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Glencore and Ivanhoe Mines Sign a US\$250 Million Financing for 100% Off-take of Kipushi's Zinc Concentrate

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IMF delegation assesses mining statistics with Antoinette N'Samba Kalambayi

The national Minister in charge of mines, Antoinette N'Samba Kalambayi, on the evening of Wednesday, April 19, conferred with the delegation of the International Monetary Fund in her office.

With the boss of mines, it was a question of mining statistics on production (2022-2023) and projections (2024-2033), the contribution of the mining sector to the budget as well as the inventory of sector reforms.

As a reminder, after the staff visit held last February, the IMF team is staying in Kinshasa from April 19 to May 3 for the assessment of the 4th review of the Government's economic program supported by the extended credit facility and the start of Resilience and Sustainability Program (RSI) negotiations.



ZCCM-IH ANNOUNCES CHANGES OF BOARD OF DIRECTORS

ZCCM-IH wishes to inform its shareholders that Mr. Gregory Chomba Kabwe resigned from the Company's Board of Directors effective 2nd March 2023. The ZCCM-IH Board wishes to thank Mr. Kabwe for his contributions to the Company and wishes him well in his future endeavours.

The Board further wishes to announce the appointment of Mrs. Masitala Nanyangwe Mushingwa as Non-Executive Director on the ZCCM-IH Board effective 7th March 2023.



THEME:

Copperbelt: Re-ignite. Rebuild. Renew



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US INTERNATIONAL DEVELOPMENT FINANCE AGENCY INTENDS TO BOOST THE ELECTRIC BATTERY FACTORY PROJECT IN THE DRC

After being received at the US State Department, the Congolese Minister of Industry, Julien Paluku Kahongya, and his colleague from Finance, Nicolas Kazadi, met with the team from the American Agency for International Development Finance (DFC) led by its Executive Director, Scott Nathan.

During this strategic meeting, the American financial agency announced that it will support the acceleration of the realization of the pan-African project to establish the first factory for the production of electric battery precursors in the province of Haut-Katanga in the Democratic Republic of Congo (DRC).

For the Congolese delegation, this expression of interest from DFC is a cause for satisfaction.

Moreover, representatives of the Congolese government have requested that the American agency also support the establishment of Special Economic Zones in the six (6) industrial areas in the country.

It is worth noting that these meetings took place in the presence of Denis Lecouturier, Kakule Vuko, and Jean-Marie Kanda, respectively the General Director, Deputy General Director, and Administrator of the Congolese Battery Council (CCB).



PRIMERA GOLD EXPORTED 354 KILOS OF ARTISANAL GOLD IN 51 DAYS

These figures were provided by the Congolese Minister of Finance, Nicolas Kazadi, via his Twitter account on Friday March 10, 2023.

Minister Nicolas Kazadi did not specify details on where this quantity of artisanal gold was purchased.

In February 2023, Nicolas Kazadi had already announced that 207 kilograms of gold from artisanal mining were exported, mainly from the provinces of South Kivu and Ituri.

Since its establishment at the end of 2022, Primera Gold has been approved as a counter for the purchase and sale of artisanal gold in the Democratic Republic of Congo (DRC).

It should be noted that this joint venture plans to install, in the next few days, a gold processing refinery in the province of South Kivu.



PRESIDENT HH URGED TO ACT ON GOLD MINE REOPENING DELAYS

Mwiniwanga Town Council Chairperson, Jonathan Chinyimba, has urged the President of Zambia, Hakainde Hichilema, to expedite the reopening of Kasenseli Gold mine.

Chinyimba stated that the delay in reopening the mine has caused increased levels of poverty and unemployment in Mwiniwanga, and has hindered the district's overall development.

Chinyimba emphasized the potential economic benefits of reopening the mine, including improved infrastructure, job creation, and increased revenue for the council to invest in the community.

He noted that the delay has led to limited revenue for the council and hampered business activity in the area.

Mr. Chinyimba has since called on President Hichilema to intervene and prioritize the reopening of the gold mine, which he believes has the capacity to alleviate poverty in Mwiniwanga.



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HITACHI CONSTRUCTION MACHINERY & FQM ANNOUNCE ZERO EMISSION PARTNERSHIP WITH SIGNING OF LETTER OF INTENT

Hitachi Construction Machinery Co., Ltd. and First Quantum Minerals yesterday, 1st March announced that they have entered into a Letter of Intent to advance the development of sustainable mining solutions at First Quantum's flagship mining operations in Zambia.

A proof of concept ("POC") will be implemented as part of the LOI; Hitachi Construction Machinery supplying the first of its full battery, rigid frame dump trucks ("battery dump truck") fitted with an ABB Ltd ("ABB") battery, on-board charger and associated infrastructure by the end of FY2023 for technological feasibility trials at First Quantum's Kansanshi copper-gold mine operations, including the S3 expansion projected for commissioning and first production in 2025.

This partnership represents a significant milestone for both companies: Hitachi Construction Machinery accelerating the validation of its zero emission mining product as part of its technology roadmap, and First Quantum progressing towards reducing its operational greenhouse gas (GHG) emissions and achieving its long-term sustainability goals by applying this battery-electric technology at one of its largest mine sites.

Hitachi Construction Machinery and First Quantum have a long-standing relationship that will be further strengthened through this LOI and POC.

The Kansanshi mine is ideally suited to these trials due to its existing trolley assist systems, which align with development of battery dump trucks.

First Quantum currently operates 41 Hitachi Construction Machinery (diesel) trolley trucks at Kansanshi, meaning much of the required infrastructure for the battery dump truck is already in place.

Developed in collaboration with ABB, Hitachi Construction Machinery's battery dump truck utilizes on-board energy storage and trolley systems to generate power.

Via a pantograph, the battery dump truck connects to overhead power lines, drawing power to allow the truck to run. At the same time, the generated energy is used to charge the battery system. This is separate to the regenerated power from the retarder braking system which will generate a high level of charge during haul road descent.

"ABB is delighted to continue its collaborative partnership with Hitachi Construction Machinery through the supply of highly energy-efficient DC/DC

converters, fitting state of the art traction batteries forming together the most efficient package to electrify rigid dump trucks," said Fabiana Cavalcante, Head of eMobility for ABB's Traction Division.

"Together, we look forward to advancing our co-creation efforts to develop solutions that enable all-electric mine operations and support customers like First Quantum in the achievement of their sustainability ambitions."

Applying a proven technology from its current trolley truck system to the battery dump truck has allowed Hitachi Construction Machinery to expedite the development of its product to market.

The retrofittable system design is also an added advantage, allowing current diesel truck fleets to be converted in the future to utilize the battery system, offering scalable fleet capability, minimal operational impact and greater value for customers such as First Quantum.

First Quantum's fleet of Hitachi Construction Machinery equipment includes 39 EH3500ACII and two EH3500AC-3 rigid dump trucks across its mining operations in Zambia, as well as several construction-sized machinery across global operations.

A further 40 EH4000AC-3 dump trucks equipped with the latest HCM/Bradken robust tray designs are on order for first delivery to Kansanshi in 2023, to support its S3 expansion project as it's scaled up.

Six new EX5600-7E (electric) excavators equipped with Bradken Eclipse buckets and incorporating loss tooth detection technology are also to be supplied, demonstrating the company's long-term commitment to reducing GHG emissions across its operations.

Continued collaboration through this battery dump truck trial is expected to directly contribute to ongoing optimization of technology, infrastructure, safety and onsite deployment strategies and processes for mining sector benefit as we approach a future of energy transition and increased demand for low-carbon equipment.

Beyond the mine site, the partnership is expected to facilitate significant investment in Zambia to deliver social and economic benefits. An in-country engine repair facility is planned for establishment, supported by both companies, which will provide an increase in employment and skills development opportunities within the local community.

COMMENT FROM SONOSUKE ISHII, SENIOR VICE PRESIDENT AND EXECUTIVE OFFICER, PRESIDENT OF MINING BUSINESS UNIT FOR HITACHI CONSTRUCTION MACHINERY

"Hitachi Construction Machinery and First Quantum have a close and respectful working relationship – since their first equipment purchase in 2004 – and we are honored to cement this further through ongoing collaboration and support with the signing of this LOI. The battery dump truck represents the future, not only for the Hitachi Construction Machinery Group but for the mining industry as a whole, and we are pleased to establish this proving ground on an active mine site and work with First Quantum on advancing this zero emission solution.

It's one of the many solutions in development that will allow Hitachi Construction Machinery to contribute toward realizing a safe and sustainable society by solving critical issues related to carbon emissions reduction and climate change."

COMMENT FROM JOHN GREGORY, DIRECTOR OF MINING FOR FIRST QUANTUM MINERALS

"Innovation in mining is integral to First Quantum's philosophy and we're excited about this technology partnership with Hitachi Construction Machinery. Pit electrification is an area of focus for First Quantum as we seek productive, safe and profitable decarbonization of our mining activities in order to deliver lower carbon intensity copper that will be essential for the global energy transition.

