

# MINING

REVIEW AFRICA

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**Worley**  
energy | chemicals | resources

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“ For now, we simply cannot walk away from 15 coal-fired power stations, ”

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INVESTING IN  
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Global project and asset services provider Worley is undeniably a leader in digital transformation through its unparalleled service offering. **P4**



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# New decade New opportunities?

By the time you read this the first month of 2020 will have come and gone. Nonetheless, let me take this one opportunity to wish *Mining Review Africa's* faithful readers and supporters a happy New Year.

So, what does the year hold in store for the mining industry? If we're honest, no one really knows the answer and 2019 proved that. Take the battery metals sector for example. Graphite, lithium and cobalt took serious price dives over the year – in contradiction to expectation.

What does that mean for 2020? We'll have to wait and see. What we do know for certain is that the EV market will make a bigger mark on our everyday lives; we just don't know when. At least that fact offers a positive outlook for the battery metals sector, albeit possibly in the longer term. Gold is still living the high price dream, as is palladium. I doubt that will change in a market reliant to some degree on crystal ball forecasting. Let's hope this will ignite some serious exploration on the African continent this year – at least for gold. We're covering this very topic in the

February 2020 edition, so keep your eyes out for that one.

Reviewing our bumper January 2020 edition – I guarantee you the very best content that you must take the time to read. It covers not only some of the hottest projects performing at present but also a few that are going to make significant headway this year. This includes a story on the Palabora Mining

Company (PMC) – when last did you read about this prominent South African miner? Having had the exciting opportunity to visit the mine late last year and travel by kibble to the bottom of the new ventilation shaft currently under construction, I am able to give you some fantastic insight into this operation.

Beyond that, we have put together a content-rich *Mining Indaba* supplement, covering all the trending topics

in mining, from finance and technology to sustainability. Let me ask you this one question – can you afford NOT to read it?

No matter what happens this year, I wish all our readers and their businesses a prosperous 2020! May the new decade mark the beginning of a successful and rewarding year for everyone. I look forward to catching up with you at *Mining Indaba*. **MRA**



↑ Editor Laura Cornish travels by kibble with the Murray & Roberts Cementation and PMC team down the new ventilation shaft under construction late in 2019



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# WORLEY

## Leading digital transformation in mining

Digital transformation is now centre stage in the mining sector – an industry which has been slow on the uptake until now but is determined to reap the substantial benefits it offers. The digital world, however, is vast and companies should look to partner with service providers who are leading the way in offering the most advanced technologies that truly deliver on operational efficiency, safety and reduced costs. Global project and asset services provider **Worley** is undeniably a leader in achieving these goals through its unparalleled digital service offering, **LAURA CORNISH** writes.



As described by a *Forbes* journalist, a digital twin is a virtual model of a process, product or service. It enables the virtual and physical worlds to be paired together, enabling users to analyse processes in order to prevent problems/ downtime from occurring. It also helps with forward planning – a huge advantage for the mining sector.

At present, the mining sector is embracing the concept, but generally only at a level that offers limited benefits. “The 3D world is a great starting place but technology has advanced well beyond this and only when you explore the greater levels of optimisation will you truly start to benefit from what a fully optimised digital twin has to offer,” says Robert Hull, Worley’s Vice President – Mining, Minerals & Metals (MM&M), Africa.

### Moving way beyond 3D

Worley is leading the way in digital transformation in the energy, chemicals and resources sectors, and taking digital design capabilities beyond 3D and even 4D.

The company has since 2012 introduced the globally recognised and standardised Building Information Modelling (BIM) principles into its design and execution capabilities. BIM is an intelligent 3D model-based process that gives architecture, engineering, and construction professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure.

“We have introduced the BIM concept to the mining sector and in doing so are creating digital information models that start at 3D level but are advancing this through to 7D which contains both graphical and non-graphical information in a common data environment,” Hull outlines.

The information at each dimension stage builds in value as a project’s stages progress until the complete data set can be handed over to the customer at the conclusion of a project, ready for operation. Each dimension of data offers customers a fuller understanding of their project, from generating accurate programme data to producing accurate estimate costs, and ultimately providing a digital data bank that can be used to drive efficient operation and management and better business outcomes.

Starting with a 3D model, 4D adds the benefit of a project schedule, providing greater insight throughout the design process. 5D allows control of cost and budget components and captures progress dynamically, allowing the entire project team to visualise project objectives.

Hull says that the company’s 5D BIM was pioneered by the Worley SA office and in 2018 the company really started to promote the values it offers customers. “We have a number of customers who are investing in the incorporation of our 5D BIM model at present,” he confirms.

With its customers recognising the benefits realised through 5D BIM, Worley is now taking 6D and 7D BIM to market as well.

BIM Manager for Worley, Russell Du Plessis, outlines that 6D plus 7D BIM allows a planned, pro-active approach to assets that is significantly beneficial, not least in terms of costs. “Our 6D digital capabilities action the commissioning of a project, while 7D allows for optimal operation.” He adds that, ideally, the information model should continue to evolve during the “in ▶

## TRUE DIGITAL COMMITMENT

Denver Dreyer, Senior Vice President: MM&M Europe, Middle East and Africa for Worley, affirms the company's ongoing commitment to digital transformation, saying that as a global centre for mining and minerals processing excellence, the business is pioneering the move away from cumbersome paper trails to instantly accessible digital data in South Africa's mining sector. "Worley is leading the way forward in terms of developing BIM capabilities for mining in South Africa, and it's a necessary step for any business wanting to prosper in the new digital age."

He adds that this requires a change in mindset of the entire project team, including the customer's side, right down to mine personnel, in order to successfully leverage the immense benefits of technology.

use' phase with updates on repairs, replacements, operational data and diagnostics to further assist with informed and effective future decision making.

"Worley's 7D design data mapping allows real-time access to operational related metadata for equipment and systems within a project in a virtual or augmented reality environment. It provides our customers with a highly valuable electronic asset that can easily geographically integrate details that were previously overlooked in paper files," Du Plessis continues. Thanks to Worley's extensive project background, it has made quick success of accessing its digital library of equipment specifications to incorporate into its modelling. "We are consequently able to develop the BIM building blocks for a prototype digital twin in just a few hours," Hull adds.

Developed to assist in designing sustainable assets, Worley's 6D data incorporates the Worley SEAL system (Sustainable Engineering for Asset Lifecycle), a unique approach to engineering delivery which integrates technical integrity and



We have introduced the BIM concept to the mining sector and in doing so are creating digital information models that start at 3D level but are advancing this through to 7D,

**ROBERT HULL**



safe and sustainable design processes under a common umbrella.

The incorporation of SEAL results in designs that are technically compliant with statutory and customer requirements: meaning assets are safer to build, operate and decommission. "One of the most important aspects of SEAL is that it also provides us with a framework that considers the full asset cycle and enables our customers to make more sustainable decisions," says Hull.

Ultimately, while there are many third party providers offering 3D modelling services to the mining sector, Worley is one of the few companies with in-house digital capabilities that have the know-how and technology to take integrated digital design and BIM right through to 7D.

Du Plessis says that 7D modelling is where true operational functionality lies and also offers customers peace of mind in terms of due diligence in the commissioning process. Furthermore, this makes 7D BIM a highly valuable tool, providing a transparent and accountable digital record. "It's the underlying data that is of value, not the virtual image, as this powerful integrated data makes it possible to provide design accuracy, look pre-emptively forward, and create an intelligent and integrated project scope that runs from the design phase right through to operation and decommissioning," he notes.

### Taking safety to a new level

Worley is constantly working to ensure it maintains its digital forefront position and is currently looking at artificial intelligence mechanisms to improve safety in the industry.

"If utilised correctly, AI can accurately predict accidents by finding, in Worley's case, safety-related commonalities from previous projects and incorporating that data into our current projects and circumstances – and then flag potential accidents during certain times and procedures, thereby enabling personnel to implement the necessary precautions to avoid incidents from occurring," Hull explains. **MBA**





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# Mike Teke's Seriti Resources

## Giving dignity back to South Africa

There may be a flurry of exit strategies in play by South Africa's major mining houses, but all hope is not lost. Coal mining magnet **MIKE TEKE**, the CEO of **Seriti Resources**, is in the process of establishing a coal powerhouse in the country – driven by the need to contribute towards a prosperous energy future and fulfil its objective to help bring dignity back to South Africa's citizens, writes **LAURA CORNISH**.

**S**eriti Resources could be described to a large extent as the Sibanye-Stillwater of the South African coal sector. Like its precious metals peer, which has spent the last few years acquiring mature assets from the country's gold and platinum majors, and rebuilding their potential, the company has followed a similar path – acquiring mature coal assets from the country's coal majors to ensure they offer long-term production and energy generation sustainability.

Teke is also the perfect candidate to achieve this. He has been in the South African coal game for decades, having built a solid career in the sector at BHP Billiton and thereafter achieving considerable success and shareholder value at Optimum Coal.

Today, Teke is building upon the legacy which he started at Optimum but is only now truly in the throes of doing. Perhaps it was fortuitous that Anglo American was looking to sell its domestic Eskom-tied assets because it gave Teke the impetus to establish Seriti Resources in partnership with three other leading black-owned businesses, to acquire the Anglo assets and in so doing ensure the sustainability of a cornerstone economic contributor to South Africa.

"I still believe in the value of coal, particularly in developing countries like South Africa that still depend on this commodity for the majority of its power generation," Teke states, sharing his view on wanting to build a business in an era when global markets are shifting their power strategies away from

'dirty coal' and more towards cleaner, renewable energy.

"The world's drive to reduce its carbon footprint and clean up the environment is an absolute necessity but we cannot eliminate our dependence on coal overnight. Even first world countries such as Germany have a long-term coal exit strategy that will reduce its reliance on coal for power generation in 2038. South Africa requires a similar energy

Seriti Resources' current three operating mines have a combined production of 25 Mtpa of coal

journey. For now, we simply cannot walk away from 15 coal-fired power stations," Teke continues.

### Anglo assets just the first step

Through his own company Masimong Group Holdings, Teke and his close working partner and colleague Doug Gain (now the CFO of Seriti Resources), joined forces with Community Investment Holdings, Thebe Investment Corporation and Zungu Investments Company, and successfully concluded the acquisition of Anglo American's three Eskom-tied coal mines Kriel, New Denmark and New Vaal for R2.3 billion in March 2018. "A consortium of strong black majors made sense, not only from an ownership perspective but also because our balance sheet ensured our ability to continue operating the mines and feeding their respective power stations – Kriel, Tutuka and Lethabo," Teke points out.

Now, three years later, the company is continuously delivering on its commitments – driven in essence by the meaning of its name. Seriti in Zulu means giving dignity and respect and this lies at the heart of Teke's focus as the CEO of Seriti Resources. "Building a business that has always promoted dignity is something the country can be

proud of and something its citizens can depend on," he highlights.

Taking over three large-scale coal mines, which have a combined coal production of 25 Mtpa, was no easy feat. Anglo is a respected and best-in-class company with a reputation to support that. "We needed our newly acquired personnel to believe that we would uphold the value and respect they associated with Anglo while at the same time putting our own fingerprint on the assets," Teke reveals.

And the company has done just that – maintaining the production momentum from its three cost plus mines required to feed their associated power stations while implementing its own philosophy of "doing things simply".

Teke's strategy to run Seriti Resources using a simple operating model of best safety, maximum tonnage and smart cost management has served the company well thus far. The business is further built on two more arms of strength which the CEO describes as intensity: driving and maintaining the numbers committed to – and consistency: treating each and every Seriti employee equally and fairly.

The Anglo deal also saw Seriti Resources acquire a 45% stake in the eMalahleni-based Greenfields coal project New Largo. Its potential was never realised under Anglo but will soon be a significant contributor to its new owner, who shares the asset with Coalzar (22.5%), the Industrial Development Corporation (22.5%) and New Largo Coal Employee and New Largo Coal Community Trusts (5% each).

### THE MEGA-MINE DREAM

In 2004, the coal industry's majors were considering the consolidation of assets to develop one massive mega-mine complex with the capacity to produce 100 Mtpa of coal. While this was a pipe dream never realised, Teke believes a similar, but smaller version could be achieved through its own asset base which comprises various contiguous mines.

"New Largo has the capacity to produce between 10 and 12 Mtpa of coal which it will deliver to the adjacent new Eskom-owned Kusile power station. Our plan is not to rest on our laurels but to do a feasibility study on the asset and potentially move it into production in 2020," Teke outlines. He is confident of securing the necessary funds.

### Acquiring South32's coal assets

The acquisition of South32's South African coal assets follows a similar storyboard to Anglo's. "The company announced its intention to sell its South African coal assets – both Eskom and export mines – and we liked the opportunity this offered and their ability to move us quickly along our dignity journey," Teke shares.

The deal, which was concluded in November 2019, sees Seriti Resources acquire the South32's 91.835% shareholding in South Africa Energy Coal (SAEC), subject to certain conditions.

Included on the Seriti side of the transaction are two trusts which will acquire equity on behalf of employees ▶

### 50 Mtpa

Seriti Resources' coal production capacity following the conclusion of its acquisition of South32's local coal mines



and communities. The remaining 8.165% interest in SAEC is held by a black economic empowerment consortium led by the Phembani Group.

The purchase price includes an up-front cash payment of approximately R100 million. In addition, South32 will receive 49% of the free cash flow generated by SAEC from the date the transaction is concluded until March 2024. That component will be limited to a maximum of R1.5 billion a year.

Once completed, Seriti Resources will increase its annual coal production to 50 Mt (excluding New Largo) and its personnel headcount from around 6 000 at present to about 15 000. "The combination of our assets will create a formidable business in this country – well into the future. I can further say with confidence that Eskom does and will continue to work well with Seriti: a strong black-owned company with a strong balance sheet."

Upon conclusion of the acquisition and the necessary regulatory permissions, which should be wrapped up before the end of 2020, Seriti Resources wants its employees to know two things:

1. The company will not lose sight of its original assets and will continue to focus on ensuring they remain an important part of the company's mine portfolio, and



## BEYOND COAL

While coal does and always will remain the cornerstone foundation upon which Seriti Resources has been built, the possibility to expand into other bulk commodities such as manganese and chrome is within the realms of possibility in the longer-term future. "The Northern Cape's manganese sector could benefit enormously from consolidation," Teke says.

- ↗ New Vaal colliery
- ↗ Kriel colliery
- ↘ New Denmark colliery
- ↘ Mike Teke and South32  
CEO Graham Kerr formalising the acquisition of South32's assets

2. The company's leadership team will be visible and on the ground at all of its mines – as it is critical not to run the business entirely from a remote head office. "This business is about quick decision making and has no need for a big brother," Teke notes.

Importantly, Teke highlights that although its asset base comprises mature mines, they all still offer +25 year lifespans. The South32 assets in particular still have significant optimisation opportunities, Teke indicates.

"With a strong asset base and an unwavering drive to maintain the success it has achieved to date, I am excited about the company's future. I am absolutely committed to this business and want to leave a lasting legacy that the country will recognise with respect and dignity,"

Teke concludes. **MRA**

Eskom does and will continue to work well with Seriti: a strong black-owned company with a strong balance sheet,

MIKE TEKE



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# Conquering current constraints

## Research programme aims to optimise mining cycles

South Africa's mining industry needs to change its current mining strategy if it is to prolong its sustainability and retain the hundreds of thousands of jobs it supports. This is the view of **Mandela Mining Precinct** programme manager **MARTIN PRETORIUS**, who heads up the Longevity of Current Mines (LoCM) programme, which is aimed at improving mining practices and procedures particularly for established platinum and gold mines, already constrained by their current infrastructure, **CHANTELLE KOTZE** reports.



The LoCM programme is geared towards identifying gaps in the mining cycle to ensure that the country's remaining deep-level gold and platinum mining operations are mined adequately and to their full potential, as cost effectively and safely as possible. The programme will do so by using more efficient systems within the mining cycle

to improve occupational health and safety performance, and increase the efficiency of extraction and reduce costs.

If a change in approach is not prioritised, it is estimated that the country's gold and platinum-group metal reserves will be depleted by 2030 and 2035 respectively, placing 200 000 direct jobs (which support up to two million dependants) at risk if the country

is unable to find a way to sustainably and cost-effectively access and process its deep-level complex ore bodies productively and profitably.

This will result in a significant negative impact on the South African economy and a failure to maximise the extraction of the country's abundant mineral wealth in the long-term.

The LoCM programme is one of six focus areas being pursued by the Mandela Mining Precinct via three work streams and three cross-cutting initiatives to extend the lives of mining operations constrained by current commodity price levels and rising costs.

The LoCM programme will work towards extending the remaining life of platinum and gold operations in the short term as these two sectors are nearing the end of their productive lives, a consequence of difficult-to-reach ore bodies or ore bodies that have become too costly to mine. Both of these aspects affect the continuity and sustainability of current mines.

"The work will entail processes of documenting and analysing the challenges and issues within the mining cycle experienced by mining companies of this description, within the gold and platinum sectors," explains Pretorius,

adding that the programme will work towards optimising the existing work process within the mining cycle.

For example, a normal gold or platinum mining cycle takes 10 hours 30 minutes to complete and is constrained by the current 8 hour and 20 minute shift durations (including the time it takes to travel to the working area), which results in a bottleneck in terms of time on face. This would require either one crew to work at multiple faces as a means to improve flexibility or instead speeding up the production cycle.

The programme aims to analyse each of the critical activities within a mining cycle with the objective of achieving a specific outcome from each of the below:

- **Drilling:** With the outcome of establishing a new and innovative drill rig with an alternative power source
- **Blasting:** Looking at lost blast analysis reporting systems and throw blasting as a means to reduce face cleaning
- **Support:** Introducing pipe stick support manufactured from waste material as a means to replace timber support
- **Shift cycles:** A literature review on the impact of fatigue on production and fatigue management as well as the development of a blueprint to guide the review of shift cycles.

Most of these programmes were completed during the 2018/19 budget period with only three programmes running into the 2019/20 budget period. These include the drilling (completed in December 2019), support (to be completed by March 2020) and shift cycle (to be completed by February 2020).

While the LoCM programme has a short term horizon focused on addressing the challenges faced in conventional underground mines, the programme will transition into a longer term plan that will investigate how to begin introducing automation into these conventional operations, enabling them to be better prepared for the future.

→ **Work in year 2 of the** LoCM programme was the R&D of quicker and lighter support systems, namely composite pipesticks



While the LoCM programme has a short term horizon focused on addressing the challenges faced in conventional underground mines, the programme will transition into a longer term plan that will investigate how to begin introducing automation into these conventional operations, enabling them to be better prepared for the future,

MARTIN PRETORIUS



### Achieving the first Locomotive outcome with the Isidingo Drill Design Challenge

The open innovation Isidingo Drill Design Challenge launched in 2018 and spearheaded by the Mandela Mining Precinct has culminated in the development of two new rock drill prototypes developed by local innovators to enhance current underground drilling operations.

Aimed at developing a new and innovative rock drill to be used in South Africa's gold and platinum deep-level mines – based on the industry's need to be lighter, more energy efficient, quieter and easier to assemble and dismantle than the current drill rigs in operation – the Isidingo Drill Design Challenge encouraged the rapid design and prototyping of rock drill concepts.

Current drilling technology is not energy efficient, as well as being heavy, noisy and prone to extreme vibration. This results in fatigue, noise induced hearing loss and white knuckle syndrome.

In addition, the conventional configuration means that operators are exposed to the most dangerous conditions of the mine, including fall of ground, seismicity, and gas blows.

In an attempt to improve the operational cost, as well as the health and safety of rock drill operators, parties interested in participating in the challenge were asked to submit a concept design based on four key criteria, namely:

- The weight of the drill must be less than 16 kg, as opposed to the current drill weight of between 28 and 32 kg; ►

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- The drill must use an alternate power source to compressed air;
- The drill design must incorporate parallelism; and
- The drill must be able to be set up and taken down within 10 – 15 minutes.

Six secondary criteria to be considered with the design of the drill is that it must produce more thrust than current drills, must be designed to operate quietly to be able to render noise levels that are less than 95 dB, must reduce vibrations for the operator, must improve on current drilling speeds or penetration rates, must be easily operable by a rock drill operator, and must be human-centred in its design.

The two prototype rock drills, which are a significant step towards modernising the way drilling is undertaken in South Africa’s difficult to access narrow-reef underground gold and platinum mines, are set to reduce the exposure of operators to dangerous conditions and contribute to the aim of zero harm in mines.

The challenge was divided into three phases. The first phase entailed the introduction of a new and innovative rock-drill concept design; followed by the prototype construction associated with testing and monitoring. The

third phase, to be undertaken during 2020, will entail manufacturing and underground performance testing and adjustments to the current design (expected to be completed in March 2020), which will culminate the development of the two prototypes as commercial drill rigs.

After a rigorous evaluation process, two local companies, namely Novatek and HPE, were selected to develop prototypes, which were tested at the Mandela Mining Precinct.

“The tests successfully illustrated both companies’ adherence to the primary criteria of enhancing the performance of the drill, reducing the exposure of operators to dangerous conditions and contributing to zero harm.

HPE presented a versatile drilling system. “With our new offering, drilling is now possible in three ways, with a novel hole guide puller, a stope drill jig, or in a conventional manner with a thrust leg,” says HPE director Ulrich Kienle, adding that its drilling system is suitable for any angle and application. “Once the first hole has been drilled, the hole guide puller repeats the process and guarantees correct burden spacing, parallelism and in-line thrusting.”

Dubbed the Buffalo, Novatek’s drill incorporates a spring, shaped

## SAMERDI STRATEGY PROGRAMMES

Besides the Longevity of Current Mines programme, the other five programmes of the SAMERDI Strategy being driven within the Mandela Mining Precinct include:

- Advanced Orebody Knowledge;
- Mechanised Drill and Blast;
- Non-Explosive Rock Breaking;
- Real-Time Information Management Systems; and
- Successful Application of Technologies Centred Around People.

like a buffalo horn, which embodies its strength, accuracy and speed. “What we delivered meets some of the criteria really well. In our early tests, we encountered improvement on the noise levels, which we were not able to replicate, but we are eager to continue working thereon for the third phase,” says Novatek MD Julian Wills.

### Shift cycle blueprint – a game changer for the industry

The investigation of alternative shift cycles for different operations, also a significant research programme within the LoCM programme, will focus on how to improve on the key elements within a shift cycle, explains Pretorius, with the objective of incorporating all of these key elements in establishing a framework, or blueprint, for the development of new optimised shift cycles going forward.

This shift cycle framework will be informed by the outcomes and learnings of the drilling, blasting and support activity programmes still underway within the LoCM programme, which will be finalised by February 2020.

“We will be inviting all stakeholders to join in on the finalisation of this process. Because we are moving this from a technical study to an implementable blueprint, we will be finalising this framework through the Successful Application of Technologies Centred Around People, or SATCAP programme, whose aim is to enable and sustain healthy and robust relationships through the hosting of workshops for all stakeholders,” Pretorius concludes. **MRA**



↑ HPE drilling system



↑ Novatek’s Buffalo stope drill rig





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# Boipelo Mining Contractors

## New Clydesdale Colliery's silver lining

Since acquiring the **New Clydesdale Colliery** (NCC) from Exxaro in 2015, ASX-listed coal miner **Universal Coal** has proven that value can still be realised from older assets. The company has achieved significant success in reopening the underground mine, increasing production from nearby open pit resources and importantly, is making smart decisions to ensure it optimises its performance. **LAURA CORNISH** visited the mine to find out more.

**N**CC is situated in the Kriel district about 35 km outside of eMalahleni, Mpumalanga. Within a year of completing the acquisition, Universal Coal brought the underground mine out of care and maintenance and back into production. Having also introduced open pit mining to the operation since then, the operation has proven to be a valuable asset for the company.

The mine is currently operating at the level required to fill the 380 000 tpm coal handling and preparation plant – generating about 300 000 tpm

ROM material from four open pit seams and roughly 75 000 tpm ROM material from the Diepsruit underground 2 lower seam. The total production output, roughly 4 Mpta ROM, equates to a +10-year lifespan – based on the current production model. The coal produced at New Clydesdale is currently sold to power utility Eskom as well as global traders on a long term offtake.

### Smart decisions keep NCC optimised

In February 2019, a number of market dynamics resulted in the underground mining contract exchanging ownership

– necessitated by the need to maintain its 75 000 tpm or 900 000 tpa ROM production target.

The necessity to secure a transformed company with substantial coal experience saw the company appoint Boipelo Mining Contractors, a Level 2 B-BBEE accredited joint venture company formed by Murray & Roberts Cementation and the Amandla TM Group. The company is an empowered turnkey contractor with services extending across the full spectrum of underground coal contract mining. Headed by executive partner and mine engineer professional Charles Makgala,



**Boipelo's three-year contract** includes mining three underground sections from the 2 lower seam using three continuous miners



**Boipelo is an empowered** turnkey contractor with services extending across the full spectrum of underground coal contract mining



**Boipelo is responsible to deliver** 75 000 tpm ROM material from the Diepsruit underground 2 lower seam

who has spent his career in the underground coal industry, his company offered NCC the perfect suite of skills, drive and empowerment.

Boipelo's three-year rand-per-ton turnkey contract includes mining three underground sections from the 2 lower seam using three continuous miners and the necessary supporting equipment – roof bolters, shuttle cars,

LHDs and tractors. The company is also responsible for the installation and maintenance of the conveyor and ventilation infrastructure.

"The performance of the underground operation is critical in ensuring that Universal Coal's long-term export quality offtake is met and this necessitated a seamless transition as well as improvement in a number of key

performance areas, including production and safety culture. From the outset our appointment required that we retain the majority of the existing contractor's 175 personnel and equipment but take the necessary steps to optimise the mine's production performance," says Makgala.

With hard work and intensive effort, Boipelo has done just that. In fact, the company has on occasion exceeded its ►



Making Sure Your Team Gets Home Safely Tonight



Boipelo's contract includes all necessary underground mining support equipment and operation

**DID YOU KNOW?**  
 Despite its age, NCC still has a 136.66 Mt resource and 54.8 Mt reserve

monthly production target and in November 2019 delivered its strongest month, totalling 112 000 t.

**Success driven by experience, passion and commitment**

While expertise is a driving factor for the delivery of its contractual obligations, Makgala has brought additional value to the project. "I want to build a sustainable operation that has a strong future beyond the remaining four-year lifespan of the 2 lower seam. This requires injecting passion and commitment into all aspects of what we do and importantly, enhancing employee motivation which I believe we've had considerable success in achieving."

The executive director wants to build the company's reputation through its

responsible approach which means going over and above. For NCC in particular, this has seen Boipelo appoint grade controllers – a decision of its own accord – to assist manage the varying coal qualities. "Since taking over the underground mine, we've achieved the lowest contamination numbers. Our focus is not only quantity but quality as well," Makgala highlights.

Thanks to his extensive experience in the industry, Makgala has also reconfigured the mine approach through improved long-term planning while still maintaining the company's short-term focus and daily targets.

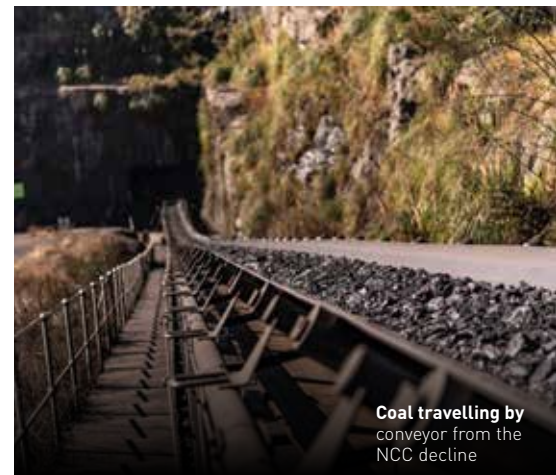
"This has been an incredible journey so far and I am determined to surpass our contractual obligation in our first twelve months in operation and build

a solid foundation for the remaining years of our journey with Universal Coal." The addition of new equipment moving forward to achieve this, as well as improve efficiencies, is a possibility and on the table for consideration.

Safety is of course another area Boipelo is committed to upholding and so it has maintained the proximity detection systems on two of the three sections originally installed on the trackless mobile machinery. It is also looking to roll this out to the third section. "Our performance is a reflection of the client's and so we must operate at a level that is acceptable to the company as well as the industry," Makgala notes. "We aim to compete according to international contracting standards and adhering to best safety practices is one of the steps by which we will achieve this."



Aerial views of NCC's underground mine surface infrastructure



Coal travelling by conveyor from the NCC decline

# 1942

The year in which the first exploration borehole was drilled at NCC - leading to its establishment

## A proud achievement for all stakeholders

To date, the transition to Boipelo Mining Contractors has been well received and was achieved through extensive consultation with New Clydesdale management and the affected employees," says Makgala.

"This is an exciting project for us," continues Allan Widlake, Boipelo Mining Contractors executive partner and new business director at Murray & Roberts Cementation. "We are bringing a depth of coal mining experience

and expertise from both JV partners, and are confident that we will continue to deliver an efficient and cost effective solution to the client."

"The joint venture represents a solid collaboration of enterprising new entrants and well-established players. While expecting a high level of quality in the services to be delivered at all times, we are also proud to be contributing to meaningful transformation in the mining sector," concludes Chris Silver, general manager at NCC. **MRA**

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**CHARLES MAKGALA**



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# Long-term demand

## Remains strong

The burgeoning electric vehicle (EV) sector has taken the mining industry by storm in the last five years with the metals and minerals used in the production of energy storage batteries – including cobalt, lithium, graphite, nickel and vanadium – taking centre stage. **CHANTELLE KOTZE** has rounded up views and outlooks on these commodities for 2020 and beyond.

The significant interest in these battery metals encouraged a flurry of mining companies to enter the race to extract them, causing prices to surge. Fast-forward to 2019 and the picture looks very different: prices have plummeted, mostly due to demand struggling to keep up with supply, and in some cases better metal substitutes being found. However, one thing remains clear: the future global demand outlook for EVs remains strong and so does the need for energy storage in renewable energy applications.

### COBALT AND LITHIUM – THE BATTERY METALS FRONT RUNNERS

According to Diego Oliva-Velez, commodities analyst at Fitch Solutions, lithium and cobalt prices are likely to remain subdued over the coming months as demand struggles to keep up with new supply coming online.

Because cobalt and lithium have received significant investor interest since 2015 due to their increasing use in lithium-ion batteries, which power the burgeoning electric vehicle industry, the resultant demand and prices for both metals have been on the rise.

“For instance, cobalt prices rose over 300% in the period from 2016 to 2018, while South America lithium carbonate prices rallied over 170% during a similar time frame,” says Oliva-Velez. However, rising prices have also spurred a flurry of investments into new cobalt and lithium projects that have significantly loosened both markets – which caused prices to start to unwind since 2018.

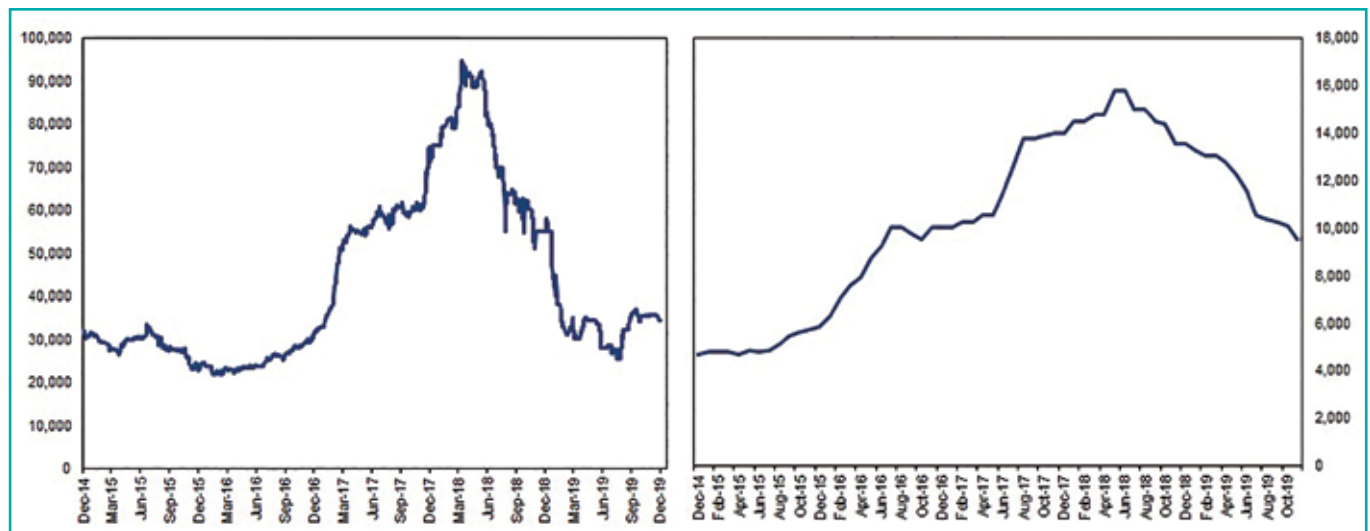
The demand outlook for both EV metals waned in 2019, as the removal of Chinese government subsidies to EV manufacturers caused a slowdown across the industry.

