell is keen to move to the drilling phase at quickly as possible. At the same time, however, the company is approaching

this next phase systematically. "We could start drilling immediately with targeted shallow holes

of between 60 and 100 m, which is not that expensive. But before doing so, we'll run some IP lines to increase our confidence in this ore body further."

In addition, Red Rock has engaged the services of a Canadian geophysical consultancy firm that is analysing the geophysical data and providing feedback to the company. With this additional layer of interpretation,

Bell hopes that they will be able to target better and so use exploration funds smartly.

A local project led by locals

While Red Rock has a myriad of interests around the world, Bell points out that Luanshimba could turn out to be a key part of the company's overall plans. He adds that a key for Red Rock everywhere is to ensure its projects are 'local led', with key management in this case Congolese. "Our ideal is to have a local company build up a team of local people and they can run the execution



and operation of the mine as far as possible themselves.

"For example, in Australia we are able to work that way easily as the culture and language are essentially the same. There is a deep pool of talent in the mining sector and people are used to working in a very corporate way. We are not quite there in the Congo. There is a great deal of talent in the country, in some aspects world-class, but they may for historical reasons lack the recent experience that comes with working overseas and with international businesses. So, there is a need for overseas input, not just of capital, but of training and exposure to different working methods."

Meanwhile, Bell is confident in the DRC's mining sector, adding that it takes patience and an understanding of the local culture to make progress in the country. He believes that the lessons learnt from their Kenya experience have helped their endeavours in the DRC.

Between 2015 and 2019, the company was engaged in a legal battle after a Kenyan Minister purported to terminate the licences for its Migori gold project, held through a local partner. However, Red Rock remained "calm, friendly and persistent", as Bell puts it, and the issue has since been resolved.

Bell is also complimentary on the progress that the DRC's mining legislation has made. "There have been a few setbacks with the regulatory framework but in general, the progress is all in the right direction. And we want to promote that message. We want to encourage investors into the DRC to see what can be done. For the rest of 2021 and in 2022, we expect to make a lot of progress and to start doing some of the things that have not been possible in the last year, like bringing investor groups to the country," he states.

Currently, exploration efforts at the project are being funded by the company; however, Bell believes that the potential that Luanshimba has shown thus far will attract funders down the line. "We have taken Luanshimba from an early-stage greenfields site to what I think may be very near being a discovery. Once the drilling work is completed, we may well have a discovery we can talk about and one that will really interest people," he concludes. MRA

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R E N E R G E N

Hydropower partnership

A boost for mine and country

Reliable, clean and renewable hydropower could soon be delivered to the Kamoa copper mine in the Democratic Republic of Congo.



 \uparrow After it is upgraded the Mwadingusha hydropower plant will to generate 78 MW of hydropower for the first two phases of copper production at Kamoa Kakula

his follows after Ivanhoe Mines Energy DRC, a sister company of Kamoa Copper SA, signed a Memorandum of Understanding (MOU) in a public-private partnership with the DRC's state-owned power company *La Société Nationale d'Electricité* (SNEL) to deliver hydropower to the Kamoa Mine.

Kamoa Copper SA is jointly owned by Ivanhoe Mines (39.6%), Zijin Mining Group (39.6%), Crystal River Global Limited (0.8%) and the DRC government. Kamoa-Kakula is expected to begin producing copper in July 2021 and, through phased expansions, is positioned to become one of the world's largest copper producers.

The partnership is aimed at working together to strengthen the grid's capacity with renewable energy through the upgrade of a major turbine in the existing Inga II hydropower plant located in the southwest of the DRC, on the Congo River: the deepest river in the world and the second longest in Africa after the Nile River.

The Inga II hydropower plant has been running for approximately 40 years, with four of the eight turbines refurbished. Turbine 5 is one of the remaining four that is awaiting an upgrade and is estimated to produce 162 MW of renewable hydropower, providing the Kamoa Copper mining complex and associated planned smelter with sustainable electricity for future expansions.

Congolese to benefit tremendously from project

President of the DRC, Félix Tshisekedi has expressed full support of the public-private partnership to upgrade turbine 5 as it will not only support Kamoa Copper's expansion plans but also provide reliable electricity to local communities. Tshisekedi commented, "Partnerships such as the one between Ivanhoe Mines and SNEL will allow us to inject additional capacity into our electrical grid and improve the living conditions of Congolese citizens by increasing their access to electricity. At the same time, the additional power that will be generated will allow Kamoa Copper to beneficiate its mining products in the DRC. This will create additional revenue for the country and as a shareholder of Kamoa Copper, the DRC sees this local value creation as a strategic imperative."

Ben Munanga, chairman of Kamoa Copper added, "This new power supply agreement is an important step toward our sustainability journey as it will provide the Kamoa copper mine with priority access to a combined 240 MW of clean, renewable electricity from the combined upgraded turbines at Mwadingusha and Inga II hydropower plants."

The first public-private partnership between Ivanhoe Mines Energy DRC and SNEL, upgrading the Mwadingusha hydropower plant, has been an ongoing success. Currently, the Mwadingusha power station is almost completely refurbished with state-of-the-art controls and instrumentation. So far, Kamoa Copper has funded the development of 70 km of road access, a water treatment plant, a medical care facility and all the required equipment and infrastructures to make Mwadingusha viable and sustainable. Once fully completed, the Mwadingusha plant will provide 78 MW of clean, hydrogenerated electricity, enough to take Kamoa-Kakula through phase 1 and phase 2 production. MRA
Major milestone for Manono Mining licence lodged with government

ASX-listed **AVZ Minerals** Limited recently announced that it had lodged all documents required in support of its Mining Licence application for the Manono Lithium and Tin Project in the Democratic Republic of Congo.

he documentation and formal application – which were submitted by AVZ's majorityowned DRC company, Dathcom Mining SA, will now be assessed by the DRC government prior to approval of the granting of the mining licence as soon as practicably possible.

AVZ's MD, Nigel Ferguson, says, "Lodging our formal application for a mining licence for the Manono project is yet another significant milestone for the company.

"It marks the culmination of our highly strategic and well executed exploration programme and is another signal that the company is rapidly advancing towards the construction phase of our mining project and, ultimately, moving into production."

"We expect granting of the mining licence to be expedited by the DRC government so that we can maintain our construction schedule to deliver the first SC6 on train by Q1, 2023."

"A mining licence will also allow the company to quickly progress Manono to a 'bankable' study level, set as a condition precedent and as required by prospective financiers of the project.

"The optimised DFS being completed will provide an updated financial projection on Manono project incorporating the results of the optimised mine redesign which is currently underway, the FEED study which is progressing smoothly under the guidance of Mincore and conditions relating to the Special Economic Zone for Manono (MSEZ) which is progressing well."

About Manono

Manono covers 188 km² and is located 500 km due north of Lubumbashi in

the south of the DRC. The historic Manono mine was mined for its tin content between 1919 and 1982. With the exception of some exploration work carried out on the old mine dumps, aimed at determining cassiterite and spodumene grades, little prospecting has taken place since 1960.

The presence of lithium mineralisation in pegmatites at Manono has been confirmed to extend along strike for more than 13 km. In addition to geological mapping and trenching, AVZ Minerals completed an initial phase of due diligence drilling in 2017, comprising seven diamond drill holes for a total of 1 739 m and testing four of the large pegmatites. In all cases, thick intervals of pegmatite were intersected and spodumene was present within all the pegmatites. MELA

An aerial view of Manono

The road to carbon neutrality

Copper and cobalt remain at the forefront

"Green" stimulus is the order of the day as economies around the world commit to building back greener post-COVID-19. This has seen a dramatic rise in the number of countries that are affirming their carbon neutrality targets, but how do they go about meeting these targets? Through the introduction of clean energy and transportation technologies, which rely on a number of key commodities including copper and cobalt for their manufacture. But the more ambitious climate targets become, the more minerals and metals will be needed to support this. **CHANTELLE KOTZE** explores the important question of whether battery metals supply will be able to keep up with increasing demand.

ccording to business intelligence firm CRU, both the copper and cobalt markets can expect ongoing demand strength as renewable energy and electro-mobility agendas accelerate over the forecasted period until 2025. Despite short-term price fluctuations, a more balanced pricing scenario can be expected over this period as markets rebalance.

Copper

Charlie Durant, CRU research manager, base metals, says that China had a big impact on copper demand in 2020, changing the annual consumption pattern altogether. Despite demand pressure in Q1, the Chinese economy recovered incredibly fast from the COVID-19 pandemic, and the Chinese copper market saw growth last year. Despite this sharp recovery, global demand was down 3% in 2020 due to falls elsewhere.

This year, CRU expects demand to bounce back at about 7% growth ex-China. However, China will continue to drive copper demand, and is currently



World refined copper consumption, Mt



consuming over 50% of the global total, says Durant, noting that strong demand is expected from China during 2021, spurred mainly by continued investment-led growth and driven less by the consumer-led economy envisioned for the future.

"That said, demand for copper is returning, driven by the electric vehicle (EV) and renewable energy markets," says Durant. While these new growth markets only constitute a relatively small portion (5%) of the overall copper market, they are expected to breach 1 Mtpa in 2021 and are expected to see double digit growth rates in future, ultimately compensating for any slowing demand from the construction or utility sectors in future.

On the copper supply side, Hamish Sampson, CRU senior analyst, base metals, says that mine production was most impacted during the second quarter of 2020 as several of the key producing regions in South America – including Peru, Panama and Mexico – went into lockdown. Importantly, Chile, the world's largest copper producer, remained largely unaffected, which halted any dramatic drop in supply.

"Despite initial expectations of a 5% drop in the global mine production, we saw a really strong recovery in the second half of the year, which kept supply relatively flat year-on-year," says Sampson.

This year, CRU expects mine output to increase by almost 3%, with producers buoyed on by the copper price. Moreover, growth is forecast to be driven



by a handful of key projects starting up this year, including Kamoa in the DRC and Khoemacau in Botswana. However, the firm anticipates that there could be some lingering disruptions while the pandemic rumbles on, compounded by a turbulent political and social calendar in Chile and Peru this year, which is a cause for concern.

There are several committed projects like Quellaveco and QB2 in South America that will continue to drive growth over the short term. However, a supply gap of around 5 Mt starts to open up by 2030. Fortunately, there is a large pool of uncommitted projects that have the potential to come online and fill this gap.

Sampson is therefore reasonably confident that supply should be able to keep up with demand. However, he adds, "If too many projects get bogged down in the feasibility and permitting stages, compounded by increased scrutiny surrounding environmental, social and governance considerations, then we could



Hamish Sampson



Charlie Durant





see sizeable deficits over the next decade to meet future demand growth."

Should these deficits in fact materialise and persist for too long, the concern surrounding copper substitution may surface in future. The reuse of copper scrap, in this case, will form a really important part of the copper supply chain – one which will grow on the back on continued copper demand – while also serving as a mechanism to keep the market in check as demand increases.

Cobalt

According to George Heppel, CRU senior consultant, there were reasons to be concerned about the cobalt market when the COVID-19 pandemic struck – with looming fears around a COVID-19-induced global recession, rising consumer debt and the affordability of EVs and vehicle OEMs scaling back their EV plans to protect their balance sheets in the wake of the recession.

In practice, the exact opposite was true. The economic impacts of the COVID-19 pandemic resulted in a massive push by policy-makers towards a "green recovery", which has consequently led to an explosion in EV sales off the back of high EV subsidy policies in Europe. In Europe alone, the UK, France, Holland, Sweden and Norway are responsible for around two thirds of total vehicle sales on the continent, and four of these five countries introduced new EV subsidy policies in 2020, Heppel points out.

"The push towards a green recovery is clear when considering the number of global EV sales, currently tracking at over 3 million units at the start of 2021. Moreover, major vehicle manufacturers



There is a very material concern around longterm shortages for cobalt...with a supply crunch from the early to mid-2020s, on the back of exceptionally high demand over the past 12 months,

GEORGE HEPPEL

FAST FACT

Cobalt supply from the DRC accounts for a

massive two thirds of

global production, while

the country's copper

supply roughly accounts for only 5% to 6% of

global production

are investing in battery technology and committing to be partly or fully electric by the end of the decade – all of which has

resulted in a strong growth story for battery metals as a whole, from which cobalt too has benefitted," says Heppel. The cobalt price of today of around US\$25/ lb is testament to the increase in demand as a result of the policies and vehicle OEM pledges, he adds.