First Quantum has spent more than ten years implementing trolley assist technology with Hitachi Construction Machinery at Kansanshi, an area in which we are now industry leading. We see this as a technological evolution towards future commercialization of a practical equipment battery solution through the use of our advanced trolley infrastructure.

"Together with in-pit crushing and conveying and electric drilling, First Quantum saves an estimated 100,000 tonnes of CO2 a year across our Zambian operations, while delivering improved productivity, cost savings and health and safety benefits. In collaborating with Hitachi Construction Machinery on battery dump trucks, we look forward to the next phase of pit electrification as we seek to further reduce our greenhouse gas emissions in line with our target of a 50% reduction by 2030."

BANKERS UPBEAT ON FQM INVESTMENT PLANS

First Quantum Minerals' investments and expansion projects in Zambia have drawn the interest of financiers in the region who recently toured its mine sites in Kalumbila and Solwezi to familiarize themselves with its operations.

The visit showcased the economic significance of the investments to the country's industrialization and diversification agenda within the mining sector and beyond.

Representatives from Stanbic Bank, Rand Merchant Bank, Absa Bank and Nedbank relayed their optimistic outlook of country's mining landscape that followed as a result of government's policy and investment pronouncements made over the last two years as well as the renewed interest in positioning

Zambia as a regional mining hub.

Stanbic Bank with affiliate Standard Bank South Africa, recently announced that it has invested over USD\$2bn in mining over the last decade.

"We are proud to have our bank partner with the First Quantum Group," said Stanbic's Head of Corporate and Investment Banking Helen Lubambe.

"This is an amazing development that contributes so much to our country, and even as ore grades [at Kansanshi Mine] are falling, solutions such as S3 are there to ensure that production is maintained and improved," she noted.

We are extremely impressed," added Absa Head of Corporate Credit, Kingstone Ngulube, underscoring the general consensus of the group

of lenders as the visit came to an end. "As you know, Zambia is heavily dependent on mining and as a bank, we want to participate in sectors that are contributing to our country's GDP growth."

With the S3 expansion and the beginning of production at the Enterprise nickel project, FQM is set to remain Zambia's largest mineral producer and contributor to the country's tax revenue.

"We are using the opportunity of the S3 project to really move forward as a business, both from an ESG (Environmental, Social, and Governance) perspective and making sure that our productivity numbers are high," said Kansanshi Mining Plc General Manager, Anthony Mukutuma.

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Glencore and Ivanhoe Mines Sign a US\$250 Million Financing for 100% Off-take of Kipushi's Zinc Concentrate

Ivanhoe Mines Executive Co-Chair Robert Friedland and President Marna Cloete, together with Chairman Guy-Robert Lukama Nkunzi and General Manager Placide Nkala Basadilua of Gécamines, the Democratic Republic of Congo's state-owned mining company, announced today the signing of an off-take and financing term sheet to return the historic Kipushi zinc-copper-lead-germanium mine to production. In addition, Ivanhoe is pleased to provide an update on construction activities for the restart of the ultra-high-grade zinc mine, which is on track for first concentrate in the third quarter of 2024.

Ivanhoe Mines' President, Marna Cloete commented:

"The off-take and financing milestones are critical deliverables that allow us to return Kipushi to production by the third quarter of next year. Most importantly, these agreements reflect the strength of our partnership with Gécamines and our commitment to the people of the Kipushi community and the Democratic Republic of Congo. The Kipushi underground mine will be the world's highest-grade major zinc operation, with an average grade of approximately 36% zinc over the first five years of production. We will also endeavour, with our partner Gécamines, to continue exploring Kipushi, including copper-rich and silver-rich zones. Kipushi soon will join Kamao-Kakula as another tier-one production asset in our portfolio, and mark the next step as we execute our plan to emerge as the world's newest diversified major mining company."

Ivanhoe Mines' Executive Co-Chair, Robert Friedland added:

"In partnership with Gécamines, we are closing in on a monumental achievement to return the great Kipushi Mine to production. When Ivanhoe Mines acquired its interest in Kipushi almost 12 years ago, the mine was flooded and in a dilapidated state. We commend the efforts of the employees of Kipushi Corporation who restored this crown jewel of the DRC. We are proud to see new, state-of-the-art mining equipment, operated by our Congolese employees, underground for the first time in three decades as we begin to open up the Big Zinc deposit, one of the richest mineral endowments anywhere on earth.

Zinc is the fourth most consumed metal in the world, and its supporting role in the energy transition is greatly overlooked as the backbone of clean energy alternatives, including wind turbines and solar panels."

Gécamines' Chairman, Guy-Robert Lukama Nkunzi commented:

"We are excited to see this historic mine returning to production with our joint-venture partner, Ivanhoe Mines. This is an important moment for Gécamines, as well as for the local community and the people of the Democratic Republic of Congo. A significant

amount of work has got us to this point, which marks another major milestone in this innovative partnership that we have formed and comes with the potential to unlock significant value for the country. Gécamines is expected to attract more investment in the future to bolster in-country transformation and value creation. The Kipushi project, by its unprecedented nature, can form a catalyst for Gécamines to become an important actor in the project's value chain and for the development of transport infrastructure."

Signing of the term sheet for off-take and US\$250 million financing marks a significant milestone as Kipushi advances to production

Kipushi Corporation SA (KICO), Gécamines SA (Gécamines) and Glencore International AG (Glencore) have signed a tri-partite off-take and financing term sheet.

zinc and low levels of impurities. The buyer will purchase the concentrate at the Kipushi Mine on a free-carrier basis, meaning the buyer will be responsible for arranging freight and shipment to the destination, with such costs reimbursed by KICO.

The US\$250 million term financing facility will be split into two tranches and drawn down quarterly, subject to conditions precedent. The facility will bear an annual interest rate of the Secured Overnight Financing Rate (SOFR) plus 7% and shall be repaid, following a 24-month grace period from signing, in quarterly instalments over 36 months.

The off-take and financing term sheet is subject to the execution of final, binding agreements, which are expected to be concluded in conjunction with the new Kipushi joint-venture agreement.

Activities to date at Kipushi have been funded by



Signing ceremony at Kipushi. Back (L-R): Ludovic Monga Banza Kabongo, Deputy GM, Gécamines; Olivier Binyingo, SVP Public Affairs DRC, Ivanhoe Mines; Jack Masangu A Mwanza, Deputy GM, Gécamines; Stephane Cormier, Advisor, Gécamines. Front (L-R): Thomas Fogel, Glencore International; Ivano Manini, General Manager, KICO; Louis Watum, Chairman, KICO; Nick Popovic, Glencore International; Marna Cloete, President, Ivanhoe Mines; Guy-Robert Lukama Nkunzi, Chairman, Gécamines; and Placide Nkala Basadilua, GM, Gécamines.

KICO is 68% owned by Kipushi Holding, a wholly owned subsidiary of Ivanhoe Mines, and the remaining 32% of KICO is owned by Gécamines. As per the terms of the agreement between Kipushi Holding, KICO and Gécamines announced on February 14, 2022, Gécamines will acquire an increasing percentage of the share capital and voting rights in KICO over time.

The off-take is for 100% of Kipushi's zinc concentrates; between 400,000 and 600,000 dry metric tonnes per annum over a five-year term. The off-take term sheet contains standard, international commercial terms, including payables and treatment charges based on the zinc industry's annual benchmark. The concentrate produced by Kipushi is expected to contain approximately 55%

way of a shareholder loan from Kipushi Holding, which totaled US\$661 million as at March 31, 2023. The remaining initial capital cost for the Kipushi project in 2023 and 2024 is US\$380 million, in line with Ivanhoe's guidance. The company is also evaluating an interim bank financing facility of up to US\$80 million.

Underground mining activities advancing ahead of schedule, in preparation for stoping of the ultra-high-grade Big Zinc deposit to commence in January 2024

In preparation for the start of underground development, early works activities were completed ahead of schedule in Q3 2022. This comprised the refurbishment and supporting of key

mining excavations, as well as blasting of the truck-tip turning bays and truck passing bays on the mine's 1,150-metre level. Explosive storage bays, an underground workshop and a machinery assembly bay were also completed ahead of underground mine development, which commenced in Q4 2022.

In Q1 2023, the underground mining contractor was appointed and commenced the mobilization of its mining equipment to site. The majority of the primary mining fleet is from Epiroc of Stockholm, Sweden, which include six drill rigs, six scooptrams (LHDs) and 13 haul trucks, as well as additional secondary support equipment. Delivery to site of the first batch of mobile mining equipment has taken place.

Mining equipment is slung down to Kipushi's 1,150-metre level via the P5 shaft. The bulk of the primary and secondary fleet will be delivered by June, with the remainder arriving later in the year as underground development ramps up ahead of the commencement of stoping in early 2024. Stopping is the process of extracting the ore from an underground mine, leaving behind an open space known as a stope.

Underground development is currently taking place to establish access to the Big Zinc orebody. A total of 682 metres of horizontal development was completed in the first quarter of 2023, over 30% more than planned. Perimeter, access and ventilation drives are now under development at several locations between the 1,220-metre and 1,335-metre levels, while decline development continues parallel to the Big Zinc deposit. The decline is currently at 1,340 metres below surface. The development rate during Q1 2023 averaged 227 metres per month. The rate is expected to increase to 300 metres per month by the end of Q2 2023 and reach more than 400 metres per month by the end of Q4 2023.