In March 2019, the Chinese government announced that from July

onwards subsidies for pure battery electric vehicles with driving ranges of 400 km or more would be cut by half. Furthermore, to qualify for subsidies, electric vehicles now need to have a range of at least 250 km, compared with 150 km previously. Without these subsidies, Chinese EV manufacturers are having to raise the prices of their vehicles, leading to reduced sales and output numbers over the past months, as they become less affordable to consumers.

However, the Fitch Solutions’ Autos team believes the subsidy cuts will only have a short-term impact on China’s EV market, as revised government policy calls for a more profound engagement from manufacturers to preserve EV market growth rates, while rising competition will continue to support the EV segment.

Fitch Solutions’ Autos team also highlights that the new policy sets out sales targets for car manufacturers,



↑ LITHIUM AND COBALT PRICES TO REMAIN UNDER PRESSURE IN 2020  
 LHC – Cobalt Spot (USD/tonne), RHC – Lithium Carbonate FOB Swap (USD/tonne)

Source: Fitch Solutions

whereby they must generate credits for selling EVs, which should prop up EV production.

Furthermore, they expect carmakers will move to offset the impact of the EV subsidies cuts with price reductions, which will see demand for EVs remain robust over 2020. Fitch Solutions forecast EV sales in China to average 20% year-on-year in 2020, slightly up from 19% in 2019.

Despite announcements of supply cutbacks (such as the premature closure of Glencore's Mutanda cobalt mine in the Democratic Republic of Congo in late 2019) and rising demand, there are a number of new projects due to come online, including Chemaf Sarl's Mutoshi mine in the DRC, CleanTeQ Holdings' Sunrise nickel cobalt scandium project and Australian Mines' Sconi project, both in Australia. As a result, Fitch Solutions retains the view that both markets will remain largely in oversupply next year – keeping a lid on prices.

Nevertheless, Oliva-Velez expects demand growth for lithium and cobalt to improve in 2020 following a disappointing 2019, as low prices attract purchases from EV battery manufacturers and Chinese EV sales hold strong.

## NICKEL TAKES THE LEAD AS BATTERY METAL OF CHOICE

Fitch Solutions' outlook for nickel over 2020 is more positive as the market will remain in deficit, buoyed by a ban on Indonesian ore exports from January 2020 and ongoing support from the Chinese stainless steel sector.

Despite a steep fall in prices since October 2019, Fitch Solutions believes that prices will rebound from spot levels into 2020 and average US\$15 000/t throughout 2020, buoyed by a tight fundamental picture.

Moreover, the global nickel market is expected to remain in a 12 200 t deficit in 2020, driven by sustained demand from stainless steel production in China.

Based on findings from Fitch Solutions' own proprietary model, nickel is set to be the primary demand beneficiary of the EV revolution on the metals side in the longer term beyond 2021, significantly ahead of lithium or cobalt – as the use

of nickel-heavy NMC cathodes among manufacturers becomes increasingly prevalent over the same period.

The NMC cathode will become the chemistry of choice for EV manufacturers over the coming years, due to its high energy density, thermal stability and low cost.

Currently, most NMC cathodes are referred to as NMC 622, so called due to the ratio of metals they contain (6 parts nickel, 2 parts manganese and 2 parts cobalt). However, due to concerns relating to the price and sustainable sourcing of cobalt, battery manufacturers are in the process of increasing the share of nickel in these cathodes in order to achieve a ratio of 811 (8 parts nickel, 1 part manganese and 1 part cobalt).

"We forecast that the share of NMC cathodes will account for 82% of all new NMC battery sales by 2029, up from just 2% in 2019. This transition will lead to an increase in average nickel content from 7.24 kg to 16.76 kg for each NMC cathode produced over the same period," says Oliva-Velez.

## Nickel upsurge reduces demand for cobalt

The transition towards nickel-heavy NMC 811 cathodes will lead to lower demand for cobalt, which will increasingly be shunned by manufacturers due to price and sustainability considerations. The unstable and restricted supply of cobalt from the DRC – the largest producer by a significant margin – makes the

metal prone to price spikes, as witnessed over 2017.

Secondly, the questionable ethical nature of cobalt supplied by the DRC, due to the prevalence of child labour and conflict mines in the country, will drive battery makers away from the metal in an effort to mitigate reputational risk.

"As a result, we forecast cumulative demand for cobalt from EV batteries over 2019 to 2028 to amount to 218 000 t, considerably less than nickel, lithium and even manganese," Oliva-Velez points out. [See graph below: EVs to Boost Nickel Demand].

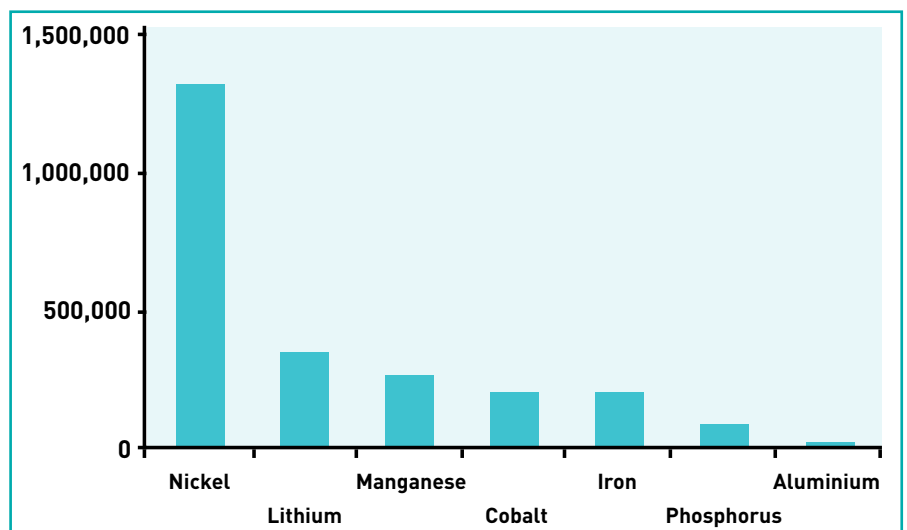
## Lithium remains an integral battery metal going forward

Lithium is found in both the anode and cathode of all lithium-ion battery chemistries, being the key element that allows batteries to charge and discharge.

Furthermore, unlike cobalt, global lithium supply is more diversified across a number of better regulated jurisdictions such as Chile, Australia, Argentina and China – making it less prone to price spikes or environmental, social and governance (ESG) concerns.

As a result, lithium will continue to be an integral component of all EV batteries moving forward – supporting global demand levels for the metal over the next 10 years.

Therefore, in the longer term, prices of all key battery metals are set to rise as demand from the EV industry ramps up, with nickel being the primary demand beneficiary. ►



↑ EVs TO BOOST NICKEL DEMAND

Cumulative metals demand from EV battery manufacturing (tonnes), 2019 – 2028

Source: Fitch Solutions

**Syrah Resources' Balama**  
graphite project in Mozambique  
while still under construction



**GRAPHITE – NEW LOW-COST SOURCES NEEDED**

The biggest driver of the flake graphite market has been the introduction of new supply from Africa – primarily from Madagascar and Mozambique.

In 2018, ASX-listed Syrah Resources brought the world’s largest flake graphite operation into production and the new production volumes introduced to the market from its Balama graphite project in Mozambique have added to excess graphite capacities in China – which has been the world’s leading graphite supplier for a generation.

As China focuses its domestic graphite output on value-added markets, there remains a need for new low-cost sources of flake graphite material – the anode material of choice for commercial lithium-ion rechargeable batteries – and Africa has several promising projects aiming to fill this role in global markets, according to Andrew Miller, head of price assessments at Benchmark Mineral Intelligence.

“At this stage the introduction of new graphite material from Africa has overtaken the demand growth, which will be largely driven by the production of lithium-ion battery anodes and, ultimately, EV penetration rates,” says Miller.

Moving forward there is a significant backlog to overcome in the market which is likely to see continued depressed prices into 2020. Longer-term however, the industry is still faced with the major task of expanding graphite production to meet the projected growth in battery demand and the low graphite prices of today will not be capable of supporting the development of many new projects.

As a result, Miller says the market is in a transition period with demand growth on the horizon and an abundance of feedstock material. The question is how much of this can be used in the lithium-ion battery supply chain and how much of this will be available ahead of the major ramp up of battery projects.

**VANADIUM – THE KEY TO RENEWABLE ENERGY STORAGE**

According to AIM-listed Bushveld Minerals, a low-cost, vertically integrated primary vanadium producer with assets in South Africa, vanadium currently benefits from having two strong uses driving its demand. One, the traditional steel sector, where vanadium is used as a strengthening alloy, which boasts a steady growth trajectory according to most general forecasts due to an increase in intensity in use of vanadium. Two, the energy storage sector, where vanadium is the primary input into vanadium redox flow batteries (VRFBs), which not only benefits the burgeoning renewable energy sector, but significantly, and perhaps more importantly, helps make existing power systems more efficient

through load balancing and other forms of grid savings.

**Upside in demand from the energy storage sector**

Research from Navigant forecasts that the size of the energy storage market will reach US\$50 billion within the next 10 years, which represents a growth rate of 58% a year to exceed 100 GWh of capacity by 2027.

While multiple technologies are expected to be successful due to their unique technical and cost advantages and suitability to local conditions, VRFBs are expected to capture approximately 18% of the market, which equates to 20 GWh of demand and nearly \$10 billion in revenue in the coming decade.

This confidence is shared by the World Bank, which recently allocated \$1 billion to a global battery storage programme (aiming to raise an additional \$4 billion in co-investment) to drive market creation and help drive down battery prices in low- and middle-income countries.

From a VRFB deployment perspective, there are already a number of large VRFB projects in progress, including the largest VRFB in the world currently under construction, demonstrating the technological benefits and proven use-cases in countries with established power grid infrastructure. In South Africa, the country’s recently published Integrated Resource Plan 2019 specifically seeks novel ways to improve grid reliability and access to power over the long-term, with a dedicated allocation of over 2 GW for new energy storage.

As a result of these developments, Bushveld Minerals is confident that vanadium will continue to feed the primary steel market, while gaining further market share of the important energy sector through VRFBs. **MRA**



**Bushveld Energy's 120 kW peak power and 450 kWh**  
peak energy VRFB located at Eskom's mini-grid located at its  
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Image: 123RF.com

# US-China trade war Dominates precious metals outlook

Will gold breach the \$1 600/oz threshold? Can silver regain the momentum it lost in 2019? And will South African strike action derail a palladium rally? Let's unpack the outlook for precious metals in 2020.

**By Philip Newman, Director, Metals Focus**

**A**s continued talk of constructive discussions being underway gives further hope to investors that a trade deal between US and China may be in sight, positive expectations towards the likelihood of a trade deal should also cap gold, and by implication silver and platinum in 2020. That said, markets feel complacent given no actual sign that risks to the global economy have dissipated. So what does this mean for precious metals in 2020?

## Will gold continue to glitter?

The gold price spent much of the Q4 2019 consolidating around \$1 500/oz. In early November gold faced renewed downward pressure after trade deal optimism revived investors' risk appetite and the Federal Reserve Board (Fed) signalled a pause in interest rate cuts. The near-term outlook for gold is largely dependent on the US-China trade negotiations. It is also arguable that the gold market needs to pause for breath, given the speed of gains

and the extended rise in investor long positions over the summer.

Despite these short-term headwinds for gold, it is still believed that the global economic and financial backdrop will remain favourable towards investment in gold over the medium term. Underpinning this will be the continued global economic downturn, further loosening of monetary policy across key reserve currencies, dollar weakness and corrections in key equity markets.

Following a period of consolidation, the gold price is projected to strengthen again before breaching the \$1 600/oz threshold during 2020.

Key upside risks include US-China trade talks breaking up without a deal, geopolitical tensions in the Middle East, political instabilities in the US and Europe (centring on Brexit), a 'more dramatic than expected' sell-off in equity and bond markets, a pronounced worsening of the US fiscal situation and aggressive rate cuts by the Fed. By contrast, should global economic growth regain momentum, it will pose significant downside risks for gold in 2020.

## Will there be a silver lining in late 2020?

After dropping from a three-year high of \$19.65/oz in September last year, to a two-month low of \$16.90/oz at the beginning of October, silver hovered around \$17/oz in the last quarter of 2019.

While it is expected that silver will eventually regain some lost ground, this is only likely to occur from late 2020 onwards) as institutional investors remain somewhat sceptical towards silver, despite the positive spillovers from gold that have benefited silver in recent months.

Also positive was news on industrial demand, which is expected to grow further in 2020, thanks to increasing electrification in the automotive sector, as well as notable gains for emerging 5G applications and a healthy photovoltaics market. That said, headwinds from the US-China trade war may create a more uncertain environment this year, signs of which have already emerged as many industries adopt a more cautious stance towards adding new capacity.

In addition, the PV industry still faces overcapacity in the production of finished

cells. This could lead to further module price erosion, which may see a renewed drive to trim silver loadings.

In terms of the price risks, in addition to the issues that concern gold, should the trade war between the US and China deepen, silver may underperform gold as the benefits of increased safe haven demand are partially offset as base metal prices weaken.

### Auto industry to drive platinum industry

In the wake of a major price correction in late September 2019, platinum stabilised in the high \$800/oz price at the start of October in the same year. Platinum's under-performance relative to palladium, which has characterised the market for most of this year, continued in that month, with its discount to palladium almost touching \$900/oz for the first time (a level subsequently breached in November).

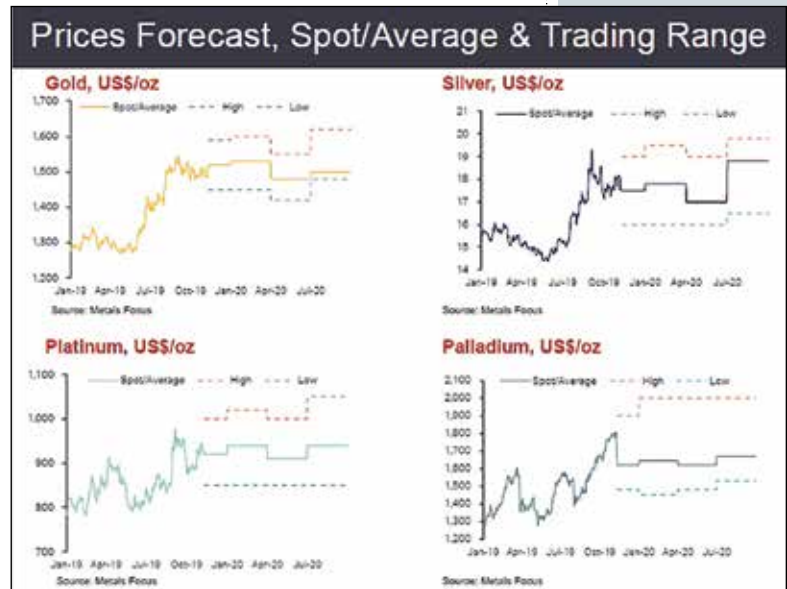
Going forward, despite platinum's record discount to palladium, there is little evidence that a meaningful switch from palladium to platinum in gasoline vehicles will emerge any time soon.

Without major improvements in platinum's supply/demand fundamentals, a structural surplus is expected to persist for the ninth year in 2020, which will weigh on investor confidence. As such, the view is maintained that the platinum price will be dependent on positive spillovers from gold to move higher in 2020.

Given platinum's positive link to gold, risks cited in the gold section will also affect the white metal. In terms of platinum specific factors, large-scale industrial action in South Africa remains the principal upside price risk, although this now appears far more remote.

### Positivity surround palladium

In October 2019, palladium set new highs, reaching \$1 825/oz. This reflected supportive supply/demand fundamentals and saw the metal



continue to outperform gold, silver and platinum. This was most noticeable in early November, when palladium was more resilient than the other three metals which have suffered losses. As a result, its premium over gold touched a new high of nearly \$350/oz, while palladium's premium over platinum briefly exceeded \$900/oz.

The record high for palladium has resulted in an upwards revision of the price forecast, with pundits believing that the price will eventually post new records in 2020.

Risks to this forecast include the threat of strike action in South Africa. However, this appears to have receded and so the most significant risk to the price outlook for palladium relates to a marked downturn in global growth. This could emerge if the US-China trade deals fails to materialise, which in turn would undermine the outlook for GDP growth, not only in these two countries but also elsewhere. Although remote, should growth dramatically improve, leading to a recovery in Chinese and US auto sales, this will create a significant upside price risk for palladium. **MBA**



### ABOUT THE AUTHOR

Philip Newman is a founding partner of Metals Focus and has over 25 years of experience. He holds a BSc (Hons) Economics from the University of Surrey.



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**SA coal reserves and resources** are abundant and can provide low-emitting, cost-effective, reliable and sustainable power well into the future.

# Coal in South Africa, and the world

## It's not going anywhere

The coal sector is living under the constant threat of being blamed by environmentalists as being responsible for a world disaster called global warming. Cliques are telling industry and government to change and adopt the 'new energy economy' or as America's infamous politician and activist Alexandra Ocasio Cortez calls it, 'The New Energy Deal'. She states that the only solution to avoid devastation to the world is to accept that renewable energy is the way to go for all energy needs, given that it is becoming so cheap, and so fast that the move to a world that no longer needs oil, natural gas, or coal is unavoidable.

### By Xavier Prévost, senior coal analyst at XMP Consulting

The industry's answer is, as Lars Schernikau puts in:

- Coal's importance will further increase in absolute and relative terms for decades to come.
- Man-made CO<sub>2</sub> has no effect on global temperatures and combustion of fossil fuels does not influence the weather.
- We cannot stop the advance of coal; we can only make this process as environmentally sustainable as humanly possible.

The Massachusetts Institute of Technology (MIT) in "The Future of Coal" 2007 states: "Coal is likely to remain an important source of energy in any conceivable future energy scenario.

Accordingly, our priority actions are to reduce the CO<sub>2</sub> emissions that coal use produces."

We strongly believe that coal is still sustainable as part of South Africa's energy mix. Contrary to the idea that 'coal is dead', SA coal reserves and resources are abundant and can provide low-emitting, cost-effective, reliable and sustainable power well into the future, using Clean Coal technologies (CCTs).

Coal mining, power generation, industrial utilisation and allied industries provide more than 700 000 jobs and this figure should increase as more mines and industries open in the future. It is well recognised that seven times that figure is the approximate

number of dependants on average allied to every person in employment.

One further fact not understood by the public is that, for every coal mine or coal industry job, many more jobs are created in support industries. This includes transport services, retail shopping complexes, schools, hospitals, and building-related activities. For these reasons, coal is the mainstay of our economy. If coal mines, for example, were to be closed, or become unproductive, many jobs would be lost, increasing unemployment and poverty. Coal supplies 95% of electricity consumed by the country. Electricity from coal is still the cheapest in the world.

Because of the current lack of incentives and funds to implement new coal projects in the country, production is not growing and because some of the large, older mines' output is decreasing, our yearly production has not improved for years. The reality is that the 2020 'Coal Cliff' is here! Some banks do not fund power stations, but funding for coal mining is still available.

Coal prices, drivers of a successful industry, have regularly increased in the local market, where some coal grades now show higher prices than similar grades in the export market. Coal mines are also currently selling more to that market, although the future of Eskom is still uncertain.

Despite Eskom and the renewables industries' assertions that they should be used in power generation, we know that, as in the EU, this can only happen at great peril to the economy, so demand for coal remains.

In countries such as China and India, coal use is growing, because they have no alternatives. A technological new solution will hopefully be found, but it is not here yet.

I am confident about the future of the industry. As Reuters Refinitiv declares in the article "Coal

The fact that the seaborne market is stronger in 2019 does challenge the narrative of a dying industry,

**XAVIER PRÉVOST**



Image: Anglo American and Elaine Banister

**Coal's importance will further increase**  
in absolute and relative terms for decades to come.

may be dying, but growth in the seaborne market says not yet", it is a bit of a surprise to look at the actual volume of coal being shipped around the globe and see that it is growing so far this year.

In the first seven months of 2019 a total of 870.8 Mt of coal, thermal and coking, was imported from the seaborne market, according to vessel-tracking and port data compiled by Refinitiv. That's 2.1% higher than the 852.6 Mt in the same period in 2018. This is not a massive increase, but the fact that the seaborne market ▶

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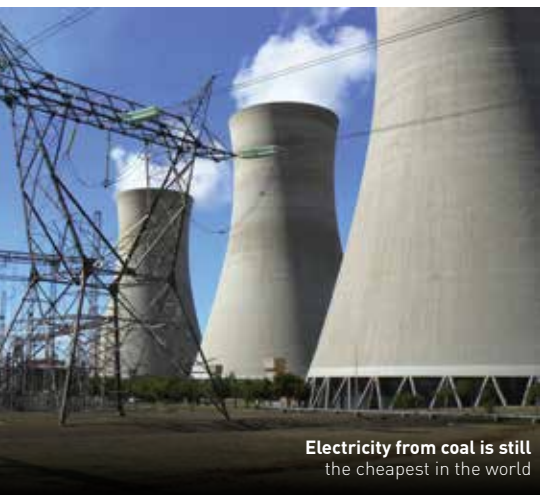
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In the first seven months of 2019 a total of 870.8 Mt of coal, thermal and coking, was imported from the seaborne market

is stronger in 2019 does challenge the narrative of a dying industry.

The overall picture for seaborne coal does remain gloomy, but as the growth in the market so far this year shows, coal remains sticky in the global energy system and any death may be lingering.

The local industry will, for many years to come, be the reliable supplier of cheap inland energy and a large source of profit for big and small producers.

The DMRE 2018 production statistics showed that of the five main commodities coal, gold, PGMs, diamonds and iron ore, coal was the highest value earner with R145.6 billion (37.5% of the total).

Observing current seaborne and inland coal prices, sizes and qualities available to the markets, let us try to provide an illustration of the status of coal supply and a foretaste of future developments.

Before 2009, inland market prices increased by approximately 10% per annum. From 2011 to 2015 by 8% and then again by 5% in 2016 to 2018.

As transport plays a big role, with logistics and fuel costs ever growing, mines closer to market have had an advantage when determining delivered price to end-users.

Coal exports, once best money-makers, are now in decline and cannot expect to support the industry as in years past.

In the seaborne market, steam coal prices fluctuate extensively, mainly due to the influence of China. The markets for exports' displaced tonnages are new developments in NE Asian countries. Trade to the Pacific, eastern

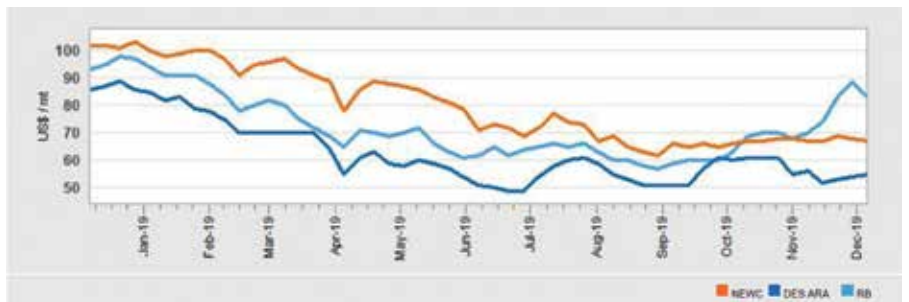
Mediterranean and Indian Ocean will grow, while exports to Europe will be replaced by growth in exports to India, Latin America and other small markets.

Exports in the future will be dominated by low-cost mined coal. Minimum contractual tonnages and sunk costs in rail, barge and terminal will promote exports at very marginal profit levels.

The future shows substantial growth in prices and tonnages in the inland market, while export prices will remain static or decrease. This will generate an

almost price equivalence between inland and export, resulting in an accelerated growth of the local market at the expense of exports.

The message for the industry is that, to cope with an expanding local demand and higher future prices, our coal production, which has been sluggish since 2013, requires more capital and the implementation of new projects and mines as soon as possible. If this does not happen and soon, alternative imports from Botswana's new mines will reap the benefits. **MRA**

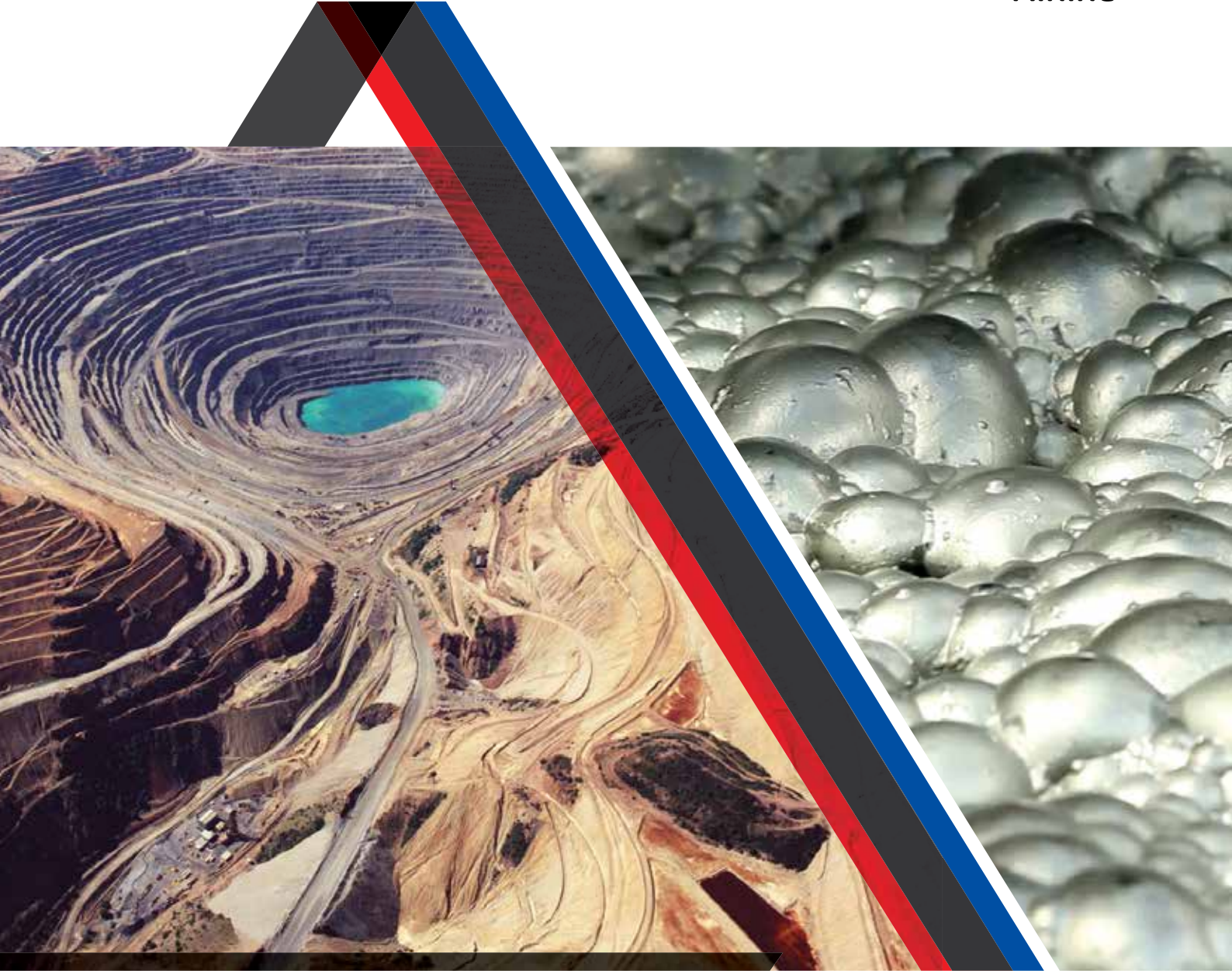


↑ globalCOAL Weekly Indices: Last 12 Months

### ABOUT THE AUTHOR

Born in La Paz, Bolivia, Xavier Prévost obtained an M.Sc degree in Engineering Geology from the University of San Andres in 1968, a Diploma in Mining and Exploration from the Montanistische Hochschule in Austria, a Graduate Diploma in Engineering from Wits' Leadership in Coal Technology Programme and an M. Engineering degree from Wits in 2002.

He has been involved in coal since 1977 and established the Geological Survey's National Coal Database (NCDB) which he managed from 1979 until 1989. After a brief spell at General Mining (Genmin) as IT Exploration Manager, Xavier joined the Minerals Bureau: Department of Minerals and Energy in 1995, as Chief Mineral Economist for Coal and Hydrocarbons. In 2007, he was employed as Coal Senior Analyst at Wood Mackenzie, a global energy company involved in coal consulting and research in Southern Africa. Since 2009 Xavier has been consulting privately through his company, XMP Consulting.



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# Global natural diamond production

## Forecasted to fall again in 2020

By Paul Zimnisky, independent diamond industry analyst and consultant

Rough diamond prices were down by over 5% in aggregate in 2019, with some categories down by double digits, according to the *Zimnisky Global Rough Diamond Price Index* – adding to the trend of flat-to-down diamond prices for most of the past decade, which has pressured the profitability of diamond miners. Moreover, on the back of Russian diamond producer ALROSA's announcement on a downward revision of its 2020 production guidance, global natural diamond production is again forecasted to fall in 2020.

Image credit: 123rf



ALROSA serves as an important supply proxy for the diamond industry, accounting for an estimated 25% of global production volume in carats and almost 30% of total value produced in dollars. For context, De Beers is estimated to account for 23% of volume supplied and 34% of value, respectively.

In late-2019, Russia's ALROSA cut its full-year 2020 production guidance to 34.3 million carats from the previous 38.7 million carats; however the company specified that the figure is subject to change and will ultimately be

the decision of the supervisory board rather than management. This figure would put ALROSA's production in line with that of De Beers, which has previously been forecasted at just over 34 million carats in 2020.

In recent years, ALROSA has been the world's largest diamond producer by volume, with output of approximately 38, 37, 40 and 37 million carats between 2019 and 2016. For comparison, De Beers has produced about 31, 36, 34 and 27 million carats over the same time period.

Regarding its 2020 production projection, on an analyst call in November, ALROSA said that the production cut ►

### Global diamond production in volume of carats (in millions)

2015	130.4
2016	135.7
2017	152.1
2018	148.9
2019	141.5
2020F	138.6
2021F	131.4
2022F	133.4
2023F	129.8
2024F	128.9
2025F	124.6

Source: Paul Zimnisky Diamond Analytics



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**FAST FACT**

Diamond supply volume is down 9% from the recent high in 2017

was not “for the sake of reducing production” but a result of “identifying facilities where a reduction in production will result in an increase in free cash flow for the company.” Adding that at many of company’s deposits and facilities “the share of the fixed costs is quite high” and that cuts would likely be at alluvial operations.

Incorporating the lower 2020 figure for ALROSA’s assets, global natural rough diamond production is now forecasted at 139 million carats, which would be down from 141 million carats in 2019, 149 million carats in 2018 and 152 million carats in 2017, according to Paul Zimnisky estimates and forecasts.

Importantly, ALROSA also said that 2020 sales guidance would be between 37 and 38 million carats and “maybe 39 million carats in a very optimistic case”,

implying that the company expects to draw about 3 to 5 million carats from inventory next year.

For context, ALROSA’s total inventory count was estimated at around 23 million carats at year-end-2019, of which approximately 10 to 11 million carats are

estimated to be “excess” inventory – an estimated 6 million carats of which were accumulated in 2019 specifically. This means that based on ALROSA’s 2020 sales projections, the expectation is to draw between 50% and 85% from the inventory that the company built in 2019. **MRA**

**ABOUT THE AUTHOR**

Paul Zimnisky is an independent diamond industry analyst and consultant based in the New York City metro area and is the author of the monthly industry report – *State of the Diamond Market*. Zimnisky is a graduate of the University of Maryland’s Robert H. Smith School of Business with a B.S. in finance and is a Chartered Financial Analyst Charterholder, and has held roles as a metals and mining analyst, arbitrage trader, exchange-traded fund developer, and consultant.

His work has been used globally by institutional investors, management consulting firms, private and public corporations, governments, intergovernmental organisations and universities.