Going forward, there is a very material concern around longterm shortages for cobalt, says Heppel, noting a supply crunch from the early to mid-2020s, on the back of exceptionally high demand over the past 12 months. This could potentially see new supply come from high-pressure acid leaching plants in Indonesia, cobalt recycling, an expansion in development of the

Chinese-owned copper/cobalt assets in the DRC or a lot more supply from the artisanal mining sector, also in the DRC.

> Artisanal mining, which is often quick to respond to increases in demand, has in the past accounted

for as much as a third of total cobalt production in the DRC. While cobalt is the battery metal at the highest risk of being exploited in ways that

damage the health of people and the environment, the looming supply crunch expected over the next four years and increasing cobalt prices could see artisanal miners respond.

The work being done in the DRC to formalise the artisanal mining sector - specifically the partnership between commodities trading company Trafigura, not-for-profit organisation PACT at



copper/cobalt producer Chemaf's Mutoshi mine in the DRC – is a step in the right direction in improving legal transparency and economic livelihoods for the thousands of local residents that rely on artisanal mining.

Given the recent success of this pilot project, it could be used as a business blueprint for the entire Katanga region, which could unlock an additional source of cobalt supply, says Heppel, noting that formalised artisanal mining of about 40- 50 tpa of cobalt could act as a mechanism to stabilise cobalt prices during times of prevailing demand.

CRU is of the view that there will need to be investment in new supply over the next few years in order to prevent significant market tightness in the early to mid-2020s, and it is unclear at this point where it will come from as the group hasn't seen any investment into the possible new supply channels as yet.

Heppel warns of rapidly changing battery chemistries and the downside risk to cobalt demand that this may have. There is very strong focus emerging from vehicle manufacturers toward lithium iron phosphate (LFP) batteries in the low-cost EV vehicle segment, which has the potential to displace cobalt demand in future, depending on consumer demand for lower cost EVs. Moreover. Volkswagen's decision to produce highmanganese cells for the bulk of their EVs may also mean lower cobalt content requirements than that needed in lithium nickel manganese cobalt (NMC) batteries.

While the demand story for cobalt remains strong, the risk of changing battery chemistries remains a risk to longer-term cobalt demand, Heppel concludes. MRA

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DID YOU KNOW?

The recycling and reuse of battery metals, such as copper, will play an increasingly larger role in supply in coming years as bullish copper demand from the renewable energy and battery energy storage technology markets persists

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Tesla's high-end vehicles rely on nickel-heavy batteries and this bodes well

No longer a forgotten battery metal

Nickel will be the key beneficiary of electric vehicle (EV) adoption against the backdrop of other battery metals such as lithium and cobalt, supported by its dominant long-range capabilities. Furthermore, a wealth of nickel deposits will position Africa to benefit from an uptrend in prices in the coming years, writes **GERARD PETER**.

hese are the key findings of a recent Fitch Solutions report that looks at the opportunities and risks for nickel in the battery revolution. The basis of the report has been founded on a recent *Mining Review Africa* webinar titled, *Nickel: The Forgotten Battery Metal* where Fitch Solutions' Carly Cassidy was a participant.

The webinar discussed an anticipated uptick in nickel demand from the accelerated growth of EV adoption and the opportunities for Africa to benefit from the battery boom. According to the report, when surveyed the role nickel currently plays in the EV and battery markets, most Webinar attendees expressed the opinion that nickel holds a "weak role as it could be replaced by other commodities as technology evolves". This attests to the perception of nickel as a 'forgotten' battery metal.

"However, Fitch Solutions expects nickel to remain intrinsic to batteries, especially those for EVs, due to its significant energy density which gives it unparalleled advantage through vehicle range and charging capacity. Nickel demand is set to be further bolstered as



Fitch Solutions expects nickel to remain intrinsic to batteries, especially those for EV,

CARLY CASSIDY

battery makers continue to minimise the proportion of cobalt metal in batteries," added Cassidy.

Furthermore, Cassidy explained that Nickel's dominant range capabilities will keep demand anchored in large automotive markets such as the US and Canada where charging infrastructure will face long-term challenges accommodating more spread-out populations. Furthermore, automakers such as Tesla will employ nickel-heavy batteries in commercial trucks and higher-end models.

Africa to benefit from demand

With battery-grade nickel to remain in a deficit, Africa's wealth of nickel deposits will position the country to benefit from an uptrend in prices in the coming years. According to the report, African nickel production will rise in the coming years, with South Africa and Tanzania to benefit the most.

At present, most of Africa's nickel mining occurs in Botswana, Zimbabwe and South Africa. In the latter two countries, nickel is most commonly mined as a by-product of PGMs.

The boom in nickel demand for batteries, and accompanied increase

in prices has already begun to renew interest in the subsector.

The development of the Kabanga nickel project in Tanzania points to upside potential to future developments of untapped reserves present in the East Africa nickel belt (EANB). In January this year, UK mining firm Kabanga Nickel signed an agreement to develop what is currently the largest global deposit of battery-grade nickel sulphide through a joint venture with the Tanzanian government. With four new projects, Tanzania leads the region in relation to nickel development projects.

Meanwhile, a high amount of nickel sulphide and potential access to valueadded processing will further support Africa's capacity to supply the battery industry. The EANB's nickel sulphide resource base gives the region a key advantage comparative to Indonesia, the dominant global nickel miner at present. Africa boasts significant resources of both nickel sulphide and laterite ore, whereas Indonesia lacks the former. While laterite ores can also be converted into battery-grade nickel, nickel sulphide can be much more easily processed through traditional mining methods followed by smelting and refining.

The ease of processing also signifies that nickel processing utilising African sulphide deposits would be less energy intensive, and thus more sustainable, enhancing the investment appeal for ESG-conscious Western producers along the battery value chain. Indonesian laterite ores require energy-intensive processing such as high-pressure acid leaching (HPAL), which carries environmental concerns, particularly about its waste disposal methods.

South Africa can cash in on upward trend

The report further states that the commencement of production at Thakadu Battery Materials US\$20 million nickel sulphate refinery in South Africa introduces Africa to value-added processing activities. Thakadu began production in March 2021, and aims to produce 16 000 tpa in 2021, later ramping up to a steady state of 25 000 tpa, sourcing predominantly from Sibanye-Stillwater's operations.

Finally, the report says that South Africa is also well-positioned to provide downstream processing for batterygrade nickel, benefiting from a higher mining risk reward index (RRI) score comparative to riskier jurisdictions in the region. In addition, South Africa's strong potential for green hydrogen production could result in a more sustainable nickel sulphide smelting process in the future. MRA

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Rally remains

Iron ore prices expected to remain strong amid tight supply

Iron ore was a clear commodity outperformer in 2020, owing to the substantial increase in demand driven by China's infrastructure stimulus and given the supply constraints. Amid initial fears that the price rally would lose traction in 2021, ratings agency **Fitch Ratings** expects the annual average iron ore price rally to remain strong, writes **CHANTELLE KOTZE**.

his is driven by the continued tight market supply, which is expected to continue for some time with

new projects only compensating for depleting mines; demand in China is expected to reduce from 2022 with pandemic related stimulus tapering off and the long-term plan to transition to a consumerled economy, while other parts of the world are expected to compensate with broadly flat global demand post 2021.

A broadly similar deficit of between 90 Mt and 100 Mt of low-cost seaborne iron ore supply that existed in 2020 is expected for 2021 and together with low inventories at the beginning of 2021 is driving the current seaborne price of

The peak steel production in 2020 in China and recovery taking hold later in the year across other global markets led to prices increasing throughout the year, with Vale revising downwards its production guidance in December triggering a rally,

OLIVER SCHUH

iron ore, which traded at about US\$167/t in March 2021.

According to ratings agency Fitch Ratings' Oliver Schuh, senior director

> of natural resources for the Europe, Middle East and Africa region, despite low iron ore demand from China in Q1, 2020, during the height of the COVID-19 lockdown in the country, steel production strengthened throughout the year on the back of an economic stimulus package. This boosted the country's steel production, in turn increasing the country's iron ore demand.

This year will, however, see a reverse of the 2020



COMPARATIVE IRON ORE PRICE ASSUMPTIONS TILL 2024

CRU's equity price forecast	Fitch Ratings' conservative
for iron ore:	iron ore price assumptions:
2021: \$130/t	2021: \$125/t
2022: \$95/t	2022: \$90/t
2023: \$85/t	2023: \$80/t
2024: \$83/t	2024: \$70/t

trend. Despite almost record-breaking steel production figures in 2020 and the start of 2021, there will be a consistent reduction in quarter-on-quarter steel production this year as the stimulus tapers off. Despite this, similar steel production levels as recorded in 2020 will be maintained during 2021.

This all-time high steel production in China will however begin to taper off from 2022 onward, as the country moves toward a more consumer-led economy, reducing focus on infrastructure and construction of the past, notes Schuh.

"The peak steel production in 2020 in China and recovery taking hold later in the year across other global markets led to prices increasing throughout the year," says Schuh.

Moreover, in December 2020, iron ore miner Vale cut its production guidance for 2021, noting a slower ramp-up of its assets in the wake of decommissioning upstream tailings dams and getting regulatory approvals, which resulted in no supply response to meet the growing demand – this drove iron prices to \$152/t in December (compared to \$122/t in November). As a result, port stocks in China were particularly low at the beginning of 2021, around 60 days before Chinese new year (compared to around 70 days the year before) and prices responded moving to \$165-170 for January and February this year, explains Schuh.

Fitch Ratings' conservative iron ore price assumption for 2021 is \$125/t, \$90 in 2022, \$80 in 2023 and \$70 in 2024. Schuh says that this is a reflection of China's all-time high levels of steel production as well as a recovery in iron ore production in Brazil (the world's second largest iron ore producing country) following the 2019 Brumadinho disaster, which caused Vale to shut down several of its mines in

February 2019 due to safety concerns following the disaster. The ramp-up schedule of Vale's assets was subsequently further impacted by the COVID-19 outbreak.

Iron ore prices are expected to normalise to the \$80/t – \$90/t price over the next five years as the supply and demand balance improves to balanced status and then small surplus. The next decade may prove interesting in terms of iron ore supply should the undeveloped Simandou iron ore mine in Guinea come into production at the end of the decade, which could add up to 60 Mtpa – 150 Mtpa of iron ore. MRA

A FINE BALANCE

Trying to keep steel production in check alongside stimulus-fuelled demand will be increasingly difficult on the back of policy changes requiring steel mills in the steelmaking city of Tangshan to curtail production in line with tightening emission standards. According to business intelligence firm CRU, although the released policy remains a draft, it indicates that the steel mills in Tangshan would be subjected to 30–50% of capacity cuts depending on emission levels in the rest of the year, which could affect long term Chinese raw material demand, pushing down prices.



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Rosh Pinah Trevali's crown jewel

After taking a knock due to decreasing demand brought on by the COVID-19 pandemic, the zinc market is starting to show good signs of recovery. This bodes well for TSX-listed **Trevali Mining Corporation's** expansion plans for its Rosh Pinah zinc-lead mine in Namibia. **GERARD PETER** finds out more from CEO and president **RICUS GRIMBEEK**.

ccording to a S&P Global report, zinc prices over 2021-2025 will be in the region of \$2 500 to \$2 900/mt. Global zinc ore extraction at existing mines will reach a peak in 2024, just exceeding the 14 million mt mark. These are promising signs for Rosh Pinah.

Now, while mid-tier miner Trevali may have a basket of lucrative mines and development projects across the globe, Grimbeek states that Rosh Pinah is the company's crown jewel. Now, with a steady cash flow and a focus on technology, it is furthering its expansion at the mine, dubbed RP 2.0.

Rosh Pinah is an underground zinclead-silver mine effectively processing 2 000 tpd (ROM). The mine has been in continuous operation since 1969 and currently produces zinc and lead sulphide concentrates containing minor amounts of copper, silver, and gold.