Stoping of the ultra-high-grade Big Zinc orebody has been accelerated to commence ahead of schedule, in January 2024. The mining method of the Big Zinc deposit will be transverse sublevel open stoping in a primary and secondary sequence, filled with cemented aggregate fill to maximize the extraction. The underground operation is fully mechanized, cost-effective and designed to enable a quick ramp-up to a steady state of 800,000 tonnes of ore per annum.

The mobilization of equipment by the underground mining contractor. The left-side photo is an Epiroc MB 282 drill rig being slung down shaft P5 and the right-side photo is a recently delivered Epiroc ST14 Scooptram (LHD).

Maintenance crew at the underground workshop, in front of a recently re-assembled Epiroc MB 282 drill rig.

Ore and waste are crushed underground, through a recently installed 1,085-tonne-per-hour primary jaw crusher, and then hoisted to the surface via the P5 shaft. Work on restoring shaft P5's nameplate hoisting capacity is underway and is expected to be completed in Q4 2023. The hoisting rate is scheduled to increase from the current 101 tonnes per hour to the nameplate 257 tonnes per hour. The crushed ore hoisted to surface will be conveyed via an overland conveyor to the Kipushi concentrator, where it will be stockpiled.

To prepare for concentrator commissioning, approximately six months of run-of-mine ore is planned to be stockpiled on surface to derisk the ramp-up of operations. Medium-to-low-grade ore, as well as mineralized waste from development, is already being stockpiled on surface.

The Kipushi concentrator will have a nameplate capacity of 800,000 tonnes of ore per annum and is anticipated to annually produce 437,000 tonnes of zinc concentrate, at an average grade of 55% zinc. Total life-of-mine production is anticipated to be 10.8 million tonnes of ore at an average head grade of 31.9% zinc over a 14-year mine life (based only on the reserves in the 2022 Feasibility Study), generating 3.3 million tonnes of zinc metal in concentrate.

The concentrator consists of conventional crushing and screening, dense media separation (DMS), ball milling, rougher flotation, tailings and concentrate dewatering and concentrate filtration. The filtered concentrate is bagged in a dedicated bagging plant for dispatch to market. Thickened tailings will be pumped to a new tailings storage facility.

Discarded material from the DMS plant will be mixed with cement in a dedicated cemented-aggregate fill plant and piped back underground where it will be used as a backfill for mined-out stopes.

3D rendering of the Kipushi 800,000 tonnes-per-annum concentrator, scheduled to produce first concentrate in Q3 2024

Since the start of construction activities in late August 2022, overall project progress is tracking marginally ahead of schedule, at 27% complete.

Detailed engineering design for the Kipushi concentrator and associated surface infrastructure is effectively complete. Procurement activities are advancing on schedule and are currently 79% complete. All long and medium-lead-order equipment items have been ordered and are undergoing fabrication. The ball mill, fabricated by

CITIC Heavy Industries of Luoyang, China, is undergoing final inspection and is due to be shipped in the coming week. The DMS plant, fabricated by Bond Equipment of Sandton, South Africa, is expected to be complete and shipped to site in the next month. The fabrication of the rougher flotation cells by FLSmidth of Copenhagen, Denmark, is 24% complete and the cells are expected to be shipped in late July.

Surface construction activities are 11% complete, currently tracking ahead of schedule. The bulk of the earthworks and civil works are nearing completion. The structural steel, piping and plate work (SMPP) contractor has been appointed and mobilized to site. Two-thirds of the structural steel requirement has been ordered, with approximately 500 tonnes already fabricated and either en route to or delivered to site. To date, 2,400 cubic meters of concrete have been poured and the first steel erection has recently taken place

An aerial view, looking southwest, of the civil works under construction at the Kipushi concentrator site (centre picture). Ore will be conveyed from the nearby P5 shaft to a run-of-mine (ROM) stockpile adjacent to the Kipushi concentrator (right of picture).

Concrete foundations of the DMS plant, with the head frame of the P5 shaft in the background. Construction activities are progressing ahead of schedule.

Erection of structural steel for the overland conveyor's Transfer Tower 3. The conveyors will move ore from the nearby P5 shaft to the ROM stockpile adjacent to the Kipushi concentrator.

Erection of the reinforced concrete walls, and support structure for the DMS feed bin, adjacent to the concentrator ROM stockpile.

Dedicated Kipushi commercial border crossing to unlock direct access to Zambia

Kasumbalesa and Sakania, in Haut-Katanga, are the two commercial border crossings that currently handle most imports and exports originating from the DRC Copperbelt. They are located 110 kilometres and 230 kilometres by road southeast of Kipushi, respectively. The Kasumbalesa border experienced significant congestion in 2022 and Ivanhoe Mines has been working with the provincial government of Haut-Katanga on a series of initiatives to reduce border congestion and streamline the process of clearing mineral products for export.

One such initiative included a Memorandum of Understanding (MOU), signed in Q3 2022, between the province of Haut-Katanga and Ivanhoe Mines, to study options for a new commercial DRC-Zambia border crossing at the town of Kipushi.

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A new commercial DRC-Zambia border crossing at Kipushi will not only benefit the Kipushi Mine but also Kamo-a-Kakula as an additional route for exporting concentrate products. In addition, the border crossing will provide socio-economic benefits to the local community of Kipushi and Lubumbashi, the capital of Haut-Katanga province, which is less than 20 kilometres away.

Initial studies have been completed and the various options presented are currently under review by the provincial government of Haut-Katanga and are being discussed with the national authorities in the DRC. Concurrently, a study is underway to upgrade roads for commercial traffic on the Zambian side of the border, connecting the T5 highway to the Kipushi border (See Figure 1). The Zambian

government has already commenced upgrades on some sections, with further infrastructure upgrades and all-weather proofing planned to take place over the next 12 to 18 months.

Health and safety at Kipushi

At the end of Q1 2023, the Kipushi Mine reached a total of 1,469,552 work hours free of lost-time injuries and a Total Recordable Injury Frequency Rate (TRIFR) of 1.2 injuries recorded per 1,000,000 hours worked in the first quarter. For comparison, the TRIFR for 2022 was 1.9. It has been more than five months since the last lost-time injury occurred at the project.

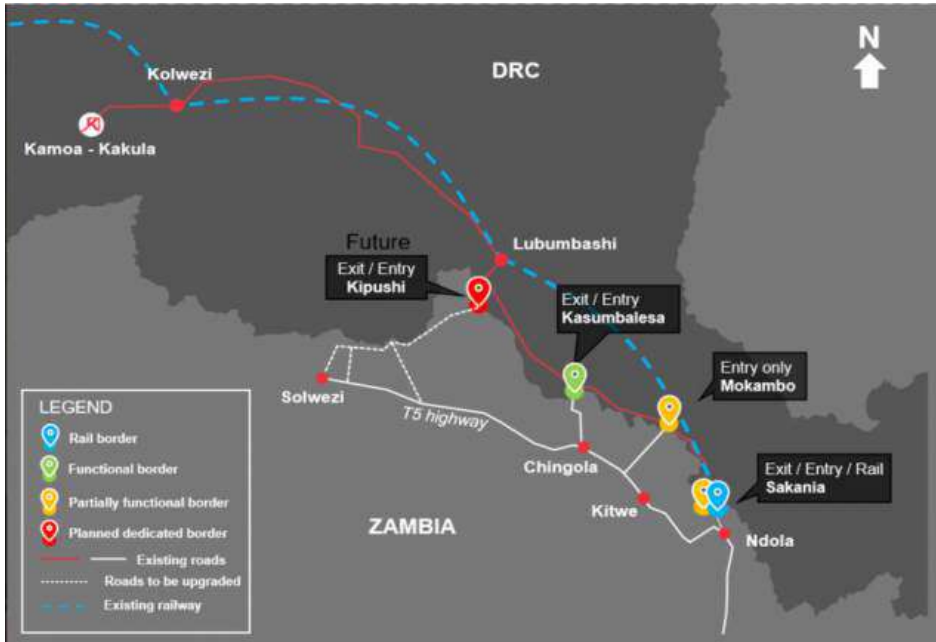
Kipushi follows the example of Kamo-a-Kakula with a strong focus on local recruitment and progressive workforce training

Approximately 1,480 employees and contractors are currently working on the construction of the Kipushi Project. Of the 536 full-time employees at Kipushi, more than 95% are Congolese and 11% are female. Female employee representation has risen from approximately 7% at the end of 2021.

A plan is underway to ensure that skills and practical experience gained during Kamo-a-Kakula's construction, commissioning and operations are shared with the leadership and operations staff at Kipushi.

Staff from Ivanhoe Mines regularly visit Kipushi and contributes to on-site capacity building, coaching and training, sharing lessons learned and experience gained at Kamo-a-Kakula, while key personnel from Kipushi visit Kamo-a-Kakula to learn from practical experience. A comprehensive up-skilling training program is also under development for Kipushi and is expected to be rolled out in Q3 2023.