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# Base Metals

## To muddle through in 2020

By Caroline Bain, Chief Commodities Economist, Capital Economics

Mounting evidence of a slowdown in global economic activity and an associated souring of investor sentiment ensured that base metals prices remained under pressure during the last quarter of 2019. And while it is expected that the global economy will avoid an outright recession, growth is likely to be subdued in 2020.

It is for this reason that there is a downbeat forecast for steel and iron ore prices in 2020. This is due to the ongoing rebound in iron ore output following severe disruptions in early 2019, as well as the view that the strength in construction activity in China is on borrowed time. That said, the outlook for copper is better than for the others.

### Copper to weather the storm

Worries about the health of the global economy and rising trade tensions weighed on the price of copper in the last half of 2019 and led to an accumulation of a net short position by investors in the futures market. (See Figure 1) Weaker global growth will probably continue to weigh on prices in the coming months. However, it is

expected that growth will be on a slightly better footing towards the end of 2020. If this proves to be right, copper is well placed to outperform other base metals.

Indeed, declining ore grades and years of under-investment in new mine projects means that copper supply will continue to be constrained this year. As such, it is expected that the copper market will remain in a deep deficit.

**China's construction revolution continues**  
to drive base metal prices



Looking ahead, a key element in the long-term copper price forecast is that weaker global economic growth is expected. In particular, it is forecast that growth in China will slow to just 2% by 2030. What's more, as the Chinese economy moves away from investment-led growth, there will be softer growth in some copper-intensive sectors and an outright decline in demand for new housing.

That said, it is expected that the negative impact of a decelerating Chinese economy on copper demand will be more than offset by three key factors:

First, copper is used heavily in several green technologies, which are growing rapidly and look set to gain critical mass over the next decade.

Second, even though GDP growth is expected to slow slightly in many emerging economies, there is scope for markedly higher copper consumption.

Third, and most crucially, the thin pipeline of copper projects will ensure that the copper market remains in a deficit. Prices should peak at an annual average of US\$8 470/t in 2025 in real terms.

But, in the final decade it is suspected that the real price of copper will be appreciably lower as both refined and scrap supply rises.

### Downbeat on the prospects for steel

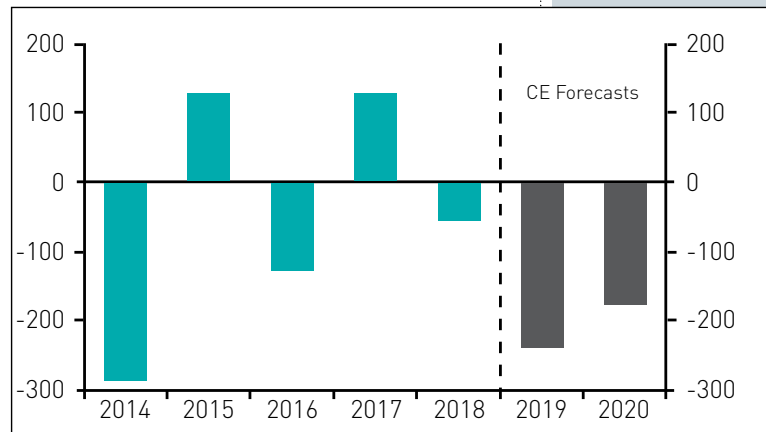
The prices of US and Chinese steel both fell in Q3, 2019. It is forecast that the price of US steel will remain low in 2020, though ongoing output cuts by producers should eventually put a floor under prices. In contrast, it is believed that Chinese steel prices have much further to fall.

For one, the downturn in land sales is a clear sign that robust construction activity in China is on borrowed time. And despite the uptick in Chinese manufacturing activity, a full-blown recovery is still a long way off. Further ahead, the ongoing structural slowdown in China and a move away from investment-led growth should weigh heavily on the price of Chinese steel.

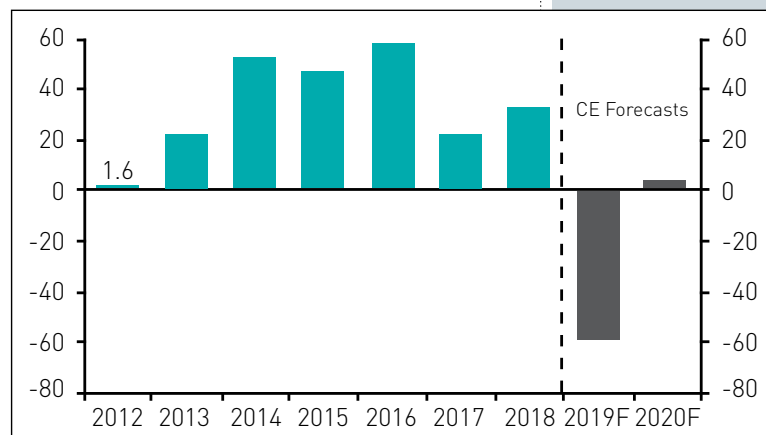
### Iron ore price to fall sharply

The price of iron ore was broadly flat in 2019, but it remains elevated, following the collapse of a tailings dam at Vale's Brucutu mine earlier in the year and a cyclone in Australia. These led to a large loss of iron ore supply which, together with robust demand for steel from China's construction sector (almost all the world's iron ore is used to make steel), is likely to result in a sizeable market deficit in the iron ore market in 2020.

However, much of the shuttered iron ore capacity has now been restarted, as partly



↑ Figure 1: Copper Market Balance (Th. Tonnes)



↑ Figure 2: Iron Ore Market Balance (Mn. Tonnes)

evidenced by the recent rise in export volumes at Australia's Port Hedland – a major iron ore port. Consequently, it is expected that iron ore prices will fall sharply as the market moves into a small surplus.

As of Q4, 2019, the price of nickel was up by over 50% compared to the previous year. The catalyst was the announcement that Indonesia would implement its ban on exports of nickel ore in January 2020, two years earlier than expected, which raised fears of a looming supply shortfall. However, three key reasons makes one sceptical that the rally will last.

First, according to Capital Economic's proprietary model, global demand for nickel had already declined in 2019 (see Figure 2) and it is expected to slow further in 2020. Second, some of the near-term loss in supply could be met by Chinese port stocks, additional processing of nickel ore in Indonesia and increased exports from the Philippines. Finally, it is estimated that nearly 200 000 t of refined nickel have flowed into off-exchange stocks since 2017. This 'hidden' supply should further mitigate the loss of output from Indonesia. ▶

“It is expected that the supply of most base metals will remain constrained in 2020.”



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## Aluminium could benefit from stabilisation

Weak demand will also weigh on the price of aluminium in the near-term. But like copper, aluminium prices should benefit from a relative stabilisation in global growth in the second half of 2020.

That said, the price of aluminium is expected to underperform copper, mainly because it is anticipated that there will be stronger growth in refined output of aluminium. Indeed, the ramp-up in production at smelters in Southern China will probably offset the loss of output from the shut facilities in Xinjiang and Shandong.

## Zinc and lead surplus delayed, but not averted

In the latter part of 2019, the price of zinc increased despite a continued rise in mine supply. Several shutdowns outside of China, most recently at Vedanta's Skorpion refinery in Namibia, have stoked supply worries amid meagre inventory levels. On the demand side, in contrast to robust steel output in China, production growth of zinc-galvanised steel has fared poorly in comparison.

Despite the near-term headwinds to zinc supply, it is forecast that the market will swing into a surplus by 2020 as the smelter capacity gradually ramps up to meet the increase in mine production. (See Chart 26) Given this backdrop,

it is expected that the price of zinc will steadily decline until 2021, when somewhat stronger global growth should provide a lift.

It is a similar story for zinc's sister metal, lead. The price of lead has risen strongly since July 2019 on the back of the closure of Nyrstar's Port Pirie smelter in Australia. Although the smelter accounts for just over 1% of global refined lead production, depleted exchange stocks have added fuel to the price rally. But given tepid demand, the price of lead is predicted to fall in 2020 as output recovers and the market moves into a surplus.

## Tin turnaround

Meanwhile, tin retains its title as the worst performing base metal of 2019.

Production cuts at Chinese smelters (equivalent to 5% of global production) should be more than offset by an increase in Indonesian output. As such, global tin supply is likely to be a touch higher and remain elevated in 2020, weighing on prices.

## Conclusion

It is expected that the supply of most base metals will remain constrained in 2020. However, low prices should increasingly force producers to curtail output and this, coupled with a broad-based drawdown in exchange stocks in recent years, is likely to raise concerns over a shortfall of supply as demand slowly begins to revive. **MRA**

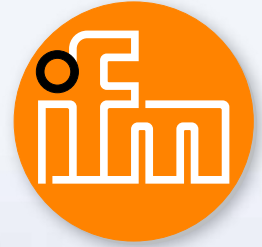


### ABOUT THE AUTHOR

Caroline Bain is the Chief Commodities Economist at Capital Economics, with overall responsibility for the Commodities Overview, Energy and Metals services.

## Long-Term Forecast Summary

End-Period	Actual				Forecasts			
	2015	2016	2017	2018	2019	2020	2021	2025
<b>Industrial Metals (US\$ per tonne)</b>								
Alumina	250	428	439	427	360	340	350	425
Aluminium	1,5	1,704	2,256	1,863	1,7	1,75	1,85	2,3
Cobalt	23,95	32,734	75,205	55	34	40	45	60
Copper	4,706	5,523	7,207	5,949	5,8	6,4	7	9,9
Iron Ore	43	80	73	72	80	70	65	60
Lead	1,797	2	2,485	2,007	2,1	2	2,2	1,6
Nickel	8,78	9,964	12,706	10,605	17	15	16	16
Tin	14,591	21,205	20,096	19,52	17	17	19	25
US Steel (HR Coil, Sh. ton)	370	600	653	724	475	500	550	600
Chinese Steel (Rebar, RMB per tonne)	1,89	3,22	4,33	3,84	3,5	2,6	2,4	2,25
Zinc	1,593	2,558	3,338	2,519	2,4	2,2	2,4	2,2



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# Palabora copper mine

## History repeated

This year, **Palabora Copper** will enter its 64<sup>th</sup> year of operation – making it one of the oldest mining operations in South Africa. Despite its age, the operation has a long and prosperous future ahead of it. This is due to a significant US\$1 billion investment from its 74% owner **HBIS Group**, a Chinese iron and steel manufacturing conglomerate. The investment entails the development of a new underground block cave mining area known as LIFT II, together with supporting underground infrastructure and a large-scale new ventilation shaft. **LAURA CORNISH** visited the site to learn more about the project.

Situated in Limpopo province on the outskirts of the town of Ba-Phalaborwa,

Palabora Copper's process plant, smelter and refinery complex stands as a landmark in the region. The mine always has been and currently remains South Africa's only producing copper operation and is the largest employer in the area.

Rio Tinto owned Palabora Copper parent company, the Palabora Mining Company (PMC), until 2013. When the giant miner left, Palabora Copper was swept up from potential jeopardy by the South African Industrial Development Corporation and in the majority, the

**IN SHORT**  
Palabora Copper, one of South Africa's most prominent copper mining operations, has achieved significant production excellence in its lifetime, and will continue doing so for many years to come.

Chinese Consortium, which is made up of HBIS, Tewoo, General Nice and the China-Africa Development Fund, which got involved through Smart Union Resources South Africa.

This resulted with the Chinese Consortium owning 74% and 26% jointly owned by the South African government through the Industrial Development Corporation, Black Empowerment Consortium and Palabora Mining Company's employees and local communities. The new owners continue to maintain the mine's compliancy with South Africa's regulatory requirements.

At the time of the acquisition, Palabora Copper was already a well-established

underground mine having transitioned from an open pit operation in 2002. The mine has maintained an average production (as per its design capacity) of around 45 000 tpa of copper rod (beneficiated from 0.55% copper). The entirety of this production is generated from the LIFT I block cave mine situated around 400 m below the open pit.

### Ensuring a long-term and sustainable future

After conducting the necessary studies, it was determined that the establishment of a new block cave – LIFT II – would be feasible in extending Palabora Copper's life to around 2033, from potential closure or a significant drop in production.

PMC Package Manager for Vertical Development Thabo Mokoena explains:



"The immediate action that the new owners had to consider was to extend the life of a then 18-year-old underground block cave mine known as LIFT I. To this effect, the construction of new declines tunnels underground which connected the old (LIFT I) and the new shaft (LIFT II) started in 2013. This in essence is similar to constructing a new mine and thus requires installing new infrastructure such as crushers, conveyor belt, ventilation shaft, etc. The new shaft (LIFT II) is situated 400 m below the old shaft (LIFT I) and is being constructed by a consortium of international and local contractors including the Australian Downer Group (Integrated Services Company) and the South African Mvusuludzo Projects, a 100% black owned and Level 1 B-BBEE emerging mine contracting and development company."

"The shaft sinking company, Murray & Roberts Cementation (SA), is responsible for sinking the ventilation shaft for the LIFT II project. The ventilation shaft-sinking project started in February 2019 and is expected to be completed in mid-2022. The project initially involved drilling and reviewing various holes to determine the best location to sink the shaft," articulates Mokoena.

Murray & Roberts Cementation project manager, Jas Malherbe, indicates that sinking the ventilation shaft is not an easy task; however, the company intends to complete the entire project without any safety incidents.

### A closer look at the new vent shaft

The new ventilation shaft will be much larger than the existing ventilation shafts at 8.5 m [finished diameter] and it will extend 1 200 m in depth. "We brought on board our top level personnel from the very early stages of the project to ensure we are all working to the same plan and shared vision. Coupled with this was the employment of ▶



Sinking the ventilation shaft timeously is critical to the overall operation of LIFT II, which will require the ventilation shaft to be fully operational when the project starts up,

JAS MELHERBE



↑ Ventilation shaft ground breaking



↑ Early stage works on the ventilation shaft



↑ Early works using a small excavator



↑ Part of the four-deck stage in place



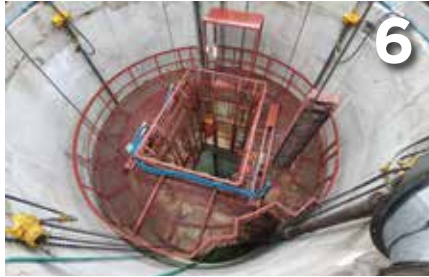
← The original open pit at the Palabora Copper mine – the underground ore bodies are located below the pit

### DO YOU KNOW THAT?

While copper forms the base-load of its business, Palabora Copper has other products such as vermiculite and copper by-products such as magnetite, sulphuric acid, anode slimes and nickel sulphate



↑ The excavator underground moving blasted ore



↑ The four-deck stage constructed and in use



↑ Surface view of the sinking stage and supporting infrastructure



↑ Using a kibble to travel down the shaft

**DO YOU KNOW THAT?**  
To save jobs, improve operational efficiencies and copper recoveries, Palabora Copper has invested in refurbishing its smelter and constructing a new flotation plant

specialised, multi-skilled teams who are able to handle various tasks on site and have undergone extensive training at our Bentley Park facility in Carletonville," says Malherbe.

Of equal importance in obtaining its safety objectives is the sinking method deployed, which is a methodology utilised by Murray & Roberts Cementations' Canadian office, first introduced at De Beers' Venetia mine and now at Palabora. "We have however taken lessons learnt from Venetia to improve the process further," Malherbe highlights.

In essence, this entails using a four-deck sinking stage (for main shaft sinking comprising a top deck, electrical deck, working deck and

observation deck) which gives personnel the ability to conduct various tasks simultaneously without compromising anyone's safety at shaft bottom.

A shaft sinking charging unit has been designed which comprises emulsion tanks and pumps which will facilitate shaft blasts safely and accurately. Before the round is fired the stage will be raised to a safe position. The maximum distance allowed for the stage above bottom will not exceed 70 m. The round will be fired from a blasting point on surface.

The lining will be carried out to the bottom of the shaft and the blasted rock will be mucked out by an excavator that fits through the stage, which will discharge into kipples. This means that

only a single person – the excavator operator – will be situated in shaft bottom during the post-blast cleaning of rock. The hoisting of rock, persons and materials will be carried out by the winder set up in sinking mode with an 11 t payload kibble. The rock will then be tipped in the headgear using an automated tipping arrangement.

"Our vision and supreme determination is to complete the project without any safety incidents. To achieve this, we are utilising the best sinking methods and skills in the industry. Our experience in this field allowed us to learn from previous projects and perfect our methods. Completing this project timeously is critical to the overall operation of LIFT II, which will require the ventilation shaft to be fully operational when the project starts-up," Malherbe concludes. **MRA**



↑ View of the new ventilation shaft (as of November 2019)



↑ Thabo Mokoena (left), Carl Heroldt, Murray & Roberts Cimentation master sinker (middle) and Jas Malherbe (right)



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- o Mine layout and scheduling.
- o Primary access and logistics.
- o Geotechnical engineering.
- o Ventilation and cooling.
- o Mine services infrastructure.
- o Mine support infrastructure.
- o Bulk utilities supply.
- o Mineral processing.
- o Process plant engineering.
- o Waste rock dump and tailings dam.
- o Manpower compliment determination.
- o Capital cost generation.
- o Operating cost generation.
- o Risk assessment.
- o Financial evaluation.
- o Project management of multi-disciplinary study teams.

## OUR SERVICE OFFERING INCLUDES:

### Study work

Study work covers everything from high level concept and scoping studies to complete bankable feasibility studies. These studies are often required to be compliant to stock exchange standards such as JORC, SAMREC or NI 43-101. Most study work also includes financial modelling and project evaluation.

### Project implementation

Once a feasibility study is complete a client often requires detailed design to be done as a basis for construction. We undertake detailed mine design,

access design, conveyor system design, shaft and decline design, backfill system design, process plant design, open pit and underground pumping and all associated mechanical and electrical design and drawings. We will readily take on EPCM responsibility for projects that we have studied and brought to stakeholders account.

### Operational improvement studies and initiatives.

Our team has broad experience in all aspects of mining and mine operations across a wide range of mining methods. This experience together with the latest developments, technology and best of breed concepts can be applied to specific problem areas to assist clients in optimising their operations. These interventions are integrated with the ongoing management of the operation and rely on teamwork between client and consultant.

### Strategy development.

The ever changing conditions in today's mining environment require constant attention to the maintenance of the correct strategy for optimum value creation from mining and exploration projects. Our team of professional mining people can assist in developing the most appropriate strategy for your unique situation.

### Due diligence work and project evaluation.

The principal engineers at Bara have extensive experience in performing due diligence work and project evaluation on a wide range of mining and exploration projects on behalf of mining houses, banks and other funding institutions, both locally and abroad.

Our experience includes work in a wide range of commodities including gold, platinum and PGMs, chrome, copper, nickel, iron ore, manganese, diamonds, coal, uranium, phosphates and rare earths for both open cast and underground projects. Our engineers have worked in various African countries including South Africa, Botswana, Namibia, Zimbabwe, Zambia, Mozambique, Tanzania, Kenya, Uganda, Rwanda, Ethiopia, Ghana, Mali, Central African Republic, Sierra Leone and Mauritania as well as Australia, USA, Ukraine, Tajikistan and Kazakhstan.

Various members of our team are recognized as competent persons for the declaration of mineral reserves by SAMREC (South Africa), JORC (Australia), CIMM (Canada) and the SME (USA).





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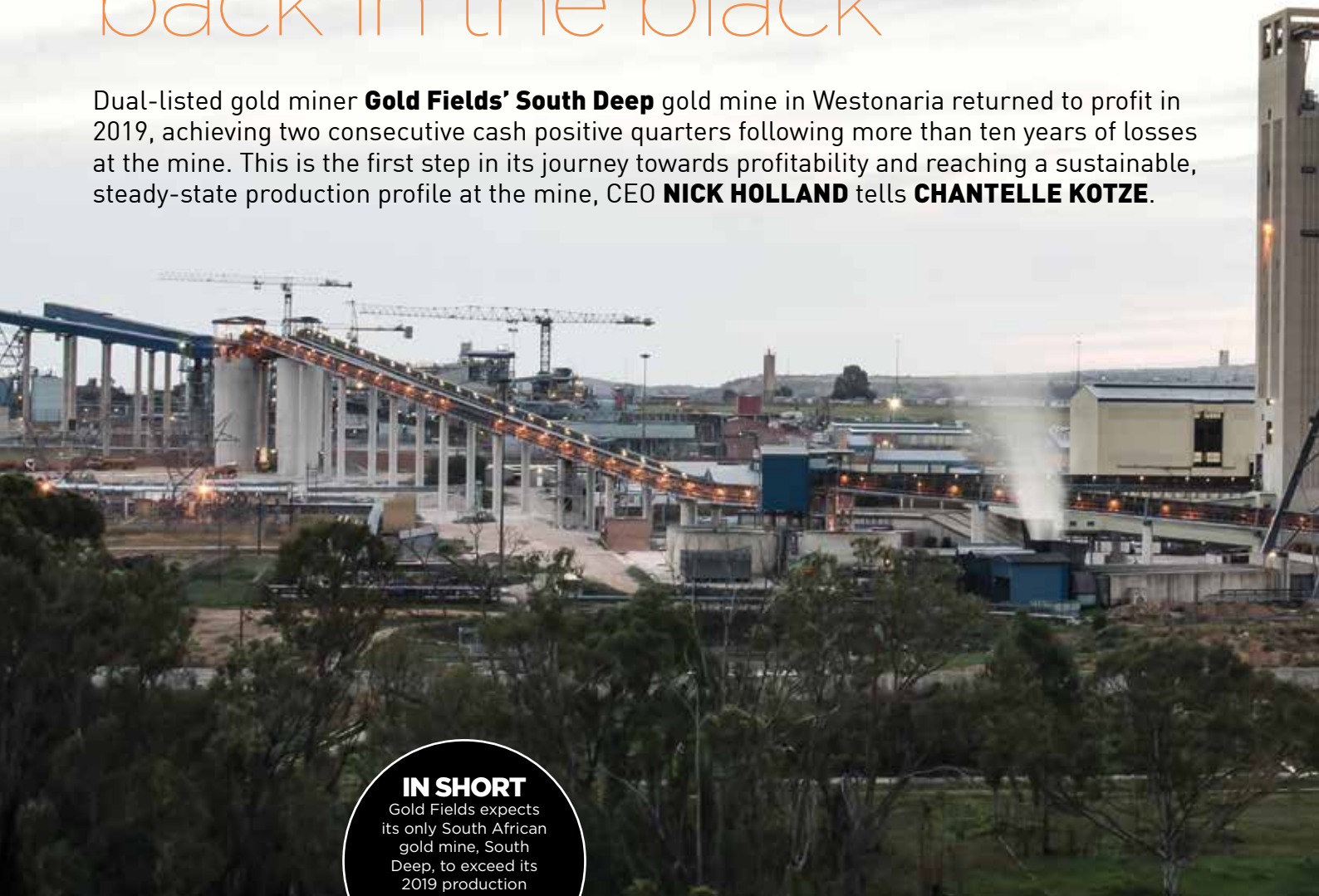
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# South Deep

## Gold Fields' SA mine back in the black

Dual-listed gold miner **Gold Fields' South Deep** gold mine in Westonaria returned to profit in 2019, achieving two consecutive cash positive quarters following more than ten years of losses at the mine. This is the first step in its journey towards profitability and reaching a sustainable, steady-state production profile at the mine, CEO **NICK HOLLAND** tells **CHANTELLE KOTZE**.



**IN SHORT**  
 Gold Fields expects its only South African gold mine, South Deep, to exceed its 2019 production guidance of 193 000 oz of gold by between 5% and 10%.

Gold Fields is in a unique position with its South Deep gold mine, which currently accounts for 47% of gold-equivalent mineral resources and 59% of mineral reserves of Gold Fields' global gold asset portfolio, in that the ore body has the potential for longevity.

Unlike South Africa's declining gold industry where ore bodies are generally

reaching the end of their lives due to depth, declining grades or where the ore body is too far away from the infrastructure, South Deep is not in this position and it is up to Gold Fields to capitalise on this unique position.

### The long and winding road

Since taking ownership of South Deep in 2006, Gold Fields has struggled to turn a sustainable profit at the asset despite

investing over R32 billion, including around R20 billion for the acquisition, in transitioning the mine from a conventional mining operation to a safe, modern, bulk mechanised mine.

With a cash-burn of approximately R100 million a month at South Deep and numerous interventions over the years to address the mine's underperformance – including optimising the mining method, extensive training and

Twin shafts at  
South Deep mine



“

Gold Fields is now in a position to optimise the entire value chain to open, mine and fill voids as efficiently as possible at South Deep, having put in place enabling factors around fleet management, training and coaching – all of which are underpinned by a commitment to safety and health,

NICK HOLLAND



2018 respectively), South Deep continued to face a number of organisational and structural challenges that impacted the mine's performance during Q1 and Q2.

As a result, the company embarked on a fundamental restructuring in Q3 2018, which saw management close loss-making areas at the mine, reduce the cost base and embark on a Section 189 retrenchment process with its trade unions (National Union of Mineworkers and UASA). The aim of this was to consolidate mining activity to match the cost structure with the level of production, explains Holland.

Following a violent 45-day protracted strike at the operation by the NUM in response to the retrenchment process which lasted almost two months, Gold Fields tabled an improved retrenchment offer which, after two rejections, was finally accepted in mid-December 2018.

Through the restructuring, a total of 1 092 permanent employees exited the business, of which 904 were retrenched, 183 opted for voluntary separation packages and five resigned.

The restructuring also saw Gold Fields remove US\$56 million from the mine's cost base and saw the operation's permanent employee workforce fall by 38% to just under 2 500 and the number of contractors from 2 294 to around 1 500.

“This fundamental restructure, the most comprehensive in South Deep's history, allowed the mine to significantly reduce its pre-restructuring cash-burn during 2019 and will also enable it to gradually build up to a sustainable production profile from this restructured position and set the mine up for long-term and sustainable growth,” says Holland. ▶

skills development, changing shift and work configurations, and outsourcing functions – the mine continued to underperform and record losses.

Despite setting in motion a massive turnaround plan to fix its base in 2015, Gold Fields failed to deliver its rebase plan in 2018 when it became evident that South Deep would not achieve the targets set out in the plan as it continued to experience cash losses.

With two labour restructuring processes under its belt (at the end of 2017 and Q1



Jumbo providing secondary support  
at South Deep mine

## The road ahead now paved with gold

After an expected slow start in Q1 2019, following the restructuring at South Deep, the asset regained its operational stride in Q2 when it showed signs of positive progress. Gold production increased by 67% to 57 000 oz in Q2 (at an all-in cost of \$1 529/oz) from 34 000 oz in Q1.

Production rose in Q3 to 61 000 oz of gold, with the all-in cost for the quarter decreasing to \$1 258/oz, which enabled the mine to be cash positive in Q3 – for the second consecutive quarter.

In order to maintain its profitability and reach a sustainable steady-state production profile over the mine's remaining life off the restructured cost base and overhead structure, Gold Fields has adopted a number of enabling activities at South Deep.

These broadly include:

- Improved organisational design with the right people in the right roles and a flat management structure;
- Rigorous performance management linked to line of sight performance;
- Improved stakeholder management, including government, trade unions and surrounding communities;
- Reliable fixed infrastructure;
- Accelerated backfill placement; and
- Improved fleet availability and utilisation.

"When we started seeing improvements in the second and third quarters, both of which turned a positive cash flow, we took a step back to identify how exactly South Deep had achieved these performance results, says Holland.

"The grassroots programme that we embarked on focused on getting the basics right and on getting our fit-for-

### FAST FACT

South Deep is the only open stoping gold operation of size in South Africa and has 33 Moz in managed mineral gold reserves at 31 December 2018

purpose workforce into a focused daily discipline so that we could bring South Deep into alignment from a cost and production point of view and being able to sustain this into the future,"

Holland notes.

South Deep, which is still in the ramp-up phase toward steady and sustainable gold production, has deliberately taken its long-term production targets off the table and avoided any reference to longer term targets to ensure that its team focuses on improving the shorter term performance of the asset. "We have therefore only given a one year view on South Deep and expect the 2020 production guidance to be a further improvement on the 2019 production guidance," says Holland.

This will be achieved on the back of executing the enabling activities at South Deep, including the opening up of new ground and productivity improvements off the back of the rationalised production fleet and the productivity interventions instated at the operation.

As part of the restructuring in 2018, the drill rig fleet was reduced by 29% from 21 rigs to 15 rigs. Coupled with the reduced fleet, and in line with the productivity interventions introduced, the average metres per drill rig (development and de-stress) have increased by between 30% and 40% year-to-date to 83 m per rig per month, compared with an average 60 m per rig per month in 2018.

Following the labour restructuring and rationalisation of the mobile underground production fleet from about 90 to about 60 units, South Deep is achieving a 30% to 40% increase in productivity, with less fleet and with one third fewer people. "This decluttering of South Deep

has placed the asset in a much better position for Gold Fields to improve on."

Holland believes that Gold Fields is now in a position to optimise the entire value chain to open, mine and fill voids as efficiently as possible at South Deep, having put in place enabling factors around fleet management, training and coaching. All of these are underpinned by a commitment to safety and health.

South Deep is now targeted to build on the momentum it has created over the last four quarters since the restructuring, with every quarter seeking an improvement on the previous one, and ensuring that this momentum can be sustained into the future. **MRA**

## HOW SOUTH DEEP EXPECTS TO EXTRACT LARGER GOLD VOLUMES

The bulk of the ore from South Deep comes from open stopes. A big driver of the volume growth to steady-state production is the increased contribution from longhole stoping, which will in turn increase the number of available faces/stopes, thereby increasing productivity.

South Deep intends to plan these stopes with much greater precision and resolution in future to ensure better compliance with the mine plan. By undertaking these bulk excavations in line with the geotechnical plan, South Deep will inherently become a more stable operation – able to maximise the volume of gold it extracts.

Sticking to this plan will also ensure that no gold is left behind in the reef and that the geotechnical integrity of the operation is not compromised by opening up too little or too much ground at any given time.

The backfill operation is also critical in the overall mine plan to ensure that the mined-out stopes are sufficiently and timeously backfilled before the next stope is mined.



South Deep processing plant

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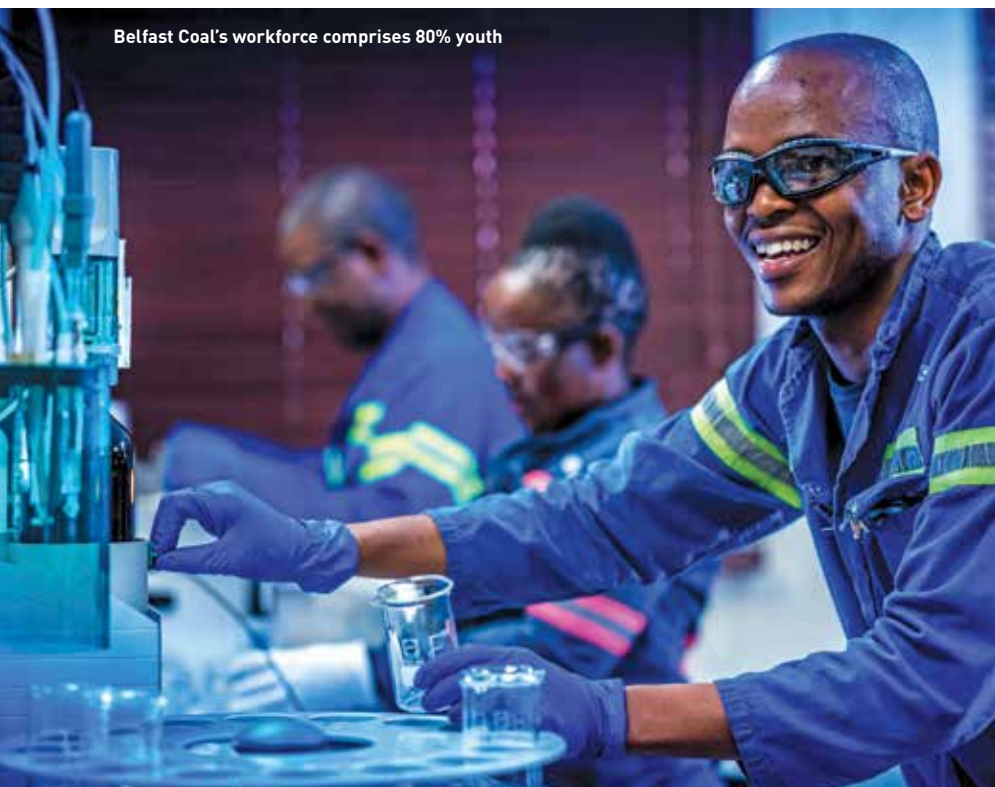
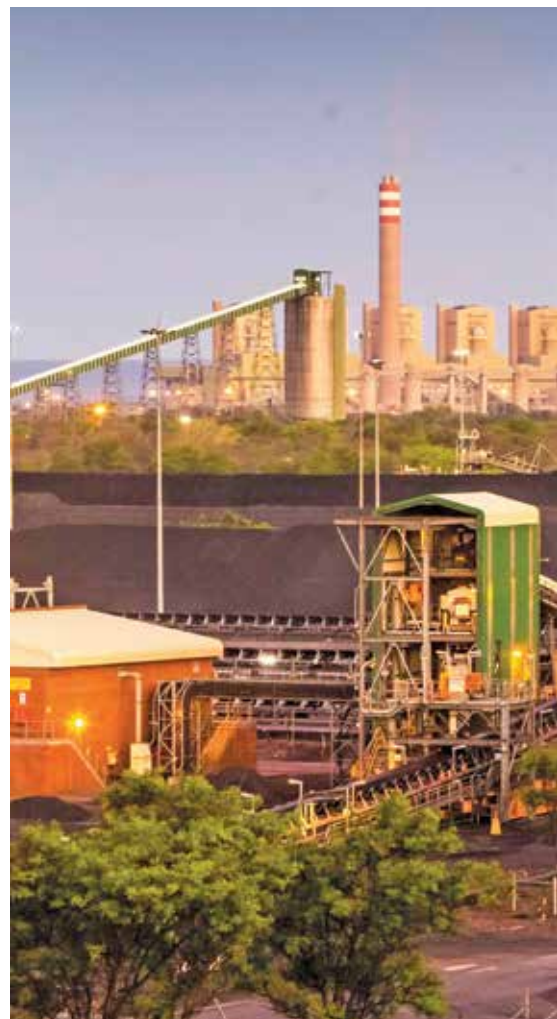
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# Exxaro's Belfast Coal

## More than just a mining frontrunner

It's the first time in Africa that a new mine has been developed incorporating a digital twin. The mine gained further kudos when it announced that it would start producing coal six months ahead of schedule. **Exxaro's** Belfast Coal mine is however more than just a pioneer of Industry 4.0 in the African mining sector. It is paving the way for the future of mining on the continent. **GERARD PETER** spoke to **PLEASURE MNISI**, manager: business optimisation at Exxaro, to get an update on progress at Belfast Coal and to learn what the future holds for this first-of-its-kind South African mine.