In August 2020, Trevali announced positive results from its NI 43-101 pre-feasibility study (PFS) based on a scenario to expand the current

IN SHORT Rosh Pinah will produce

3 600 tpd in a 10-year mine life but it has the potential to go for another +20 years.

throughput to 3 600 tpd by modifying the process plant, constructing a paste fill plant, and developing a dedicated portal and ramp to the WF3 deposit. According to Grimbeek, the PFS showcases "good

economics", including a

capital build of just under US\$100 million. "The real benefit for the company is that Rosh Pinah will expand its production on an annual basis. This really drives down the cost profile of the business to a mid-60c per pound all-in-sustaining-costs (AISC)," he explains.

Trevali is currently completing a feasibility study which will be published in H2, 2021. "The study is going well and we are looking at multiple options but we are very confident in the project and will focus on its delivery in the next couple of years," states Grimbeek.

For now, the expansion is set to deliver a 10-year mine life at Rosh Pinah. However, given that the mine has been operating for more than 50 years, Grimbeek is confident that the mine's life will expand well beyond this.

But there is also greater value that stretches beyond the expansion Grimbeek outlined. Trevali has a joint venture with global miner Vedanta to develop its Gergarub zinc-rich body located approximately 15 km northwest of Rosh Pinah. "I believe that RP 2.0 will allow us to mine that ore body and we will be able to put this ore through the expanded plant as well. By utilising our existing and expanded plant infrastructure, we will not need to invest heavily in the establishment of a fullscale, additional processing facility at Gergarub, while still enjoying the benefits of another seven to eight year's life of mine. This equates to a +20-year mine life at Rosh Pinah," explains Grimbeek.

Strong financial position

When it comes to financing the project, Trevali is in good stead. The company recently put its Caribou zinc mine in Canada, which was on care and maintenance at a cost of \$6 million a year, back into production. Now the company is hoping to generate organic cash flow from Caribou which will be used to support the funding RP 2.0. Grimbeek believes that with the zinc price around \$1.20 to \$1.30/lb, the company is expected to generate



significant cash flows from Caribou and the rest of the operating portfolio to fund Rosh Pinah's growth.

He adds that the company's overall liquidity position is quickly improving from the weak zinc market experienced in early 2020, meaning that Trevali may not have to go to market to fund the expansion project once the feasibility study is complete. "We are looking at the project closely and an investment decision will come after the feasibility study is published."

While many mining operations were hampered as a result of COVID-19, Grimbeek states that this was not the case at Rosh Pinah and the operation remains firmly on track. "Throughout the pandemic, we managed to keep the operation going. We brought in new health and safety protocols to ensure our personnel would remain healthy, he adds.

Building a mine of the future

Right from the very onset of the expansion programme, there has been a strong



focus on technology. In fact, Rosh Pinah is the company's flagship digital mine. Here, Trevali pilots technology before implementing it at its other operations.

Currently, the company is in the process of implementing an operating

"

The study is going well and we are looking at multiple options for financing including a significant portion from organic cash flows but we are very confident in the project and will focus on its delivery in the next couple of years,

RICUS GRIMBEEK

platform developed by mining software and consultancy company, MineRP. This includes an underground Wi-Fi system that can track people and equipment, thereby enhancing productivity and safety. It is also putting more systems





↑ An overview of the RP 2.0 expansion project

and process mechanisations in place in the processing plant.

Other technological advances include autonomous drone surveying. This will increase the scope, accuracy and frequency of underground surveying and enable faster turnaround times between surveying efforts and information required to make important decisions.

Another major development is the use of drilling telemetry. This allows

for real-time access to drill machine data so that operators can see drilling performance and progress as they do the work. The information is also made available to the mine planning and execution teams through the underground network so that they know at any time if work is being delivered according to plan.

"We are also looking at a solar farm as part of our effort to reduce



↑ An aerial view of the current mine

our environmental footprint. RP 2.0 definitely has a world-class future," adds Grimbeek.

In addition, RP 2.0 will bring significant benefits to Namibia and its citizens. "We are expanding the mine, so we are naturally going to have higher volumes of workers. Also, when you bring in new technology, you get people out of dangerous situations because you can have operators controlling from surface.

"We are going to spend around \$90 million to fund the expansion and that excludes the solar farm. That is a lot of money coming into the country. Also, a solar farm will always outlive the mine it is powering, in turn showing our commitment to long-term sustainability for our communities and our commitment to creating a low carbon energy source for people in that community," states Grimbeek.

Grimbeek reiterates that Rosh Pinah is an important part of the company's strategy going forward. "We have a well thought-out strategy to expand the mine and any zinc operation achieving an all-in-sustaining-cost of about 65c per pound is a tier one operation and this is what we will have in Rosh Pinah," he concludes. MEA Condra (1) 20 ton cap #/0 0078 year 2008

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Glencore Technology

Using fine grinding and flotation to deliver a major evolution in minerals concentration

There is a conflict emerging between the trend to lower grade ores and the trend toward more efficiencies from mineral processing. Degrading ores need more processing, with more energy and equipment being used. **Glencore Technology**, which develops, markets and supports technology that delivers flowsheet improvements, has created a new concentrator which helps solve this conflict, writes **CHANTELLE KOTZE**.

he fine grinding IsaMill and Jameson Cell flotation technologies, which were originally developed at Glencore's mining sites, have undergone significant change and improvements over the years as they reduce plant footprint, save water and energy and improve mineral grade and recovery. The result is a major evolution from conventional concentrator circuits.

Speaking during a webcast, Glenn Stieper, manager for mineral processing at Glencore Technology, detailed how the new and optimised concentrator design, using the trademarked IsaMill and Jameson Cell technologies, could dramatically reduce footprint, improve performance and decrease CAPEX and OPEX expenses.

The right technology for the job

Stieper announced that Glencore Technology has been awarded a contract to install its new concentrator at the the Ozernoye polymetallic project in Buryatia, Russia. The lead/ zinc concentrator will, from its 2023 commissioning, process 875 tph from a circuit comprising new high-throughput Jameson Cells and newly launched M20,000 IsaMills.



The trademarked IsaMill and Jameson Cell technologies could dramatically reduce footprint, improve performance and decrease CAPEX and OPEX expenses,

GLENN STIEPER

FAST FACT

The trademarked IsaMill is used extensively in base metals, PGM, gold processing and magnetite grinding applications

"The whole flotation circuit will be half the footprint of conventional technology and will need about half the energy," Stieper points out, noting that the 19 Jameson Cells within the optimised concentrator, replace 63 conventional tank cells, while three M20,000 IsaMills

with 5 MW motors will also be installed.

Ozernoye's mineralogy is complex and requires the right flowsheet to improve the recovery and concentrate quality to ensure the economic viability of the project. Its mineralogy is remarkably similar to Glencore's McArthur River zinc-lead-silver mine in Northern Australia. It's that operation that originally brought about the need to create the IsaMill ultrafine grinding technology to achieve the required grind size to liberate the zinc.

Meanwhile, combined with the Jameson Cell – a high-intensity froth flotation cell that combines intense mixing with small bubbles achieving rapid flotation without mechanical agitation – more value can be created from lower grade ore and sulphides.

"In a world progressively moving toward lower grades and higher throughputs, this concentrator circuit could be a game changer," says Stieper, not only at Ozernoye but any operation with complex base metal mineralogy.

Iterating this, Alexandr Kanarskiy, chief metallurgist at Ozernoye, said that due to the depletion of highgrade mineral resources and the tendency towards decreasing the size of the valuable component in the initial ore, the processing flowsheet at Ozernoye will likely become the benchmark in the field of complex finely disseminated ore enrichment across the globe.

The flotation complex is expected to be delivered to site during Q1 to Q2, 2022; installation should be completed around early-2023, with full plant commissioning scheduled for Q2, 2023.

Meanwhile, base and precious metals miner Hudbay Minerals is refurbishing its New Britannia mine in northern Manitoba, Canada, and has chosen to create a new flotation circuit made entirely of Jameson Cell flotation cells, to process ore from the Lalor mine, which contains copper, zinc, gold and silver. The 70 tph flotation circuit will use four Jameson Cell flotation cells, (compared with 11 conventional cells) – a decision that was driven by the realities of the Lalor ore body and desire to reduce costs and footprint and increase net value.

Matthew Taylor, metallurgy manager at Hudbay Minerals, says that the company chose Jameson Cell technology for its ability to handle varying swings in the head grade, for its range in carrying capacity and its ability to wash within each cell. "These factors will allow us flexibility to produce either a final concentrate from the rougher feed within the first cell or enable us to send the rougher tail to a cleaner circuit for further upgrade, depending on the head grade," says Taylor, noting that the Jameson Cell can be used in rougher, scavengers and cleaner flotation.

Although typically deployed in the cleaner stages of a processing plant, Taylor believes that Jameson Cell technology could find future applications within the rougher stage of mineral

DID YOU KNOW?

Jameson Cell flotation cells can achieve higher recoveries and grades, with a substantially smaller footprint, using much less electricity – all part of the evolution to a more sustainable future

processing and potentially even overtake mechanical cells in this application. Jameson Cells may also be suitable for circuits for metals that it has not traditionally been used in, such as copper and molybdenum separation. At the same time, he felt the IsaMill may find application closer to the head of the flowsheet – to where the bulk of the materials handling is taking place, with the potential of displacing ball mills in certain applications where feasible.

Installation at New Britannia is currently in progress and the flotation circuit is due for commissioning in Q4, 2021. MRA



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THE MINING VALUE CHAIN | STEP 3: PROCESS PLANT OPTIMISATION

Comminution sustainability

An industry game changer on the horizon

Sustainability has become the axis point around which mines operate. It has become an important driver in the decision making process and holds the key to securing investment and longevity. Consequently, service providers must uphold this principal as well, and **Weir Minerals** is doing just that as it looks to deliver new and sustainable solutions – particularly in the industry's comminution circuits – that will reduce energy usage and water consumption, lower maintenance requirements and have an overall positive environmental impact, **HOOSEN ESSACK**, process manager at Weir Minerals Africa tells **LAURA CORNISH**.

core component of Weir Minerals' business, one that is geared towards improving its own sustainability as well as that of its clients, is process optimisation. "This is what motivates our employees and has become central to everything we do," starts Essack. "Our objective to reduce our own carbon emissions by 30% by 2024 and 50% by 2030 is testament to the value we place on sustainability and is something that must reflect in the work we do for our clients as well."

More recently, this is being demonstrated in the test work the company is undertaking at its Netherlands-based premises to deliver revolutionary, cost-effective and environmentally sustainable comminution circuits in Africa. This more specifically entails the incorporation of the company's Enduron HPGRs (high pressure grinding rolls) and air classification into the milling circuit. On average, the company estimates that each installation of an Enduron HPGR saves around 12 000 tonnes of CO₂ annually – on both energy and grinding media – which equates to removing 3 500 cars from the road.

HPGRs traditionally operate in closed circuits, utilising a wet or dry screen to classify or separate the higher proportion of fines generated by the rolls. In competing high power size reduction technologies like SAG, ball and rod mills, operations use water and grinding media to create size reduction and move the material through the system.

The combination of HPGR and air classification in a circuit uses air from fans to separate and move the ground product through the system, which needs to be recycled through the HPGR for further grinding. To do this efficiently, it incorporates both static and dynamic classification systems. The static portion of the system removes coarser particles for recirculation to the HPGR, before they reach the dynamic classifier and cause wear.

The fans then blow the finer particles up into the dynamic classifier, where the final product cut is made, eliminating the need for ball or rod mills in some circuits.

"The test work we are working on presently is aimed at a specific application - for a large-scale processing plant," Essack notes. "We have secured ore samples from

site and are conducting our test work using this material. The results achieved to date are positive and demonstrate

the successes this comminution combination can deliver."

in 2021

 $m \uparrow$ The Enduron® HPGR and air classification demonstration plant has been designed and built in the UK for testing of materials from a customer site



↑ The combination of Enduron® HPGR and air classification circuit uses air from fans to separate and move product through the system

While the next step will see Weir Minerals corroborate its test work

further, Essack 150 years

reiterates that the end result, if implemented as part of the Weir celebrates this milestone birthday full-scale plant, will guarantee not only that

a traditional SAG mill will be made redundant, but that it can deliver an efficient circuit that will reduce energy consumption by as much as 40%, use no water and control dust pollution through the use of purified air.