Figure 1. Map of the current and planned commercial DRC-Zambia border infrastructure.



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ANGLO EXPLORES ZAMBIA AMID GLOBAL COPPER SUPPLY CRUNCH

ANGLO American is returning to full-scale exploration for copper in Zambia after signing the provisional JV agreement it struck with London-listed junior Arc Minerals in May last year.

In terms of the deal Anglo will own up to 70% of the JV company in return for the investment of up to \$88.5m including up to \$14.5m in cash. Arc – through its subsidiary Unico – will retain a meaningful 30% stake in any exploration discovery made by the joint venture.

According to John Meyer – analyst at London broking and research firm SP Angel – "the historic agreement marks the return and restoration of relations between Anglo American and the Zambian government.

The settlement is a meaningful event for both Zambia and Anglo with both parties working to ensure mutual respect and co-operation."

Meyer added, "Anglo appear to have a definite plan for development of copper to the west of Zambia inspired by Dave Wood, the discovery manager for Anglo in Zambia.

"The sheer scale of the investment, as indicated in the JV agreement, should enable Anglo to fully explore Arc's large and highly prospective package of licences in the west of Zambia.

These are in the Domes region of the Zambian Copperbelt which supports the giant Kamoa, Sentinel, Lumwana and Kolwezi copper mines. Arc claims two significant early discoveries at Cheyeza East and Muswema North.

"We understand all parties want to finalise the transaction as soon as possible

and for drilling to begin at the start of the imminent dry season."

Anglo's move is taking place against widespread predictions of a looming supply crunch in copper which is a metal essential to the energy transition with huge amounts needed for the construction of electric vehicles and in renewable energy equipment such as wind turbines.

Meyer commented, "we can see other majors following Anglo American into Zambia and other highly prospective regions as they ramp up exploration to discover the next generation of copper and nickel mines.

While automotive manufacturers struggle with efforts to thrift valuable commodities the world still looks to be a very long way short of the metal tonnages required to meet the demands of the EV revolution."

Arc executive chairman Nick von Schrinding said the deal was a major turning point for Arc Minerals and commented, "Upon closing this will see the recommencing of the exploration campaign by the Joint Venture under the management of Anglo American whom we are delighted to be partners with going forward."

This will be Anglo American's third venture into the Zambian copper industry. The group's original mines were nationalised in the 1960's after the country became independent under former President Kenneth Kaunda.

Anglo returned in the 1990's after Kaunda left office to help revitalize the country's collapsed copper sector under a new government more interested in foreign investment.

The group then pulled out again when subsequent governments proved to be more hard-line in attitude to the country's mining business.



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Global mining equipment: suppressing the different fire risks

Worldwide, the mining industry continues to work long hours to fulfil intense operating schedules. As a result, most of today's heavy duty mining equipment is in use almost 24/7.

Operating in an extremely demanding environment; with significant vibration, prolonged vehicle use and significant dirt and dust all increasing the risk of overheating, which means heavy duty mining vehicles are unavoidably prone to elevated fire risks.

What's influencing fire risk?

Although a mine's specific hazards will be identified in its own risk assessment, there are several general concerns that need to be addressed to guarantee the safe operation of heavy equipment in a mine environment.

1. Overheating

It can be difficult to always keep engine compartments clean on busy mining sites, since operations inherently produce a lot of dust and debris, which accumulates over time. To limit the risk of overheating, it's crucial that this is adequately monitored and managed.

Overheating can significantly increase the risk of a fire, even though it doesn't necessarily cause one on its own. When combined with other factors that can be brought on by an equipment's wear and tear over time, such as loose cables, sparks or damage to a diesel-engine vehicle's injection pipe, overheating can significantly increase the risk of a fire.

Although a certain level of overheating is a given for mining equipment, it must be managed to avoid bigger issues that raise the risk of fire.

2. Electrification

In keeping with global sustainability goals, there is a noticeable increase in the use of electric vehicles and equipment on mining sites.

Although probably less prone to overheating, electric vehicles (EVs) bring about a distinct form of fire risk, which originates from the lithium-ion (li-ion) batteries that are typically used to power them.

There are four primary causes of Li-ion battery fire risks:

- Over/under charging
- Mechanical influences or failures
- Exposure to heat
- Production issues.

Each of these problems has the potential to result in an internal short-circuit within the battery, which frequently results in a condition known as thermal runaway. Rapid temperature increases in a battery during thermal runaway can cause a fire, the release of potentially dangerous gases (often including hydrogen fluoride (HF), carbon monoxide (CO), carbon dioxide (CO₂), cyanide) and massive explosions.

A short-circuiting battery will release poisonous fumes before temperatures start to climb, signalling the start of thermal runaway. It's crucial to spot thermal runaway at this stage in order to reduce risk, and doing so calls for a special protective solution, because conventional detection systems frequently don't do so until temperatures have begun to rise.

3. Automation

The pandemic has accelerated the rise of automation of mining trucks and equipment, which enables continuous operations, lowers health risks linked with working in mines and boosts operational effectiveness.

Vehicle automation does change the fire risks, even if it represents a huge technological advance for miners. For instance, it may be more difficult to rapidly identify a fire risk and put the necessary preventative measures in place when vehicles are working autonomously and farther away from the mine's employees.

The need for autonomous detection and suppression solutions is increasing as a result of this. These solutions can detect and respond almost immediately to suppress risk, reducing the chance of downtime and limiting damage to the vehicle and other valuable assets.

How can operators reduce risks?

Operators can take a number of important precautions to lessen the various fire dangers posed by large machinery and vehicles, including:

1. Understanding the risks – through a comprehensive risk assessment.
2. Reconsidering the risk assessment map as processes, equipment and

technology changes.

3. Selecting the right detection system that addresses the site's individual risks.
4. Understanding li-ion battery chemistry to select the best protection solution.
5. Choosing the right suppression agent for the given application.
6. Minimising false activations by ensuring systems are compatible with vehicle technology.
7. Protecting all equipment – eg both combustion-engine vehicles and EVs.
8. Ensuring regular maintenance to keep systems operating effectively.
9. Training key personnel, so they know how to respond in the event of a vehicle fire.
10. Considering the site as a whole, including how new vehicles and machinery will operate in context.

Creating specialised solutions to handle specific dangers is essential for effectively suppressing fire risks at mining sites. This will ultimately increase safety and save downtime for operations.

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AFC PARTNERS WITH XCALIBUR FOR AFRICA'S NATURAL RESOURCE MAPPING

Africa Finance Corporation (AFC) the leading infrastructure solutions provider in Africa, and Xcalibur Multiphysics, the worldwide leader in airborne geophysics, have announced their intention to partner on mapping, developing and co-financing natural resource projects that will spur minerals and critical raw materials beneficiation in Africa.

The primary goal of the alliance is to support the development of the natural resource value chain on the continent, contribute to the energy transition by reducing dependency on fossil fuels and support the path to more diversified and sustainable economies.

The partnership was announced at a signing ceremony at the Mining Indaba in Cape Town, South Africa.

AFC and Xcalibur, through their partnership, will prioritise projects to locate and identify AFC's focus minerals, including precious, base and critical raw materials, comprising gold, diamonds, bauxite, manganese, copper, cobalt, graphite, lithium and rare earth elements.

As a result, African countries will have access to improved geological data, which will de-risk investments in the sector, create local jobs, unlock mineral resource wealth and ultimately support a more just energy transition on the continent.

Xcalibur will lead in providing the technical and mapping expertise, while AFC will lead in identifying and implementing investment and financing solutions for approved projects. Project development in seven priority countries is well advanced, extending soon to other African countries.

AFC is one of the largest investors in Africa's natural resources sector, leading transformational projects such as Nigeria's Segilola Gold Mine, the country's first private sector-led, commercial-scale gold project.

The Corporation is also the lead investor in several precious and transition metal projects in the region, including the Karowe diamond mine in Botswana, the Kipushi copper and cobalt project in the Democratic Republic of Congo, the Franceville and Okondja

manganese mining projects in Gabon and the Alufer Mining bauxite project in Guinea.

These investments, among others, target in-country value-addition and beneficiation from Africa's natural resources. The approach multiplies employment creation, increases export prices and government revenues, reduces trade costs and, importantly, minimizes the carbon footprint associated with exporting raw materials and reimporting finished products.

"Africa has the largest reserves of the minerals and metals required for the global energy transition; the challenge is a lack of investment in mining, transportation, clean energy and processing," remarked Sameh Shenouda, executive director and chief investment officer of AFC.

"This is exactly what this partnership aims to address, and we look forward to working with Xcalibur to develop and finance critical projects that transform Africa's resource wealth into economic fortune and spur economic diversification."

CMOC RESOLVES MINING ROYALTIES DISPUTE IN DRC

China's CMOC Group Ltd. has made a breakthrough in its long-running dispute with state-owned partner Gécamines over mining royalties in the Democratic Republic of Congo (DRC). This development could enable CMOC to begin exporting its stockpile of battery metals to global markets.