Belfast Coal's workforce comprises 80% youth

Taking over 20 years to develop at a cost of R3.3 billion, Belfast Coal is a digital and connected mine that centres on one of the last A-grade, high-yield coal deposits in Mpumalanga. Construction began in November 2017. The mine was only expected to start producing coal in 2020, after breaking ground in July 2018. In September last year, Exxaro announced that it would start producing high-grade thermal coal six months earlier than expected.

"For the year (2019), we are targeting between 1 and 1.2 Mtpa of coal and we have been ramping up slowly and will definitely reach the 1 Mtpa mark by the end of year, which is what we budgeted," explains Mnisi.\* "This is quite remarkable considering that we never planned to start producing in 2019; it has always been a 2020 project. This proves that the use of technology to manage the project and coordinate the value chain process is already reaping rewards at Belfast Coal."

Belfast Coal is the first mine in Africa to feature a digital twin



It is envisaged that Belfast Coal will primarily produce A-grade, export-quality coal (typical 6 000 kcal/kg) at a projected volume of 2.2 Mtpa, and a secondary-quality product (typical 21.5 MJ/kg) for local use or export of approximately 0.5 Mtpa. The mine has a 17-year lifespan for the first phase operation with a potential second phase that could increase the life of mine.

### Value chain optimisation

In order to ensure that the mine was on schedule, Mnisi states that there were work packages that were managed digitally to track progress on what needed to be done. "We worked with more than 50 partners; however, the most important thing for us was to have our own platform and use the Internet of Things (IoT) to connect across the entire value chain. By developing our operating system on a platform basis, it enables us to scale plug-and-play initiatives and remove those components that are not working. It also ensures that we are not forced to stay with a particular partner for the entirety of Belfast Coal's lifespan."

In order to develop its digital twin and create a connected mine, Exxaro looked abroad for working

“

The manner in which we use drones and remote control to conduct a blast at Belfast Coal, the younger generation sees this as being 'cool',”

PLEASURE MNISI



examples. At the heart of it all, the company focused on tech start-ups, particularly on their DNA and their way of thinking in how they go about generating innovative ideas to digitally transform mining operations. "In 2017, we started crafting our digital strategy so we brought in two consultancy houses, Deloitte and Accenture, and asked them to come up with bottom-up ideas to create this digital mine," adds Mnisi.

We consequently settled on six initiatives that focused on the visualisation of the supply chain. This enables us to see challenges and constraints that we were not always able to see before and have visibility of the entire operation from pit to port."

As with all operations in its value chain, Belfast Coal has an Integrated Operations Centre: one point where the company can get an immediate snap shot of the entire mining operation. From the outset, the centre has been manned by employees with expertise from across the entire value chain. In doing so, Exxaro was then able to identify gaps in the operation that needed to be addressed and also started collecting data, which Mnisi says is the third pillar of Belfast Coal's strategy. "We started accumulating data from all the points in ►

**DID YOU KNOW?**

Through the use of technology including virtual reality, Exxaro is able to have a real-time view of Belfast Coal operations from its head office in Centurion.

the value chain and in those parts where we began to see maturity, we applied predictive analytics on some of our critical equipment.

"For example, by using drone surveying technology to determine the location of particular grades of ore bodies and using predictive analytics on our loaders, we were able to superimpose the two and now we are able to determine the volume and quality of ore that each truck is loading. This is part of our overall Mineral Resources Management Integration: namely, determining the coal geology, what we've moved and to which stockpiles, how we wash the coal and determining what type of coal, marketing and logistics is required."

Mnisi adds that when the company decided on an overall automation strategy, unlike other mines that have opted to fully automate, Exxaro looked at those areas where automation offered high value with less disruption to the workforce so that the change is easily adopted. In those areas where operations are more labour intensive, the company will integrate automation when replacing equipment during Belfast Coal's life of mine.

**Youth-based mine**

Being a new mine, Belfast Coal does not have to deal with the much debated issue that automation will result in job losses.

As such, Exxaro was able to hire a young workforce to operate the mine. "About 80% of our workforce is below the age of 35. And when you look at the unemployment rate in South Africa, it is the youth who are most affected. With basic maths and thinking skills, coupled with the buzz around technology that is going on in their community and the country as a whole, these young people are keen to work at Belfast Coal as they see their opportunity to become future-proof if they work at this new-age mine," explains Mnisi.

In this way Belfast Coal is helping to develop mining's workforce of the future. "Mining has never been fashionable: it is engrained with hard labour, fatalities, etc. However, if you take, for example, the manner in which we use drones and remote control to conduct a blast at Belfast Coal, the younger generation sees this as being 'cool'. Without really verbalising it, our young team appreciate the fact that they are at the forefront of changing this so-called boring traditional industry into a modern digital industry."

**A boost in safety**

Importantly, automation is also helping to ensure that health and safety standards are maintained at Belfast Coal. For example, by attaching a digital safety tag to a worker's PPE, the company can control where that worker

is allowed to go. "The moment a worker walks into a zone where they shouldn't be, the Integrated Operations Centre is alerted, thereby preventing a possible incident," adds Mnisi.

Another important initiative is digitally monitoring speed limit zones on the mine. "By simply using real-time monitoring of drivers in the pits, not only can we monitor their speed and prevent an accident but it also allows us to confront those drivers with hard facts if they ever transgress the speed limit," explains Mnisi.

Belfast Coal is more than just a digitally advanced mine that is producing

high grade, clean-burning thermal coal. More than 6 000 direct and indirect jobs were created during construction, seeing almost 20 000 people benefiting, mainly from the local Nkangala District Municipality community.

Belfast Coal is expected to contribute R39 billion to local GDP over its life of mine, with the district's GDP gaining an estimated R2.1 billion per annum, including R966 million – a full 1% increase – of direct impact on the district municipality.

This, together with the ability to teach its young workforce the skills needed to future-proof themselves in the 4IR, Belfast Coal is truly helping to shape the future of mining in Africa. **MRA**

**6 months**  
The time Exxaro was able to reduce for the start-up of Belfast Coal

\*Info correct at the time of interview in December 2019

**Using drones and remote controls to conduct blasting enhances safety**





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For more information, contact :

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# Bagassi South mine

## Worth its weight in gold

TSX-listed gold mining company **Roxgold** has proven itself as a successful gold project developer in the highly prolific Houndé greenstone belt region of Burkina Faso in West Africa. The company has developed a track record of reaching milestones ahead of schedule, first with the impressive delivery of its **Yaramoko project** and the **Zone 55** mine, which poured first gold within five years of discovery, and next with its second high-grade gold mine, **Bagassi South**, which came online in September 2019. **CHANTELLE KOTZE** spoke to president and CEO **JOHN DORWARD**.



**Bagassi South looking north to processing plant**

### IN SHORT

Roxgold's Bagassi South mine is the company's second underground mine to come on line within the Yaramoko gold project in Burkina Faso. This high-grade satellite mine has increased production and lowered costs - demonstrating Roxgold's ability to execute projects successfully.

Roxgold has made a name for itself as one of only a handful of companies that has had a smooth mine development career. With two mines under its belt, the company is not stopping there and has already expanded into Côte d'Ivoire with its latest gold asset, Séguéla - which the company acquired from ASX-listed Newcrest Mining in April 2019.

The company's 55 Zone mine, within the greater Yaramoko gold project in Burkina Faso (where Bagassi South is also located), went from initial discovery in 2011 to production within five years. The company poured first gold in May 2016 ahead of schedule (and on budget) an impressive 13 months from breaking ground, and later declared commercial production in October of the same year. Roxgold has not missed a beat in its three and a half years of operation, Dorward quips, pointing out that the mine has managed to exceed its production guidance in both 2017 and 2018, and should reach the lower end of its 2019 production guidance too.

At the end of 2019, Roxgold will have produced approximately 480 000 oz of gold from Yaramoko (well above the anticipated feasibility study production levels) and has been able to maintain its mineral resource base through continued exploration work that targets extensions to the existing orebody at depth (which currently extends to about 1.2 km below surface and remains open at depth).

With about seven years of mine life remaining at 55 Zone (based on reserves), Roxgold will establish its second underground resource drilling platform about 600 m below surface during H2, 2020. This will allow the company to drill into the inferred material at depth, enabling it to convert about 200 000 oz of the inferred mineral resource into indicated resource, extending the life of mine to at least 10 years.

### Bagassi South adds to Yaramoko production

Although a relatively small operation, Bagassi South was discovered soon after 55 Zone came into production and is a stone's throw away from 55 Zone on the Yaramoko property.

Bagassi South consists of two gold deposits: QV1 and QV Prime, and is geologically similar to 55 Zone with an average grade of 15 g/t. The mine, which benefits from shared infrastructure, management and support services already in place for the 55 Zone mine, is a fully functioning stand-alone underground mine, says Dorward.

In order to bring Bagassi South into production, Roxgold had to expand the existing processing plant throughput by 50%, which involved the installation of a new secondary crusher, expansion of the carbon-in-leach circuit from six to eight tanks, the addition of a new tailings thickener and tails line, and gold room processing capacity expansion. With the addition of Bagassi ►

### FAST FACT

The processing plant is currently running 30% above the 1 100 tpd nameplate capacity

**Processing plant expansion at Yaramoko**





South, Yaramoko has seen a notable increase to its production profile, achieving record gold production of 16 000 oz at a head grade of 11.5 g/t in October – just a month after Bagassi South declared commercial production.

“Bagassi South has also had a positive impact on the company’s cost structure on a per ton basis, with an average operating cost of US\$150/t processed, which is a 16% reduction compared to Q3, 2018 driven by increased throughput and strong cost control at Yaramoko,” Dorward notes.

With a measured and indicated mineral resource of 236 000 oz grading at 15.2 g/t of gold (at QV1), Bagassi South has a five-year mine life, and will continue stoping activities in 2020 over the next four years, with potential resource growth opportunities coming from the parallel structures surrounding the QV1 vein.

Moreover, Roxgold will undertake a drilling programme at the mine in 2020 to expand the resource and try to convert the inferred mineral resource at the QV Prime deposit into the indicated category.

### Continued growth in West Africa through Côte d’Ivoire pipeline

According to Dorward, Roxgold’s future growth is underpinned by the Séguéla gold project in Côte d’Ivoire, as it enables the company to create long-term value for its shareholders.

The Séguéla project, which has over 28 highly prospective exploration targets, is a second key asset with significant growth potential both in the near term through the near-surface Antenna deposit and its satellite opportunities, as well as a highly prospective large land package.

Roxgold has rapidly advanced the Séguéla project, having declared a maiden Antenna deposit indicated resource of 496 000 oz grading at 2.4 g/t of gold – only three months after acquisition. With four drilling rigs currently active



Bagassi South has had a positive impact on the company’s cost structure on a per ton basis, with an average operating cost of US\$150/t processed,



JOHN DORWARD

### TRULY UNIQUE

Despite the recent insecurity and unrest in eastern Burkina Faso as a result of attacks by armed groups within the West African country, Burkina Faso remains a truly unique mining jurisdiction that has allowed for the quick development of the 55 Zone and Bagassi South deposits within the Yaramoko gold project. There are not many mining jurisdictions where you can advance a modern underground gold mine from discovery to production within five years. We expect to see history repeat itself with the rapid advancement of the Séguéla project – which will make Roxgold West Africa’s next multi-asset producer.



↑ Drill rig operating at the Antenna deposit within the Séguéla project

↙ Underground operations at 55 Zone

on site, the company has been conducting an aggressive 28 000 m drill program, targeting extensions of the Antenna deposit as well as its nearby satellite deposits: Agouti, Boulder, P3, and Ancien. Initial assay results from these deposits have been very positive, with a recent headline hole from Ancien returning 19.73 g/t gold over 23 m (SGRC329).

Roxgold is planning on an initial preliminary economic assessment (PEA) for Séguéla in early 2020, followed by a push towards a feasibility study by the end of the year.

“The PEA will be a high quality study which will pave the way for our future development of Séguéla,” says Dorward. “The satellite pits around the Antenna deposit have the potential to increase the mineralisation and enhance the potential economics of Séguéla by adding additional low-cost near-surface ounces.”

Knowing Roxgold’s track record of bringing online projects in record time, we would not be surprised to see Séguéla quickly move up the value chain and advise investors to keep an eye on this company. **MBA**

### WHAT THEY ALSO SAID

Yaramoko is a significant cash generator and it is Roxgold’s strategy to invest this cash into organic growth opportunities in and around its existing mines as well as external prospects, which aids in fulfilling its ambition to expand its footprint further into West Africa

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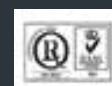
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# Lucara's Karowe

## Glowing production performance set to continue

Tri-listed diamond miner **Lucara Diamond Corporation** (Lucara) has celebrated multiple successes at its **Karowe** mine in Botswana, which in 2020 will move into its eighth year of full production. The mine has generated significant revenues for both company and country and is responsible for delivering three of the largest diamonds ever recovered – globally. And the future looks even brighter as work gets underway this year to transition this mine from open pit to underground – extending Karowe's mine life while gaining access to the most valuable part of the ore body, CEO **EIRA THOMAS** tells **LAURA CORNISH**.

The AK06 kimberlite – Lucara's flagship Karowe operation – has only just begun to tap into the potential it offers in terms of quantity and quality of diamonds. This is hard to believe considering the mine has produced a number of large, special stones over what was originally expected to be a lifespan ending in 2026.

The results of a feasibility study announced in November 2019 revealed

**IN SHORT**  
Karowe offers the opportunity to become the first underground diamond mine in Botswana.

the compelling economics to develop an underground mine below the existing open pit – an option that until this study was not believed to have any viable merit in doing.

"Just two years ago we envisioned a top down approach - mining the ore body to the deepest point in the open pit that was still economically viable," Thomas starts. "But after more than 30 000 m of drilling and two years of study and investigation to understand the ore body at depth,

we have identified that an underground expansion is far more economically viable than we had originally believed."

The ore body becomes more valuable at depth, Thomas continues. "Not only does the overall diamond content increase at depth but the actual preponderance of large, high value stones increases as well. As such we now have a bottom up approach rather than our original top down approach."

### Feasibility study highlights

The Karowe underground feasibility study will double the mine life (to end

Aerial view of Karowe open pit



Lobe -Type	Classification	Ore (Mt)	Diluted Grade (cph)	Contained Carats ('000s ct)	Price (US\$/ct)
<b>Open Pit</b>					
North	Probable	0.6	10.0	56	222
Centre	Probable	3.2	15.1	478	349
South – EM/PK(S)	Probable	3.6	23.9	850	777
South – MPK(S)	Probable	10.2	10.8	1,098	631
Open Pit	<b>Total</b>	<b>17.4</b>	<b>14.2</b>	<b>2,481</b>	<b>618</b>
<b>Underground</b>					
South – EM/PK(S)	Probable	16.3	19.9	3,246	777
South – MPK(S)	Probable	17.1	10.6	1,807	631
Underground	<b>Total</b>	<b>33.5</b>	<b>15.1</b>	<b>5,053</b>	<b>725</b>
<b>Stockpiles</b>					
North	Probable	0.4	12.7	51	222
Centre	Probable	0.4	12.8	54	349
South – MPK(S)	Probable	1.8	9.5	151	631
Mixed	Probable	4.0	5.0	198	609
Stockpiles	<b>Total</b>	<b>6.4</b>	<b>7.1</b>	<b>454</b>	<b>542</b>
<b>Combined</b>					
All	<b>Total</b>	<b>57.3</b>	<b>13.9</b>	<b>7,988</b>	<b>681</b>

↑ **Table 1** Karowe mine mineral reserve estimate

in 2040) from the original 2010 mine design and add net cash flows of US\$1.22 billion and gross revenue of \$5.25 billion – beyond the \$1.5 billion already generated in revenue since 2012.

A \$718 million after-tax NPV (5%) has been determined for the combined open pit and underground mine with no real diamond price escalation. “We have taken a very conservative pricing outlook in our numbers but even so have delivered strong economics. It is however important to note that a return to diamond prices observed in 2015, which we believe could start in 2020, would nearly double the NPV (5%) of this project to \$1.4 billion,” Thomas states.

Interestingly, large diamonds have contributed about 15% of Lucara’s total revenue to date and this has not been factored into the project’s underground model or financial figures.

The combined open pit and underground indicated resource now stands at 54.27 Mt at 15.3 carats cph for a contained diamond resource of 8.3 million carats (excluding stockpiles).

The company has also chosen what Thomas describes as a less risky mining method. “Long hole shrinkage underground bulk mining will provide the earliest possible access to higher value ore,” and allows for a short payback period of 2.8 years and low operating costs of \$28.43/t processed.

On the basis of a construction start in mid-2020, ore from underground mining will seamlessly

“Not only does the overall diamond content increase at depth but the actual preponderance of large, high value stones increases as well,”

**EIRA THOMAS**



**FAST FACT**

Karowe’s South Lobe – containing the EM/PK (S) zone – has produced the large majority of Karowe’s big diamond recoveries, including:

- the most recent 123 carat diamond (in September 2019);
- the 1 109 carat Lesedi La Rona;
- the 813 carat Constellation; and
- the 1 758 carat Sewelô diamond (in April 2019).

**POWER UPGRADE**

Naturally, an underground mining operation requires more power and this is an area that requires some investment from Lucara. The mine is tied into Botswana’s national grid but stability has been a challenge up to now. “We have had positive discussions with Botswana Power Corporation and are currently completing a feasibility study which evaluates constructing a new powerline to feed from a new substation. This is a fairly prescriptive process but we are comfortable that we’ll have the line in place when we need it and are excited at the prospect of having a more reliable form of power,” Thomas highlights.

integrate into current operations, providing mill feed starting in 2023 with a ramp-up to the processing plant by 2026.

The underground mine is designed to access the South lobe kimberlite resource below the current planned bottom of the open pit (which is expected to be at approximately 700 meters above sea level (masl), to a depth of 310 masl).

Thomas explains that the Karowe open pit mine consists of the North, Centre and South lobes. “The South lobe itself is further differentiated into different zones, the MP/K (S) and EM/PK (S). These two units are present in the open pit today but as we mine deeper the EM/PK (S) dominates as the main rock type and we lose the North and Central lobes completely. The EM/PK (S) zone has to date produced most of our large diamonds, is almost twice the grade of MP/K (S) and contains coarser diamonds and for this reason our underground plans hold so much merit,” Thomas outlines.

**Forward steps: from now to production start-up**

The Lucara board have acknowledged the compelling opportunity Karowe underground presents and have authorised the first steps necessary in taking the project forward.

A budget of up to \$53 million, which will be funded from operating cash flow, has been approved for early works related to the proposed underground mine. This includes detailed engineering, design work and the start of sinking two vertical shafts (production and ventilation) of approximately 765 and 715 m deep respectively, which will gain main access to the underground ore body and drive its production. The majority of the necessary infrastructure ▶

Karowe processing plant



### UPSKILLING IN PLAY

Once operational, Karowe will be the **first underground diamond mine in Botswana**. As such, the company needs to develop the skills set and have a plan in place to ensure its workforce is equipped to operate the mine. "There are a lot of skills and well educated citizens in the country which should ensure a smooth training process," says Thomas. The company currently employs 300 permanent employees; of which all will transition to the underground mine from surface.

will be located at the 310 mast level – which constitutes granitic host rock and therefore good support.

"We are taking a fast track approach to the project which requires access to our underground ore before the open pit resource is depleted," Thomas confirms.

An investment decision to proceed further with the full extent of the project is subject to receipt of all required authorisations and the arrangement of debt financing, which is expected in H2, 2020. "I am confident however that the

\$4 billion of additional revenue this project will generate for the company and its stakeholders will ensure it proceeds. We would not have received approval to move forward with over \$50 million in 2020 without the confidence that this project's merits can be successfully exploited."

Once the necessary authorisations and funding have been secured, the project kicks into top gear in 2021, which will be Lucara's biggest spending year. Construction thereafter continues for another three years – ensuring the mine

is fully operational by 2026. "There is likely to be an overlap in production generated from the open pit and underground mine, but thanks to our chosen mining method, neither surface nor underground will be compromised," Thomas notes. "We will also have access to existing surface stockpiles during the transition should production from the mine itself drop for a period."

With no major changes required to Karowe's process plant or mill, the mine will continue to process between 2.6 and 2.8 Mtpa – meaning this project in essence is a life extension rather than an expansion project.

"We do know however that the ore body continues deeper. As we sink and advance our underground development we will continue to drill further to evaluate the potential of extending the mine further at depth in the future," Thomas reveals. **MRA**



Some of the top Karowe diamond finds from 2019



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# Makhado's production start-up

## Brown works his magic

The long-term success of dual-listed coal miner **MC Mining** is largely dependent on its ability to develop and operate its flagship **Makhado** coal project, which for years has sat dormant within the company's project portfolio. Under the leadership of CEO **DAVID BROWN**, in 2019, the company outlined a financially feasible development approach that will see the project move into development within the second quarter of 2020, **LAURA CORNISH** writes.

### IN SHORT

MC Mining will soon cross the finish line which will see it start construction at its flagship Makhado project.



Makhado comprises a significant coking and thermal coal resource – enough to have quantified the vision of building a R4 billion, 5.5 Mtpa coal operation in the company's 2009/2010 earlier years

## THE ALL-IMPORTANT QUESTION

MC Mining needs R750 million to take Makhado Phase 1 through to production (this includes the repayment of the current Industrial Development Corporation debt that is on the balance sheet). To date, the company has secured a new R240 million debt facility agreed with the Industrial Development Corporation to help fund the project. "We are looking at an equity deal as well – at holding and/or project/company level. We are in discussions with various South African and international institutions to bridge our funding gap and are confident of meeting our end H1 2020 deadline for this," Brown confirms.

The last 10 years in MC Mining's (previously Coal of Africa) history could be summarised as a pre- and post-Brown era.

The pre-Brown period saw a coal mining business struggling to keep its head above water with a suite of non-performing assets and undeveloped projects. There is no need to go into further detail about this.

The post-Brown years, which started in 2012 when the recent ex-CEO of Impala Platinum joined the company (as a non-executive chairman in 2012 and then as CEO in 2014), has delivered a revolutionary business turnaround. The company's non-profitable mines have either been sold or placed on care and maintenance and the acquisition of the Uitkomst mine in KwaZulu-Natal brought the company back to production life.

Most importantly, Brown has played a pivotal role in finding a solution that will see MC Mining's Makhado project, located in the Soutpansberg coalfield in the Limpopo province, eventually move into construction and shortly thereafter, operation.

### The evolution of Makhado

The quality and value of Makhado has never been in question. The asset comprises a significant coking and thermal coal resource – enough to have quantified the vision of building a R4 billion, 5.5 Mtpa coal operation in the company's 2009/2010 earlier years.

"Quite obviously, we would never have found a home for this volume of coal. And the possibility of raising that much cash to build the mine has always been an impossibility," Brown states.

But he has clearly made it his mission to find a way to bring Makhado to fruition and while it has taken years to find a feasible solution – one that has also evolved over the past two years – he has done it.

Building the mine in 'bite-sized' chunks is the answer and is also a strategy that has evolved over time.

The concept of Makhado 'Lite' was initially introduced and this curtailed production to a 4 Mtpa ROM coal operation, yielding 1.6

to 1.8 Mtpa of saleable product. This would solve problems around capital expenditure requirements and a reduced footprint was also attractive. But even the development of this considerably downsized project was delayed due to a lack of access to two key properties where the mine's east pit, processing and other infrastructure would be located.

Refusing to suffer further delays, the company has introduced a new plan to enable a faster start-up and give MC Mining the necessary momentum to upscale in size with time as the mine starts generating cash.

### Finding Makhado's start-up sweet spot

In preparation to build up to the envisioned Makhado Lite production, the mine will now be developed in two smaller phases – Phase 1 and Phase 2 – which the CEO believes is a reflection of the ongoing innovation within the company to "get this mine's product to market". "This rationale was the result of possibly facing further delays to acquire the necessary surface rights and the need to reduce costs even further," Brown explains.

While the project is now fully permitted and the necessary surface rights awarded, the necessity to move into Makhado Phase 1's execution is a matter of priority and will signal the long-awaited start-up of what remains a game-changing asset for the company.

Phase 1 will commence with the development of the Makhado west pit as well as modifications to the existing Vele colliery processing plant which will be used to wash the Makhado ore.

The drilling programme completed in Q4, 2018 confirms the west pit's limit of oxidation at 17 m below surface, indicating that the coal deeper than this has not oxidised. This is shallower than the previously modelled depth of 30 m and translates into a lower strip ratio of 2.08 m<sup>3</sup>/t over the nine-year life of the pit.

The approximate 3 Mtpa of ROM coal from the west pit will be mined by an independent mining contractor using a truck and shovel, modified terrace mining method. The ROM ►

“

Even at the much reduced size, once operational this mine will enable the company to be self-sufficient and this alone is enough of a motivator to ensure we make this project a reality,

DAVID BROWN



**1.1 Mtpa**

The volume of saleable coal MC Mining will produce from Makhado Phase 1



◆ The Vele plant – once operational – will be upgraded to process Makhado's ore during Phase 1



### SOUTH AFRICA'S REGULATORY ENVIRONMENT

Despite the progress DMRE minister Gwede Mantashe has made in bringing political stability to the mining industry through the new Mining Charter, Brown believes the regulatory environment remains complex and particularly difficult for juniors to navigate. "The number of permits and approvals required is extensive, timely and costly and should be something that the government reconsiders."

coal will be hauled to a crushing and screening plant consisting of a feeder breaker to crush the coal that is then scalped, removing the coarse parting and waste. The circa 2 Mtpa of scalped ROM coal will be transported by road to the Vele colliery for final processing.

"The Vele plant will need to be modified to facilitate the simultaneous production of hard coking coal and export quality thermal coal," Brown notes. The plant modifications consist of, amongst others, a new fines circuit comprising reflux classifier in series with the existing spiral plant, low density secondary wash plant and a froth flotation plant to capture the ultra-fine coal.

It will be managed by independent processing experts to produce approximately 1.1 Mtpa of saleable coal comprising 540 000 tpa of coking

coal and 570 000 tpa of thermal coal which will be trucked to the Mesina siding where it will be delivered to ArcelorMittal.

At this new production volume, Makhado Phase 1 will take just nine months to construct, a month to move into production and another five months to reach full production.

"We have based our numbers on a US\$150/t long-term coking coal pricing structure which we feel is accurate given the supply and demand fundamentals. At this price Phase 1 alone will deliver a three-year payback and an IRR in excess of 40%."

Makhado Phase 2 will see MC Mining move into the area's earmarked east and central pits and further entails the construction of a new process plant. This would be used for Makhado Phase 1 production and another

1.9 Mtpa of saleable production from Phase 2 – of which 50% has already been contracted for offtake. This project expansion requires a 12-month construction period and will need a four-month ramp-up to reach full production after which it can operate at this rate for 37 years. "I will deliver a similar payback period and IRR," Brown confirms.

There can be little doubt as to how Makhado will change the face of MC Mining – for the better. "Even at the much reduced size, once operational this mine will enable the company to be financially self-sufficient and this alone is enough of a motivator to ensure we make this project a reality," Brown concludes. **MBA**

# SPECIAL REPORT

# Investing in African Mining Indaba

Part 2

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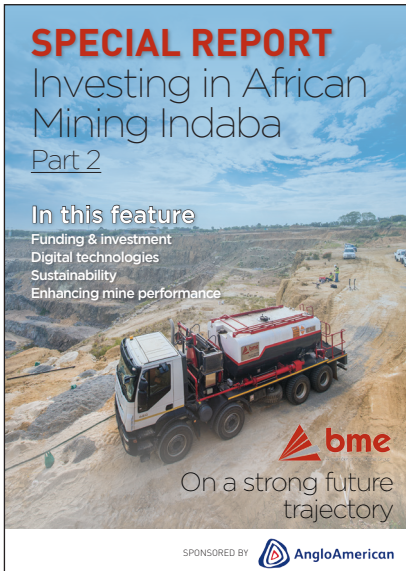
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BME's AXSIS electronic  
detonator

# Redefined business strategy

## Sets BME on strong future trajectory

Blasting and explosives specialist **BME** has entered the final year of its five-year strategy in which it aims to leverage its strong southern African organisation's business processes and manufacturing capabilities to better service its expanded African and international mining market. Well on track in meeting the objectives it has set out to achieve over the past four years, MD **JOSEPH KEENAN** is confident that the company has built a strong southern African base capable of better competing in a digitally evolving mining industry with its enhanced technology and service offering, writes **CHANTELLE KOTZE**.

**B**ME's five-year reorganisation, restructuring and recapitalisation strategy has focused on creating a diverse, fit-for-purpose and scalable company capable not only of meeting market demands but also withstanding changes in any one of the markets in which it operates.

This, Keenan believes, will create long-term sustainability for BME, whose business model remains firmly based on delivering value to its customers by helping the mining sector improve its productivity and add value to operations while delivering cost effective technologies and services.

### Explosive international growth

A strong focus of BME has been on expanding its geographic footprint and had early in the strategy already begun to identify where mining companies were spending their exploration capital and which regions offered potential future interest. This exercise gave BME a good idea of which regions it should focus its global expansion on to better support the mining industry.

BME subsequently identified the Australia-Asia, Americas, central African and west African regions as future growth markets. Once these markets were identified, the company geographically diversified its management teams so that the company's regional managers are operating in BME's identified growth markets and can therefore better tailor its technology and service offerings towards the growth markets in which BME aspires to operate.

Since identifying these global growth regions, BME has made significant progress in establishing itself in these regions.

In the Australia-Asia region, BME completed the acquisition in 2018 of Australia-based Advanced Initiating Systems – a company that BME was instrumental in establishing. Rebranded to BME Australia, BME will use this as a



base to expand its technologies and service offering in Australia.

Meanwhile, on the African continent, BME continues to strengthen its presence in both central and west Africa – where it has already created two hubs: one in Bamako, Mali to serve the west African region and one in Zambia, able to serve the central Africa region.

In central Africa, BME has opened a new office in Lusaka and a storage facility and distribution centre in Solwezi, Zambia to better service the central African region, while in west Africa BME has established eight emulsion plants in the region.

In the Americas region, BME shipped its first orders of AXXIS electronic detonators to Colombia in 2016, and expanded sales into Peru and Chile throughout 2017 and 2018. The company also opened an office in Denver, Colorado in 2018, while in Canada, the company entered into a joint venture (JV) with Consbec. The JV, called BME Mining Canada Inc., is a manufacturing and service company for the surface and underground mining market that will create opportunity for BME's growth and expansion in the region.