"In addition to achieving these benefits, we won't compromise on the performance of the comminution circuit - because over and above the benefits already mentioned, our solution will provide improved throughput and performance, improved particle separation and significantly reduced downtime as well," Essack notes.

"This is a game changer in terms of new plant design."

HPGRs still controversial?

The mining industry's uptake of HPGRs has been relatively slow – as is the case with any 'newer'-age technology. But this is changing, Essack confirms. "We have a long list of installed HPGRs across the globe which demonstrate the benefits this technology has to offer and the steadily increasing interest in this product within the mining industry.

To ensure it offers an enhanced product, Weir Minerals has invested heavily in ensuring its Enduron HPGR



This [HPGR/air classification circuit combination] is a game changer in terms of new plant design,

HOOSEN ESSACK



 Λ Weir Minerals' installed base of Enduron® HPGRs demonstrate the benefits of the technology Ψ Environmental benefits of HPGR technology contribute towards mining's sustainability objectives



range can live up to the arduous grinding tasks required from any comminution circuit – especially hard rock applications. "Through our extensive understanding of heavy duty engineering, we have applied the learnings to our HPGRs to produce a robust product using the best materials, construction techniques, design dynamics, forces and modelling," he explains.

One example that demonstrates this is the company's proprietary studs, which offer longer lasting and reduced replacement requirements.

"In essence, the industry's adoption of HPGR technology is increasing – largely because of the environmental benefits it has to offer that contribute towards mining's sustainability objectives," Essack highlights. MRA

PROCESS OPTIMISATION EXTENDS TO CYCLONES

Be on the lookout for Weir Minerals' exciting launch of the company's new Cavex CVD hydrocyclone in 2021 which offers 30% more capacity than the previous model and delivers improved cut point performance as well. There are already nine installation sites across Africa using this new cyclone technology. **DE BEERS GROUP**

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Kareevlei Process optimisation leads to optimal production

AIM-listed diamond producer **BlueRock Diamonds**, which owns and operates the **Kareevlei diamond mine** in the Kimberley region of South Africa, is on the cusp of completing a major expansion. At the heart of the expansion is commissioning a new and improved processing plant, writes **CHANTELLE KOTZE**.

he expansion strategy at Kareevlei is aimed at increasing annual throughput to 1 Mt and extending the life of the mine to a minimum of 10 years, says BlueRock Diamonds COO Gus Simbanegavi, who is also the CEO of the local operating subsidiary Kareevlei Mining. Simbanegavi, who took on the role in mid-2019, with an initial focus on increasing production levels at the mine, is spearheading the execution of the expansion plan.

According to Simbanegavi, a key focus of the expansion plan has been achieving the correct economies of scale on both the mining and processing sides of the operations: "The material handling of what can at times be a difficult product in both the mining and plant operations is what we have been focused on optimising," he explains.

Prioritising the process plant

The company first undertook a plant configuration review in 2015, due to

ongoing operational challenges, which found that a plant reconfiguration and upgrade was needed – firstly, to reduce variable costs and secondly, to provide a more consistent product to the plant to enhance processing efficiency and improve grade.

This entailed the repositioning of the pans and scrubber as well as the construction of new primary crushing and pre-screening circuits, allowing the materials handling facility to feed into the plant at a higher rate.

Next, the company began to tackle the bottlenecks at the plant. The secondary crushing circuit was not

The new 1 Mtpa processing plant is expected to be fully operational by the end of July 2021 operating optimally and necessitated an upgrade to the circuit with the installation of an additional cone crusher to operate alongside the existing cone crusher.

The second cone crusher, which began operating in August 2019, enabled the company to maintain production volumes and to build stockpiles of crushed ore in line with the company's production target of 40 000 tpm, which it achieved ahead of schedule in September 2019.

With the dry end of the processing plant performing as expected, the wet end of the plant was struggling to keep up with the increased crushing levels. This necessitated the installation of a third 16 ft diamond pan, which was commissioned in December 2019, and helped improve diamond recovery and increase production.

Moreover, to enable the mine to produce on a continuous basis as opposed to a seasonal basis due to the rainy season, part of the work included



reviewing the working cycles to allow the mine to be operated all year round – 24/7, 365 days a year – says Simbanegavi.

With his sights set firmly on increasing production at Kareevlei even further, Simbanegavi was given the green light by the board to commission a new 1 Mtpa plant on site as part of the expansion strategy. The key drivers being the optimisation of the resource Once the new plant is fully commissioned... yearly throughput will be 1 Mtpa as envisioned from 2022 onward,

GUS SIMBANEGAVI

and to drive down costs due to the economies of scale impact.

Despite this tumultuous past, marred by ongoing operational challenges and the lockdown restrictions resulting from the COVID-19 pandemic in 2020 in which the mine was closed for 50 days between March and May (putting both its production and expansion plans on hold), BlueRock Diamonds is finally on the road to improved diamond processing capacity:



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thanks to ongoing work on the existing processing plant and the new processing plant, currently under construction.

New plant on track

According to Simbanegavi, the rationale behind the new plant was for it to be significantly more reliable than the old plant, even during the rainy season, by minimising downtime due to a number of plant design improvements which will ensure a more stable operation.

The dry end of the new plant features a 160 to 180 tpa primary crushing circuit where a jaw crusher crushes the material from <500 mm in size down to <75 mm in size. This material feeds into a primary screen which removes the -18 mm material, sending it straight to a stockpile tunnel for further handling. Meanwhile, the >18 mm <75 mm material is then diverted to a secondary crushing circuit comprising two cone crushers, which crushes the material down to <18 mm. This feeds back via a closed circuit to the primary screen to be screened, where it joins the <18 mm material stockpile tunnel.

Simbanegavi explains that the aim of the stockpile tunnel is to limit rehandling of the crushed material, as the <18 mm stockpiled material is fed directly via a feeder belt in the steel tunnel into the wet end of the circuit for further processing. The <18 mm material is then diverted into two respective lines, each line comprising a scrubber, screen and two pans. The material is first fed into a scrubber and discharged onto a screen which removes the 1 mm fines. The >1 mm <18 mm material is then sent to a pan feed bin where it is fed on a continuous rate onto two 16 ft diamond pans at 80 tpa. Once separated on the pan, the coarse material reports to a coarse tailings dump while the concentrate (which compromises 1% of the original kimberlite material by mass) reports to a dense media separator which concentrates the material even further. The final concentrator passes through an X-ray sorter at which point the diamonds are recovered.

The rationale for having two lines within the wet end allows for greater flexibility during plant maintenance. Simbanegavi highlighted that the both plants will be run simultaneously during Q2, to minimise the disruption to production during the plant transition.

Simbanegavi says that the new plant is expected to be fully operational by the end of July, a month later than previously anticipated. The critical dry end of the plant was completed and commissioned in February, while the wet end of the plant is still under construction, but nearing completion. The aim is to have the first line in the wet end commissioned by July, at which point the old plant will be decommissioned and two of the diamond pans from the old



 Λ The critical dry end of the new processing plant was completed and commissioned in February 2021

plant relocated and installed at the new plant, followed by the commissioning of line two, soon thereafter.

1Mtpa production profile in sight

In April, the company revised its 2021 production guidance. It noted that while it is still targeting production in excess of the bottom end of its existing 2021 guidance of 850 000 t, for prudence, it is reducing its published guidance for 2021 of tonnes processed to between 750 000 t and 850 000 t. In terms of carats produced, the company also adjusted its guidance to between 30 000 ct and 39 000 ct.

"Notably, once the new plant is fully commissioned, the company's production profile is expected to be significantly less impacted by the rainy season and yearly throughput will be 1 Mtpa as envisioned from 2022 onward," Simbanegavi says.

Once commissioned, the company will undertake continual optimisation work which will provide leeway to slightly increase throughput if needed. MRA

KAREEVLEI AT A GLANCE

The Kareevlei diamond mine consists of five known diamondiferous kimberlite pipes ranging from <0.5 ha to 5.6 ha. The five pipes have a combined inferred mineral resource of 10.4 Mt or 516 200 carats. Mining operations started in 2015 at KV2, since then KV1 and KV2 have been amalgamated into one opencast pit, the Main Pit, and are the source of ore in the present operation. Mining on KV5 will come on stream in 2021 with the biggest pipe KV3 planned to be mined from 2022.

The average value of all diamonds sold from Kareevlei exceeds US\$350 per carat, placing Kareevlei into the top 10 kimberlite mines in the world in terms of average value per carat. The company's most recent diamond sale of a 14.8 carat diamond for \$167 000 equates to \$11 300/ct.



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Engineering solutions provider **FLSmidth** was chosen as the preferred provider for four large bolted thickeners for a coal customer in Mozambique – designed to improve plant output. Two of the thickeners are designed to reduce water load on the filters allowing for a drier filter product, while the other two thickeners recover water from the plant tailings.

he installation, which includes E-Volute feedwell technology for superior flow distribution, will contribute to achieving optimal water balance in the customer's coal plant in Mozambique. Measuring 45 m in diameter, the thickeners will assist in achieving a drier product from the filter plant and control the density of material to the belt filters. This will improve the plant's output, reiterates Howard Areington, FLSmidth's general manager for projects and account sales in sub-Saharan Africa and the Middle East.

"Our test work on the material to be treated gave us the scientific basis for determining the best thickener



solution, including the size of the tanks," Areington says. "This data was then incorporated in the structural and mechanical elements of the design."

An important aspect of a bolted thickener is that its construction is quicker and safer, he says, requiring only a fraction of the welding to be conducted on site. This suits the conditions for the project, which is remotely located.

The extent of welding in the construction of normal steel thickeners typically runs into kilometres. It is far more cost effective to do this in controlled workshop conditions, where quality can also be better managed. By contrast, the amount of on-site welding required by a bolted thickener can be measured in metres.

"FLSmidth's bolted thickener technology has been embraced globally, especially in areas where installation costs are high," Areington explains. "Australia still has the highest number of FLSmidth bolted thickeners, but the technology has steadily been adopted around the world with multiple installations in southern Africa, Europe and South America."



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↑ The design of the thickeners features FLSmidth's well proven bridge-mounted rake

As mentioned, the thickeners include E-Volute feedwell technology for superior flow distribution. This leads to lower flocculant consumption, better settling rates and improved overflow clarity for the optimal performance of the thickener.

"Controlling the cost of flocculant – the single most important reagent in this process – is key to our thickener design," he says.

Despite the COVID-19 lockdown, good progress was made on the fabrication of the thickeners in South Africa, according to FLSmidth project manager Kevin Kockott. This has been managed by leveraging FLSmidth's global resources and the design teams' ability to work remotely.

"Our local South African office collaborated closely with our engineering

hub in Salt Lake City in the United States, ensuring that our engineering work on the project was able to continue without interruption," Kockott says. "Working with a highly respected fabricator also allowed us to limit the impact of the lockdown. Good planning – including the procurement of certain materials before the hard lockdown – gave us added ability to expedite our preparations for fabrication."

The design of the thickeners features FLSmidth's well proven bridge-mounted rake drive, known for its simplicity and ease of operation. The rake mechanism includes a proprietary low-profile style with tubular rake arms. These are able to move high-yield stress material with minimal drag and torque exerted on the drive mechanism.



Areington emphasises that all mechanical elements are designed for long life. This limits the intervention of the plant personnel in regular maintenance.

"We take particular care to ensure the drive mechanism delivers optimal uptime, and delivers a lifespan of 20 to 25 years," he says. "As part of our test work, we measure the yield stress of the material as a key determinant in selecting the drive size. This is generally a function of the underflow density."

Most of the large thickeners operating in the southern African market – up to 120 m in diameter – have been supplied by FLSmidth. He highlights FLSmidth's impeccable group pedigree in terms of thickeners.