According to a filing made by CMOC on the Hong Kong stock exchange on Wednesday 19th April, both companies have reached a "consensus on the royalties issue" at the Tenke Fungurume operation.

The exports from Tenke, a major source of copper and one of the world's largest cobalt mines, were blocked by Congolese authorities since July last year due to the dispute.

No financial details of the agreement were

disclosed, and the filing did not mention any plans for exports. However, CMOC has continued to operate the mine throughout the dispute. However, the value of the copper and cobalt hoard stuck in the DRC was estimated to be around \$1.5 billion as of late February.

According to CMOC, smooth progress at Tenke will "further release" production capacity at the site, where an expansion is expected to start producing this year. This news caused CMOC's shares to soar by as much as their daily 10% limit in Shanghai and surged as much as 12% in Hong Kong.

The heart of the standoff was Gécamines' claim that CMOC was lying about its mineral reserves and that it owed Gécamines \$7.6 billion in royalties and interest. The two companies also needed to negotiate a sales contract to set the terms for

future exports.

Gécamines officials, a court-appointed administrator of TFM, and Congo's mines ministry did not immediately respond to text messages requesting comment outside normal business hours.

The resolution of this dispute will be watched closely in the cobalt market, where Tenke accounts for around 15% of global production. The prices of the battery material have fallen by nearly 60% in the past year due to weaker demand and rising supply from other mines.

In its statement, CMOC said it will strengthen joint activities with Gécamines, promote the economic development and well-being of the DRC, and make "greater contributions to friendly cooperations between China and the DRC."

GLENCORE SENTENCED TO PAY \$700 MILLION IN US AFTER BRIBERY GUILTY PLEA

U.S. judge on Tuesday 28th February ordered Glencore Plc to pay \$700 million in connection with its guilty plea over a decade-long scheme to bribe foreign officials across several countries.

The sentence handed down by U.S. District Judge Lorna Schofield in Manhattan federal court consisted of a \$428.5 million fine and \$272 million in forfeiture, in line with a plea deal reached last May between the mining and commodity trading giant and federal prosecutors in Manhattan.

Prosecutors have said Glencore paid more than \$100 million in bribes to officials in countries including Nigeria, Brazil, Venezuela and the Democratic Republic of the Congo to win business or avoid audits.

The fine is 15% below what U.S. sentencing guidelines recommend and reflects credit for Glencore's cooperation, including by providing documents that were located abroad and investing "significant resources" in improving ethics and compliance,

prosecutors said.

Overall, the Swiss-based multinational has said it expects to pay more than \$1.5 billion to settle bribery and market manipulation accusations, including more than \$1 billion in the United States.

Last year, Glencore was ordered to pay \$341 million in fines and \$144 million in forfeiture after pleading guilty to a market manipulation charge in Connecticut federal court.



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MINING TO COMMENCE IN ZAMBIA'S LOWER ZAMBEZI NATIONAL PARK DESPITE ENVIRONMENTAL CONCERNS

Mwembeshi Resources Limited, the company granted a license to conduct copper mining in the Lower Zambezi national park, is expected to start production before the end of this year, according to Emmanuel Tembo, the Member of Parliament for FEIRA constituency.

Tembo confirmed that preparations for mining have progressed, with the first production set to take place this year. The decision by Zambia's ruling UPND government to proceed with the mine has raised concerns among environmental experts who have called for a

halt to the project.

They question how the country will benefit from the proposed mine when previous governments have failed to maximize the benefits of existing large-scale mines in other provinces.

Despite this, Mr. Tembo believes that it would be foolish for the country to remain impoverished when it has numerous mineral resources that could bring in greater wealth.

He decried the fact that the Lower Zambezi is rich in various minerals, yet its people still live in poverty. Tembo stresses that the

commencement of actual mining in the area will increase revenue collection for the country and result in more businesses opening in the region.

The Lower Zambezi National Park, established in 1983, spans over 4,000 square kilometres and lies on the north bank of the Zambezi River in southeastern Zambia.

The proposed mine has reignited the age-old debate between mining for huge profits and the need to protect the environment, which the tourism sector has managed to handle better in the past.

KOBOLD METALS APPOINTS FEMALE CEO TO LEAD THEIR COPPER UNIT IN ZAMBIA

KoBold Metals, a Silicon Valley start-up that utilizes artificial intelligence to detect battery metal deposits, has appointed a lady CEO to head its copper unit in Zambia, making her the first female executive to hold such a position in a mining exploration company in the country.

Zambia is Africa's second largest copper producer and is witnessing a high demand for copper in the transition to a low-carbon economy.

Data from S&P Global Market Intelligence reveal that as of 2022, top female executives at global metals and mining companies held just over 11% of C-suite positions.

Mfikeyi Makayi, who hails from Zambia and holds a

master's degree in mining engineering from Britain's Camborne School of Mines, has worked with Canadian miner First Quantum Minerals and Caterpillar before assuming her current leadership position in Zambia.

In an interview, Makayi expressed her excitement, saying, "I am the first Zambian woman running an exploration or even a mining company in the country... (Mining) is something that will drive our economy into the future if we get this right."

Zambian President Hakainde Hichilema is targeting an increase in the country's copper production to three million tonnes a year by 2032, from around 850,000 tonnes last year. Hichilema emphasized

that "KoBold Zambia, with Mfikeyi at the helm," will play a critical role in achieving the country's ambitions to increase copper output.

KoBold has exploration partnerships with mining giants BHP Group and Rio Tinto and is supported by Breakthrough Energy Ventures, a climate and technology fund founded by Microsoft's Bill Gates and backed by Amazon's Jeff Bezos and Virgin's Richard Branson. Its Mingomba copper project in Zambia contains 247 million tonnes of ore with a high grade of copper, and it requires about \$1 billion in investment to be built. It is a joint venture with Australian private equity firm EMR Capital and state-backed miner ZCCM-IH.

EPIROC WINS LARGE ORDER FOR MINING EQUIPMENT IN DRC

JCHX, a mining contractor, has ordered several Epiroc loaders, mine trucks and drill rigs, including service support, for use at the Kipushi zinc, copper, germanium and silver mine in the Haut-Katanga province in southern Democratic Republic of the Congo. After decades of production the mine closed for care and maintenance in 1994. Construction started last year to re-open the mine, with late 2024 as target to start production.

The equipment order is valued at about MUSD 17 (MSEK 175) and was booked in the first quarter 2023.

"We look forward to supporting JCHX in making operations at the Kipushi mine as safe and

productive as possible," says Helena Hedblom, Epiroc's President and CEO.

"JCHX has been a customer of Epiroc for many years, both in Africa and Europe, and we are pleased to continue delivering innovative solutions that will help to optimize operations at Kipushi," says Sami Niiranen, President of Epiroc's Underground division.

JCHX International Division President Mr. Youcheng Wang comments: "From the Group headquarters to the front-line team, Epiroc sets the highest priority on this equipment order, also when it comes to on-site technical support."

The ordered equipment, manufactured in Sweden, includes Scooptram ST14 loaders, Minetruck MT42 haul trucks, and Simba production drill rigs.

The Scooptram and Minetruck machines will be equipped with Epiroc's telematics system Certiq, which allows for intelligent monitoring of machine performance and productivity in real-time, and with Epiroc's Rig Control System, RCS, which makes them ready for automation and remote control.

The Kipushi mine is owned by Kipushi Corporation, a joint venture between Ivanhoe Mines of Canada and Gécamines, a DRC state-owned mining company. The mine will be powered by clean, renewable hydro-generated electricity.

PIONEERING KIBALI PLANS FURTHER PARTNER-BASED DEVELOPMENT

Since Kibali went into production 10 years ago it has not only grown into Africa's largest gold mine, it has also opened a new mining frontier in the DRC and stimulated the development of a thriving regional economy in the country's North-East province, says Mark Bristow, Barrick president and chief executive.

Speaking at a media visit to Kibali yesterday 26th March, Bristow said the mutually beneficial partnership between the company and its local stakeholders, notably the government, contractors, service providers, employees and the community, had demonstrated that it was possible to build and operate a successful, world-class mine, run by host country nationals in one of Africa's remotest corners.

In the 13 years since the acquisition of the property which became Kibali, it has invested more than \$4.6 billion in the DRC, with payments to: local contractors and suppliers alone amounting to almost \$2.4 billion; \$1.4 billion going to the government

in the form of royalties, taxes and permits; salaries amounting to \$621 million; and the investment of \$196 million in infrastructure development and community support.

"Kibali has multiple partnerships with local businesses, many of which we have actively mentored, such as the all-Congolese team that built the mine's Azambi hydropower station," Bristow said.

"Kibali's three continuously upgraded hydropower stations and their battery back-up system have put it in the lead of the Barrick group's green energy drive. At present, approximately 80% of the mine's power requirement is provided by renewable energy sources and this will rise when the planned new solar plant is commissioned in 2025, further reducing Kibali's carbon footprint as well as its costs."

For the fourth successive year, exploration more than replaced the gold that Kibali mined in 2022, extending the

mine's Tier One¹ production profile to 2033 and growing reserves to a level equivalent that in the original 2010 feasibility study, despite producing more than 6.4 million ounces of gold since commissioning². It continues to explore for additional reserves to replace depletion at Kibali and for new growth opportunities elsewhere in the DRC.