Similarly to the Canadian JV, it is BME's preference to operate with local business partners in new markets and is looking to enter similar strategic partnerships in its identified growth regions, says Keenan, with the aim of fostering more holistic operations and opportunities for both BME and the local business partner.

In addition to entering new global markets, BME has also invested heavily in the "infrastructure" of the company, as Keenan puts it, which entailed establishing an enhanced company structure, with improved business systems and processes to better manage its global operations, as well as new manufacturing and automation technology at its manufacturing facilities.

Having achieved several milestones in realising its strategy, BME can confidently say that it has laid a solid foundation for future success – from which the company has already started reaping strong reward and from which it will continue to benefit as the strategy draws to a close this year.

"The final year of the strategy hinges on leveraging from the foundations we have laid over the past four years and starting to drive real value from the work we have done in our growth regions while continuing to innovate and invest in assets for the continued growth of the company," says Keenan.

The final year of our strategy hinges on leveraging from the foundations we have laid over the past four years and starting to drive real value from the work we have done in our growth regions,

JOSEPH KEENAN



## Merging innovation and digital technology

BME understands the need to be innovative in its approach and thinking around technology if it wants to be a competitive player in the digitally evolving mining landscape, says Keenan, noting that this is something that BME has successfully showcased in its range of AXXIS electronic detonation systems, which has undergone constant redevelopment.

BME has been working on its next generation AXXIS system – AXXIS TITANIUM – which provides the user with additional features and benefits to the existing range of AXXIS electronic detonators. AXXIS TITANIUM, which will be available to the market this year, is also more user friendly, more robust and safer than earlier models.

Moreover, BME is in the process of developing wireless capabilities within the AXXIS range of electronic detonators as the next step in the evolution of electronic detonators. "While there are existing wireless detonation systems on the market, our aim is to improve the ease of use for the operator while also delivering a turnkey range of detonation products in-house for our customers to choose from," says Keenan. The wireless detonation system, currently in prototype stage, will begin field trials this year. **MRA**



**BME is innovative in its approach and thinking** around technology in the digitally evolving mining landscape

Mining Indaba Portfolio Director **Simon Ford** and Head of Content **Tom Quinn** shared more of the key points with **Laura Cornish**. For more information, see the December 2019 edition.

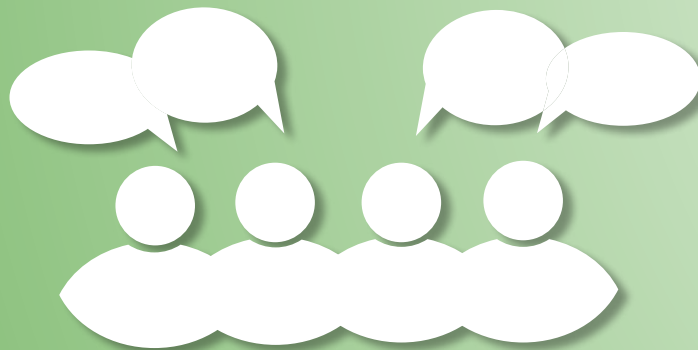


## New matchmaking platform

The matchmaking platform is not new to Mining Indaba, but under new owners Hyve Group, the system for 2020 will be more sophisticated – allowing searches to be refined by more specific parameters including commodity and region

## Encouraging networking after hours

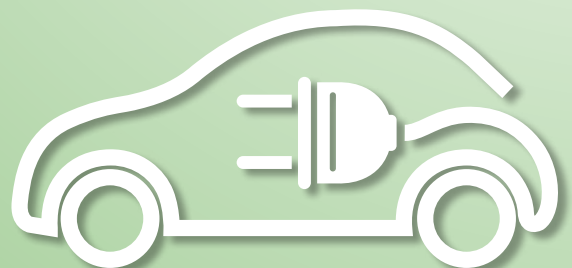
Because one of Mining Indaba's key drives is encouraging networking opportunities, the event is boosting occasions to do so by introducing an after-hours party on the Tuesday evening. Open to all delegates, it gives everyone a chance to chat in a more informal environment and is themed 'Bringing the industry together for an evening of celebration'



# MINING 20 HERE A KEY HIGH PA

## Battery metals: a two-day event

Battery metals remains a key focus topic at Mining Indaba 2020 – being driven by new technologies and the electric vehicle market. Hyve Group is looking to bring some of its automotive partners (through other key Hyve events) to the conference





## Returning with renewed focus and attention

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# INDABA 20 RE THE HIGHLIGHTS RT 2



## For the first time

For the first time ever, Siemens will be presenting at Mining Indaba. Siemens Southern Africa CEO Sabine Dall'Omo will deliver insights during the 4IR panel discussion



## Climate change and sustainability

Experts will discuss:

1. Extreme weather patterns
2. Transport disruption affecting supply chain reliability
3. GHGs from Scope 2 & 3 emissions and reduction strategies
4. Increased competition for climate-sensitive resources

# 2020 Vision

## Africa's mining outlook

Millennials, a battery metals scarcity and automation are just some of the trends that are expected to shape the African mining sector in 2020. These are also some of the hot topics that will be discussed in detail at this year's *Investing in African Mining Indaba*. Here are six key issues the African mining industry will likely come up against in the next 12 months and beyond, as reported by the event.

### 1. Getting millennials to come to the party

In its 2019 trend report, Deloitte's *Tracking the trends 2019: The top 10 issues transforming the future of mining* highlighted an issue that many in mining will already be familiar with – the industry is struggling with a perception problem among younger people looking to choose a career path.

"Right now," says Deloitte, the mining industry is not attracting sufficient numbers of diverse candidates to truly move the dial on its diversity and inclusion strategies. To shift this balance, companies will need to change their talent attraction and retention policies."

Out of Deloitte's *2019 Millennial Survey*, results from the South African cohort reflected the desire millennials have to work in fields that create social impact and positive change.

"As miners grapple with the challenge of rebuilding their skill base and developing a workforce capable of bringing the industry along the technology pathway it needs to remain competitive, they must find new ways to motivate their workforce," says the report.

As we enter 2020, the African mining industry – as well as the industry at a global scale – will continue to grapple with the generational shift of the workforce and understanding how to attract and retain millennial workers.



### 2. Tackling youth unemployment in South Africa

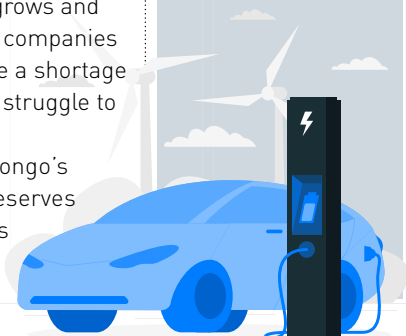
"We are very much alive to the fact that youth unemployment is indeed a national crisis," said South African President Cyril Ramaphosa on National Youth Day in June. With unemployment rates inching up to 27.6% in the first quarter of 2019, 2020 will be an interesting time to see how President Ramaphosa's government can use the mining industry to help ease the severe unemployment rates for South Africa's youth population.

According to Stats SA, almost two-thirds of those who are jobless in South Africa are in the 15-34 age group; around four out of 10 young people do not have a job.

### 3. The impending scarcity of battery metals

As demand for electric vehicles (EVs) grows and their rate of manufacturing increases, companies including Tesla say we are likely to face a shortage of the key metals required for EVs and struggle to keep up with this mounting demand.

From the Democratic Republic of Congo's (DRC) cobalt supplies to the copper reserves the DRC and Zambia have on offer, it's no wonder they are being tapped for their battery metals. ▶



“As with many other traditional sectors, the mining industry is having to embrace the global shifts that are taking place.”

**RICHARD HAIGH**



a Hyve event

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Despite the demand for EVs, investment in the companies carrying out the mining of these battery metals is lagging, with a burgeoning risk of a global shortage in the minerals growing more likely. Tesla's global supply manager for battery metals, Sarah Maryssael, as well as carmakers including Ford Motor, Toyota and BMW have said that the auto industry needs to start investing directly in battery metal mines to make sure supplies are secure for the coming three to five years.

To combat the potential scarcity, companies like Ford – which is looking to launch EVs in the coming year – and Samsung are looking at ways to reduce the amount of cobalt used in their rechargeable batteries and make EVs that are more affordable and less at risk from the battery metal shortage.

#### 4. Brand values matter

Like many of the more traditional sectors, the mining industry has taken a cursory approach to brand and reputation until recently. In 2020, we'll continue to see the mining industry, particularly the big players, take more of a pointed look at how they are perceived not only by shareholders, but also by wider society.

Richard Haigh, head of mining practice at consultancy Brand Finance, states, "As with many other traditional sectors, the mining industry is having to embrace the global shifts that are taking place, notably the rise of technology, environmental issues and new entrants to the market. In order to combat these shifts, and to ensure brands stay ahead of their competitors, companies within the resources sector are embracing global branding matters."



In July 2019, BHP CEO Andrew Mackenzie talked openly at a business breakfast in London about the need for drastic action – beyond carbon pricing – to be taken to combat global warming. "Use of emissions intensive products from the resource industry have contributed significantly to global warming, said Mackenzie. He announced that BHP was spending \$US400 million on developing a climate investment programme with the aim to reduce emissions from its own operations and those of its resources. The short-term goal for the company is to cap its 2022 emissions at its levels from 2017, with a longer-term goal to achieve net-zero emissions by 2050.

After the success of BHP's re-branding and 'Think Big' marketing campaign, there's no doubt we'll continue to see other brands in the mining industry follow suit to help combat what Mackenzie described as an "indisputable" emerging crisis.

#### 5. Uncertainty over the DRC

With global risk consultancy Verisk Maplecroft's 2019 *Resource Nationalism Index (RNI)* report seeing 30 countries registering a significant increase in resource nationalism metrics last year, the Democratic Republic of Congo (DRC) was one of the more notable on the list.

The RNI measures the risk of expropriation, the imposition of more stringent fiscal regimes, and the pressure for companies to source goods and services from local providers. For the DRC, its place on the list is most likely a result of the new Mining Code, which allows for more government interventions and oppressive fiscal terms – this could result in the government taking even greater control of natural resources.

With resource nationalism creeping to the forefront in the DRC, investors are being squeezed from all directions. Since the new Mining Code came into place in June 2018, the government has been attempting to block commercial asset

transfers, trying to seize operators as a way to get more profit, and preventing exports from a cobalt mine.

As well as the DRC, there are seven other countries with the 'extreme risk' rating – Venezuela, Tanzania, Russia, North Korea, Zimbabwe, Swaziland and Papua New Guinea.

#### 6. Electrification and mine design innovations

In a bid to improve the potential sustainability of their operations and contributions, many mining companies around the world are looking at ways to electrify and/or automate their mines.

While electrification is not exclusive to the African mining industry, it is something that will become more pertinent globally with the potential it offers to reduce the energy costs of mining, as well as making it more sustainable and safer as an industry. Whether it involves switching from diesel-powered engines to electric, or hiring workers with stronger data processing and digital literacy skills, the industry is ripe for change.

This is not a change we will see overnight, or come to fruition in 2020, but something that will require a fundamental shift from the industry as a whole, at a global scale. Moving from conventional ways of working to the use of electrical equipment will require upskilling, collaboration with equipment manufacturers, and an overall rethinking of how mines are designed. **MRA**



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# Banking on the future

It's not just about the money anymore

By Shirley Webber, Absa CIB, Head: Natural Resources, ABSA CIB

Sustainable investing has been rising significantly in Africa, particularly in the mining space. Many investors support schemes to improve community development and create transparency and disclosure with increasing demand for information about how mines are responding to the environmental threat. Today, the importance of Environmental, Social and Corporate Governance (ESG) has become important when it comes to banks providing funding for projects or clients.

The commitment of 130 banks from 49 countries to the United Nations Principles for Responsible Banking which were adopted in September 2019 marks an important milestone for the banking industry and so for the mining industry as well.

The principles guide banks on how to align their business strategy with society's goals. This framework will undoubtedly play an important role in building a more sustainable future through a combination of project funding and investment considerations.

The Principles for Responsible Banking consist of six principles that set a global standard for responsibility. These are:

- Alignment (business strategy to society's goals)
- Impact and target setting (increasing positive impacts and managing risks to people and environment because of our activities)
- Clients and customers (activities to create shared prosperity for the future)
- Stakeholders (engaging to achieve society goals)
- Governance and culture (effective governance)
- Transparency and accountability (reviews and reporting on sustainability)

As responsible lenders committed to facilitating economic and sustainable growth, banks must acknowledge sustainability challenges such as social inequality...

SHIRLEY WEBBER



## Symbiotic relationships are key

Because stakeholders and society should be equally important for financial institutions, financial services corporates will need to ensure that all risk management categories are carefully considered before committing funding the projects in future.

As an example, as a leading financier of resource projects, with focus on mining, metals, oil and gas, Absa has seen sustainability become an even bigger focus when considering funding projects across Africa. Natural resources in all their forms are diminishing and it's imperative that we all work in a sustainable and responsible manner to extract what is needed.

The key role of a bank is evolving and now includes also making sure that where funding is provided, the economy and communities should benefit as well. Going forward, when considering funding of certain commercially viable projects which include natural resources and extraction, lenders will place additional focus on the positive impact of our funding and involvement on a country's developmental goals, the environment and its people.



Banks can only grow if they understand the symbiotic relationship between growth aspirations and the positive impact on country development, environmental protection and social responsibility goals.

As responsible lenders committed to facilitating economic and sustainable growth, banks must acknowledge sustainability challenges such as social inequality, growing population, increasing unemployment, pressure on natural resources, as well as climate change.

In addition, banks must also understand how energy poverty and infrastructure deficits worsen these challenges. In this respect, now more than ever before, financial institutions can pave the way to more sustainable economies by lending to economic activities that optimise the best return for the general community.

Capital providers can guide customers and stakeholders in their requirements for funding by applying the Equator Principles which include applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the World Bank

## ESG KEY DRIVERS

For mining companies, a sustainable strategy has to consider a number of factors which will require the sector to evolve and improve its ESG strategy including:

- Disclosure of impact on climate and clear policies to reduce carbon emissions
- Transparent and accountability around corporate governance and associated policies; and
- Ability to demonstrate the positive social impact of projects, i.e. local content, community engagement.

Group Environmental, Health and Safety Guidelines for various sectors and for funding natural resources extraction transactions.

This therefore means that any lending policy decisions should take a balanced view of the impact on the economies, their development plans, on the communities, stakeholders, investors, clients and the environment at large. These considerations are non-negotiable and should be adopted as standards. **MRA**

## ABOUT THE AUTHOR

Shirley Webber is Head: Natural Resources at Absa Corporate and Investment Banking (CIB). She joined Absa Bank Limited in 2011 and her responsibilities include maintaining and growing relationships in the mining, metals, oil, gas and chemical industries. She has B.Com Honours in Financial & Strategic Management from the University of the North West.



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# Get real

## And get ready

Appointing advisors is something many companies do with some trepidation. Keeping a tight rein on expenses is business as usual for junior explorers and developers, and so making the right choices about when to seek advice, and from where, is an important consideration.

**By Sascha Keen, Director,  
Noah's Rule**

Executive teams need to be realistic about what they can practically manage internally, in terms of skills and time, and boards need to consider whether all the right questions have been asked and answered, especially from the perspective of shareholders. Does the company need a full-service offering, delivering an outcome, or more of a coach/mentor providing specialist oversight and input to the core team? The answer will be different in every case, and getting the process right the first time is best for all stakeholders, but not always where companies end up.

To say that the public equity capital markets for junior mining stocks are tough at the moment is nothing new. The sector has been on the verge of a recovery for some time, and while very good projects and teams will always find capital, the weight of money has still not returned to the junior end of the market, neither across the board nor en masse. As an industry, we need to stop looking around the room for the bitcoin or cannabis bandit who stole the money and consider why retail investors remain on the sidelines.

In the current low interest rate environment, debt and credit funds seem to be popping up overnight. The attraction of debt funding and the number of possible sources has never been greater. Yet it is the all-important equity



Image: 123rf.com

↑ **Choosing how to finance your development and negotiating** the right deal that shares and allocates risks and returns between the company and professional investors can be the difference between shareholders being well rewarded for risk or merely carrying it

component that is often the elusive slice of the pie needed to complete the financing equation. Chief executives are keenly aware they must attract attention with compelling stories, but equally they can only go to the well so many times and delivering on expectations is the key to share price momentum.

Even when targets prove up to be resources; commodity prices head the right way; and studies show the viability of projects, misjudging the timeline to bankability of any project will hit the equity investor hard. Needing twice as much money and/or time to get to the point where professional lenders and investors will risk their capital can be potentially fatal when funding is scarce. In a cyclical industry, avoiding missteps along the development path can be the difference between catching the investment wave and being left behind.

In our long experience, when it comes to financing a new development, being well prepared for the financier audience is crucial. Good projects and teams will attract financier attention early, but while they are eager to engage, we observe that few companies are ready to respond. Before embarking on a dialogue with the finance community, ensuring you are "lender ready" or on a clear path to being so, will lead to a tight, well executed process rather than a journey of ►

“The sector has been on the verge of a recovery for some time,”

**SASCHA KEEN**





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↑ **Misjudging the timeline to bankability of any project will hit the equity investor hard**

exploration, false starts and possible unwelcome surprises. That process should start internally, well before the completion of a feasibility study.

Establishing a realistic timetable may sound obvious but working backwards from a deadline to having full funding

available and considering the multiple workstreams that need to be managed to deliver that outcome is a complex process. Clarify the checklist of items that need to be delivered or loaded into a data room. Determine which of these require independent review. Consider if the information meets the calibre and detail required of financiers and ensure it is consistent across all reports and models. Identify gaps as early as possible, and assign the task of closing them to the right people.

Only once the house is in order should attention turn outside. Borrowers must have a clear engagement strategy, based on a realistic understanding of your risk profile in the eyes of a lender.

Before engaging, know your alternatives, both the providers and the products. Then, be prepared to accurately assess and compare them across the full range of criteria, not only direct cost, but also risk, opportunity cost, strategic value, and dilution. Know in advance who you should ideally be dealing with and the terms you should be seeking. Importantly, be clear on the minimum equity you will need to raise, when to do it, and how plausible that is at your current market capitalisation. This process alone can take some time and pass several iterations, as initial findings may not be as expected.

When the strategy and desired terms are clear, ensure sufficient time is budgeted to reach final terms, complete credit processes and document the transaction. Consider what the conditions precedent to drawing that

finance will be, and what is required to meet these, especially when not all will be within your control and may have third party approval processes. Understand what can be done in parallel and what must be done in sequence.

Even this short overview presents a daunting mountain to climb and shows that the delivery of a “bankable” feasibility study is merely one step in the journey from developer to producer. Seeking the support of appropriate and proven advisors, be they technical, financial or legal, is an inherent part of this process.

Mining development comes with risks, and correctly identifying and addressing those risks is fundamental. Choosing how to finance that development and negotiating the right deal that shares and allocates risks and returns between the company and professional investors can be the difference between shareholders being well rewarded for risk or merely carrying it. Getting it right as an industry will hopefully give retail investors the confidence to come back, and stay. **MRA**

## ABOUT THE AUTHOR

Sascha Keen has more than 20 years’ experience in financial advisory, banking and general management with institutions in Australia and Europe, including the last eight years as a director of debt advisory with Noah’s Rule – financial advisors specialised in mining project finance advisory and commodity and foreign exchange risk management. Based between Europe and Australia, Keen is ideally placed to assist and represent companies sourcing and negotiating facilities with banks and agencies located in these key mining finance hubs. He holds an MBA from ESADE Business School in Spain, a Bachelor of Commerce from the University of Western Australia, and a Graduate Diploma of Applied Finance and Investment from the Securities Institute of Australia (FINSIA).

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↑ **The attraction of debt funding has never been greater.** Yet it is the all-important equity component that is needed to complete the financing equation

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# Juniors

## Would the majors buy your asset?

What makes a mining company, especially one operating in Africa and especially a 'junior' attractive to an investor? Ha. Ask a dozen people – you'll get a dozen answers. Ask a 100 people, a 100 investors, and you'll get 200 answers. Many of them will be different. But there will definitely be the important, 'basic', well known 'fundamental' factors all experienced investors look for.

**By Peter Major, Director: Mining, Mergence Corporate Solutions**

**Juniors require a leader that** has climbed to the top and driven successful businesses in the past

Those factors include:

- Location/geography;
- Asset/ore deposit;
- Liquidity;
- Ownership.

Perhaps the most important – 'who is driving the bus'. Investors/promoters like Robert Friedland or Rob Still carry enough gravitas and success with them that many investors will almost blindly follow projects that 'the two Robs' are putting their money into. But how about on a 'do it yourself investment'? Where you are the leader – not a follower? Is the effort and risk worth it?

This is worth considering. Large companies are:

1. Safer and more liquid than smaller companies. Say an Anglo American versus a Pan African or Durban Deep;
2. Well diversified in geography – say an Anglo or Billiton versus an Exxaro or ARM or an AngloGold or Goldfields versus Harmony or Pan African Resources.
3. Well diversified in product, is safer and often better than less diversified producers. Again – Anglo American or even ARM versus a pure gold or coal or other single commodity producer.

One can even bore down further. For instance, look at the diverse income stream of a PGM producer in South Africa as opposed to a pure gold producer. South Africa's PGM producers' revenue is now almost 30% each from platinum, palladium

and rhodium. The other three of the six PGMs, plus base metals plus chrome, all combined, can be 10 – 12% of the total revenue stream. Now that is diversification in its own right – especially compared to a Stillwater or North American Palladium who receive 80 – 85% of their revenue just from palladium alone.

But as we all know too much diversification can also 'average out/cap' returns as well. Everyone on earth wants to know 'how do I get ahead of the market'? How do I get 'better' than market returns? Thinking out of the box and putting in more time and effort 'should' counter out a lot of the higher risk and leave you with the higher return.

Junior miners connote many thoughts in our mind. Most people's vision of a junior miner is an undercapitalised little producer toiling away on a bare minimum budget and ore body – in hopes of hitting a real mother lode ore deposit and or seeing a massive increase in the price of the mineral they are mining. THAT is what most people envision when they think of junior miners.

“Most people's vision of a junior miner is an undercapitalised little producer toiling away on a bare minimum budget and ore-body – in hopes of hitting a real mother lode ore deposit,”

**PETER MAJOR**



### A new era junior

But from an astute investor's perception there is another junior miner. He is one who is from a traditional, large-scale, well experienced and capitalised mining company. This new era junior owner/manager knows what the large companies can and cannot do well. As important – he knows what the big companies want – new and attractive ore deposits and investment opportunities.

## ABOUT THE AUTHOR

Peter Major began his investment career with Allan Gray in 1989 as a gold mine analyst. He then spent 10 years as head of mining and later senior fund manager at Nedcor Investment Bank. In 2001, he set up HBD Asset Management as CIO with Mark Shuttleworth, with assets of US\$530 million and managed a return of 30% pa average to \$1.5 billion by 2005.

In 2006 Major joined Cadiz where he became director: mining, focusing on private equity, capital raising and M&A activity in the mining and resources sector. Cadiz Corporate Solutions was taken over by Mergence Investment Managers in December 2019 – Same team but with a new owner.

Image: 123rf.com



← A track record holds a lot of credibility for junior miners' management teams

and so he would probably begin his search in the Canadian or Australian (or even UK) small cap space.

If he finds what he wants there – great – first problem addressed (to some extent – liquidity and transparency – and Stock Exchange rules and regulations too). Now it's time to check out the ownership and management of the company – as well as their financials and plans. And checking out means 'review their track record'. (Why on earth would you give someone money in such a risky business – if you didn't know and trust his track record?)

And unlisted junior miners? Oh boy. THIS is where the action and demand really are. There are tens of thousands of unlisted junior mining companies and they all want your money – all of it. They have limitless ideas and opportunities and only need 'your' money in order to become the next Voisey Bay or North American Palladium or Stillwater Platinum or even Barrick or Anglo American.

Now not all of these unlisted juniors are scams. Many do have an actual dream or hope of becoming successful. Some even have a prospect! And some of those may even have a genuine prospect/ore body. But it's up to 'you' to decide how viable/valuable this is. And not only the ore body – but the metal itself. Gold and the base metals are generally the easiest to mine, process, transport and sell. And to understand. Iron, coal, chrome and manganese need location, grade and

logistics. The exotics? Tantalum. Lithium, PGMs, Rare Earths? Many ways to come short here.

Cash flow is king – always. And, how is the company getting its cash? Even if not profitable a company with any kind of cash flow is a big plus as a junior, for the company and shareholders alike. Burn rate is a sibling of cash flow. How long can the company last on current financial resources; and what sources of cash are available to it and at what rate; and what is the company's consumption of money? And where is that money going to? Salaries and related? Capital? Exploration or development or promotion? How good is the company at all of these and other essential activities? And don't forget where your dilution and or contribution fits into all of this.

Choosing a junior miner as an investment is high risk and a lot of work. You can't rely on finding another sucker. You have to know that your junior has a great ore body that a larger company will want, in a location it can stomach and that your junior has the management and owners to 'get it there' – while you are still young enough to see and enjoy the reward. Happy gambling! **MRA**

**Mining shares have performed well these past four years with South Africa's RESI averaging 26% p.a in \$ – matching the world's best market – the SP 500**

Such junior mining companies are very focused, generally well managed and often well capitalised too. But more often than not, they are unlisted, which does add more risk as there is much less liquidity and transparency. Investors really need to do their homework when marrying into 'these' firms as a later divorce is near impossible and almost always hugely expensive.

Let's create an example. Why would an investor want to consider investing in an African junior? Generally – the investor is keen on a certain metal/mineral and he believes Africa to hold great deposits of that commodity. The investor knows unlisted companies are difficult to trade

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# Holding the purse strings

## Investment options remain limited

For good reason, millennials are known to be the most technologically advanced generation of the current workforce. As such, it is a given that they have the necessary competencies to lead the African mining sector into the age of Industry 4.0. However, it is not easy going for millennial-led start-ups to gain a foot in the door due to funding limitations. That's because funding options have not changed in an industry set in its traditional ways of thinking.

**By Aviona Mabaso, Group Legal Counsel, Bauba Resources**

The stark reality is that funding options for mining projects have not changed. There are still basically two options: loan or equity. Most mining companies are funded on debt and rarely on equity. That's because a loan with interest poses a safer risk than equity for an investor – if a project goes bust, then at least the lender has a strong chance of getting (at least some of) the loan back, even if it takes some time to do so.

How do millennials, particularly those from previously disadvantaged backgrounds, become involved in start-up mining companies at ownership level? Unless a person comes with special knowledge and skills, then there isn't much value in them for mining companies other than to fulfil their empowerment obligations as determined by the laws of the country. Put differently, a start-up mining company needs money and skills/knowledge, not another mouth to feed.

### Production-based investment

It must be noted that applications for mining and prospective rights require companies to show upfront where the

money for a project will come from. Most of the time these applicants use loan undertakings or show some kind of positive cash balance.

One way that these start-ups could secure investment is through production based funding. For example, prepayments in exchange for an offtake or the cession of offtake agreements as security for a loan are becoming increasingly popular. It sounds simple, but practically it means you must have a buyer before you have pulled anything out of the ground.

If by some sort of miracle a millennial start-up is able to secure an offtake agreement (with or without a prepayment) prior to obtaining a mining right (to help fulfill the financial means requirement of the application), that offtake partner would not see its first delivery for at least a year or two, depending on whether it is a Greenfields or Brownfields project. In turn, the mining company will not be able to generate its own profits until then.

As such, it would probably be more beneficial if financial institutions lent money to small-scale mining operations based on mining permits or even financed shareholdings in a millennial start-up company and placed

While crowd sourced equity funding is gaining traction internationally, funding options for millennial mining companies in Africa are still limited

experienced mining professionals on their boards to help manage a project.

Mining permits have the potential to create real opportunities for new and young entrants into the industry. To make mining a more attractive sector for millennial start-ups, they should not have to provide proof of funding for projects, or at the very least, the Department of Mineral Resources and Energy (DMRE) should be a bit more lenient with regards to those companies' financial positions.

### Other options are limited

In addition, companies can turn to funding organisations to get a cash injection, particularly international donors like the International Finance Corporation (part of the World Bank) and the African Development Bank or the Industrial Development Corporation in South Africa.

No doubt, there are risks associated with organisations funding youth-entrant companies. There is always the potential for abuse of funds and 'fronting' for personal gain. However, in my opinion, such behaviour is indicative of shoddy moral standards of those individuals alone and so one should not paint every young start-up with the same brush.







The stark reality is that funding options for mining projects have not changed,

AVIONA MABASO



Another investment platform that is gaining traction is CSEF (crowd sourced equity funding). This is a form of funding which enables project owners to raise funds from a large number of small investors. Already platforms such as Canadian-based Red Cloud Klondike Strike exist, connecting owners of current mining projects at all stages with investors. Unlike unregulated crowdfunding websites, investors would receive shares of the company when crowdfunding mining projects. This money still comes in as either a loan or equity.

Investment through cryptocurrency is also making inroads in mining, although this is more prevalent in countries such as Australia and Canada and it is yet to impact mining in Africa. The risks involved and the regulations around this digital medium of exchange are still unclear and it will take a few years for both investors and investees to embrace financing projects using cryptocurrency.

At this moment, millennial start-ups in African mining are still reliant on investors with actual money. Sadly, for now, it remains a case of new players, old investment options. **MRA**



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### About the author

Aviona Mabaso is Group Legal Counsel at Bauba where she is part of a young team of decision makers that are challenging traditional norms when it comes to operating mines. In 2019, she was named amongst *Mining Review Africa* most influential women in mining on the continent



# Human and machine

## Your ticket to 4IR

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By **Jamie van Schoor, CEO of Dwyka Mining Services**

As the tech world rides the curve on buzzwords such as the Internet of Things (IoT), Blockchain and Artificial Intelligence (AI), the global mining industry is experiencing a sudden technology boom, driven by solutions focused on safety, productivity and mine-wide optimisation. This is good news for African mines and even better news for the continent, if we can better negotiate the narrative around how technology can support the human and machine challenges we face in mining.

With a finger on the pulse of new technologies making a positive impact in mining, I see the following as mission critical considerations for adoption and adaptation to participate in the Fourth Industrial Revolution (4IR):

### Change management

There will be a widening skills gap between theory-based knowledge and the mud-in-boots mining experience. It is critical that capability and competency of users are understood from the start so that adoption of the technology will yield a positive impact on their workflow.

There will be a definite adoption of non-traditional methods being used to foster buy-in such as change management specialists being incorporated on mine sites, gamification training programmes on mobile applications and encouraging mentorship programmes for organisation wide inclusion.

### Connectivity

A mine-wide, high-broadband and low latency connection is a pre-requisite to bringing humans

and machines closer in mining and keeping both safe. This is especially relevant in underground mining where a reliable, robust and resilient wireless network is required as the ticket for participation in the 4IR.

With each mine site being unique, there is no one-size-fits-all approach. This means a hybrid solution is often required to connect various locations on surface and underground and this is the lever for device and data linked opportunities.

### Wearables

Empowered by a robust, reliable and resilient network, real-time data provides the key to unlocking the benefits of short-interval control and dynamic planning for intuitive scheduling changes. Where connectivity is solved, there will be a steady embrace of mobile wearable devices on human and machine.

While there are data and privacy considerations to navigate for wearables with mining staff, the mining sector is serious about driving a safety-first culture. And it will require all the technology and computing power possible to improve safety records in pursuit of Zero Harm for all.

### Data integrity

Accelerated by advancements in connectivity and the volumes of connected IoT devices, it is predicted that the number of data points will rise substantially year on year. The securitisation of databases, movement to Blockchain type technologies and an increase in ICT security to mitigate cyber related risks are key areas that provide assurance of mission critical data. (Read more on cybersecurity on page 92)

“A cultural shift to consider the impact and value addition for both human and machine needs to be adopted,”

**JAMIE VAN SCHOOR**





Image: 123RF.com

With AI being earmarked as a critical tool for the future, it is important to remember that data points are the building blocks of this future embrace. A shift from adopting good data to great digital data will be required to best leverage these.

### Autonomous solutions

An exciting trend, with a radical impact expected on the survey and geotechnical industry, is the rise of autonomous solutions like the GPS-denied drones from Emesent and other robotic solutions now firmly entrenching their way into global mining workflows.

With similar robotic solutions being tested and developed for mining, it is clear that machines will increasingly deliver previously unattainable data from unsafe areas allowing for the completion of repetitive and unsafe tasks to deliver safer mining practices.

### Digital twinning

As an early advocate of the benefits of visualisation from experience with 3D simulation software like Ventsim and Pumpsim, it is clear that there is a positive impact that visualisation delivers across languages, disciplines and reporting levels for a 'meeting of the minds'.