"Our large installed base of units around the world is testament to our cutting-edge thickener technology," he says. "We have also secured most of the market for paste thickeners globally."

FLSmidth's involvement with the Mozambique project goes back almost a decade to the first phase of the plant's development, according to vice-president for mining in sub-Saharan Africa and the Middle East, Alistair McKay.

"The company has provided a significant amount of processing equipment in the coal preparation plant," McKay says. "This partnership has been extended into the second phase, with the supply of reflux classifier technology through to pumps, screens and feeders. We have also fulfilled the maintenance of our equipment, so we have had a team on site for many years." MRA

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The company understands the importance of a well-balanced production process – from primary crushing and screening, through secondary scrubbing/screening, recrushing and screening and finally, the coarse and fines dense media separation. Vibramech's broad range of custom-designed mineral processing equipment, caters for the variables that may affect the feed rate across these processes.

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Water security SA mining companies play their part

According to the World Economic Forum, a shortage of clean, fresh water presents the greatest global, societal, and economic risk over the next decade. Mining has always been heavily dependent on water and now there is an ever-increasing demand for mining companies to contribute towards water security, both in their operations and the communities where they operate. Commendably, some companies are already stepping up to help protect this precious resource. **GERARD PETER** and **LAURA CORNISH** report.



WATER IN MINING SPECIAL REPORT

ater security is a growing concern. particularly in the light of an evergrowing global

population. In fact, by 2030, the global population is expected to reach 8.5 billion and could face a water shortfall of 40%. What's more, water scarcity is a problem faced in many parts of Africa, a continent with a long history of droughts. Even more concerning is the fact that nearly 1 billion people on the continent don't have access to clean water. Without doubt, mining has a considerable impact on water security as mines rely heavily on this important resource in their operations.

Sadly though, mining also has a legacy of misusing water resources, including contaminating, polluting and completely decimating vital water sources. Fortunately, in recent times, there has been a greater commitment on the part of mining companies to use water resources in a more sustainable and responsible manner. In addition, responsible water usage is an important part of a company's ESG practices, something that investors are now looking at closely. Already in South Africa, some companies are taking the lead by looking at new ways to use water more efficiently and responsibly and these are those companies.

Working towards a waterless mine

With 75% of Anglo American's assets located in water-constrained areas, the company is embracing its role as a water steward to ensure a sustainable supply to its operations and the communities around them.

"The company's Sustainable Mining Plan targets a 50% reduction in freshwater usage by 2030, against the 2015 baseline. Ultimately, however, Anglo American wants to achieve waterless mining, with its operations requiring no freshwater withdrawals," says Jana Marais, spokesperson for Anglo American.

Among the initiatives that the company has put in place to realise waterless mining is dry tailings disposal. Water sent to tailings disposal often represents the largest water



↑ Coarse particle recovery plant at the El Soldado mine in Chile

loss at a mine. Fine particle slurries in particular are difficult to dewater, and current dry disposal options have prohibitive capital and operating costs. "As part of it pioneering Concentrate the Mine concept, Anglo American is exploring low-cost methods to minimise the amount of water sent to the tailings pond in the first place," adds Marais.

The approach combines coarse particle flotation to concentrate the minerals, and dry stacking technologies to dewater the residual waste, producing dry, stackable tailings. Essentially, it allows a mine to float particles at sizes two to three times larger than normal, making it easier to extract water from the process and leaving a waste stream that is dry and stackable.



 Λ The water from the scavenger boreholes at the company's Mogalakwena mine will contribute to the site's water security and potable water savings

Anglo American has been testing coarse particle flotation technology at its El Soldado operation in Chile. With the process changed to treat larger-diameter material and coarser grinding, there has been an increase in mill throughput, water, energy and cost savings, and a waste stream that is easier to handle.

However, there will always be a portion of ultra-fine particles that also require processing. In partnership with major chemical companies, the company has done some promising lab work on copper tailings using additives that separate interstitial water from fine metal particles – not only making them easier to recover but also resulting in dry, stackable tailings.

Another initiative is dry separation. This involves finding innovative methods



 Λ Anglo American has undertaken a number of initiatives to supply potable water to host communities

for dry comminution. More targeted comminution creates a pre-concentrate of the ore, rejecting and dewatering waste far earlier in the process. Early estimates indicate the potential for a 30 to 40% reduction in water used per unit of mineral production, as well as other benefits, including increased production," adds Marais.

Marais adds that Anglo American is also exploring ways of using less water when separating waste rock from ore. Currently, the company is conducting laboratory testing of a non-aqueous processing technique by using a bespoke polymer instead of water to separate the valuable ore from the remaining waste rock particles. "Applicable across most of its core assets, the company is confident that these dry processing techniques will allow us to re-use 80% of process water, thereby moving it closer to its goal of a waterless mine," she states.

In addition to implementing watersaving technologies, Marais explains that various initiatives are underway to increase water security in the areas where it operates by reducing its reliance on fresh water and supplying potable water to underserved host communities.

"For example, Anglo American Platinum has reduced its potable water usage, as a percentage of total water usage, from 38% in 2016 to 29% last year. This was achieved in three main ways: namely re-using water on-site; embarking on projects to use less water; and using poor quality water such as

SPECIAL REPORT

treated effluent that was not used by communities," she explains.

To reduce its freshwater needs, the company has invested heavily in municipal wastewater treatment initiatives. These projects include upgrading the Polokwane wastewater treatment plant at a cost of around R118 million, and an ongoing effluent treatment project in Rustenburg, which will reduce its dependency on potable water from Rand Water Board while improving water security for the town. An added benefit is that the company pays the Polokwane, Mokopane and Rustenburg municipalities for their treated effluent, providing them with a much-needed income stream.

Building a lasting legacy

Precious metals miner Sibanye-Stillwater – one of the largest employers in South Africa – is likely also one of the country's largest water consumers and water dischargers. This requires the company to examine its water management activities with strict discipline.

"Our water use management efforts demonstrate our commitment to protecting this resource and minimising our impact on consumption and discharge into the environment," starts Grant Stuart, senior vice-president: environment at Sibanye-Stillwater.

He highlights the group's strategic objectives in this regard, as detailed in its 2020 integrated annual report:

• Demonstrate thought leadership in water conservation and water demand management (WCWDM) practices;

- Ensure the availability of water to support safe and productive operations:
- Minimise the impact of all operations on water resources;
- Drive sustainable mine closure strategies; and
- Meaningfully engage stakeholders to promote responsible water conservation and water demand management.

Water risk management: PGMs

Sibanye-Stillwater's gold and PGM operations have unique and diverse water-related opportunities, challenges and risks. The group's South African gold operations and US PGM operations (located in Montana in the United States) are water rich and so water discharge compliance and water independence from potable water sources are focus areas. The SA PGM operations are water scarce; therefore water security, for safe production, plays a key role in the WCWDM strategy.

"Water scarcity is a focus at our SA PGM operations where the Rustenburg, Kroondal and Marikana mines are located," Stuart notes. Access to potable water is limited and added strain is emerging as a result of expanding communities.

Prolonged droughts and water scarcity has been identified as a key climate change-related water risk. Added to this is the risk of water restrictions and water cost increases imposed by municipalities as water becomes more scarce.



 $\boldsymbol{\uparrow}$ Water monitoring at one of Sibanye-Stillwater's operation's water plants

Mitigation measures include, among others, to implement actions to reduce water reliance from external suppliers and the development and responsible execution of WCWDM plans, based on predictive modelling.

Sibanye-Stillwater's PGM operations used 76% of the total 23 051 Ml used in 2020 for industrial purposes and the remaining 24% for domestic purposes. Rand Water Board (RWB), the supplier of potable water to the PGM operations, is under severe pressure due to constrained supply to the Rustenburg region and the increasing pressure on the Integrated Vaal River System, the primary source of RWB's water. As a result, restrictions of 20% were imposed on all consumers, including the PGM operations, during much of the year under review.



 Λ Constant biomonitoring by Sibanye-Stillwater ensures that the enviroment remains in a pristine condition

SPECIAL REPORT WATER IN MINING

"To improve our water supply security and reduce our water use, we have pursued a number of initiatives," Stuart notes.

These include the installation of boreholes to support Kroondal under emergency conditions. Securing alternative groundwater sources (outside of RWB supply) is also well underway with 10 Ml/day already secured from the Haartebeespoort canal. Optimising water recovery from tailings storage facilities through scavenger wells is further under investigation to ensure security of supply at the Marikana operation. The integration of Marikana with the Kroondal-Rustenburg footprint has also presented opportunities to balance water requirements across the footprint, more specifically with the infrastructure installation to transfer excess available water from Marikana to the Kroondal and Rustenburg operations reducing our reliance on RWB.

"We are further looking at the potential to convert old open cast pits into water storage reservoir systems which we can use for our own operational needs but importantly will also leave a positive legacy of providing additional water resources to our communities post mining," Stuart highlights.

Importantly, the company has identified that leakages within its own circuits are a threat when dealing with water scarcity. Consequently, it has implemented an automated monitoring system across its operations (also gold) from 2016. "This enables us to implement focused remedial measures with accuracy," he continues.

Water risk management: Gold

By comparison with its SA PGM operations, Sibanye-Stillwater's gold operations deal with a very different water challenge – excess water as a result of penetrating deep-level aquifers at depth. Water-related risks at these operations include regional closure, the management of the surplus water that requires continual pumping to keep underground workings dry and the treatment required to ensure the water quality is compliant when discharged.

While these deep-level operations are generating significant water, Sibanye-Stillwater is currently reliant on potable water sources for some 30% of its water use. "This therefore presents us with an opportunity to find ways of becoming independent of our external water suppliers and furthermore potentially alleviating the supply challenges experienced at SA PGM operations. In 2020 the SA gold and PGM operations successfully reduced consumption by 12% year on year, with our US operations largely already independent," Stuart reveals.

Significant progress has been made in respect of driving water independence

at the gold operations. A borehole to supply the Cooke gold processing plant was completed in the first quarter of 2020, rendering the gold plant totally independent from RWB. An extension to Driefontein's water treatment facility is also underway. The 5 Ml treatment extension will see the mine almost completely independent from municipal water supply by Q4, 2021. The Kloof water treatment plant, which forms part of Phase 1 of the operation's independence drive, will reduce the reliance of the Kloof operations on RWB by approximately 33% in Q3, 2021.

Beyond this there is a major water project under review – the potential to collaborate with RWB as it looks to secure about 500 Ml per day of water outside of the Lesotho Highlands water scheme. "We have 200 Ml of water available on the West Rand, some 40% of the RWB requirement that could reduce this RWB requirement significantly – and augment the water requirements of Gauteng, the economic hub of South Africa," Stuart shares.

Impressively, while Sibanye-Stillwater's water management activities reside with operational improvements and cost reductions, there is significant focus on working towards improved water conditions, not only for the communities around which it operates but also the greater South African economy.



 Λ Biomonitoring close to the company's gold operations



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↑ Canyon Coals' Sewage Treatment Plant at its Khanye Colliery contributes to the overall health of the wetland system

Collaboration key to water security

In a water stressed country such as South Africa, there is a need for this precious resource to be sustainably managed by all users. It is with this in mind that Canyon Coal has put in place a host of measures to reduce water requirements across all its mining operations, and manage this important resource responsibly at all times.

For starters, the company has a team of environmental specialists which form an integral part of the projects team, responsible for developing mines and compliance in its current operations. All of its operations are fully licensed, each with an approved Environmental Management Programme and Water Use Licence, which are audited internally and externally annually.

Melissa Pillay, licensing and compliance manager for Canyon Coal, explains that monitoring on all sites is conducted by independent specialists and samples are analysed in South African National Standards (SANS) accredited laboratories. "Furthermore, all of the company's operational mines have approved Water Use Licences (WUL), issued by the Department of Water and Sanitation (DWS) in terms of the National Water Act. These WULs have very stringent conditions and employees and contractors are contractually and legally bound to adhere to these conditions," she adds.

Flow meters are installed at all locations where water is extracted or moved between facilities at operations. The volumes are recorded to, firstly, measure compliance with the WUL conditions and, secondly, monitor the company in terms of its water use.