The mine also continues to invest in the recruitment and training of Congolese nationals, who already account for 95% of its workforce and 76% of its leadership, with special emphasis on the skills development of potential managers and technicians.

The Barrick group is an industry leader in sustainability with a strategy that holistically links the management of challenges related to climate change, poverty and biodiversity loss. Kibali has a particular interest in the future of Africa's biodiversity and will write a new chapter in its long support for the DRC's Garamba National Park with the introduction of a sustainable population of white rhinos in partnership with African Parks and the DRC people.

DRC'S FINANCE MINISTER INSISTS ON CERTIFYING MIBA'S RESERVES BEFORE IMPLEMENTING \$453M RECOVERY PLAN

The "MIBA SA" has been experiencing serious difficulties for twenty years, the first visible signs of which appeared around 1998. They worsened over time to lead to the cessation of production in November 2008 and to resume in 2011 to date at an insignificant level. This company expects the government to finance its recovery plan estimated at 453 million USD to be implemented in 5 years.

The Minister of Finance, Nicolas Kazadi addressed the issue relating to the recovery plan for the Minière de Bakwanga (MIBA) during the press briefing held on Tuesday, April 25, 2023. For the national treasurer, the application of the recovery plan for the MIBA should only be done after the certification process for the underground reserves of this perimeter.

"MIBA has a huge history. It owes its

employees and suppliers several hundred million USD. No mining investment is made, if one does not have the exact evaluation of the reserves which are in the perimeter of the basement of the mine considered.

MIBA does not have a good knowledge of its reserves. She has already consumed mines that were on the surface. It has great reserves but which are not fully known enough.

We have given priority to the certification of reserves in this part of the country which has not only diamonds but also nickel and chromium," said Nicolas Kazadi.

For Nicolas Kazadi, the current certification of MIBA's reserves will allow investors to take an interest in MIBA again.

"As soon as we have finished the current certification, we will have elements to bring in investors. In the meantime, we are saving the essentials, by paying the employees'

salaries every month," said Nicolas Kazadi.

To enable MIBA to better relaunch its activities, Nicolas Kazadi announced funding of at least 3 million USD for the construction of an electric dam to increase the energy capacity of the city of Mbuji-Mayi.

"There is also the question of energy which concerns the whole province. We are making investments to strengthen energy production capacities in Mbuji-Mayi to enable MIBA to survive a little better," he said.

In the Democratic Republic of Congo, Miba, the Bakwanga diamond mining company, has long been one of the flagships of the country's economy. After several years at a standstill, it gradually restarted in 2011. But today its business is no longer as lucrative. In the 1980s, it supported 40,000 people, employees and their families.

ZAMBIA'S 2022 GOLD PRODUCTION DROPS BY 38%

Zambia's 2022 annual Gold Production has dropped from 2,432 metric tons produced in the previous year 2021 to now 1,515 metric tons produced in the year 2022.

According to a consolidated mineral production report obtained by the *Zambian Business Times* –ZBT, the 2022 reduction represent 917 metric tons. The drop is largely attributed to lack of traction by the mines ministry to formalize known artisanal mining activities and failure to timely re-open Kansenseli and Mumbwa Gold Mines among others.

At a time when gold mining is supposed to have been on the increase, traditional leaders and concerned residents of Mwinilunga in North Western Province

have told ZBT that corrupt senior officials in government have been resisting re-opening the gold mine as they have some illegal miners sneaking in to mine.

A legislator from the gold rich Mwinilunga district accused the Zambia National Service –ZNS (a state security wing charged with the responsibility of guarding the mine) of facilitating gold theft from then closed Kasenseli mine. Gold mining is a Lucrative amen which can be financed even locally but some corrupt government technocrats want to sell to cash in on commission and facilitation fees.

Meanwhile, a Mining Expert Edward Simukonda has attributed this massive decline to the

continued closing and failure to re-open gold mines like the state owned Kasenseli Gold Mine and Mumbwa Gold mine among others. Simukonda told the *Zambian Business Times* – ZBT- that the continued closure of the state owned gold mine and others is negatively affecting Gold production in the Country resulting into reduced forex inflows.

The continued closure of the state owned Kasenseli Gold Mine in Mwinilunga District is also affecting the country's revenue generation. Simukonda said Government had also restructured its system at the Cadastre department which he said had also affected a number of companies leading to the slowed down production.



DRC-ZAMBIA-USA TRIPARTITE EVALUATES THE AGREEMENT ON THE BATTERY INDUSTRY

After the INDABA Mining Forum in Cape Town, South Africa, the agreement on the battery industry was once again at the heart of discussions within the DRC-Zambia-USA tripartite, on Saturday April 15, 2023, in Washington, DC, United States.

Signed in December 2022, the memorandum of understanding is in line with the objective of the DRC and Zambia to set up a productive supply chain, from the mine to the assembly line, while committing to international standards to prevent, detect, and prosecute corruption throughout this process.

"We have been invited by the Biden administration. I, Julien Paluku Kahongya, the Congolese Minister of Industry, and my colleague from Finance, Nicolas Kazadi, were received this Saturday in Washington DC at the

State Department by the Deputy US Secretary of State for the Economy, Energy, and the Environment, Mr. José W. Fernandez.

We were there to assess the collaboration agreement signed in Washington last December between the Congolese, Zambian, and US Governments for the development of a regional value chain around the battery and electric vehicle industry," said Julien Paluku, the Congolese Minister of Industry.

In addition, Julien Paluku specified that this meeting precedes the launch of the pre-feasibility study for the installation of the first manufacturing plant planned in the province of Haut-Katanga.

According to Julien Paluku, this meeting was an opportunity for the American administration to reaffirm its firm determination to support the

realization of this major project likely to boost several African economies.

However, it should be noted that the DRC produces more than 70% of the world's cobalt.

Zambia is the world's sixth-largest producer of copper and the second-largest producer of cobalt in Africa.

These resources brought together through this cooperation constitute essential elements of the energy transition that the world urgently needs.

It should be noted that the electric battery supply chain development plan will enable open and transparent investments to build a value-added and sustainable industry in Africa, serving a just energy transition for workers and local communities.

ZAMBIA AND DRC AGREE TO 24/7 KASUMBALESA BORDER OPERATION

Zambia and Democratic Republic of Congo (DRC) have signed a Communique to start operating Kasumbalesa boarder facility on a 24 hours window.

Copperbelt Province Minister Elisha Matambo, Mines Minister Paul Kabuswe and Commerce & Trades Minister Chipoka Mulenga met their DRC counterparts at Kasumbalesa Boarder on the Copperbelt Province of Zambia last evening.

The DRC entourage included Commerce & External Affairs Minister Jean Lucien Bussa, Vice Governor Haut Katanga Region Jean Claude Kantwa and DRC Ambassador to Zambia Paulo Costa.

The Communique was signed between Zambia and DRC following the meeting the two Head

of States Mr Hakainde Hichilema and his counterpart Mr Felix Tshisekedi had in Ethiopia recently.

Zambia's Minister of Commerce & Trades Chipoka Mulenga signed on behalf of the Zambian government while DRC Minister of Commerce and External Affairs Jean Lucien Bussa appended the signature on behalf of Congolese government.

Addressing the media, two ministers disclosed the agreed items in the Communique ; all boarder agencies to start operating on 24 hour window to be implemented after one week of signing the Communique, both countries agreed to authorize all types of commercial goods to pass through Kasumbalesa, Kipushi and Mukambo boarder facilities, Zambia agreed to upgrade boarder facilities at

Kasumbalesa, Kipushi, Sakania and Mukambo boarders.

Other agreed measures are Zambia to reconsider night restrictions of movement of commercial cargo to be implemented within one week of signing, DRC to put a new building at Kasumbalesa boarder for effective processing of documents and DRC committed to upgrade parking and risky yards and also to construct a ring road on the Congolese Side.

DRC requested Zambia to hold next meeting in DRC on a day to be communicated by the Congolese authority to go and cement more agreements aimed at benefiting two peoples.

The agreed Communique is aimed at ending the traffic empassé at Kasumbalesa boarder to enhance trade not only for two countries but also for entire SADC and COMESA region.



DRC DOMINATES GREEN METAL PRODUCTION, BOOSTING COBALT SUPPLY IN 2022.

The cobalt market has seen its biggest increase in supply in 2022, driven by booming production of the crucial battery metal in the Democratic Republic of Congo and Indonesia, according to specialist trading firm Darton Commodities, reports. [mining.com](https://www.mining.com).

Mined cobalt supply rose 23% to 187,060 tonnes in 2022, in a surge in supply that erased a large deficit seen in 2021 and left the market in one of its biggest surpluses ever. At the end of the year, Darton said Monday in its annual cobalt report.

This surge in supply has been driven by increases in the DRC – which accounts for around 75% of global supply – as well as Indonesia, an emerging power in the small but rapidly growing market.

The DRC produced more than 111,000 tons of cobalt in 2022.