With advances in LiDAR scanning and mapping of both surface and underground areas as well as critical infrastructure, the creation of digital twins represents a powerful platform for integration into mine planning and reconciliation solutions once processed.

### A new way of thinking

In conclusion, as we embrace these and other technologies for improvements in safety, productivity and optimisation, a cultural shift to consider the impact and value addition for both human and machine needs to be adopted and adapted on a case by case basis.

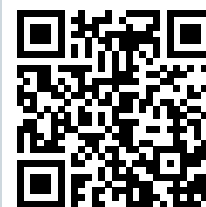
The symbiosis between human and machine is an exciting phenomenon that will deliver large scale improvements for mining in time. Through careful consideration, patience and the realisation that machines only augment human effort in mining, a safer more sustainable industry will be realised. **MRA**

### ABOUT THE AUTHOR

Jamie van Schoor is CEO and founder of Dwyka Mining Services. He has grown the Dwyka Mining Services technology platform into a leading mining technology vendor on the African continent. With a desire to leave a lasting positive legacy in mining, he is an advocate of technology being the catalyst for safer and more sustainable mining practices

\*(Reference: FutureCrunch)

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# XR-rated

## Future-proofing the mining industry

The use of virtual reality is quite prevalent in various industries, including mining. However, Accenture has taken it a step further with its new Extended Reality (XR) digital operational management system. Technology MD **MOLEBOGENG LEKALA** outlines this trailblazing system for **GERARD PETER**.



Image: 123RF.com

In a nutshell, Accenture Smart Operations System integrates best-of-breed technology with components of XR, including augmented reality, mixed reality and virtual reality. It creates a unique user experience and ‘ends distance’ by providing an end-to-end overview of the business and all its units and mines that are widespread across remote locations, via an interactive 3D visualisation dashboard.

More importantly, it enables hands-on monitoring and management of the entire business’s network capability and operations from one central point, in close to real time. This in turn promises substantial improvements in business processes and ultimately, a notable positive impact on the bottom line.

### Key benefits

“The four key business benefits that are realised through this intelligent platform are real-time monitoring, performance optimisation, a ‘smart workforce’

and immersive training. Real-time monitoring is enabled by leveraging Internet of Things (IoT) devices, which in turn yields a range of business results,” explains Lekala.

“This, for example, includes instant notifications and detection of faulty network components that enable swift corrective action to decrease downtime, as well as the typical substantial production and final losses as a result thereof. In addition, it enables proactive change management to facilitate ongoing predictive maintenance management which will reduce future unscheduled downtime and enable the business to sweat its assets.”

The second key building block of the system, namely ‘performance optimisation’, accelerates performance significantly, through human-centric product visualisations and demonstrations. This focuses on elements such as throughput uplift that increases tonnages, operational cost

reductions, and time-to-value which improves productivity across the entire value chain.

Lekala continues: “The ‘smart workforce’ component of the system leverages elements of extended reality to empower the workforce to utilise innovative technologies to resolve day-to-day issues that are experienced on the ground, such as troubleshooting, fault location and maintenance. In addition, it enables management to gain a clear view of the productivity of the workforce.”

For example, augmented reality can support a technician when looking at any piece of equipment, such as a server, through wearable headsets or mobile devices, and immediately detect issues through easy-to-interpret graphically displayed data.

In addition, the new system uses live video feeds, which enables the IT expert to supervise and guide the onsite technician throughout the process, verify and check that it is installed

correctly, and immediately close the job card upon completion.

"The insights gained from the 'Smart Workforce' component are compounded through the fourth building block of the solution, namely 'immersive training', which enables knowledge capturing and sharing to reduce future errors and defects in processes," says Lekala.

"Studies show that the extended reality elements of the training system are also proven to increase knowledge retention by 75%, as compared to the market average of anywhere between 5 and 10%. This is especially important in high risk areas where ongoing safety training is a critical concern. Another benefit that is derived from this online training platform is that it reduces downtime and travel costs for staff to attend training at remote locations."

Right through from decreasing waste of time and resources, increasing productivity and optimising business processes to maximising profits, this system is poised not only to yield a multitude of tangible and non-tangible business results, but also to break new ground in the mining arena.

Proof-of-concept for this solution, which is also completely scalable for future growth and expansion, has been completed and piloting is



Studies show that the extended reality elements of the training system are also proven to increase knowledge retention by 75%,



**MOLEBOGENG  
LEKALA**



about to commence, after which implementation will be rolled out through a phased approach.

Accenture has a unique first-of-its-kind inhouse innovation centre that is purposefully dedicated to the ultra-rapid development of applications to future-proof companies for the continuously changing business landscape, through the latest and most progressive new technologies, skills and methods of working.

"This particular solution has been developed in a record period of three weeks, enabling almost unheard of go-to-market speed. This has furthermore enabled the mine to not only disrupt the industry, but also to ignite ecosystem competition," concludes Lekala. **MRA**

## XR FOR DUMMIES

Extended Reality (XR) refers to all real-and-virtual environments generated by computer graphics and wearables. It is an umbrella category that covers all the various forms of computer-altered reality, including Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR).

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# It's all about the money

## Making the case for OT cybersecurity

Image 123RF.com

Mining companies need money in order to protect themselves from cyber crime. In order to get funding, new cyber risks need to be understood at board level.

**By Mike Burgess, Regional Director, GECI**

Africa is pinning its growth ambitions on a Fourth Industrial Revolution (4IR) enabled economy. But 4IR adoption without putting cyber safety first could undermine growth efforts and expand the risks to mining, manufacturing, heavy industry and key infrastructure.

Operational technology (OT) is under a growing risk of cyberattacks, bringing with it the risk of far-reaching and costly impacts. But OT in most traditional heavy industries and infrastructure facilities have been run in silos behind 'air gaps' for so long that the board assumes they are safe from attack. However, traditional approaches are no longer enough to secure heavy industry and infrastructure from cyberattacks.

The traditional 'air gap' between IT and OT is closing amid new business requirements associated with digitalisation, and this is increasing the potential attack surface and hence the cyber risk. "We see a growing trend for ransomware and crippling attacks launched against key systems that keep infrastructure and societies functioning worldwide.

“OT security should be framed as a strategic one, rather than a technology issue,”

**MIKE BERGEN**



Mines are starting to adopt IIoT and intelligent automation across the entire pit-to-port chain, from autonomous vehicles to robotic drilling, and all of these new technologies are connected. Unless this new smart mine environment is built on a foundation of industry-specific cybersecurity, mines risk financial losses, threats to human health and safety and even complete shutdown. With margins as tight as they are, no mine can afford this risk.

### The threat is real

Cyber risk has become such a major threat to the sector that *Ernst & Young* lists cyber risk among the top five business risks facing the mining and metals industry. And attacks on industrial facilities are taking place all the time, costing industries billions. For example, Norsk Hydro, an international aluminium, hydro and solar power firm, fell victim to a cyberattack that crippled its computer networks in March 2019. Its operations in some 50 countries were forced to revert to manual operations and clipboards for weeks to conduct their business, leading to serious operational inefficiencies and sales losses.

This attack was launched through an employee clicking on a phishing email triggering a relatively new strain of ransomware called LockerGoga, and spread throughout all their international operations centres, causing losses so far forecasted at \$75 million. Such attacks are occurring and increasing weekly.

As mining operations embrace digitisation and IIoT to optimise their processes, they are increasingly opening themselves up to the risk of attack by cyber criminals, activists, and even possibly competitors or national enemies. So, automation is a double-edged sword, and mines need to make cybersecurity a top priority.

### It's about business, not IT

But motivating for additional spend on top of existing, traditional cybersecurity spend can be challenging. It is best to outline the significant risks the organisation could face in the event of an attack, including costly production outages leading to financial losses, catastrophic safety failures and environmental damage leading to potential liability issues, and theft of corporate IP leading to loss of competitive advantage.

The discussion with the board around OT security should be framed as a strategic one, rather than a technology issue. Key factors to be considered are risk management, safety and regulatory and compliance requirements.

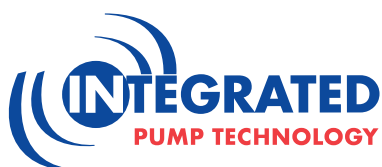
Presenting to the board with a focus on facts, risks, the future, and actionable plans; including a mapping of the current cybersecurity framework to an accepted maturity model. The board should also be alerted to any known threats and the potential business risk of each.

Given the potential implications to the health and safety of human lives, environmental damage, financial losses, and in a worst-case scenario the very ability of a company to function, it is important that OT network security be addressed in a manner like IT network security – including having board-level visibility.

Nobody can afford to ignore 4IR progress with its known benefits of business efficiency and safety in mining. But mines wishing to move into the 4IR have to build cybersecurity into their strategies and systems from the ground up in both IT and OT environments, to counter the growing cyber risks facing them. **MRA**

### ABOUT THE AUTHOR

Mike Bergen is the Regional Director: Middle East & Africa for GECI International. GECI offers cybersecurity solutions for both administrative (IT) & industrial (OT) environments. In South Africa, GECI has partnered with Sinac Group, a 100% black-women owned company, to offer its cybersecurity solutions to local companies.



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# Digital transformation in the mining industry

## Here's what you need to know

Today, progressive miners are restructuring their operations with digital technologies carrying the burden of their day-to-day tasks. This enables engineers to focus on strategic projects and on enhancing productivity. Technologies from other industries, as diverse as natural language processing, bioelectric sensors and commercial drones, are being used in a range of applications from health and safety to asset management, all with great impact.

**By Gareth Halstead, Subject Matter Expert: Mineral Processing, DataProphet**

### Understanding the challenges in driving digital innovation in mining

Like any paradigm shift, there is an initial resistance to innovation and the change it entails. Operational challenges such as equipment breakdowns, design problems, and even political instability are common distractions in the complex task of digital transformation.

Resources that would be allocated to the deployment and implementation of new technologies are re-allocated to address these issues. Whilst larger mining houses may benefit from dedicated teams to evaluate and deploy new technologies, mid-tier and junior miners should look to partner with technology vendors for support. Either way, mining houses need to find a way to leverage

“

Mining houses need to find a way to leverage disruptive technologies to improve their competitive advantage,”

**GARETH HALSTEAD**







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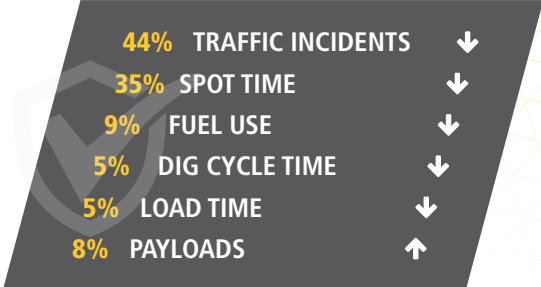
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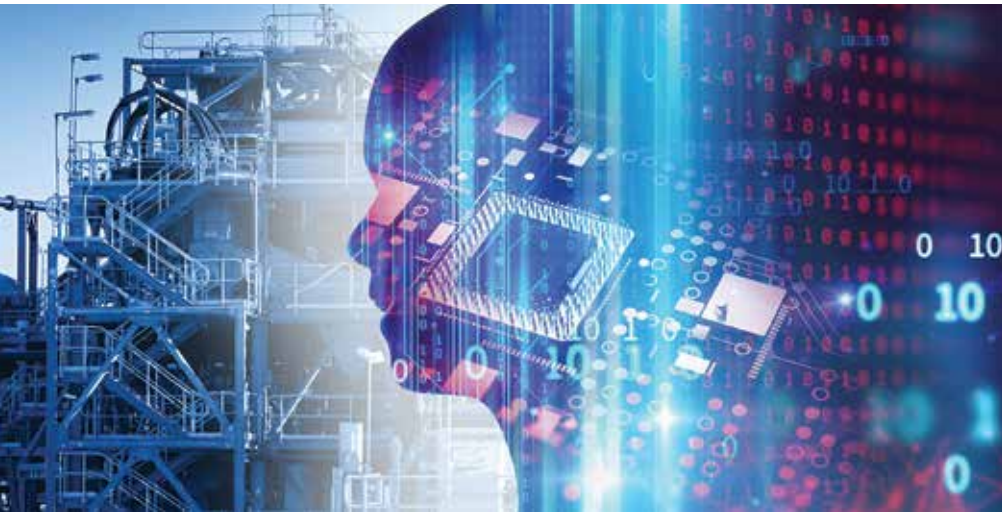
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these disruptive technologies to improve their competitive advantage.

### Making a significant impact

Despite the challenges, there are a number of machine learning and AI applications making a significant impact in this industry today:

- **Predicting the location of mineral deposits:** Machine learning models ingest satellite and drone imagery to better predict the location of mineral deposits. Given the cost of exploration, any improvement in finding a suitable ore body provides a profound cost saving.
- **Replacing hard sensors:** Control mechanisms often require real-time measurements of systems which cannot be measured directly or are in an environment which is not conducive to physical sensors. In these cases, soft (virtual) sensors can be used to infer the state of the system without significant investment or compromising on process knowledge.
- **Optimise flotation circuits:** A well-known use case for soft sensors is the prediction of grade and recovery based on features extracted from images of the bubbles produced in froth flotation. Modern approaches to this problem rely heavily on branches of machine learning such as neural networks to interpret these features.
- **Improved health and safety:** Society has adopted a stance of zero-tolerance for injuries and fatalities on mines. The complex and multifaceted environment in which these incidents occur is rich

in unstructured data from multiple sources. A novel approach to this problem is the use of natural language processing to analyse large corpuses of text such as reports to identify risks related to health and safety.

- **Optimising production:** Intelligent control is the next step towards full automation of beneficiation plants. Brownfield sites are often data rich and machine learning models can easily be trained upon this data. The outcome is an optimised control plan which is cognisant of the interdependencies between parameters within the plant. Whilst continuously ingesting data from across the entire plant, the system provides operators with only the changes for their section, to avoid information overload.

For a solution to be described as AI in its true sense, it needs to be integrated into the data environment to continuously learn and update its understanding of the environment. Many existing AI solutions sit on a continuum from being fully integrated with continuous learning, to simple models built off a static dump of data. Unless prescriptive, these AI technologies are effectively advanced analytics.

Can digital technology help mines in Africa to overcome common challenges?

Remote mines in developing countries face additional challenges to those in the developed world. These include the availability of spare parts and the ability to attract highly skilled engineers.

Developments in automation and intelligent control enables engineers to monitor and prescribe changes to process parameters remotely – making the necessary changes from anywhere in the world. At the same time, it is important to ensure local talent is upskilled through e-learning programmes and simulators.

### How does the future look?

Having passed the peak of the last super cycle, mining companies are looking for efficiencies in their operations. Digital technologies, such as AI, present a unique opportunity for miners to improve their operations and achieve these efficiencies.

Mines and beneficiation plants will be fully autonomous in the future. Engineers will be free from the burden of day-to-day operations and will monitor operations remotely, allowing them to spend more time on strategic improvements. The ability to prescribe optimum control parameters, using an expert execution system (EES) from remote locations, will also lead to safer plants and enhance production outputs. Health and safety will be improved further by automating and using machine learning to better understand the inherent risks in the operation.

The future is about intelligent, autonomous and highly optimised mining operations – with an eye on extending operations outside of earth's orbit. **MRA**

### ABOUT THE AUTHOR

Gareth Halstead has been helping to optimise and find efficiencies in mineral processing plants for almost 10 years. He started his career as a metallurgist in Australia, before joining a large OEM where he worked as a business development engineer for India, North and West Africa. Since joining manufacturing AI specialist company DataProphet in 2016, Gareth has been providing expert industry knowledge, driving the adoption of Industry 4.0 technologies in mines and beneficiation plants around the world. He holds a Master of Enterprise degree and BEng Chemical Engineering degree from The University of Manchester.

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# B2Gold

## So much more than just a miner

Gold mining major **B2Gold** may be recognised as one of the largest gold producers across the globe but must also be acknowledged for the commitment and drive it places on leaving a positive and lasting environmental legacy in the regions where it operates. One of the company's most recent investments in this regard is a project aimed at helping Namibia's local communities protect their black rhino population. **LAURA CORNISH** spoke with **MARK DAWE**, MD and country manager for B2Gold Namibia, to find out more about this incredible initiative.

**D**id you know that three rhinos are killed for their horns every day in Africa? Did you know that between 1960 and 1995, black rhino numbers dropped by a shocking 98% across the continent?

Namibia is home to the largest remaining population of black rhinos on earth. In Namibia the last free-roaming populations of black rhinos can be found. Fortunately, they live in harmony with the region's communities who have become protectors of their welfare – and as such their own livelihood.

But protecting these magnificent animals is no easy feat. Poaching and the illegal trade in rhino horns is driven by a demand in Asia where it is believed that rhino horns can cure diseases and bestow status – when in reality it does neither.

But ancient beliefs are hard to change, and they are driving rhinos, animals that have walked the earth for more than 50 million years, to the verge of extinction.

The Namibian north western population of black rhinos roams an area of approximately 25 000 km<sup>2</sup>, with no national park status, few roads and no control over who comes in or out. Despite this widespread area, the devotion of surrounding communities and local rhino-focused NGOs have ensured that not a single rhino has been lost to poaching in more than two years. Today, a rhino-based economy has developed in Namibia's northwest, with rhino tracking central to tourism development that in turn provides jobs, income and hope for the future.

"Because the rhinos belong to the communities, they are incentivised to protect them at all costs," Dawe points out.

### B2Gold's ground-breaking initiative

B2Gold has a strong presence in Namibia – and has been producing gold from its Otjikoto gold mine (situated 300 km north of Windhoek) since 2014. Under the leadership of B2Gold Corp. President and CEO Clive Johnson, and the local MD Dawe, the company has since day one been determined to operate successfully and harmoniously in the region but even more importantly, give back to the country more than it is taking out.



Image: Owen Evans

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### Includes Certificate Of Thanks from Save The Rhino Trust Namibia:

Your support for community driven efforts to protect the black rhino will be acknowledged in a letter signed by *Save the Rhino Trust* Namibia's Global Ambassador, Namibian-born Supermodel Behati Prinsloo.

### Striking presentation:

The bar is encapsulated and presented in a handsome box made of sustainably harvested wood.

### Twenty-four carat gold:

Au 999.9 – The gold used to produce the bar is as much a part of Namibia's natural heritage as the black rhinos themselves.

### Exacting standards you can trust:

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Image: Lugh Lippe for Save the Rhino Trust

“We take our corporate social investment initiatives very seriously and believe we are leading this effort in Namibia. We want the country’s communities to benefit from their rightful land which is suffering severe devastation as a result of the worst drought ever experienced in the country, resulting in large numbers of wildlife and livestock perishing. Considering the country’s natural endowment is now the only source from which to generate a livelihood in the north-west, this is beyond distressing,” Dawe reveals.

On the back of this dire situation, B2Gold has launched a ground-breaking, never-been-done-before initiative to protect the black rhino through community enabler programmes.

The company is donating 1 000 oz of gold from Otjikoto to produce 1 000 limited edition Rhino gold bars which have been designed internally. The gold bars will be refined at South Africa’s Rand Refinery and will be made available to Namibian and international investors as well as consumers looking to purchase this unique product and contribute to B2Gold’s efforts.

There will be 10 x 0.5 kg bars, 690 x 1 oz bars and 300 x 0.5 oz bars. The cost of the gold bars is pegged to the spot price of gold on the date of sale, plus a 15% conservation premium. They will be available at the end of January and B2Gold will undertake a substantial marketing drive during the week of *Mining Indaba* to drive investment interest.

“This represents the first time that gold, a natural resource from the ground, is being used to provide sustainable funding to community-backed initiatives for the protection of an iconic global treasure, the critically endangered black rhino. We believe this is redefining conservation financing,” Dawe highlights.

Proceeds from the sale of the Rhino gold bars will be managed by B2Gold and an advisory committee that includes representatives from Save the Rhino Trust Namibia, Integrated Rural Development and Nature Conservation,

Namibia Chamber of Environment, and the Ministry of Environment and Tourism.

The funds will be used in two ways: A portion of the proceeds will be invested to provide long-term sustainable financing for black rhino conservation, while significant funding will be applied immediately to conservation actions in the field. The target beneficiaries are the Communal Conservancies that fund patrols, intelligence activities and logistics through the Rhino Rangers programme. Most of this support will be directed through Save the Rhino Trust Namibia (SRT), Integrated Rural Development in Nature Conservation (IRDNC), the Communal Conservancies that run the Rhino Rangers programme and the Ministry of Environment and Tourism’s anti-poaching units.

This initiative will go a long way towards ensuring that the communities will be able to build and add to their success in their remarkable efforts to prevent the extinction of these animals, which they consider to be their birthright.

### Greater potential

Dawe says the entire project was first conceptualised in 2018 and was initially aimed at developing a legal tender coin. This, however, entails a lengthy process of legal compliance that requires approval by the Bank of Namibia and the country’s cabinet. “As a result of the crisis and drought in the country, we needed to expedite the process and opted to start with the gold bars, the concept of which we finalised in August 2019,” Dawe explains.

Following the successful conclusion of the Rhino gold bar project, B2Gold may look to continue the project by using some of the gold bar funds to produce gold coins. “Ultimately, we see potential to produce a Namibian-equivalent of the Kruger Rand or Canadian Maple Leaf that will continue to generate funds to help the Namibian rhinos and their supporting communities in a sustainable manner,” Dawe concludes. **MRA**

“The Rhino rangers from the local communities, who track and follow the rhinos for days on end, walking hundreds of kilometres and sleeping under the stars in the vast and wild landscape are the real heroes of conservation,”

**MARK DAWE**

↑ The Namibian local residents are very protective of their black rhino population

→ A tracker at the fireside at dawn prepares for a long day ahead



Image: Dave Hamman for Save the Rhino Trust



# THE RHINO GOLD BAR

| CREATIVE PHILANTHROPY FOR THE FUTURE OF OUR PLANET |

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## WHAT DIFFERENCE CAN **1000 OUNCES** OF GOLD MAKE?



Through a ground-breaking donation of 1000 ounces of Namibian gold by B2Gold, organizations and individuals have the opportunity to contribute directly to the protection of the last free-roaming population of black rhinos left in the world by investing in a limited edition Namibian Rhino Gold Bar.

Proceeds from the sales will provide long-term sustainable funding for rhino conservation on communal land in Namibia, where a rhino-based economy is developing – supporting livelihoods and providing hope for the future to rural communities.

This initiative is administered by B2Gold and its Advisory Committee and supports the activities of Save the Rhino Trust Namibia, Integrated Rural Development and Nature Conservation, Conservancy Rhino Rangers and the Ministry of Environment and Tourism, for the benefit of black rhino conservation and communities in northwest Namibia.

*These are graphic renderings and not the final product.*

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# Environmental trends

## What the new year holds in store

Mining companies in Africa can look forward to an increased focus on issues of social impact in environmental regulations in 2020 – and also more assertive enforcement by regulators and authorities.

**By Darryll Kilian, Partner and Principal Environmental Consultant, SRK Consulting**



### Trends emerge to overcome challenges

Regulatory frameworks for environmental management in the mining sector have tended to be quite stable this year, with a few countries modifying their mining frameworks to further enhance the positive social impact of mining operations. The overall message is clear. Governments are seeking better ways of making the most of mining's benefits when it comes to community development.

The trend to reduce negative impacts of mining also continues – including issues like resettlement and compensation. This trajectory is unsurprising, given the high risk ranking of mines' social licence to operate. Indeed, the moves by most African countries to codify social impact requirements in their mining codes or legislation are closely aligned to the best practice guidelines of global financial institutions. These are all positive steps towards a more sustainable future for the sector.

Regulations alone, however, are not always enough to facilitate moves in the right direction. Enforcement is also vital to ensure compliance and a level playing field across the industry. While many countries still struggle with administrative capacity, there are ongoing efforts by governments, funders and donors to build muscle behind the laws. Compliance will therefore remain a key imperative for miners across all environmental, social and governance (ESG) issues.

This is not always easy in conditions where mergers and acquisitions occur frequently – as they do among miners in Africa. Such transactions are often disruptive, bleeding out vital institutional memory that understands the daily demands of compliance. At worst, this can put mining rights at risk.

What are the areas, then, where mining companies will need to be particularly astute about ESG compliance?

With communities increasingly aware of their rights and leverage, the science of engagement is an ever more valuable





discipline. Many mines lack the insights and expertise for this, but there is a growing body of experience and knowledge in this field that industry needs to embrace.

A related and equally important area is managing the issue of artisanal small-scale mining – on both closed and operational mining sites. Often ‘stuck in the middle’ between governments and artisanal miners, formal mining companies struggle to navigate this complex and conflict-ridden terrain. It is unclear where solutions will come from, as stakeholders search for new approaches.

Water will continue to be a contested resource, especially in water-scarce countries. It already sparks regular tensions between mines and communities. National regulations will see tighter control of water quality, and mines need robust systems to monitor and control water discharge. Mines are likely to continue their efforts to implement technologies that will result in improved water efficiency. Climate change is further complicating these demands on mines, which are exacerbated by variability of rainfall in many areas.

The related risks extend beyond securing enough water for plant processes and other uses: there are design implications for flood defences and tailings dams. As water regulations evolve, governments are asking mines more detailed questions about their strategies and provisioning. Funders continue to raise the bar of best practice, requiring in-depth information about how water-related risks are mitigated on a project basis.

The global climate change focus extends to the rolling out of carbon tax, a step that South Africa has already taken. As significant energy users and carbon emitters, mines will feel the brunt of such taxes. The bottom-line pinch is likely to incentivise mines to adopt alternative technology in their operations in order to reduce their carbon footprint.

So much for the trends that can generally be regarded as challenges. There are other trends of a more positive nature that are worth a mention.

↑ Significant investment is being made in transmission infrastructure in Africa

“

For those mines that can switch from diesel generators to the national grid, their environmental impact is likely to be considerably reduced and their sustainability improved.”

**DARRYLL KILIAN**



## Trends emerge that drive industry positivity

The New Partnership for Africa's Development (NEPAD), now the official development agency of the African Union, has been pursuing opportunities to strengthen infrastructure around the continent – notably in power supply, roads, ports and rail. As these roll out, mines will be among the first to benefit, and not just in terms of cost. For those mines that can switch from diesel generators to the national grid, their environmental impact is likely to be considerably reduced and their sustainability improved.

The Southern African Power Pool (SAPP) – comprising the state-owned utilities in the sub-continent – has been ahead of the curve in this process. Upgrades to high-voltage power lines and construction of strategic interconnectors are part of its focus, promising to bring relatively low-cost electricity closer to remote mining locations and ensure a reliable power supply.

In parts of southern Africa, large investments are being made in hydro-power schemes that will link into and strengthen the regional power grid. Plans are also afoot in East Africa for interconnectors that can lower the cost of doing business and improve security of supply.

The continent's infrastructure efforts are being supported by international development financiers like the World Bank, and there is also considerable investment from countries like China. The resulting greater security of electricity supply will be a foundation element for new mine development or Brownfield mine expansions alike in much of Africa. By contrast, the constraints related to South Africa's power utility are likely to negatively impact miners' development projects. **MRA**

### ABOUT THE AUTHOR

Darryll Kilian (MA HDE (UCT), CEAPSA, MSAIEES) has a depth of environmental policy, planning and assessment experience gathered over 27 years' environmental work with both public and private sector clients. His projects have included country strategy development, strategic environmental assessment and management frameworks, as well as state of environment reporting. He has undertaken projects throughout sub-Saharan Africa and prior to joining SRK he was responsible for Danida-funded bilateral programmes and projects in southern Africa, including the Environmental and Social Management Framework (ESMF) developed by SRK Consulting (SA) for the Southern African Power Pool (SAPP).



Exxaro's Education and Learner Development programme is an example of successful socio-economic initiatives. Last year it helped four of the top five Grade 12 National Senior Certificate (NSC) High Schools in the Victor Khanye Local Municipality district

# Community development

## Paradigm shift needed

A sea change in the way that both government and mining companies approach development initiatives is what is required for communities to benefit from infrastructure and social services in the long term. This is according to the **Southern African Institute of Mining and Metallurgy (SAIMM)** president, **MZILA MTHENJANE**. **GERARD PETER** reports.

While it may seem that when mining companies take to the soapbox to highlight the successes of their social development programmes, it is mere talk-shop, Mthenjane believes that mining companies are indeed serious about ensuring that "no community is left behind by mining". "My view is that the industry is serious about community development," he states.

"The manner in which we are expected to implement social development programmes is largely through the social and labour plan (SLP) which has to be aligned to a municipality's Integrated Development Plan (IDP). It is through these IDPs that mining companies select projects that the municipality plans to implement, and these projects are then funded and executed and eventually handed over to the municipality for long-term sustainability."

However, due to the financial and governing challenges that many municipalities face, Mthenjane states that the sustainability of these programmes is not always realistic. "After these programmes have been developed and handed over to municipalities, they are supposed to be maintained and operated in a way that continues to provide such services and manage these programmes for continued service delivery. This can be a challenge for cash-strapped municipalities. ►

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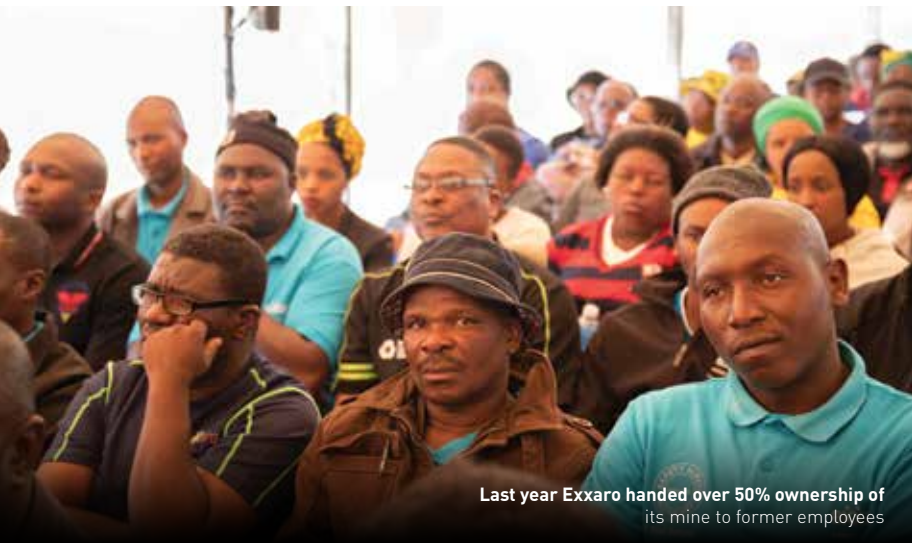


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Last year Exxaro handed over 50% ownership of its mine to former employees

### Looking at the bigger picture

According to Mthenjane, the way forward is to ensure a collaborative effort in community development programmes in line with provincial and even national levels. "A lot of mining companies are already in their third cycle of social and labour initiatives which are typically five-year programmes of investment and development and you will be hard-pressed to find, throughout all mining companies, the extent of infrastructure development that includes programmes that can benefit a large number of communities," he argues.

As an example of a collaborative effort on a provincial level, Mthenjane cites the Impact Catalyst – launched in Limpopo in October last year. It is a collaboration that consists of a diverse set of partners including two mining companies – Exxaro and Anglo-American – World Vision and the Council for Scientific and Industrial Research (CSIR). "The aim is to use mining to drive the economic development plan of Limpopo on a provincial level. The idea was born out of mining companies moving away from implementing social impact programmes through social and labour programmes, which are more localised, to a more regional programme that has a bigger impact on the province.

"What's more, the size of the challenges we face at a community level are quite large and vast and cannot be addressed by a single mining company alone but rather through collaborative efforts. Implementation of social development programmes needs to be done on a provincial level and national level. There should be one plan in terms of what is required for investment from government – not a health plan that is separate from an educational plan or an infrastructure plan, etc."



The size of the challenges we face on a community level are quite large and vast and cannot be addressed by a single mining company alone,

**MZILA MTHENJANE**



The focus needs to be on ensuring that youth have marketable skillsets

### Initiatives starting to pay dividends

As stated earlier, mining companies are committed to long-term community development initiatives. Examples include initiatives implemented by Exxaro in the various mining communities where it operates.

Exxaro's Community Development Manager, Tebogo Leepile, explains: "The community projects that we invest in address the current socio-economic challenges and offer solutions beyond the life of our mines, for our communities to become independent and sustainable.