Pillay adds that Canyon Coal's processing plants are equipped with filter presses which mechanically dewater the ultra-fine coal material using special filter mediums to exert pressure on the coal material to separate solids (filter cake) and liquids (clean water). "These presses result in the recycling of 30% to 40% of water, resulting in a considerable reduction in the total water use in the individual processing plants," she states.

Moreover, the company's mines utilise closed water reticulation systems, which ensure that no contaminated water is released from the site into the surrounding environment. All contaminated water is channelled via dirty water channels and collected in pollution control dams (PCD). This water is in turn used for dust suppression within the mine's boundary and also pumped from the PCD back to the processing plants for reuse."

Inflow from ground and rainwater into the opencast pits is also used to supplement the water requirements at the company's operations, be it for dust suppression or processing requirements. The inflow water is pumped to the PCDs. This reduces the need to source water from outside the mine boundary and thus aids in preserving surrounding water resources.

In addition, Pillay points out that a Sewage Treatment Plant (STP) was recently commissioned at the company's Khanye Colliery near Bronkhorstspruit.

The STP treats sewage water from the mine and discharges treated water into an adjacent wetland system, as stipulated in the approved the WUL. The water quality is tested on an ongoing basis. "This contributes to the overall health of the wetland system by improving the water quality and maintaining a constant flow of water," she concludes. MRA



 Λ Water collected in Canyon Coal's pollution control dams is pumped back to the process plants for reuse
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Water use licences Red tape delays application process

Mining companies in South Africa face an arduous task when it comes to securing a water use licence. This is mainly due to laborious legislative processes that create bottlenecks. What are the stumbling blocks and how can these be overcome? **GERARD PETER** finds out more from **GARYN RAPSON** and **KIRSTY KILNER**, both partners and environmental lawyers at law firm **Webber Wentzel**.

ccording to Rapson, the major stumbling block hindering the issuing of a water use licence is the determination of water reserves. Reserves are the minimum amount of water that needs to stay in a water resource. For starters, the National Water Act says that the Minister of Human Settlements, Water and Sanitation has to gazette reserves for all water resources in the country. However, he explains that there's a long process that needs to be followed to get to that point. "The department needs to go through a specific scientific procedure to determine the reserve for any water resource in the country. Today, I don't believe that any final reserve has ever been published by the department. And that is the number one stumbling block to all these licence applications, because the law says that the reserve has to be taken into account before a licence can be issued," he states.

Rapson adds that because of the delays of final reserves being published, the department has to determine a preliminary reserve for every water use licence application that is issued in the country. This, he explains, is not an easy process and takes time.

When the Act was drafted, it made allowances for the regulation of water usage at a catchment level. Catchment areas cross provincial lines and consider a water resource in its entirety. According to the Act, these are supposed to be controlled through the establishment of catchment management agencies who will be responsible for issuing water usage licences in their respective catchments.

Applicants often have to present a mountain of technical paperwork when applying for a water use licence



However, Rapson points out that this has been an extremely slow process. "There's only been a handful of catchment management agencies that have been established in the country and not a single one of them has the powers to issue licences," he states. As such, every licence that is issued by the department must be processed at a national level and signed off by the minister, adding further delays to the process.

A myriad of technical information

Kilner adds that while the Act has better defined the process of obtaining a water use licence, it remains an administrative challenge, hence the backlog. "In fact, this backlog has resulted in many mining companies operating without a water use licence for many years. I think the department is a bit overwhelmed. It's also quite a technical process – not just a matter of a mining company simply submitting an application outlining their water requirements. There are all kinds of technical assessments that need to be done and there also needs to be public participation. So the process itself tends to be a bit laborious," she states.

Rapson points out that because a licence application is so detailed, it can comprise upwards of 10 Lever Arch files in some instances. "The applications themselves contain a host of technical specialists' input. For example, for any application, you would need to prepare a salt balance report, present the findings of a geohydrological study, and include surface impact assessments.

"Also, if you're going to build any storage infrastructure on your site, whether it's dams or waste areas, you have to get your technical design signed off by the department." To further add to application delays, Rapson states, there is only a single person in the entire country that can sign off on the detailed technical designs of storage facilities. "So, you can imagine if you have one man that signs off on every single design in the country, delays are inevitable." Kilner further points out that the country's current water crisis also has an impact on the determination of water reserves. "Also, there are challenges from competing industries and NGOs who will really scrutinise what the department is doing and what it authorises. So, there really has to be a careful balancing act, which feeds into the amount of time that is taken to process these kinds of applications and make sure that the right processes are followed," she adds.

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Speaking at *Mining Indaba* last year, President Cyril Ramaphosa made a declaration that government is committed to streamlining the water use licence process, reducing the application process from the current 300-day period down to 90 days.

Sadly, while the declaration has been made, and although water use licensing application regulations have been published which talk to the 300 day limit, this is difficult to achieve. "It's all well and good to say you want to truncate the process, but if you have all of these kinds of inherent stumbling blocks, it will be difficult to live up to those promises," says Kilner.

Both Rapson and Kilner agree that the way forward is to implement the actions to determine the reserves throughout the country and establish the catchment management agencies. In this way, there will be no bottlenecks at a national department level and the process of issuing water usage licences can be expedited. MRA

...You can imagine if you have one man that signs off on every single design in the country, delays are inevitable,

GARYN RAPSON



SPECIAL REPORT WATER IN MINING



Dealing with water risks

Shared responsibility needed

The mining sector has a key role to play in contributing to good global water management and supporting the objectives of the United Nations Sustainable Development Goals. However, this can only be done by mining companies working collaboratively with all stakeholders. **GERARD PETER** reports.

ithout doubt, there are a number of water risks associated with mining. However, by integrating broad water risks into their business model and by pro-actively collaborating with local communities, mining companies can demonstrate to investors their management of water risks, build trust among all stakeholders, and show respect for other water users and the ecosystems in which they operate.

This was the general consensus of the panellists in a recent webinar titled *Water Risks in the Mining Sector: Why* they matter to business? Organised by the Responsible Mining Foundation, the webinar focused particularly on a shared responsibility to mitigate water risks. It also highlighted the role that investors can play in ensuring water security.

Leading the discussion was Hélène Piaget, CEO of the Responsible Mining Foundation. She pointed out that on the whole, mining operations require a lot of water whether it is fresh water, recycled water or desalinated water. On top of that, mining also releases toxic waste onto tailings storage facilities and such waste could find its way into rivers and lakes. Piaget added that water in the context of mining is always local. "It happens in a community and has an effect on activities such as farming or even on far away cities that are down river that rely on the river for drinking water. Therefore, there needs to be a shared responsibility for valuing water – everyone should share the responsibility of mining minerals," she stated.

Weighing in on the conversation, May Hermanus, adjunct professor at the University of the Witwatersrand, stated that once a mining operation has been established, there needs to be consideration about how the mine impacts on water resources and what safety measures are in place to protect such a resource, both during mining and after mining. "Another key consideration is the chemical reactivity of the mineral or metal that is being mined as well as the waste material that is being produced," added Hermanus. "So, if chemical reactivity is an issue, it is important to know whether mining will liberate acid building compounds or radioactive materials. Also, if acid mine drainage is a risk, can heavy metals in the host rock or soil be mobilised?"

According to Hermanus, the measures and the costs involved have to be determined upfront and need to be considered by investors. "Is the mine located on a large ore body or an isolated ore body? Are there other mines located on the same ore body? What will be the collective impact on the water resources? All of these measures need to be considered by financial backers. Remember, when water risks are underestimated both mining companies and investors are courting disaster."

Real results and not mere policy

Another point of discussion during the webinar was mine tailings impoundments and the water associated with them. Hermanus cautioned that people who are homeless and destitute often see these areas as viable habitable land. However, the consequences of habitation of this land has severe impacts on the health and well-being of these people.

Also on the panel was Vagner Diniz of the *Instituto Camila e Luiz Taliberti* in Brazil. Diniz suffered a personal loss during the Brumadinho dam disaster two years ago. He pointed out that the effects of the disaster are still being felt today by the local community. This includes people falling ill and the quality of water in the area being compromised due to the contamination by heavy metals.

Diniz cautioned that any funder of a mining operation needs to carefully

consider the impact such an operation will have on water security. "Investors should not just rely on mining companies showing them their ESG policies; they need to see the proof of these companies engaging with communities and implementing their policies," he added.

SPECIAL REPORT

Meanwhile, Peter Kindt, head of metals, mining & fertilisers (EMEA) at ING Bank in Holland, agreed with Diniz about the role that investors can play in ensuring that water risks are mitigated. He stated that investors have a key role to play in setting the tone and driving mining companies to take action.

Furthermore, Kindt pointed out that nowadays, many investors are leaning towards putting money in companies with strong ESG principles. "However, rather than just having policies in place, companies need to be on a genuine trajectory to improve their ESG ratings. Sustainable business is better business. Those mining companies that engage in reduced water usage have a better prospect of getting investment," he concluded. MRA

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Hydropower Tirupati Graphite chooses green energy in Madagascar

LSE-listed specialist graphite producer and graphene developer **Tirupati Graphite** is investigating ways to harness hydropower at its Madagascan graphite projects in a bid to ensure that its operations are sustainable and have a low carbon footprint. It would also provide a green source of natural flake graphite to the burgeoning electric vehicles and green technologies markets. **CHANTELLE KOTZE** speaks to CEO **SHISHIR PODDAR** about the company's hydropower ambitions in Madagascar.

n line with its sustainable mining strategy, Tirupati Graphite has set itself the ambitious target to meet 100% of the power requirements for its Madagascan projects using hydropower. "Increasingly, consumers and manufacturers alike realise that achieving 'zero carbon at use' is only one part of a larger goal and that there is a need to look holistically at all of the processes along the entire supply chain. Accordingly, as highlighted by the strong demand for our primary flake graphite, there is significant preference for the lowest impact deposits around the world. With this in mind, we remain

> Our hydropower energy initiatives will help us reduce our carbon footprint by almost 50% and also result in cost savings,

SHISHIR PODDAR

focused on delivering a green source of graphite for the 150+ applications and uses of the commodity. Our hydropower initiatives are part of this strategy, which will help us reduce our carbon footprint by almost 50% and also result in cost savings," says Poddar.

Born out of its India-based holding company Tirupati Carbons & Chemicals, Tirupati Graphite has inherited wideranging expertise in the entire flake graphite value chain from mining to graphene production. It is focused on creating value through its two primary mining and processing projects in Madagascar, the Greenfields Vatomina project and the Brownfields Sahamamy project, its specialty graphite projects and graphene & technology centre in India.

The company's strategy is to increase its production capacity of high-quality flake graphite concentrate with up to 96% purity to 84 000 tpa by 2024 from the 3 000 tpa currently being produced at Sahamamy. In line with this, the company commissioned its first 9 000 tpa production module at the Vatomina mine in April, taking the capacity across both projects to 12 000 tpa of flake graphite. An additional 18 000 tpa of production is targeted by early 2022, savs Poddar.

The company therefore aims to achieve its 84 000 tpa production target by bringing online a total of 21 000 tpa of graphite production at Sahamamy and 63 000 tpa of graphite production at Vatomina by 2024, explains Poddar, highlighting the strong and growing demand for the company's eco-friendly products in the global ex-China graphite markets.

Having successfully brought the Sahamamy project back into production in 2019, the company set its sights on the redevelopment and refurbishment of the existing 50 kW hydropower plant at Sahamamy – last operated in 2005 with an increased capacity to 100 kW.

Following further assessments of the hydropower plant during 2021, the redeveloped hydropower plant, due for completion by end Q4, 2021, is anticipated to meet Sahamamy's current power consumption of about 100 kW,

resulting in an estimated ongoing saving of approximately 10% in the operating cost per ton of output and a 50% reduction in carbon emissions.

In meeting its green energy targets as its Madagascan operations ramp up, the company is simultaneously accelerating further studies and detailed planning on the back of the earlier conducted prefeasibility studies for an

1000 kV

its operations by Q2 20200

The amount of hydropower capacity

Tirupati Graphite is targeting across

additional 900 kW of hydropower capacity.