It was observed that this surge in supply coincided with a sharp slowdown in demand from the electronics sector, which rivals the electric vehicle industry as the biggest consumer of battery metal.

While surging EV sales helped fuel a sharp rise in prices at the start of 2022, cobalt has since fallen more than 60% from its June peak.

Global mining production is estimated to have increased by 42% between 2020 and 2022 amid the easing of supply chain constraints related to Covid-19, the ramping up of existing operations and the commissioning of several new

mines, according to Darton.

In 2022, Glencore Plc was by far the largest mineral miner in the world, mainly from its two operations in the DRC. Eurasian Resources Group and China's CMO Group Ltd., which also have significant operations in Congo, followed the Swiss company as the biggest producers.

Last year, 44% of the world's mining supply was owned or controlled by Chinese companies, which also account for 78% of refined cobalt output, according to Darton estimates.

Mining output is expected to increase by around another third over the next two years, the UK-based trading house said, the same source reports.



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NORTHWEST ZAMBIA'S DOMES REGION HIGHLY PROSPECTIVE FOR COPPER MINING

According to Nick von Schirnding, Executive Chairman of junior explorer Arc Minerals, the Domes region in northwest Zambia is highly prospective for copper mining, making it one of the most promising areas in the world for the commodity.

The region is attracting attention from several mining majors due to the fact that First Quantum Minerals' Sentinel mine produced 816,435 tonnes of copper in 2021, making it Africa's biggest copper mine.

Arc Minerals has an area of 870 km² of land in the Domes region, where it is exploring for copper. Von Schirnding said

that the region is a new copper mining province within Zambia and currently accounts for more copper production than the traditional Zambian Copperbelt.

The company's exploration efforts in Zambia have resulted in "encouraging" results, with virtually every drill hole intersecting copper mineralization. Anglo American signed a joint venture agreement with Arc Minerals in May 2022 in relation to the Zambian licenses.

Arc Minerals is a London Stock Exchange-listed mining company with a focus on exploration and development of copper and cobalt deposits in Africa. The company was founded in 2017 and is

headquartered in London, United Kingdom. Arc Minerals has interests in several mining projects across Zambia and the Democratic Republic of Congo (DRC).

In Zambia, Arc Minerals holds a majority stake in the Zamsort copper-cobalt project, which is located in north-western province of Zambia. The project has shown significant potential for copper and cobalt mineralization.

In the DRC, Arc Minerals owns a 99% stake in Casa Mining, which holds exploration licenses covering over 1,200 square kilometers in the gold-rich eastern region of the country.



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ZIMBABWE TO LAUNCH GOLD-BACKED DIGITAL CURRENCY



Zimbabwe's central bank has announced plans to introduce a gold-backed digital currency to the public from May 8th. The move is aimed at stabilizing the country's currency, which has fallen 35% against the US dollar this year, and providing an alternative to the US dollar for transactions.

The digital tokens will be sold through banks in local and foreign currency at a 20% margin above the interbank mid-rate, and will be introduced in two phases. Initially, they will be used for investment purposes before being rolled out for transactions.

According to the central bank governor, John Mangudya, the tokens are intended to expand the value-preserving instruments

available in the economy, enhance the divisibility of investment instruments, and widen their access and usage by the public.

To support the project, the central bank has been building gold reserves and acquiring other precious minerals since 2022. The bank's monetary policy committee member, Persistence Gwanyanya, has stated that the project will require approximately \$100 million of gold.

The plan for the digital currency was approved by the monetary policy committee in March, following the introduction of gold coins as a store of value in Zimbabwe in 2022. Nigeria became the first African country to launch a digital currency in 2021.

ANGOLA, ZAMBIA, AND DRC CREATE TRADE CORRIDOR TO TRANSFORM REGIONAL SHIPPING

Angola, Zambia, and the Democratic Republic of Congo (DRC) have signed an agreement to create a trade corridor that could potentially revolutionize the transportation of the region's resources.

The corridor, known as the Lobito Corridor, will connect the mining areas of Katanga province in the DRC and the Copperbelt in Zambia to the Atlantic port of Lobito in Angola.

According to mining company Pensana in a statement, "harmonizing regulations on the corridor and infrastructure development will allow the three countries to transport metals used to manufacture electric vehicles and wind turbines from inland mines to port", significantly reducing transport time from weeks to days.

The Lobito Corridor is set to become an alternative strategic route to the export

markets of Zambia and the DRC and offers the shortest route that connects the main mining regions of these two countries to the sea.

The three states, all members of the South African Development Community (SADC), have agreed to jointly develop harmonized regulations and corridor systems to promote infrastructure development.

The agreement also includes the joint management of a commercial corridor to and from the Atlantic port of Lobito, which was recently awarded a concession to the Portuguese infrastructure group Mota-Engil for a US\$450 million upgrade.

The transport ministers of the three countries have signed the agreement to facilitate the Lobito Corridor, which will significantly enhance the region's transportation system and help to drive economic growth.



SEAFLOOR MINING LOWERS BATTERY METALS' ENVIRONMENTAL IMPACT, STUDY FINDS

The Metals Company (TMC) on Tuesday 21st of March released the results of a lifecycle assessment of the environmental impacts of the company's NORI-D Polymetallic Nodule Project carried out by Benchmark Mineral Intelligence.

TMC's project in the Clarion Clipperton Zone (CCZ) in the Eastern Pacific Ocean, between Hawaii and Mexico aims to bring online the planet's largest undeveloped deposit of battery metals. The nickel, cobalt, manganese and copper are found in potato-sized rock-like nodules

The Benchmark study assessed, among others, the global warming potential, acidification, eutrophication, particulate matter formation and water consumption of mining, transport, processing and refining of the metals including an intermediate NiCuCo matte product and end-products nickel sulfate, cobalt sulfate and copper cathode.

The comparison to producing the same metals via key land-based routes, including from Indonesian nickel laterites and mixed cobalt and copper sulfides and oxides mined in the Congo showed NORI-D performed better in almost every impact category.

Currently the DRC is responsible for some 70% of global cobalt production, while Indonesia's share of nickel output has grown to over 40%. NORI-D only underperforms when it comes to global warming potential and water consumption of cobalt sulfate from one land-based route from the DRC refined in China.

When it comes to nickel production the comparative impacts are particularly dramatic – the study found that Vancouver-based TMC's nickel sulfate product would outperform not just Indonesian nickel but all other key land-based production routes, lowering emissions by between 70-80% on average, including with 70% lower global warming effects.

Seafloor Mining lowers Battery metals' Environmental impact, study finds 2
NEW SEABED MINING CODE

The International Seabed Authority (ISA) has been working on a framework for deep sea mining since 2014 and is set to issue its approved mining code within months.

It is estimated that 21 billion tonnes of polymetallic nodules are resting on the ocean floor in the CCZ. Almost 20 international mining companies have contracts to explore the region which collectively span an area of 1.28 million km², with 1.97 million km² of the region also under protection. Accounting for 90% of all nodule exploration activity, the area is considered the most prolific area for ocean mining.

TMC through its subsidiaries holds exploration and commercial rights to three polymetallic nodule contract areas in the CCZ regulated by ISA and sponsored by the governments of Nauru, Kiribati and the Kingdom of Tonga.

Millions of years old, the nodules grow by absorbing metals from the seawater, expanding slowly around the core of a shell, bone, or rock.

TESLA'S CO-FOUNDER MAKES GAME-CHANGING ANNOUNCEMENT ABOUT THE FUTURE OF EV BATTERIES

Great news for anyone hoping to buy an electric car in the future and for anyone who cares about our planet: A company that recycles lithium-ion batteries just announced that after a yearlong pilot program, it was able to recover important metals from used batteries at an incredible rate of more than 95%.

The company, Redwood Materials, was founded by JB Straubel, one of the five Tesla co-founders and the company's former CTO.

Tesla has been slowly moving the world away from transport powered by dirty energy sources and toward electric vehicles. EVs are much less destructive to our planet than gas-powered cars, which release around 5 tons of planet-warming gases per year.

However, one issue with EVs is that their batteries rely on lithium, a chemical that has to be extracted from the Earth via mining. This mining process uses excessive amounts of water and is highly destructive to the surrounding environment.

Though its effects are not as bad as the effects of mining for dirty energy sources like oil and coal, they must be meaningfully addressed in order

for EVs to truly be considered environmentally friendly.

That's why Straubel moved on from the car company to start Redwood Materials.

The problem facing lithium recycling in the past was not that it couldn't be done. It's that the infrastructure was not yet in place for it to be economically viable for profit-driven companies.

Previously, there have not been enough used lithium-ion batteries recycled on an industrial scale. But as EVs become more and more popular, that is changing quickly.

And if the preliminary results are any indication, Straubel's Redwood Materials is more than ready to occupy that space.

For the past year, Redwood Materials has been collecting old EV battery packs from automakers such as Volvo, Ford, and Audi. In total, it collected 1,268 battery packs and recovered the lithium, cobalt, nickel, and copper contained within at a whopping rate of above 95% efficiency.

As Electrek points out, this is even better when you consider that the recycling efficiency rate of gasoline is 0%.