"For example, our Enterprise Supplier Development (ESD) programme is already starting to bear fruit for both parties. "Exxaro's ESD programme that kick-started in late 2017 is aligned with the Department of Trade and Industry (the dti) Code of Good Practice which states that 3% of the net profit after tax for entities whose annual turnover exceeds R50 million must be allocated for funding of small, medium, and micro enterprises (SMMEs). In the past two years, we have supported 50 businesses with loans and grant funding of approximately R360 million. Of the 50 enterprises, 29 were Exxaro suppliers at the time the funding was provided."

Leepile explains that the programme has been successful because the company focused on black-owned SMMEs and how it could capacitate them to improve their provision of services to Exxaro and take up other opportunities elsewhere. In that way, the company improves its procurement levels from these enterprises. This goes beyond realms of just basic services but also provides SMMEs with loans and grants to provide contract mining to the company. "For example, we have gone forward to provide loans for businesses owned by black women at our Belfast mine for logistics for transporting coal from the mines and the

coal siding which is about 25 km away from the mine.” She adds that the company, along with the South African Digital Content Organisation (SADICO), has created a Youth Exponential Development programme known as ‘YDx’. “Exxaro invested R40 million into the programme over a 12-month period to provide digital technology training to 400 youth in Lephalale and Thulamela municipalities in Limpopo, and Emalahleni, Victor Khanye, Emakhazeni, Steve Tshwete and Govan Mbeki municipalities in Mpumalanga.

In May 2019, 34 participants engaged in ‘train the trainer’ programming which touched on digital technology concepts, including telecommunications and broadcasting, as well as Fourth Industrial Revolution concepts such as the internet of things, artificial intelligence, robotics, 3D printing, nanotechnology, autonomous vehicles, cryptocurrency and cybersecurity. “Those initial participants have in turn begun training an additional 366 local

youth in digital skills such as website and mobile application development, cell phone and computer repairs, digital migration, airtime sales and e-financial services,” adds Leepile.

In addition to training, participants were also assigned to various technology cooperatives that would receive mentorship and support for one year. Under SADICO’s guidance, it is intended that these cooperatives grow into fully-fledged businesses.

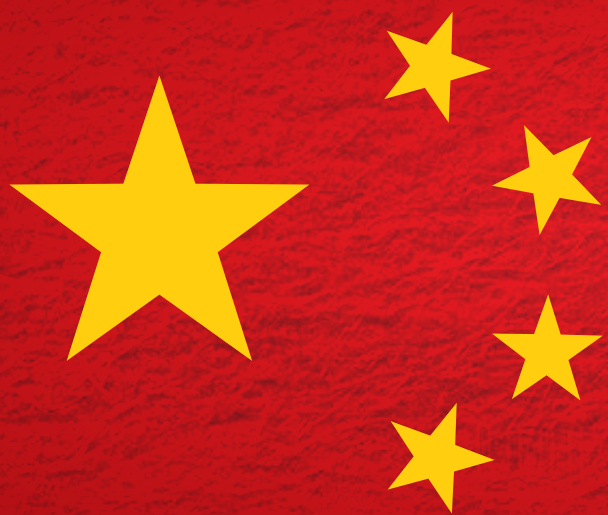
### Clearly manage expectations

While it is important that formidable partnerships are formed between mining companies and communities, it is important to clearly outline the expectations of such partnerships right from the outset. A case in point: In April last year, Exxaro handed over 50% ownership of its Arnot mine in Mpumalanga to its former employees.

“It’s important to manage expectations”, emphasises Mthenjane. “People don’t understand what it takes

to own or run a mine – it is capital intensive and it is all relative to the asset base and resources of the owner. Now you are giving a mine to a community who doesn’t have the financial resources to manage or operate the mine.”

That said, Mthenjane adds that thankfully, some communities have recognised that although they own the mine, they do need professional services to manage and operate it. “One example is the Royal Bafokeng Nation, where it commercialised and separated its mining assets from the community, in terms of managing and operation, and created a link in terms of the dividend flows from the commercial assets to the social vehicle for community development. Professionals operated the mines while the community leadership continued to look after the best interests of the community, proving that such partnerships, if managed correctly, can be highly beneficial,” he concludes. **MRA**



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**Anglo American's** Greenside colliery has installed a 90 kW grid tied solar farm at the mine, and this produces enough energy to power all the surface offices at the mine

## INNOVATION THROUGH SUSTAINABLE TECHNOLOGY

Sustainable technology can reduce the environmental effects of mining operations. Some of the top effects of mining on the environment can be lessened by:

- Hybrid diesel-electric loaders
- Smart digitisation
- Machine learning
- Automated vehicles
- Robotic drilling operations
- Moles or tunnel-boring systems (TBM)
- Underground electrification and infrastructure

# Accountability

## Anglo American aligns with UN Sustainable Development Goals

Diversified mining company **Anglo American** has reiterated its commitment to being a global leader in sustainable mining at its second annual Sustainable Development Goals accountability dialogue series. The company's trademarked FutureSmart Mining programme – which brings together step-change innovation in technology and sustainability – aims to use new technology to transform the physical processes of mining, and the way in which Anglo American does business and contributes to the betterment of society. **CHANTELLE KOTZE** writes.

Anglo American launched its innovative Sustainable Mining Plan (SMP) in 2018 as part of its FutureSmart Mining programme. The SMP, which was the result of rigorous and far-reaching consultation, acts as a blueprint for the company's future in that it commits the company to a series of ambitious medium and longer term goals until 2030.

"Anglo American has integrated and aligned its SMP targets into the framework of the United Nations' Sustainable Development Goals (SDGs) – which itself comprises a list of 17 targets developed to guide global development – to ensure that every advancement made in relation to mining can be applied to development beyond the industry," says Anglo American chairperson Nolitha Fakuda.

"This alignment has created a common framework to allow partners and

stakeholders to collaborate effectively and hold each other accountable in reaching these goals and targets."

Anglo American's three major areas of sustainability within its SMP include:

- **Trusted corporate leader:** Advocating for the highest standards of governance to drive transparency and trust in mining and mined products.
- **Thriving communities:** Building thriving communities with better health, education and levels of employment.
- **Healthy environment:** Maintaining a healthy environment by creating waterless, carbon-neutral mines and delivering positive biodiversity outcomes.

Each of the three global sustainability "pillars" comprises three "stretch" goals, respectively, that will be implemented in bespoke five-year plans

at each of Anglo American's global operations until 2030. These plans will be flexible and responsive to an operation's local context, priorities and opportunities, but will be aligned to the global sustainability pillars, stretch goals and targets.

Speaking at the first Sustainable Development Goals accountability dialogue series in March 2018, Anglo American chief executive Mark Cutifani said that while the company's metals and minerals are the precious ingredients that enable and celebrate so many aspects of people's modern lives; Anglo American's role in today's world is far greater than simply being a supplier of physical products.

"If Anglo American is to play its part in creating a sustainable future for the world and improving the lives of all of us who live here, then we must be prepared to challenge our business and ourselves, by re-imagining mining," he said.

Because the company's sustainability strategy goes far beyond compliance with mining law or regulatory requirements and is rather about making a more strategic and holistic impact on the ground, Anglo American has been on a journey to better align the implementation of its SMP to the 17 targets within the UN SDGs, while also considering how it can support South Africa's National Development Plan and the African Union's Agenda 2063 at the same time. ►

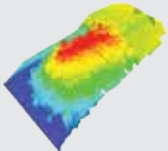
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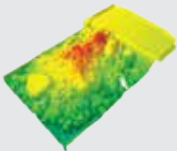
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- Dynamic/in-motion load scanning operation
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- Graphical 2D load images
- Real-time load volume measurement system
- Cloud-based reporting
- iOS/Android app integration
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**Production Monitoring**



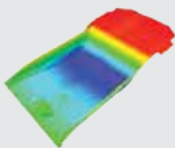
- Autonomous operation
- Real-time load volumes
- Real-time load position analysis
- Production alerts

**Material Density**



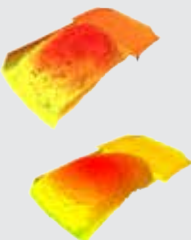
- Real-time material density per load
- Autonomous operation
- Mine dispatch interface

**Carry-back Monitoring**



- Real-time carry-back monitoring
- Carry-back alerts to dispatch
- Auto adjust for production tracking
- Autonomous operations

**Load Optimisation**



- Manages shovel operator performance
- Improves load optimisation
- Reduces maintenance costs



**Payload Pro Cloud Solution**





↑ **Anglo American chairperson Nolitha Fakuda** speaking at the Sustainable Development Goals accountability dialogue series

### Collaborative regional development

At the core of Anglo American's plans to bring long-term and sustainable development opportunities to the regions around its operations is collaborative regional development.

The Narrative Lab director Aiden Choles explains that it starts by identifying socio-economic development opportunities with the greatest potential in a region through spatial planning and analysis.

"Collaborative regional development creates a catalyst for partnerships with a broad range of stakeholders, including community representatives; faith groups; businesses and entrepreneurs; government; academics; and NGOs."

By creating partnerships with appropriate development experts,

Anglo American is able to deliver on its commitment to building foundations for long-term, sustainable development in its host regions, far beyond the life of the mine.

According to Choles, the multi-stakeholder platform that the SDG accountability dialogue facilitates makes visible the full scope of value that the organisation creates for society and creates dual accountability between organisations and stakeholders.

"In 2018, Anglo American was able to successfully identify a R78 billion-worth budget spend across its business units linked directly and indirectly to the SDGs. This is an increase from the R67 billion spent in 2017," he says, noting a solid spread of spending across 16 of the 17 UN SDGs.

Moreover, Choles noted that the bulk of the 2018 budget spend aligned to four main SDGs – with 72% of the budget spend orientated towards the three SMP sustainability pillars.

These results were a good indication that there is a solid foundation on which Anglo American can start to build on while implementing its SMP.

While the research methodology currently focuses on the inputs, such as cash spend, the methodology is being refined to focus more on reporting on the outputs and impact that the investment spend is having – not only on the SMP but also on the UN SDGs and African Union's Agenda 2063 aspirations and goals.

### Sustainable economic development in Limpopo

In October 2019, Anglo American announced its partnership with Exxaro, the Council for Scientific and Industrial Research (CSIR) and World Vision International to work in collaboration with the government of Limpopo to drive sustainable economic development in the Limpopo province through a multi-sector initiative, known as the Impact Catalyst.

The Impact Catalyst forms part of the collaborative regional development programme, which seeks to create long-term economic prosperity in the company's host communities and regions through partnerships, beyond the expected life of a mine.

Several feasibility studies and pilot programmes are underway in Limpopo, as part of the Impact Catalyst's efforts to stimulate economic development in the region. These span integrated game farming, agriculture, agro-processing and biofuels, waste recycling and social project opportunities on community health.

Other projects currently in the pipeline for the Impact Catalyst include a wide-ranging enterprise and supplier development programme, which aims to create small businesses that supply goods and services to mines and businesses, and an integrative geo-spatial planning capability, which was developed by the CSIR and will be co-founded by Anglo American. **MRA**

**French utility Engie and Anglo American are** collaborating to develop and fuel a hydrogen-powered mining haul truck for a mid-2020 debut



### AMBITIOUS TARGETS

As part of the stretch goals to 2030, Anglo American has committed itself to achieving the following:

- Create five jobs off-site for every job on-site in the communities in which we operate
- Help targeted schools in host communities perform as per the top 20% of state schools
- Reduce greenhouse gas emissions by 30% and improve energy efficiency by 30%





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# Transforming South African mining For the future

The **Council for Geoscience (CGS)** is a state science council responsible for the collection and curation of all geoscience data throughout South Africa.



↑ **Figure 1: A CGS scientist collecting groundwater sampling samples for subsurface process modelling**



↑ **Figure 2: A CGS scientist investigates the emplacement mechanism of an Iron-Titanium-Vanadium magmatic plug in the eastern Bushveld Complex, Limpopo Province.**

One of its primary functions is to use geoscience data towards sustainable development within the natural environment of South Africa. The CGS aims to do this through integrated multidisciplinary programmes that focus on: minerals and energy research and development; land-use and infrastructural development; health, groundwater and environmental sciences; exploring for innovative geoscience solutions and international diplomatic research, especially across southern Africa.

Through these research themes, CGS contributes to the development of key sectors within the South African economy. Of these, the mining and minerals development environment has featured prominently for decades. The mining and minerals industry has always been the backbone of the South African economy. Not only has this industry supported and enabled an extensive job creation and skills development but it has also contributed significantly towards the global demand for industrial and raw materials.

In recent years, the contribution of the mining sector to the South African economy has decreased considerably. This is largely attributed to the increasing complexity of deeper mineral extraction, other international frontier mineral exploration regions and transformation within the downstream industrial markets that is adjusting the international mineral market.

The decline in growth within the mining and minerals development field adversely affects the employment and job creation rate in South Africa. However, despite this, South Africa still houses many mineral systems that host large volumes of untapped and globally-significant resources. These include precious and base metal sulphides that are important for the electronics, automotive and industrial fields.

Typical fossil fuels that powered the industrial revolution are slowly giving way to minerals that can support cleaner and more efficient energy generation. These particularly include the critical minerals and elements that support the rapid growth in the renewable energy sector.

The global demand for critical minerals that can support development within this changing global landscape can be further supported through the development and evolution of the South African mineral's sector. However, to achieve this, the country will need high-resolution geoscience data.

## Three-pronged approach

CGS is taking the lead in the implementation of several key programmes that specifically look into the past energy development in South Africa. This includes the characterisation and modelling of the environmental response to long-standing minerals development (e.g. Figure 1) and an extensive high-resolution geological mapping programme to identify key critical mineral resources (Figure 2).

These programmes aim to develop the requisite and strong geoscience knowledge to allow policy makers and investors to make decisions that may enable accelerated development of the South African minerals value chain, and continue to grow South Africa's role as a minerals and energy global powerhouse. **MRA**

# COUNCIL FOR GEOSCIENCE

January 2020

The Council for Geoscience (CGS) is the national custodian responsible for the collection, compilation and curation of all onshore and offshore geoscience data and information. The CGS aims to use this information and knowledge to develop geoscience solutions to real-world challenges in South Africa.

## GEOSCIENCE MAPPING

Geoscience mapping is the core function of the CGS and aims to develop fundamental geoscience knowledge using an integrated and multidisciplinary approach as well as innovation that merges several onshore and offshore geoscience themes such as geology, geotechnical studies, geochemistry, geophysics and economic geology for mineral and energy resources and their mineralising systems information to boost sustainable exploration for economic growth.



## ENGINEERING GEOLOGY AND GEOHAZARDS

As the custodian of the national seismological network, the CGS monitors and maintains a geohazard inventory for South Africa. This information is primarily used in developing effective and novel geohazard mitigation solutions for safe and judicious land use. Modern artificial intelligence techniques are applied in subsidence mapping and seismic hazards characterization.



## WORLD CLASS FACILITIES

The geoscience functions are supported by a multi-faceted laboratory that performs a wide range of analytical services such as petrography, whole rock geochemistry, petrophysics, coal science and hydrochemistry. The CGS also manages a geoscience museum, library, bookshop, and national core repository which are used by the scientific community and the general public.



## AFRICAN FOOTPRINT AND OTHER COLLABORATIONS

As the permanent secretariat of the Organisation of African Geological Surveys (OAGS), the CGS has an impressive footprint in the African continent where various geoscience services have been rendered in line with global standards, international policy and governance. The CGS also collaborates with various academic institutions and science councils around the world.




## WATER AND ENVIRONMENT

The CGS carries out hydrogeological studies and aquifer modelling and is also responsible for environmental geoscience research which aims to provide sustainable solutions to monitor and mitigate the impact of geology and mining activities on the health of the environment including its inhabitants.

## CGS AT WORK

- The CGS is undertaking an integrated and multidisciplinary geoscience mapping programme across South Africa.
- Some of the recent projects include:
  - Multidisciplinary geoenvironmental baseline investigations in the Southern Karoo for possible shale gas development, which uncovered previously undefined groundwater aquifers.
  - Regional soil geochemical sampling and detailed follow-up surveys, particularly within the Northern Cape, North West and Mpumalanga provinces.
  - Geothermal energy and carbon capture and storage research, which aims to expand the current renewable energy mix of South Africa and decrease the carbon footprint.
  - Ground stability and geotechnical assessments for infrastructure development in the Northern Cape and Free State Provinces.

## CONTACT US

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Council for Geoscience



# Digitalisation

## Changes the milling game

Milling OEM and service provider Loesche has incorporated digital technology into its service offering – introduced to market through an internally designed operating software which complements the quality of the milling process, SA sales manager **JONATHAN SMITH** explains.

“Loesche has a fantastic product, and through strategy and continuous technological development of its mills, we have been able to approach new markets and industries, offering new processes that have been developed by our R&D department and technical teams,” says Smith.

The company has consequently launched its LM master software which allows the owner to optimise the performance and availability of the mill, live in the control room or remotely offsite. The software optimises the mill performance continuously, adjusting automatically to ensure the lowest power usage and optimal product production.

“We call this the Loesche Artificial Intelligence system for plant operation and mill optimisation. Online controls and instrumentation allow the user to



The Loesche LM master software enables mine owners to optimise the performance and availability of their mills



verify and record critical values and adjust the mills performance whilst the mill is in operation," Smith outlines.

### Loesche technology delivers unparalleled success

Large mining institutions and engineering houses do not want to risk change from standard practices due to the unknown. But they must embrace change and new technologies that will take them into the future, says Smith.

Every day mining operations are challenged with new threats. For example, the comminution circuit of a mine uses 50% of a total mine's power. By incorporating Loesche equipment, mines can reduce this by 30 – 40%, effectively reducing power use by the same margin for nearly the entire operation.

"The large amount of the success that Loesche has had in the ore industry is with mining institutions that are really focussed on change for the better to improve recovery with the reduction of down time, maintenance, water usage, chemical usage, and waste. Loesche is able to help in all these spheres with the bonus of improved recovery of the mineral," Smith highlights.

Loesche walks alongside its clients and ensures that its guarantees have been met before leaving site. The company furthermore also provides training and education for on-site staff to ensure the end user is comfortable with the processes and the technology. "Support does not end here because we are around the corner to aid the mine at any given time." **MBA**

# Brelko Conveyor Products

## Setting the standard at Sukari gold mine

Conveyor belt cleaning equipment designer and manufacturing company **Brelko Conveyor Products** has been working closely with gold producer Centamin at its Egypt-based Sukari gold mine in standardising a complete conveyor belt solution at the mine which is fully complemented by technical and aftersales support, writes **CHANTELLE KOTZE**.



↑ Sukari gold mine: Before installation



↑ Sukari gold mine: After installation

**B**relko's relationship with Centamin began in 2015 following a site visit to conduct a conveyor audit. On completion of the audit, the company proposed a Brelko product test, which mine management agreed to.

For the product test, which took place in 2015, Brelko was awarded the contract to install its products, where needed, on an entire conveyor belt section at Sukari to solve the problems being experienced at the mine at the time, which included spillage, belt damage and downtime within the conveyor network.

According to Brent Weller, Brelko area manager for USA & Africa, the initial test installation which Brelko carried out over one week proved to

be extremely effective. "This led to the ongoing standardisation project which still continues to date," he says.

The project scope included the installation of Primary and Secondary Conveyor Belt Scrapers, along with V-Ploughs to eliminate spillage from the transfer points. Brelko also installed Keyskirt to seal transfer chutes at transfer points as well as a self-aligning Belt Tracking System to ensure the conveyor belts remain aligned. Moreover, the installation of the company's Hi-Impact Idler System was undertaken to address the damage that was occurring to the conveyor belts due to inadequate impact management.

### Addressing inadequate impact management

Brelko's Hi-Impact Idler System was specifically designed to address areas along the conveyor belt system where significant impact from particle sizes in excess of 150 mm causes damage to the conveyor belts, rollers and structure. While this system is also extremely heavy duty and robust it is at the same time serviceable, says Weller.

"Our main focus in designing the system was to incorporate our proven torsion mount system. This enables the system to immediately absorb any impact, thereby minimising damage to the belt and extending the life of the conveyor belt."

#### DID YOU KNOW?

Brelko's package approach to conveyor installation has proved to be extremely effective for Brelko in Africa

As part of its ongoing research and development into product improvement, Brelko significantly improved its Hi-Impact Idler System when it included the unique polyurethane rollers into the design of the units.

"This product improvement was able to extend the life of the systems while also guaranteeing a shorter lead time for manufacture," Weller notes.

The installation of Hi-Impact Idler Systems helps to significantly reduce damage caused by large particle sizes being transferred onto conveyor belts. "The longer the belts remain in good condition, the more effective all the other related products on the conveyor perform, thereby extending run times and increasing productivity," Weller explains.

Also part of the company's impact management range is its universal and combination Feedboots, which further enhance the sealing benefit of the company's Keyskirt. The Feedboots, which operate at the various transfer load points of the conveyor belt, are designed for fine and lump sizes up to 100 mm.

Since 2015, Brelko has sold around 1 800 Hi-Impact Idler Systems and significantly more Feedboots – about half of which have been sold into Africa alone. These two products form an integral part of Brelko's product offering and have also been installed around the globe.

### Ongoing support

As part of Brelko's ongoing support, the company's service technicians visit the mine during planned shutdowns to install new products as well as to maintain the existing installations. The company's senior service technicians also conduct regular on-site training for all the maintenance crews involved at Sukari.

"We expect the scope of our work to eventually transition into more of a fully-fledged proactive inspection and maintenance offering," says Weller. **MRA**

### SUKARI GOLD MINE AT A GLANCE

Centamin's flagship Sukari gold mine, the only operating gold mine in Egypt, currently produces about 500 000 ozpa of gold

With a total combined open pit and underground reserve estimate of 7.2 Moz, the Sukari gold mine has a 15-year life of mine with strong potential for continued production growth above 500 000 ozpa through on-going exploration.

Exploration at Sukari is currently focused on continuing to expand the high-grade underground reserve and resource, thereby supporting both the longevity and expansion potential of this low-cost centre of production.

Over the coming years, continued development of the Ptah, Amun and Cleopatra declines will allow the underground drilling programme to progressively expand into the lateral and depth extents of the ore body.



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# Bearings International

## Targets growth through the mining sector

Being part of the **Hudaco Group** gives **Bearings International** (BI) the ability to increase its mining presence, both in the region and on the continent. This is according to offer marketing manager **Victor Strobel**, who has been appointed to the Product Management team, with the main goal of consolidating the company's marketing efforts into profitable growth.

“BI currently has a low double-digit market share in the mining segment. However, we see the industry as a key target for BI going forward, and as such we have invested in a business development specialist for the segment earlier this year,” says Strobel.

With more than 60 years in the bearings and power transmission industry, the company puts its experience to good use by going great lengths to ensure its product range and services meet the changing needs of clients, industry and business. Being part of the broader Hudaco Group, the company is also able to leverage synergies across a broad range of companies, meaning it can offer a complete product basket at its extensive branch network countrywide.

From bearings to variable speed drives (VSDs), motors, gearboxes, sprockets and chains, BI offers total solutions for a diverse range of customers, applications, and industries.

Backed by an elite technical team, BI covers the full spectrum of customer requirements, and is able to ensure immediate availability of products through a nationwide network of branches as well as promote regional and continental growth.

“For Southern Africa, we plan to appoint a dedicated person to focus on growing our businesses into Southern Africa early in the new year,” explains Strobel.

Meanwhile, Hudaco already has a presence in Kenya to serve East Africa and plans to expand the product offer there to include BI product ranges early next year as well.

### New structure optimises service offering

In addition, BI has successfully implemented a new Business Development Leader (BDL) management structure, with a dedicated and

focused approach to core market segments.

These segments are mining, agriculture, sugar, OEMs, steel, FMCG, automotive, services and infrastructure, wholesale and retail, and cement, pulp and paper and chemicals.

“BI's unique approach is to target existing and potential customers at grassroots level. The sales force will therefore service the daily customer requirements. The BDL team, on the other hand, will look specifically to nurturing co-operative relationships with all relevant internal and external stakeholders,” Strobel explains.

### Customer is still king

Despite its massive product offering, Strobel states that the BI is still keenly focused on ensuring that high customer service levels are still maintained. “The key to maintaining high customer levels with a host of different product offerings is twofold. The first is to maintain good stock levels of all product offers, to have the right stock, at the right place, at the right time.

“The second is to continuously educate and train our staff on the products, their features and benefits and added value to the end user. To this end, we have introduced a digital Training Academy platform at BI, for all of our sales staff, whereby they can log in and do online training on all of the products available in the branch network.

“While the customer bases throughout our network are different, there are definite synergies that we can tap into. It is all about positioning ourselves as a total solutions provider that is a single point of contact for all of our customer needs, as well as making them aware of everything else we are able to offer them. This is where BI's focus on customer service and support is critical, as it is able to back up all of the products it supplies with the necessary technical expertise and experience,” he concludes. **MRA**

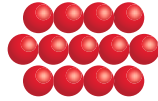
“

For BI, it is all about the breadth of our product offering, which extends far beyond our customers' core focus,

**VICTOR STROBEL**







**REINFORCED eARTH**  
SUSTAINABLE TECHNOLOGY



Mining &  
Minerals

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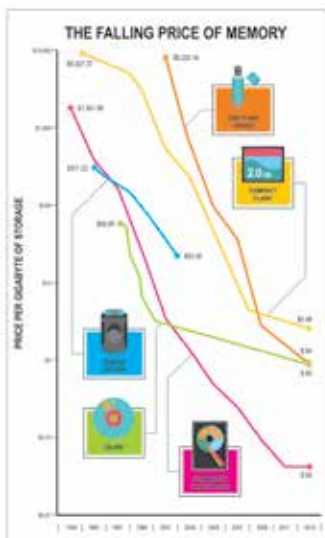
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# Disruptive Technology

## Offers reliable blasting data

Electronic detonators have been on the market since the early 90s, but unlike other industries, the technology has not taken any giant leaps forward. Until now, that is.



↑ Figure 1: Falling price of memory



↑ Figure 2: HydraDet's advanced ScreenHunter

Today, HydraDet offers a comprehensive suite of electronic delay detonator (EDD) solutions and technologies. "In a nutshell, we offer our clients unprecedented flexibility using the best available technology significantly below industry base cost," says MD Martin Plichta.

According to Plichta, the preceding statement can be seen as a contradiction as there is often a perception that "you get what you pay for". "Whilst this may be true in many situations, the exponential rate of technology growth as defined by Moore's Law (1965) shows that the number of transistors on an integrated circuit doubles about every two years, though the cost of computers has halved. Hence, it becomes clear that not using new technology is costly." Figure 2 the steep drop in cost of memory over time.

Although utilising the latest technology will, in the long-term, inevitably result in cheaper component parts, development can be expensive. EDD ASIC (application specific integrated circuit) development has cost tens of millions of dollars in

the past. Some suppliers have therefore opted to utilise a standard off the shelf microprocessor which is inferior from a safety, range, flexibility, leakage etc. perspective, whereas using an ASIC would be the more appropriate component.

To sustain themselves, early adopters that have incurred development costs amortise the expense into the sales price. A consequence of the high cost barrier of development results in suppliers being resistant to re-design (some EDDs are nearly 30 years old). "It therefore becomes possible for newcomers to the industry to benefit from the baseline market value set by their predecessors and opt for higher profit margins due to the customer's perceived market price," adds Martin

A further obstacle facing the mining sector is the low volume adoption of the technology. With annual sales of 20 to 30 million EDDs worldwide out of a market exceeding 1 billion detonators, the cost benefit is slow to be realised. Having less than five ASIC based EDD suppliers worldwide, there is a substantial chokehold on expansion in this sector.

### Thinking outside the box

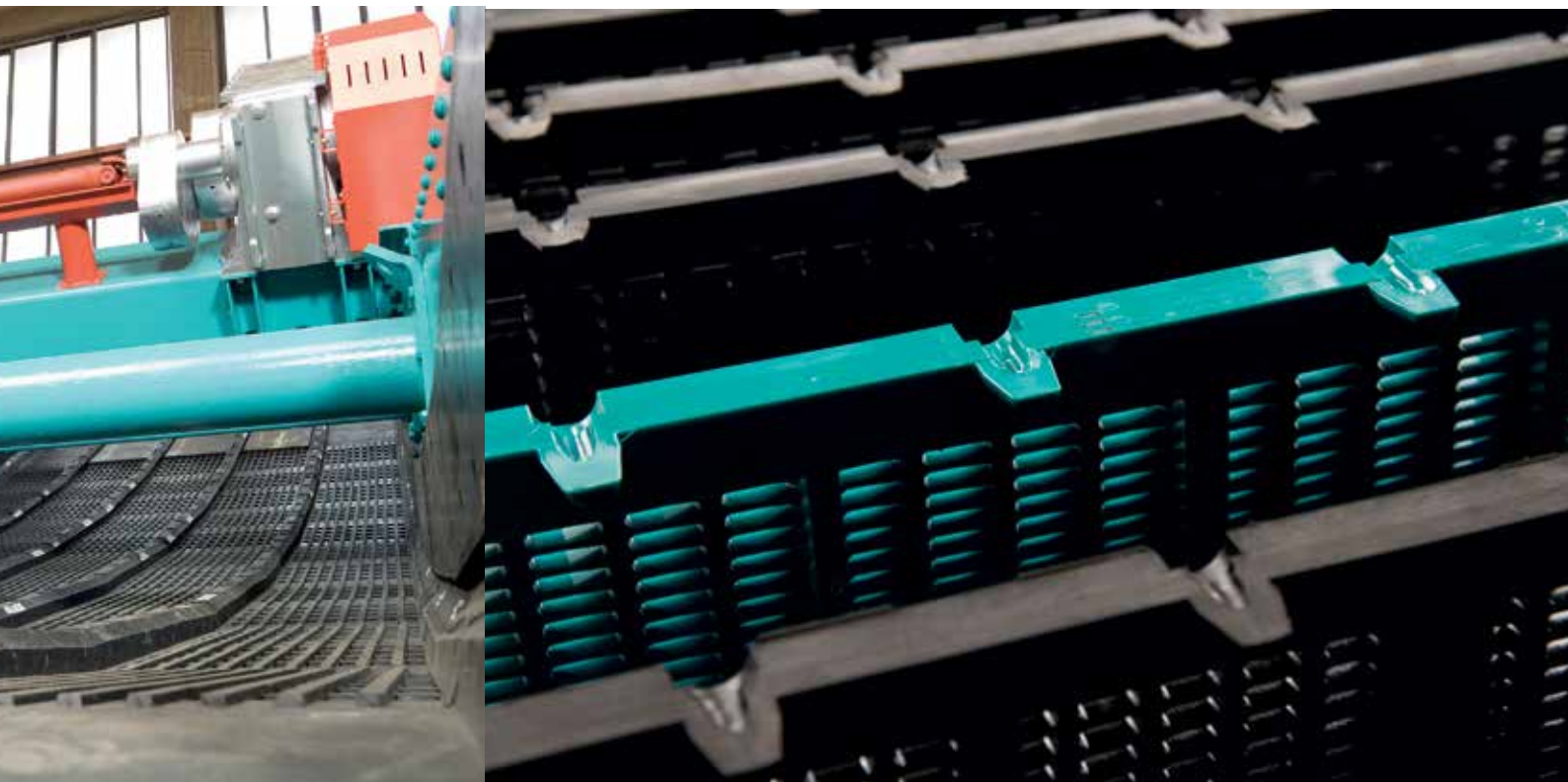
Plichta explains that HydraDet is able to break the mould and offer a new paradigm. "Integration with third party software, offering EDDs to competitors (both components and completed units) and hardware are all disruptive options that will be valuable to shift the market towards embracing new technology and stimulating the mining sector."

An image of the user interface (UI) can be seen in Figure 1, as an example of what is available for competitors to modernise their own offerings; the software is fully customisable.

A key benefit of the EDD technologies is a higher integration with cloud analytics, providing strategic metrics which can be tailored to provide security, performance, cost and productivity insights.

"It is not necessary for HydraDet to inflate pricing; using the key strategy of continuously developing new technology from a low cost base means the customer benefits and volumes for EDDs can more rapidly grow. Our aim is to remain at the forefront of this revolution and to provide customers with ever better solutions," concludes Plichta. **MRA**

# First in Africa – vibrating screens and screen media under one roof



Schenck Process continues to focus on customer proximity and is the first company to offer in-house production facilities in Africa for both vibrating equipment and screen media, all under one roof.

**onegroup. onepower. onefuture.**



# Vibramech looks forward to 2020

After securing the largest order in the marine diamond industry



Manufacturer of vibrating mineral processing equipment **Vibramech** is exceptionally honoured to have received its largest single order in its 43rd year of operation – to supply over 30 units of vibrating equipment to the latest state-of-the-art marine diamond processing vessel in 2020.