At Sahamamy. an additional 450 kW will be brought online, which will

ensure that the company is able to supply 100% renewable energy to the next 18 000 tpa production modules at the operation. Meanwhile, at Vatomina, the company undertook a study in 2018 into the possibility of establishing hydropower capacity in the area. At that stage, the company had identified

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two potential locations, which together could produce a combined 450 kW of hydropower. "Going forward, we will initiate detailed studies into the development of this so that the 450 kW of hydropower can be brought online at Vatomina by as early as Q2 2022," says Poddar.

He explains that the availability of natural water in perennial streams

> at elevations will allow the company to fast-track the development of the hydropower plant as no back and forth pumping of water will be required.

SPECIAL REPORT

Moreover, the company is investigating solar and wind power opportunities in Madagascar with the overall strategy of maximising the use of renewable energy for all of its power requirements as much as is doable in the areas in which Tirupati operates, Poddar concludes. MBA

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SPECIAL REPORT WATER IN MINING

The Multotec filter press was added to dewater the sludge to a 50% moisture level

Toxic water washed away

The global mining industry is going green – or at least is in the process as it looks for environmentally sustainable solutions that demonstrate a clear journey towards greater ESG compliance. A large-scale gold operation in West Africa has recently taken a positive step in this direction, having invested in a water treatment plant that purifies treated process water to a level suitable for discharge into the environment, writes **LAURA CORNISH**.

he design, construction, installation and commissioning of the water treatment plant was undertaken by metallurgical and process equipment firm Multotec.

Unathi Mkruqulwa, process engineer at Multotec, shares the journey in providing a world-class plant that demonstrates the company's water treatment capabilities and collaborative approach to delivering sustainable solutions for the mining industry.

The challenge

"Our client was looking to discharge water from its operation into the environment but was unable to due to the high volumes of arsenic in the water," Mkruqulwa starts. "With 10 ppm of contained arsenic, this is well above the International Finance Corporation's required discharge limit."

The solution

The starting point, Mkruqulwa continues, was test work, which Multotec conducted at its facilities in South Africa after securing the necessary water samples from site. Having determined a process that would work, in 2019, the company secured the full-scale project in February 2020.

With an initial small scope change to the project – which saw the plant relocate from its original intended position at the tailings storage facility to the return water dam – it was completed and commissioned over January and February 2021.

Now fully operational, the plant removes the arsenic using a two stage ferric sulphate treatment process. "Housed within the plant is an additional circuit which first converts ferrous sulphate to ferric sulphate – which is then able to precipitate the arsenic from the water," Mkruqulwa explains. Iron flocculants are recognised as the most effective compound for removing contained arsenic and are also fast at doing so.

Designed to treat 150 m³/h of process water, the plant is successfully reducing the arsenic level from its original 10 ppm to <0.1ppm, a globally acceptable standard to release into the environment.

Impressively, the final plant design and construction required further adaptation when Multotec discovered an unexpected challenge – the presence of cyanide in the water. Quick to adapt, the company added a cyanide treatment circuit to the plant which neutralises the cyanide upfront before moving through the arsenic precipitation phase.

"This in some ways could be considered the easier challenge to overcome," Mkruqulwa notes. "Delivering a plant to a remote region in Africa during ongoing COVID-19 related

SPECIAL REPORT

lockdown measures presented its own difficulties and required additional planning and preparation. Known for our flexibility and adaptability and absolute commitment to helping our customers succeed, this ultimately posed no additional problems as the Multotec team constructed the plant on site over the Christmas period ensuring it could be completed on time. This was followed by a three week commissioning period on site in February."

Multotec brought to the project its holistic dewatering solutions by adding its filter press to dewater the sludge produced from the process to a 50% moisture level. The water abstracted during this process is recycled upstream of the arsenic treatment plant.

What's next?

"The plant has been a phenomenal success and is treating the arsenic to the desired $\leftarrow 0.01$ ppm," Mkruqulwa highlights. On the back of this, the company is however looking to conduct a process optimisation exercise which includes the addition of an online arsenic analyser.

Typically, arsenic levels are monitored in a laboratory and can take days to return results. "Through the incorporation of an online analyser, we will be able to monitor arsenic levels in the water in real time, allowing us to address any potential problems quickly and efficiently, a value-add



offering which will enhance the overall performance of our plant significantly." This value add service from Multotec is in line with the company's move towards the future world of digital solutions providing real-time monitoring of clients' processes. This enables quick reaction to negative changes in plant performance or condition and allows clients to maintain a continuously optimised operation.

Ongoing support

While Multotec will continue to offer training to on-site personnel, it remains committed to providing any



 \uparrow The water treatment plant commissioned by Multotec is successfully reducing the arsenic level at a large-scale gold operation in West Africa

necessary or required after sales support. The company has a branch in Ghana, which provides localised and speedy support in the West Africa region. "Ghana is the hub from which we service all of our West African customers," Mkruqulwa indicates.

"Not only is this the largest arsenic precipitation plant we've successfully delivered to date, but the incorporation of an online arsenic analyser further demonstrates the commitment we have to providing the industry with digitally relevant products that enhance the performance of our equipment and solutions," Mkruqulwa concludes. MEA

THE WATER TREATMENT PLANT PROCESS

The water from the return water dam is pumped to the plant where it first passes through a cyanide removal plant. From there, it is pumped into a feed tank and then the ferrous conversion plant where two products are produced – clean water and sludge. The sludge is fed through the filter press and the clean water pumped to a storm water dam from where it can be discharged into the environment or recirculated back into the plant.

Desilting process ponds

Maintenance key to maximising efficiency

Process water ponds/dams may not be core to the functionality of an operation, but they are an important element of the greater mining process. As such, these ponds should be maintained on an ongoing basis, which requires regular desilting to prevent the build-up of slurry material. Integrated Pump Rental's (IPR) MD Lee Vine and rental development manager Steven du Toit talk to GERARD PETER about this topic in greater detail.

ccording to Vine, the aim of desilting a process pond is two-fold. Firstly, it is to increase water capacity and secondly, it is to recover valuable materials that may have unavoidably made their way into the ponds.

In recent times, IPR has noticed an increase in demand for its desilting services in order to improve the functionality of process ponds. "The typical trend we are observing however is that the large majority of ponds contain up to 90% slurry, reeds and debris. This puts a strain on mining operations which consequently have to manage reduced water storage. This in turn forces the mines to desilt their ponds under urgent circumstances to prevent environment-compromising spillage. In worst case scenarios we have seen companies invest in new ponds which is very costly, " he explains.

Vine adds that the demand for desilting is being driven by the need to push production levels. This increases the potential for thickener failures which further results in a high amount of fines making their way to process ponds. Furthermore, Du Toit points out that as South Africa approaches the winter period, cleaning up process ponds becomes of even greater importance. "Ponds need to be fully operational during the high rain season. "By desilting the ponds during winter, we can assure the mines that they have enough water storage capacity during the rainy summer months."

One product that has proven to be highly effective for desilting operations is IPR's SlurrySucker dredging unit. Designed and engineered by the company, the SlurrySucker is capable



SPECIAL REPORT

of extracting high slurry tonnages due to the design and engineering of the dredge head.

Portable and remotely operated, the SlurrySucker can be used without the need to shut down the mine or the process pond. Du Toit points out that the SlurrySucker has not only been designed to keep process ponds operating but has also been designed with safety and the environment in mind. "This innovation has zero risk of contaminating process water and because it is remotely operated, there is no risk to personnel either," he states.

A solutions-driven company

Vine adds that while the SlurrySucker is capable of cleaning a fully silted process pond, the machine was built to be for maintenance as well. "The SlurrySucker should ideally be used as a dredging unit when the pond is 40% full of slurry and we basically skim the 2 m that is sitting at the bottom of the pond.

"While a small amount of silt is as a result of mining itself, the majority of silt in a pond is uncontrollable and is caused by rainfall or dust that sits in the V-drains, making the maintenance approach far easier in the long run to control," he explains.

Currently, the company is working on the latest version of the SlurrySucker -Version 3. This updated product allows for hydromining and dredging to be conducted simultaneously via remote control from the side of a pond.

IPR offers its clients the opportunity to buy or rent the SlurrySucker. Should a client choose the latter option, then IPR provides maintenance work to mine ponds once a year for cleaning



 Λ The winter period is the ideal time to desilt process ponds and dams

MEETING THE GROWING DEMAND FOR DEWATERING SERVICES

Following the extensive rains in most regions of southern Africa, Vine points out that there has been a major increase in demand for rapid dewatering. "As such, we have increased our fleet by 30% to accommodate the huge demand all over South Africa for high flow units, contract dewatering units, our submersible units and all of our accessories for both underground and surface mining," he explains.

purposes. However, whether a client chooses to own or rent any piece of IPR equipment, the company employs a full engineering team that assesses ponds on site – an application at no cost. In addition, IPR's technical team offers full on-site training for all its clients.

Furthermore, IPR offers a range of solutions depending on application, from mobile diesel self-priming units, electric self-priming units, submersible electric dewatering units, mobile diesel slurry units, pump flotation devices, hose float devices, electrical panels and piping applications. The company is also the South African distributor for Sykes self-priming diesel driven pumps which are available for sale and rent.

It is this wide product offering along with ongoing customer service that Vine says makes IPR more than just a pump rental company. "We are a solutions provider company. We are there to assist and conduct maintenance when necessary. IPR does the servicing of all its own rental equipment and the advantage of this is that we are there on site ensuring that our equipment is working efficiently at all times," he concludes. MEA



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 o, what is the answer to this problem? A new look at using the latest technology and processes
 will enable mining houses to continue to exploit highly valuable resources and comminution specialist Loesche can help.

The Loesche Vertical Roller Mill or VRM is a dry process that reduces mines' need for large amounts of water to operate efficiently.



Due to the high reduction ration of a VRM, engineering houses can reduce the footprint of a comminution circuit, specifically reducing capital outlay as well as operating expenses," says Loesche SA sales and marketing manager Jonathan Smith.

The Loesche VRM can accept ore lumps of 80–120mm depending on the mill size, from which the ore can then be milled dry to the required particle size in one pass," he continues. The below flow diagram can be simplified and streamlined to suite any operation.

Starting at the run of mine side of the comminution circuit, the tertiary crusher will most of the time be removed as well as all associated equipment such as screens, feeders, conveyors, water pumps, piping, and sprayers – this is possible due to the large feed size to the VRM.

Due to the nature of the VRM process, the material is milled, classified, and transported to the bag house as a dry product, allowing the exposed mineral surfaces to remain clean and uncontaminated. Consequently, the material can be stored in a silo ensuring a constant supply of material to the downstream recovery circuit.

When floating, contaminates from the milling process like iron (wear from the mill charge) mix with water, causing oxidation and this plays a large role in reagent usage. Due to the dry process of the VRM and the nature of the milling process, particles are not oxidised, and the ore flow has a much lower level of contamination from wear. The VRM has a typical usage of around 10% compared to that of a wet ball mill circuit, thus allowing for cleaner concentrates.

As product can now be stored in a silo, the possibility of de-coupling the comminution section from the recovery process enables the mine to be flexible. In short, the mill can be undergoing basic maintenance whilst the recovery circuit is still operational, "Smith Highlights.

The VRM also generates a much steeper particle size distribution, which gives a better floatable range, giving the recovery circuit a higher yield concentrate, with a reduction of oversize and ultra-fines which is waste that requires water and reagents.

A constant dry feed enables the slurry density to be controlled almost precisely, which will have an impact on chemical and water usage. As a result, better settling velocities, less pollutants, and efficient water purification with less evaporation will be experienced allowing for the possibility of a smaller water reticulation circuit.

"The end result is the better management of water usage to ensure the viability of the mine," Smith concludes. MRA



Ecological transformation Optimised resource management leads the way

With a spotlight on the harmful effects of certain businesses on the environment, most mining operations are under pressure to ensure they not only meet regulatory requirements, but also choose the correct approach to existing problems that won't harm the environment.



↑ Veolia offers a full mine lifecycle partnership

s such, resource management company Veolia is committed to and is acting upon ecological transformation, in response to the environmental emergency.

Veolia is fully committed to supporting the mining industry as a partner through the following:

- Additional production/yield improvement;
- Enhancement of social licence to operate;
- Improvement of cost position;
- Promotion of sustainability and a greener image;
- Moving water, waste and energy operations from a risk to a business opportunity; and
- Identifying and leveraging state-ofthe-art solutions.

The starting point of a journey with Veolia would be to look at the true cost of water in a mining operation. This is to determine water-related risks including water scarcity, extended water shortages, flooding, external water contamination and water price increases.

The consequences of not addressing these issues have been illustrated by several examples.

For example, a parastatal development bank was forced to pay remediation costs when the environmental pollution caused by poor management of an African chrome mine became apparent and their operations were shut down. The clean-up costs at the time amounted to US\$560 000.

This is just one instance where mismanagement of wastewater has had devastating implications. Veolia can assist with mitigating risks, through a phased approach, with any required Capex expenditure being planned for. It is the company's belief that all mines should strive towards Zero Effluent Discharge (ZED) programmes. To date, Veolia has assisted several African operations to achieve this.

Contributing to the circular economy

Veolia offers a full lifecycle partnership, from mine exploration, development, construction and operation to closure – ensuring all appropriate local standards are met. The company's expertise in the field of Operations and Maintenance (O&M) ensures that all water and wastewater plants are run efficiently and ultimately reduce operational costs for the client.

Veolia has some 350 registered technologies that can be harnessed. Digital technologies, like the unique "Hubgrade" system, a remote monitoring management tool, enable plants in all industries to run optimally and extend their lifespan. The advent of Veolia's Impact 2023 further refines its services and total solutions mandate within the context of the circular economy.

In addition to this, Veolia also invests in waste recycling programmes that encourage skills development and job creation initiatives. Its participation in the Baobab project, a 3rd Place in Durban, which is dedicated to sustainable living and innovative waste solutions, serves as a good example. **MRA**

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million inhabitants connected to wastewater systems

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million people supplied with drinking water

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million metric tons

waste treated

SPECIAL REPORT WATER IN MINING



Preventing Day Zero Businesses key to ensuring that

the taps don't run dry

South Africa's recent droughts are teaching mining companies a life-changing lesson: We can no longer simply assume that clean water will always be available to keep operations running smoothly. In fact, water stress can put business models in jeopardy.

his is according to Gert Nel, partner and principal hydrogeologist at SRK Consulting. Nel says that responsible water management is becoming a cornerstone of any sustainable business model, with investors starting to look more critically at how water risks are mitigated.

"When putting together a business model for a multi-million rand business development, a key factor will now be the reliability of water supply," says Nel. "Can you trust the local and regional water services provider to always offer a sustainable water source, and what are the broader environmental, social and governance (ESG) issues you will face with securing your own supply?"

He highlights that the signing of a contract with a public service provider





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does not necessarily guarantee water supply if all available traditional sources simply run out. "Indeed, the experiences of severe drought in cities like Cape Town and Port Elizabeth show that the communities' basic right to water will take precedence, and businesses will be left to develop their own solutions in a crisis," he says.

In this context, groundwater remains the most readily accessible resource to businesses – as long as it is used and managed in strict accordance with ESG best practice. This means earlystage scientific investigations into the viability of boreholes, as well as careful adherence to the regulatory framework.

"While desalination has been considered in coastal locations, it is a relatively costly option and takes years to implement," says Nel. "Drilling boreholes is generally the only practical option, but businesses might be located on a very poor aquifer which could be low-yielding or have an unacceptable water quality."

Water a key ESG factor

To ensure the integrity of the business model, developers generally require the involvement of a professional groundwater specialist to investigate and highlight the groundwater development potential of the town, city or area in which the operation will be established. These studies will also include a consideration of the number

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6 000

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 Baseline Scenario 2000 and 2050

↑ As global water demand grows rapidly across all use categories, competition for the world's finite water resources is placing added risk on business sustainability

of existing groundwater users in the immediate area, and their respective water uses.

"The question that needs to be answered is whether there is enough groundwater for your business, in addition to the other private and public users in the area," says Nel. "A hydrogeologist can compile a numerical groundwater model that delivers scientific predictions on the future availability of groundwater in the area you're investing in – taking into



"

Irrespective of the specific environmental and social context of the business, it is wise to engage experienced scientists and engineers in preparing a water solution for a sustainable business plan, JJ GERT NEL account both existing use and the likely increased demand in the future. This is standard practice in the mining sector, for example, and all sectors can learn from this."

Domestic ELivestock

Manufacturing Electricity

Legal compliance is of course a key aspect of ESG, and this requires early planning to accommodate the potentially lengthy permitting period. Boreholes require a water use licence (WUL), which can take up to two years to approve. Having the necessary licence in place gives a business the ability to start drilling and preparing the necessary infrastructure for self-supply of water in case of a drought.

"This creates the vital back-up water supply to mitigate the operation's risk in situations when the usual water supplier is unable to deliver," he states. "It does need the investment in studies and permitting well in advance, though, as it will be too late to respond once 'Day Zero' is in sight."

Nel reiterates the importance of considering ESG impacts related to the drilling of boreholes, and the crucial need to follow due process.

"If you drill boreholes to provide a supplementary or sole supply to your business, and you don't follow scientific, environmental and social due processes, you could face public resistance," Nel warns. "Surrounding

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"

We are far from meeting the SDG water goals, which target the availability and sustainable management of water and sanitation for all,

FIONA SUTTON

borehole users could well accuse you of depleting their groundwater, or even causing the failure of their businesses due to their only water supply source drying up."

While it might be possible to address these claims through detailed hydrogeological investigations, it cannot always be assumed that the scientific answer will be accepted by all stakeholders. Careful processes of communication and consultation – and perhaps even collaboration over the use of available groundwater – will help to manage the risk of reputational damage or worse. "Irrespective of the specific environmental and social context of the business, it is wise to engage experienced scientists and engineers in preparing a water solution for a sustainable business plan," Nel says. "The regulatory, social and physical landscape is complex, and there are a number of pitfalls that a responsible business would do well to avoid."

South Africa way off the mark

Meanwhile, it appears that more has been said than done about meeting South Africa's water challenges; with the 2030 timeframe



 Λ Fresh water demand will be 6 900 km³ per year by 2030

for meeting the Sustainable Development Goals (SDGs) looming, the country needs a new urgency on its water stewardship responsibilities.

This is the view of SRK Consulting principal consultant Fiona Sutton, who is urging businesses to take a more proactive approach to achieving water sustainability in their operations and supply chains.

The United Nations Industrial Development Organisation (Unido) has forecast that global fresh water demand will be 6 900 km³ per year by 2030 – some 40% over the global sustainable fresh water supply of 4,200 km³ per year – if current water practices continue.

"We are far from meeting the SDG water goals, which target the availability and sustainable management of water and sanitation for all," says Sutton. "Many companies highlight water issues in their policies, but do not seem to have taken the vital steps toward implementation of more sustainable practices."

She highlights the importance of raising awareness about what water stewardship really involves: Using water in a way that is socially and culturally equitable, environmentally sustainable, and economically beneficial. This can best be achieved through a stakeholderinclusive process that includes both site-based and catchment-based actions, she argues.

"With growing populations and economies, changing lifestyles and global climate change, there is increased pressure on our water resources," Sutton says. "The private sector, government and other players urgently need to play their part and collaborate to ensure shared water security."

She notes how the Covid-19 pandemic has thrown water challenges into stark relief, with business facing increased risk as a result of insufficient water access in communities. "Many employees live in communities which are not adequately served with water services, making it difficult for them to adhere to good hygiene practices, collectively known as WASH – or water, sanitation and hygiene," she says. "The pandemic has brought home the risks to business, as these employees may



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SPECIAL REPORT WATER IN MINING



 Λ The mining sector faces a tough task as it competes with communities and other sectors for water resources

be more likely to become infected, thereby needing to take sick leave or worse still bringing the virus into the workplace." The Covid-19 pandemic will pass but water challenges related to climate change and associated drought and flooding risks will be with us a lot longer.

To make practical progress on their water stewardship journey, Sutton urges the use of global best practice tools like the International Water Stewardship Standard from the Alliance for Water Stewardship (AWS).

"The AWS Standard offers a credible and globally-applicable framework for major water users to understand their own water use and impacts with practical guidance on how to effectively manage these impacts," she says. "Part of the solution is for companies to work collaboratively and transparently with others, most importantly the local communities, for sustainable water management within the context of their wider water catchment." Practical steps and guidance in the AWS Standard help water users to improve their water practices for better on-site water performance, while also contributing to wider sustainability goals. She noted water crises are being exacerbated by climate change and are now acknowledged as societal risks due to their far-reaching consequences.

"According to the World Economic Forum's Global Risks Report, environmental risks now make up four of the top five risks in terms of impact – in other words, the damage they can cause," says Sutton. "With water being so closely associated with environmental issues, this should send a warning to us."

Sutton emphasises that the advantages of good water stewardship are substantial and include gaining efficiencies that allowed corporate initiatives to pay for themselves over time. By incorporating local stakeholders into these initiatives the knock-on effects of good water stewardship will benefit society as a whole and can contribute to a corporate's ratings on environment, social and governance (ESG) criteria.

"The journey starts with an understanding of the business's water dependencies and impacts and develops to allow the mitigation of operational and supply chain water risks," she says.

"Taking effective steps in this direction gives businesses a competitive advantage and boosts their brand value – while assuring investors that the enterprise is viable for the long term."

"By building relationships with local water-related stakeholders, companies can enhance the positive impact of their initiatives and also help address challenges shared by others in the catchment," concludes Sutton. MEA



↑ Water stewardship is now a key aspect of ESG

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Air supply Redefining mining ventilation

Meeting the demands of mining operations in Africa was the main focus of the development of TLT-Turbo Africa's auxiliary and booster fan range.



 Λ TLT Turbo's underground ventilation fans at Newmont's Subika mine in Ghana

ecause energy efficiency is one of the main drivers of mining equipment usage and minimum efficiency requirements on certain equipment are often legislated, TLT-Turbo has identified the need and opportunity in the market for more efficient mining fans compared to those currently in use.

"We are striving to change the industry's mindset on the use of such fans to ensure proper fan selection for the ventilation required. In optimising mine ventilation, efficient, high quality auxiliary and booster fans can add as much value as surface fan installations," explains Michael Minges, technical director at TLT-Turbo Africa.

Fans in this range offer several innovative additions to enhance performance to provide better underground ventilation. The fan range was developed using the latest in engineering flow technology, which allowed the company to improve the aerodynamics, and thus efficiency of the fans. A unique stator design and aerodynamic fairings, all manufactured from wear resistant composite materials, result in improved efficiencies and reduced noise levels. The modularity of the fan casings allows for quick and easy assembly with interchangeable ancillary fan parts.

The motor mounting in coherence with a machined impeller track ensures low and controllable blade tip clearances for improved performance and efficiencies. Pad mount motors are used for all fan sizes and help reduce vibration levels in the axial direction of the motor significantly, which leads to longer motor bearing life and lower maintenance requirements. The fans can be supplied for in situ alteration of fan blade angles, eliminating the need for them to be transported from the mine site to the factory.

Meeting clients' expectations

"All fans are tested according to ISO 5801, unless the client agrees to type testing on higher volume orders. We ensure the client quoted performance is met before the fans leave the factory," adds Vusi Madlopha, head of sales and marketing.

Ease of maintenance was also a major consideration in developing the new auxiliary and booster range. Furthermore, the modularity of the product design and the interchangeable standardised parts allow for quick turnaround time on parts supply.

TLT-Turbo Africa has received several orders for these fans since the range was launched in 2018. These orders include South African clients seeking a solution for deepening a gold mine, and for a major copper mine in the DRC as an exclusive supplier. "The feedback that we have received thus far is that the fans are meeting and sometimes exceeding our clients' expectations," says Minges.

"Continual product development and keeping up to date with the latest technologies is ingrained within the engineering teams of TLT-Turbo. Ensuring that innovations are market and client driven with the result being a benefit to the industry, puts us in the forefront of advancement in ventilation solutions," Madlopha concludes. MRA



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