The equipment in question ranges from heavy duty/high capacity primary scalping screens to diamond recovery feeders. The large primary scalping screens (the largest operational on sea-going processing plants) have been meticulously designed and tailor-made for this specific application and have been designed using the latest finite element and strain gauge techniques.

In 2020, Vibramech anticipates to maintain its performance of producing over 500 units per year, and despite a challenging mining environment, expects to show some growth due to the aforesaid marine diamond processing order.

The company remains confident for 2020, as it fully understands the harsh operating conditions to which vibrating screens, grizzlies and feeders are subjected in the mining industry. As such, the company is cognisant that its designs need to cater for both abrasive and corrosive environments.

“Our equipment needs to withstand the high wear associated with the

screening of abrasive ores. We also have a range of speciality liner materials, paint specifications and wear prevention compounds which are used to combat the effects of corrosion in the marine and refinery applications. Vibramech even offers the option to install a screen in stainless steel,” explains Vibramech MD David Massey.

As sound dynamic behaviour is essential to ensure vibrating equipment reliability, all equipment is built to perform within strict dynamic parameters. All internal mating surfaces are machined in order to maintain stringent dimensional tolerances. In addition, the company’s quality assurance programme makes provision for a full 3D vibration analysis to be conducted on all equipment prior to release. This is used as a benchmark for the life of the equipment.

A significant percentage of the screens supplied are manufactured under the Siebtechnik licence which was awarded to Vibramech in 2005. In particular, Vibramech has continued

to supply 4.3 m wide screens to both local and overseas projects, with numerous screens being supplied into the African market.

In addition to conventional screens, Vibramech is the southern African licensee for Hein-Lehmann Liwell screens. These machines have been designed specifically to screen fines from a ‘sticky’ feed in a dry screening operation, and have a worldwide reputation for being the market leader in this field.

Vibrator motor and geared exciter repairs form part of Vibramech’s service offering, with repairs conducted to OEM specifications. URAS vibrator motors and Siebtechnik geared exciters are part of Vibramech’s key product offering. These units, as well as other OEM vibrator motors, are refurbished in Vibramech’s 8 000 m<sup>2</sup> under crane factory.

Vibramech has distributed URAS vibrator motors as part of its vibrating equipment product offering since 1981 and is the exclusive URAS vibrator motor distributor for Africa and the Middle East. **MRA**

The Clarion Events office in Africa, formerly trading as Spintelligent, is a multi-award-winning Cape Town-based exhibition and conference producer across the continent in the infrastructure, energy and mining sectors.

With a track record of over 16 years, the mining portfolio offers turnkey events in Africa's mining hotspots such as the DRC and emerging markets such as Nigeria and Rwanda with respectively: DRC Mining Week, Nigeria Mining Week and East and Central Africa Mining Forum. The portfolio is supplemented by the key industry publication: Mining Review Africa and its news portal: miningreview.com, produced by Clarion Events' in-house media department.

# CLARION EVENTS MINING

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# Doppelmayr vertical conveyors

## Handling materials in any challenging terrain

Underground mining presents many challenges in effectively transporting material – limited space as well as the necessity to avoid exhaust emissions and heat development are two of the many difficulties faced by this industry sector. The **Doppelmayr vertical conveyor**, enabling lifts of up to 750 m, opens up new material transport opportunities for underground mining, providing the opportunity to reduce haul truck fleets as well as related exhaust emissions.

The novel concept adapts the proven RopeCon system to the specific requirements for an underground application. The system uses a conventional conveyor belt to transport the material to the surface continuously. This belt is equipped with side walls and cleats, forming pockets for the material. Axles are bolted to the belt at regular intervals to support it. Running wheels fitted to either end of the axles guide the belt. In the loading station, the wheel sets run on guiding rails, which safely guide the belt into the shaft. In the shaft itself, ropes guide the belt at all times.

Maintenance is simple and cost effective, as all moving parts are mounted to the belt and will pass the terminals at regular intervals. Maintenance tasks can be easily carried out there. Ropes and shaft are inspected by a camera system which is attached to the belt. Access to the shaft is not required, neither for installation nor for operation.

### Technical specifications

Vertical lift	up to 750 m*
Conveying capacity	2,000 t/h*
Max. lump size	up to 150 mm
Clear shaft diameter required	3.5 m*

\*Depending on material specifications and operating conditions. Please see below examples:

Example 1	90°
Vertical lift	700 m
Conveying capacity	700 tph
Example 2	90°
Vertical lift	600 m
Conveying capacity	1 000 tph

Like a conventional conveyor, this system can be loaded by a transfer conveyor or by an ore pass. Above ground, the material is transferred to another conveyor, a RopeCon system for example, or it can be discharged onto stockpiles.

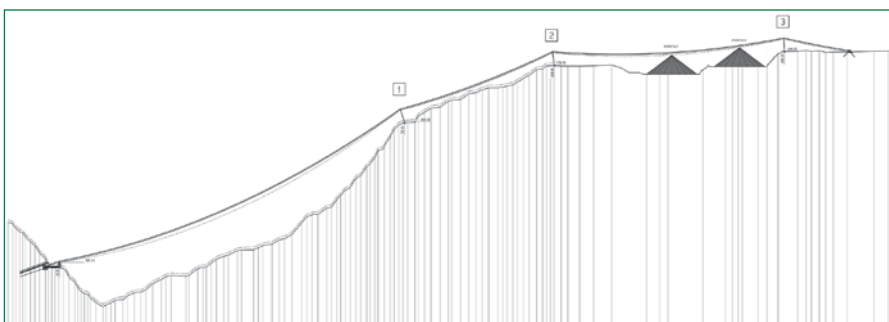
Re-use of existing ventilation shafts is possible for this transport system.

As the main drive is installed above ground, underground heat development is reduced.

### RopeCon – directly out of the pit

RopeCon is a suspended conveyor which transports your material on a flat belt with corrugated side walls and is perfectly suited for rugged terrain or to cross obstacles of all kinds. As with conventional belt conveyors, the belt performs the haulage function. The belt is fixed to axles arranged at regular intervals to support the belt. Running wheels are fitted to either end of the axles. These run on track ropes with fixed anchoring and guide the belt.

These characteristics make Doppelmayr's RopeCon system a cost effective and continuous transport solution. For instance, to transport material from the underground mine portal to the processing plant, crossing the pit. As the system is elevated, the footprint across the pit is minimal and trucking underneath the track is possible. It can also handle steep inclinations and allows for several stockpile discharge points. **MRA**



The RopeCon is tailored exactly to each project's requirements.

If you have a specific project in mind for which you would like to evaluate Doppelmayr's systems, please contact us directly by e-mail at [dttd@doppelmayr.com](mailto:dttd@doppelmayr.com).



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# DEMOCRATIC REPUBLIC



## MD SERVICES SARL

MD SERVICES Sarl, is a 100% Congolese Shareholding Company, specializing in the recruitment and management of human resources, which, over the years, has built a flawless reputation throughout the entire Democratic Republic of Congo and has emerged as a major player for many companies active within the country; not only in the mining sector but also in cement and oil exploration.



Mr Didi MUDOGO,  
Managing Director

### MD SERVICES SARL, ENGAGES HIGHER SPEED

For more than a decade, to meet the concerns of its clients, MD SERVICES Sarl continues to combine the useful to the pleasant. The high performance achieved is a testimony to the constant finesse in its actions, the dynamism, the continuation of well-accomplished works and the maintenance of the effort for the emergence of new talents within its staff. Thus, clients who have found full satisfaction in its services, become more than faithful and many other structures investing in various fields converge towards it to be better served. Let's say, meeting the local and expats needs of its clients is the top priority for MD SERVICES Sarl. Innovative approaches in a perspective of development of companies as well as the qualification and awareness of its staff are well established.

**BE REASSURED**

### MD SERVICES SARL, PROVES ITS PROUESSES

With the management of expatriates, this added value, is certainly a new asset, devoting its demarcation to its field of activity.

Do you have any concerns regarding the management of expatriate employees in the Democratic Republic of Congo? The precise orientation and the appropriate solution are reserved for you by MD SERVICES Sarl.

Through major stages of the process of recruitment, selection, reception and integration of staff, the management of expatriates is ensured with an undeniable delicacy. these processes include, inter alia, the obtaining of various visas (Žying visas, airport / port, travel visas, work establishment visas, ...) from the Executive Management for Migration



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MD SERVICES SARL  
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# OF THE CONGO

STATEMENT

## THEY TRUST US

EXCAVATION &  
TRANSPORT OF MINERALS



EXPLOITATION OF TIN



EXPLOITATION OF OIL



EXPLORATION &  
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FAMECO

ENGINEERING & CONSTRUCTION

BEVERAGE FACTORIES



and obtaining of work permit from the Ministry of Labour. MD SERVICES Sarl prides itself on having the title of " Best companion " of companies concerned about the success of their investments in the Democratic Republic of Congo.

## MD SERVICES SARL, SHOWS ITS RANGE OF CLIENTS

MD SERVICES Sarl's clients are spread over several investment sectors, including: Exploration and / or exploitation of gold, cobalt, lithium, copper, tin, limestone, oil, etc...



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# Mixing specialists

## The best in the game

35-year-old industrial agitator and mixing specialist **Mixtec** continues to excel as a leader in the industry with inhouse high level agitator designs, extensive R&D, exceptional customer service and specialising in a wide range of impellers expertly matched to its clients' specifications.



Founded as a family-owned and operated business, the company has grown to great strength over the years and still adopts continuous improvement for its product development and technology. This has always been the core ideology behind the company's global success as the premium provider of fluid mixing technology. The company prides itself on ensuring efficient designs which are robust and economical and has been involved in various process technology developments.

Advances in impeller technology and design techniques have improved the performance and efficiency during gold leaching, carbon-in-pulp adsorption, biological leaching, cyanide destruction/detox, conditioning, solvent extraction and attrition scrubbing to name a few.

No other industry has benefited more from Mixtec's ability to refurbish and improve upon existing agitators than mining and refining, producing not only power savings but also increasing the operational life of existing agitators. The mining industry has many varied process conditions and agitators seldom perform just one simple duty, hence Mixtec makes it its priority to explain and ensure their clients are aware of advantages and limitations

of each specialised mixing unit. This includes new impeller technology and its capabilities in the reduction of the loading of the agitator drive assembly and associated structures. Mixtec also offers full technical and maintenance support to all sites with their efficient after sales service.

Mixtec is the expert in producing various agitators for the largest mining, refining and industrial plants and has successfully designed and commissioned mechanical agitators to operate in tanks larger than 6 000 m<sup>3</sup> with mixing systems more than 38 t, impellers manufactured



over 7.6 m in diameter and shaft lengths over 21 m. For such applications. Mixtec's Series 4 000 heavy duty agitator drives are available in standard models up to 450 kW but can easily be larger when required.

A pioneer in impeller technology and engineering capabilities, the company continues to invest in future research and development to ensure its products are constantly evaluated for improvements that will enhance processes, efficiency and operations. This is achieved through its R&D departments as well as trained design, engineering and commissioning personnel who are specialists in fluid handling applications.

Given the wide variety of applications and processes for mixers and agitators, Mixtec offers a wide range of custom configurations which it has gleaned over its existence since 1984, resulting in its agitators being employed throughout the world in a host of projects including gold, copper, zinc, lithium, water treatment and phosphate plants, where Mixtec has met and exceeded its clients' requirements.

Moving forward, Mixtec will continue to produce state-of-the-art technology, design and equipment, allowing it to set itself apart from competitors using its specialised capabilities in processing and mixing. **MRA**

# MIXTEC

FOR MIXING TECHNOLOGY



*The perfect blend  
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Mixtec is considered by many as, '**setting the benchmark**' in power consumption and effective mixing equipment technology in the mining and refining industry, therefore it remains the superior choice for agitation.

## PROCESSING APPLICATIONS WE ARE INVOLVED IN:

### **CIP/CIL**

Biological Leaching | Flotation | Solvent Extraction | Draft  
Tube Circulators | Chemical Makeup | Anaerobic & Anoxic  
Mixers | Reactors | Autoclaves | Albion Process |  
Backfill

The Walz scanner system has been designed to interface directly with mine site data infrastructure systems



# Local business optimisation

## Fostering global technology partnerships

Optimisation of business operations in the bulk material transportation industry is being revolutionised by innovative volumetric scanning technology.

allows for the data to be delivered to key mine site personnel, in real-time, for monitoring and analysis.

Passing beneath a laser, each haul truck bucket is scanned and referenced by advanced algorithms and sophisticated software resulting in an accurate volume estimation, generated by 2D load images. Using this method, load volumes can be calculated to within a proven and tested +/-1%.

Volumetric load scanning technology aids in the accurate monitoring of:

- **Production** – autonomous operation; real-time load volumes; real-time load position analysis; production alerts;
- **Material density** – real-time material density per load; autonomous operation; mine dispatch interface;
- **Carry-back** – real-time alerts to dispatch; auto adjust for production tracking; autonomous operation;
- **Load optimisation** – manages shovel performance; improves load optimisation, reduces maintenance costs.

This technology is poised to revolutionise the bulk material transportation industry.

### Flexible weighing where you haul!

In addition to its volumetric load scanner system, Walz Scale facilitates weighing where you haul with its range of portable axle scales designed and constructed to be the industry's most dependable, most accurate, and longest lasting heavy-duty axle scale system on the market today.

The portable axle scales will outperform and outlast most any other axle scale on the market. These scales are built to work in your tough environments and a wide range of configurations is offered to accommodate your specific implementation needs. There is a range of different weight capacities, power options, display and print options, pad configurations, optional removable ramps, USB interface options, terminals, transport options, and of course a range of prices to fit your budget.

The mining series of portable mining truck scales are used for earth foundations allowing mine sites to transport their scales directly to their haulage asset.

Truck scales are often integral components of a business. Whether your operation weighs just a few trucks per day or hundreds, accurate and reliable truck scale systems are integral to ensuring business efficiency and profitability. **MRA**



The mining series of portable mining truck scales are used for earth foundations, allowing mine sites to transport their scales directly to their haulage asset

Accurately weighing items in motion is highly specialised and achieved by only a handful of companies globally.

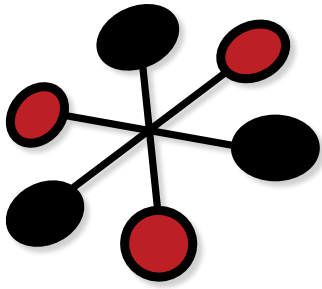
Trysome Auto Electrical Engineering has recently collaborated with one such company, Walz Scale USA, to bring innovative, digital solutions to the local mining and transportation industries with a big focus on real-time information monitoring.

Every business entity that relies on weighing strives to increase production efficiency, reduce maintenance costs and maximise on safety whilst maintaining accuracy to increase profit.

Having more accurate weight data means you can keep closer track of your payloads, obtain precise measurements of incoming and outgoing materials, and maximise the load capacity of haul trucks without overloading.

Where accurate volume and tonnage is imperative, direct, non-contact, in-motion, volume measurement is the most accurate payload measurement available.

The Walz scanner system has been designed to interface directly with mine site data infrastructure systems. This



# INGWENYA

## MINERAL PROCESSING

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A contractor of choice to the coal mining industry in the cost-effective supply of coal processing plants, and operating and maintaining them to a standard that meets the client's throughput, quality and safety requirements.

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Specialising in:

- Operations of Processing facilities
- Design & Build of Coal Processing Plants
- Feasibility & Due Diligence Reports
- Engineering Design and Fabrication

IMP is open to various models for operation of coal processing plants:

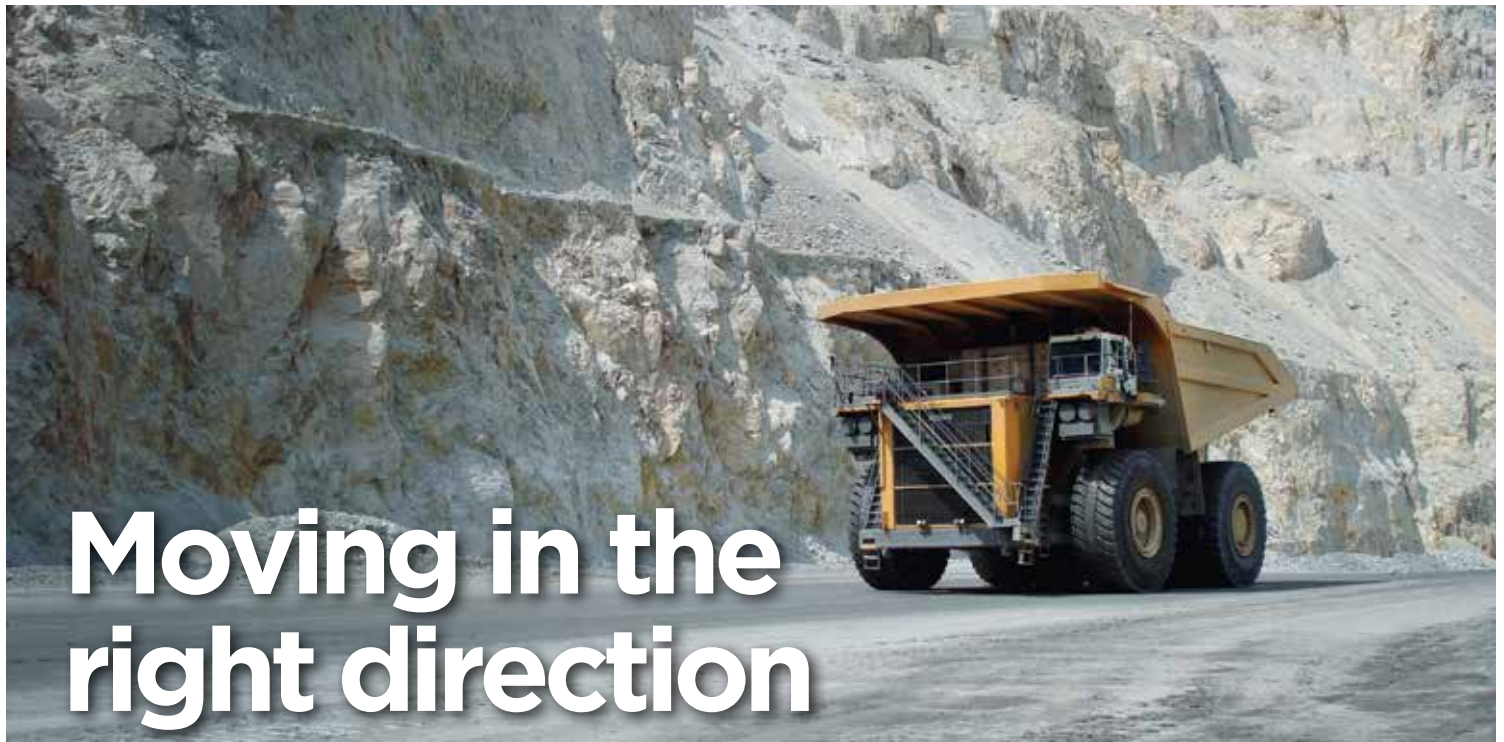
- BOOM (Build, Own, Operate & Maintain)
- BOOT (Build, Own, Operate, Maintain & Transfer)
- Modernization of Plants
- Consultations: Due diligence, Pre-feasibility and Bankable feasibility studies, metallurgical troubleshooting.

IMP is equipped with a 4000m<sup>2</sup> in-house workshop Bomax to build tailor-made, easy-to-operate, modular plants with short lead times.



Ingwenya Mineral Processing (IMP) Ltd is a South African-owned company with 52% black ownership based in Emalahleni, Mpumalanga Province. Since 2006 IMP has designed, built and commissioned successful coal processing plants. IMP is expanding its footprint beyond South African borders with operations in Botswana.





# Moving in the right direction

## Mining quickly adapting to IIoT

Productivity in the mining sector globally has declined by 28% over the last decade, according to MineLens data from McKinsey. However, the harnessing of data and the utilisation of automated systems offer the potential to enhance the productivity, efficiency, and safety of mining operations into the future.

Currently, the implementation of the Industrial Internet of Things (IIoT) technology in mining is still in its early stages. However, according to Vernon Moodley global industry manager for mining, minerals and metals at Endress+Hauser, the sector is steadily finding its feet in the digital world and is quickly catching up to other industries at the forefront of change. "The pace at which the mining industry is adopting IIoT technology is actually quite quick, particularly when compared to the chemical industry, where, for example, there are a lot of restrictions and quite a lot of rigidity when it comes to standards. From what I see, people in the mining industry are more flexible – they want to learn from other industries. And that is the difference," he states.

According to Moodley, mining companies are increasingly turning to digital solutions to boost efficiency, productivity, and safety. "Mining companies are at a discussion phase

of figuring out answers to important questions such as: Where do we go? How do we do this? And what do we do with it? Importantly, this stage includes implementing trials with new technologies.

"And these trials are not about changing the whole infrastructure of a plant; they are small step-by-step trials to try to boost efficiency and to get a little bit more information to the right people at the right time," he adds.

And it is the potential to get accurate information to the right people in a timely, efficient fashion that makes cloud services a boon to mining operations. Cloud technology enables the fast transfer of data. "The cloud service that Endress+Hauser offers provides data from field instrumentation. The information goes to maintenance teams, allowing them to receive automated updates on when a sensor will need to be replaced. This means that they can order preparations in advance and prepare for the scheduling of shutdowns. It enables a much more pragmatic and proactive maintenance routine," states Moodley.

### Going forward with IIoT

Asked what advice he could give to the mining industry about what it should be focusing on when it comes to IIoT, Moodley says that companies need to be aware that moving too quickly can be a mistake. "The potential is there, and if they want to have it realised they can. When we go to a plant now, we do workshops and talk about these things. It's not just all about hard selling: it's about discussing what they want to do, the potential available, and how quickly they want to move into digitalisation," he states.

But introducing an IIoT cloud system isn't something that is easy to do, he warns. It is new territory, not just for mining but for any process industry, and companies have to do it in small steps, in a logical, sequential manner, and with a view to why it is important.

"What always needs to be remembered is what you can get from digital implementation: cost reduction, safety and environment protection. In mining, they are the three pillars that drive the Industrial Internet of Things," Moodley concludes. **MRA**

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# Dupleix Liquid Meters

## Celebrating 60 years in the industry

For the last six decades **Dupleix Liquid Meters** (DLM), a proudly South African organisation, has embodied quality and service when it comes to providing its customers with the right products.



**D**L M is renowned for having the right solutions for overpressure protection; flow, level and density measurement; automation and control requirements and maintains a substantial stock holding with a branch infrastructure capable of providing skilled technical and sales service.

As a company that employed just eight people when it began as Dupleix Valves in 1960 and then merged with SA Liquid Meters back in the 1980s, DLM has grown into an organisation that now employs over 150 staff members around South Africa.

As the company began to grow, so did the need to focus on a brand that best represents the quality and professionalism that DLM offers in its products and services. The new re-brand of DLM was launched to the public at the end of 2018 and has over the last year established a more proficient standing in the market.

Over time the company has developed into three divisions: namely Valves, Flow and Instrumentation.

**Valves:** DLM's extensive range covers all operating types and is available in a wide variety of materials to suit different media, pressure and temperature requirements. It is one of southern Africa's leading suppliers of valves, pneumatic actuators and accessories as well as instrument valves and fittings for severe service applications in the mining industry.

**Flow:** DLM's Flow division focuses on the southern African petrochemical market for accurate measurement and control of fuel. It delivers a technologically superior range of products and solutions that are sourced both locally and internationally to meet the demanding liquid custody transfer applications for fuel distribution, rail and road transport. Terminal automation and reconciliation software is also offered to complete the fuel depot requirements.

**Instrumentation:** DLM's Instrumentation division focuses on industrial and process field instrumentation for flow, level, temperature and pressure measurement as well as specialized instruments for moisture analysis and control. Refractometers for concentration measurement and interface detection and a full range of boiler control equipment.

With over 40 local and international suppliers in its portfolio, DLM is always looking to provide a full package solution

for its customers and has recently added new product lines to its range such as smart positioners for control valves, solenoid valves and pressure and temperature gauges.

DLM has also been active with the engineering, procurement and construction management (EPCM) companies and has worked together with them on large mining projects in South Africa, Madagascar, Namibia, the DRC and Zambia, and has a physical presence in both Namibia and Madagascar.

The company has spent a number of years focusing on the mining segment and establishing infrastructure in South Africa to support the local industry.

"We want to continue on this growth track by strengthening our foothold on Africa and establishing business partnerships with local distributors in country. DLM is focused on placing the right resources and people in country to provide the best solution for all," the company concludes. **MRA**







VALVES | FLOW | INSTRUMENTATION

# DUPLEIX LIQUID METERS

Strengthening our foothold in Africa



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# Cobalt producers

## Top notch precipitation reagent compensates for low prices

The demand for electric vehicles, at the start of 2019 anticipated to be high, has been slower than expected – and the consequent result has seen a fairly steep drop in battery minerals pricing, including cobalt. There is however no need to curtail cobalt production. Through **Martin Marietta's MagChem40** product (distributed by minerals processing reagent specialist Magnesia Solutions, an Axis House group company), cobalt miners are guaranteed the most effective and efficient cobalt precipitation, alongside reduced costs. Axis House MD **JUSTINE STUBBS** speaks to **LAURA CORNISH**.

Precipitation of cobalt for leach solutions today still remains the premium hydrometallurgical process used to recover cobalt.

And while there are many precipitation products available on the market such as calcium oxide, sodium carbonate and sodium hydroxide, Stubbs says that magnesium oxide (MgO) has been proven to be the preferred pH modifier/precipitation agent in this process.

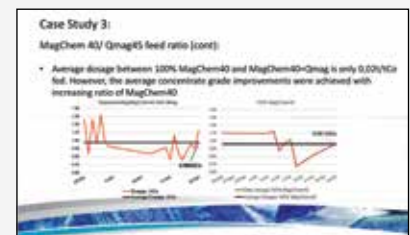
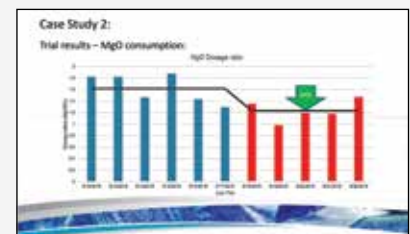
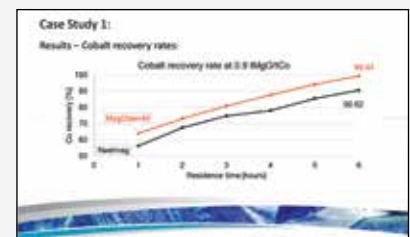
"Axis House has worked with Martin Marietta Magnesia Specialities – producer of MagChem40 and the largest producer of Synthetic magnesia in North America since 2010 – and Magnesia Solutions in 2016 took over the distribution agreement," Stubbs explains.

"MagChem40 is undeniably superior in nature to the various cobalt precipitation products available on the market, including other MgO products. MagChem40 light burned MgO offers the highest purity and best reactivity. This synthetic product also requires a lower dosage (as much as 25% less) than naturally produced MgOs – the combination of these benefits results in higher cobalt recoveries and better product grades in the fastest possible time," she continues.

This product has been available to the global cobalt mining industry (which largely constitutes operations in the Democratic Republic of Congo (DRC)) for +10 years. However, the current low pricing environment dictates that miners re-evaluate options to ensure

### CASES IN POINT

As part of the relaunch, Axis House showcased three case studies conducted on pilot and industrial scale cobalt operations using MagChem40 to showcase its benefits:



their cobalt processing performance is optimised, and MagChem40 delivers on this objective.

On the back of wanting to relaunch and reinvigorate interest in the MagChem product, Axis House and Magnesia Solutions successfully held a formal event in November 2019 and were joined by representatives from Martin Marietta to share the product's benefits with the widespread DRC audience in attendance.

In build-up to the event, Axis House conducted extensive test work on the product through the establishment of a pilot plant at its premises in Kolwezi. This was aimed at optimising and reducing MagChem40 consumption while gaining the same recovery benefits it has always delivered. The results of this test work were shared on the day.

### How MagChem40 is sourced and produced

MagChem40 is synthesised by reacting magnesium chloride brine with



Axis House hosted an event late last year to showcase the benefits of MagChem40

hydromelitic lime – sourced from Martin Marietta's +50 life underground brine reserves in Michigan and dolomitic limestone quarry (also the largest in North America) in Ohio.

"It is the quality of these brine and limestone products that produce such a pure quality MgO reagent," Stubbs reveals.

With currently 15 DRC-based MagChem40 clients, and two local facilities in the country, Stubbs and the Axis House team are equipped to understand the existing and emerging local sector's needs and provide a service and products that meet those needs. "MagChem40 is a perfect example of this," Stubbs highlights. **MRA**



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# Africa Mining Forum

## Putting Rwanda on the map

Following the resounding success of the inaugural *East & Central Africa Mining Forum* last year, the event has now been rebranded as the *Africa Mining Forum*.

held in Kigali in October last year, 730 attendees from 42 countries at the event were impressed by the two-day conference and exhibition. The attendance and interest in the event clearly indicates that Rwanda is becoming a mining hub in the region.

This is because the country has enormous untapped resource potential, particularly gold and high-grade lithium.



Furthermore, because of its supportive legal and regulatory framework, Rwanda is ranked as one of the top three easiest countries in which to do business in Africa, thereby making it attractive to investors.

Event director Elodie Delagneau adds: "Hosted by the Rwanda Mines, Petroleum and Gas Board, the *Africa Mining Forum* is a premium annual mining investment event that will attract

local, regional and international key stakeholders and investors to East and Central Africa, and more particularly Rwanda. This will enable regional growth and help establish a sustainable platform in a stable and modern economic hub in sub-Saharan Africa." **MRA**



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# Mining in Nigeria

## Is teeming with potential

**Nigeria Mining Week (NMW)** has the potential to become a major international event as the country's mining sector is on an upward trajectory. This is according to Nigerian Minister of Mines and Steel Development, **ARCH. OLAMILEKAN ADEGBITE**.

In an exclusive interview with *Mining Review Africa*, Adegbite commented that last year's NMW, held in Abuja in October, was an improvement over that of past editions as there were many more participants. "It is my wish to upgrade the event to an international event like Mining Indaba (South Africa), PDAC (Canada) and Mines and Money (London). This is what we are working on," he stated.

Furthermore, Adegbite is buoyant about Nigeria's mining sector which for many decades has been somewhat neglected. "The mining sector has been in very bad shape over recent decades – stemming from the neglect it went through as a result of the oil boom. The big expatriate mining companies left the country and the sector went into the doldrums. However, with the advent of the Nigerian Mineral and Mining Act 2007 and the Nigerian Mineral and Mining Regulations 2011, the country has relaunched itself once again as a mining destination.

"One of the highlights is the formalisation of artisanal miners. More than 1 500 cooperatives have been registered nationwide as mining cooperatives and about 250 private mineral buying centres are also registered to facilitate trading in mineral commodities. To ensure environmental mitigation in the mines field, environmental laws and regulations are being enforced to the letter."

### Significant investment

One of the most notable achievements to date is the National Integrated Mineral Exploration Project (NIMEP). US\$45 million has been invested in this nationwide project which includes the exploration of base metals, rare earth metals and industrial metals. "Preliminary results are encouraging and are being presented at different fora that we have been to," adds Adegbite. "The end result is to provide commercially viable data that can be accessed



↑ Last year's event attracted the largest numbers ever with 1,159 attendees from 19 countries and 38 sponsors and exhibitors

“One of the highlights is the formalisation of artisanal miners,”

**ARCH. OLAMILEKAN ADEGBITE**

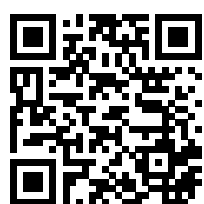
by foreign investors for bidding, which will deepen mining activities in the country. Also, upgrading of the Mining Cadastre Office (MCO) to an online platform, which enables interested mineral title applicants to access its services, is another notable achievement.”

While Adegbite acknowledges that there are challenges to mining in Nigeria, such as illicit trading, minerals smuggling and inadequate funding, he sees plenty of potential for the sector to grow and contribute significantly to the country's GDP and create employment opportunities. "Currently, there is a bilateral agreement between Russia and Nigeria to revive Ajaokuta Steel Company, which on completion will place the country on the map of steel producing nations. This single project is capable of generating employment for our youth and also earn foreign exchange for the country."

Adegbite has also urged mining communities to be supportive and investor friendly. "Mining is not only capital intensive but has a long gestation period. So communities should be patient and always provide a serene environment for mining operations and also be moderate in their demands.

"The Nigerian mining sector is on the upward trajectory to become the biggest in Africa. I would like to invite new investors to take advantage of the vast potential that the country's mining sector offers," he concludes. **MRA**

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