MACHINE LEARNING IN THE OIL AND GAS INDUSTRY: ML ROLES AND APPLICATIONS

Machine learning (ML) is a technology that is having a critical impact on the oil and gas industry and is becoming an important technology for industry stakeholders. Here is where it is having an impact today, what ML applications are being used, and what the future holds.

WHAT IS MACHINE LEARNING?

Machine learning is a branch of artificial intelligence (AI) in which computer systems are trained to receive large sets of data and derive a conclusion. This training can come in addition to or instead of manual programming.

These intelligent machines learn over time using the data they receive and update themselves to perform better the next time based on their experience.

This AI process can be compared to the way people learn. Children don't need to be programmed to understand the world. Instead, they learn by watching their parents and the environment around them.

As they learn and grow, they behave differently based on their new experiences and focus on the things that bring the most value. Similarly, machine learning can help oil and gas companies use data to focus more of their time on the highest-value opportunities.

Of course, the more data companies have, the better their machine learning opportunities will become. This is an exciting prospect for oil and gas companies, which regularly deal with mountains of information about oil and gas pipelines, well testing, geophysical data, and much more.

An accurate statistical analysis of this data can help make millions of dollars' difference to a company's bottom line. Learn more here for a primer on what is machine learning.

ML IN THE OIL AND GAS INDUSTRY

ML in the oil and gas industry can be divided into three main categories:

1. Extraction of knowledge from data. As mentioned, the oil and gas industry generates enormous data. However, that data is of little use stored in a logbook or computer program. With the help of machine learning, this data can be processed to make the inferences and decisions that can shape a company's trajectory.

2. Predictive analytics for planning and forecasting. Oil and gas companies can also put past data to use, such as one well's oil production history or a collection of seismic surveys done in a certain area. Machine learning can help companies use that data to make predictions.

For example, if a company has collected data regarding how oil production from wells typically varies during the year, they can use machine learning to predict how much oil will be produced in future years. This knowledge can then be used for long-term planning to make the oil company more profitable.

3. Optimizing production through data. When oil and gas companies are extracting fuels from the earth, it is critical to do so as efficiently as possible. Machine learning can help companies use their data to identify the most efficient ways to set up production. This can include anything from determining optimal well spacing, deciding where to drill, and testing different techniques for fracking.

These three categories exhibit how machine learning can help oil and gas companies make better decisions today and plan for the future based on past data. This will be critical as they face the challenges of improving their workflow while adapting to new technologies.

MACHINE LEARNING APPLICATIONS IN THE OIL & GAS INDUSTRY

There are several areas where machine learning can be applied to help improve oil and gas industry workflows, including:

- Real-time drilling
- Reservoir engineering
- Oil and gas production and procurement
- Downtime prevention
- Well testing
- Geophysical analysis
- And more

What many people do not yet realize about machine learning is how it can benefit humans on the job. The above application areas include a wide range of tasks that involve oil and gas industry employees. Machine learning can help these employees become more efficient at their jobs, help them make better decisions, and improve the quality of products they produce.

WHAT ARE THE ML CHALLENGES IN OIL AND GAS?

Machine learning is already making a positive impact across many industries. However, the transition will not happen overnight. As the oil and gas industry prepares to incorporate machine learning, it is important to recognize the challenges involved:

Increased need for scientists. The first significant challenge is the oil and gas industry's need to hire data scientists qualified to extract knowledge from industry data.

This may be difficult for companies that already have a shortage of workers or companies in regions where there aren't many people with data science skills.

Data processing power. Another challenge is the large amount of data oil and gas companies deal with daily. This means that the machines doing the analysis will need to be very powerful to process it all in a reasonable amount of time.

Up-front time investment. Finally, training the machine learning algorithms to recognize valuable data patterns for oil and gas companies will require a great deal of time and effort. However, the payoff of accurate models to make data-backed decisions will be worth it for oil and gas companies.

The realization that machine learning techniques can be successfully deployed for oil and gas companies is still occurring across the industry. As more energy companies investigate ML use cases, we will see an increase in its adoption. This will certainly change how oil and gas companies operate, and it is just one example of how data science is changing how we do business.

THE FUTURE OF MACHINE LEARNING IN THE OIL AND GAS BUSINESS

Oil and gas companies are already using machine learning to help with prediction models, produce better results from their resources, and optimize their processes. Machine learning has the power to revolutionize the oil and gas industry. This forward momentum is crucial for the sector solely responsible for keeping the rest of society moving.

In the coming years, we will see more and more ML technologies used by oil and gas companies around the world. In fact, the future of the oil and gas industry can be found in the convergence of many different technologies, including machine learning. Companies who adapt early can improve their resource optimization and gain a more detailed look at their progress.



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We are thrilled to announce that as media partners of **DRC Mining Week 2023**, we are currently working on a special edition of the **CKM eMagazine**. This edition will be distributed at the **DRC Mining Week 2023** in Lubumbashi, **Democratic Republic of Congo**, from June 14-16, 2023.

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OYU TOLGOI MINE BEGINS BATTERY ELECTRIC JOURNEY WITH A NORMET SMARTDRIVE UTIMEC

Oyu Tolgoi in Mongolia, one of the world's largest copper-gold mines, recently received its first battery-powered mining vehicle for trials – a significant milestone for the underground operation and a testament to the successful collaboration of multiple teams.

The machine is a Normet Utimec MF100 Material SD where SD stands for SmartDrive – Normet's modular Li-ion battery electric vehicle (BEV) architecture designed to optimise energy consumption and performance in underground mining and tunnelling applications.

IM understands that the machine is fully owned by Oyu Tolgoi and is just the first of several equipment types to be trialled at the mine, including prime movers such as LHDs but also drill rigs and bolters.

The Utimec machine will start operation in the coming months after workforce training and establishment of charging infrastructure, which is in progress.

Normet says the model is designed for bulk material transportation in underground mines and tunnels. It has a 10 t payload capacity and two different platform versions with the one at Oyu Tolgoi equipped with a crane for loading

and unloading.

It has a fast charging capability, and two high-torque direct drive electric motors, which provide instant torque and efficient operation without any local emissions.

Energy recuperation technology comes as a standard feature. Batteries are charged during downhill driving and deceleration which further increases total efficiency of the operation.

The maximum speed is 20 km/h, and a fully reversible 4WD with high traction capability and instant torque ensures safe and sure movement in difficult ground conditions.

The majority of the braking is done via electric motors recuperating energy, but the vehicle also includes efficient hydraulic dual-circuit oil immersed multi-disc brakes to provide additional braking power when it is needed.

The vehicle has a front axle suspension system, which improves safety, driving comfort and increases component lifetime.

In terms of the bigger picture at Oyu Tolgoi, at the end of the December 2022 quarter, a total of 19 drawbells had been fired. Drawbell progression accelerated

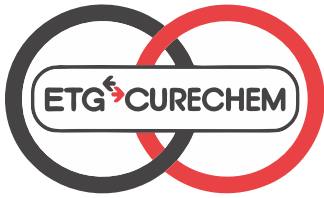
as a result of improvement initiatives implemented by the Oyu Tolgoi teams, bringing projected first sustainable production from Panel 0 forward to the first quarter of 2023 (previously first half of 2023).

At the end of December, shafts 3 and 4 sinking reached 378 m and 507 m below ground level, respectively. Final depths required for shafts 3 and 4 are 1,148 and 1,149 m.

Construction of conveyor to surface works continued during the quarter with civil scope of works completed and other contractors mobilized to site. Study work for Panels 1 and 2 (which are required to support the ramp-up to 95,000 t of ore per day) remains on track to be completed in the first half of 2023.

Rio Tinto now has a 66% interest in Oyu Tolgoi LLC, the mine operating company, following its successful completion of the acquisition of Turquoise Hill Resources Ltd; with the Government of Mongolia retaining 34%.

This is allowing Rio Tinto to focus fully on strengthening its relationship with the Government of Mongolia and it says is moving the project forward with a simpler and more efficient ownership and governance structure.



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GLOBAL CARMAKERS NOW TARGET \$515 BILLION FOR EVS, BATTERIES

Global automakers are planning to spend more than half a trillion dollars on electric vehicles and batteries through 2030, according to a Reuters analysis, amping up investments aimed at weaning car buyers away from fossil fuels and meeting increasingly tough decarbonization targets.

Less than three years ago, a similar analysis by Reuters found car companies planned to spend \$300 billion on EVs and related technologies. But looming zero-carbon mandates in cities such as London and Paris and countries from Norway to China have lent additional urgency to the industry's EV-related investment commitments.

The most recent analysis shows carmakers planning to spend an estimated \$515 billion over the next five to 10 years to develop and build new battery-powered vehicles and shift away from combustion engines.

But industry executives and forecasters remain concerned that consumer demand for EVs could fall well short of aggressive targets without substantial additional incentives and even greater spending on charging infrastructure and grid capacity.

Brian Maxim, head of global powertrain forecasting at AutoForecast Solutions, likens the growing investment commitments in vehicle electrification to the Cold War: "Once a few manufacturers announced EV programs, everyone else had to announce their own or be viewed as being left behind."

However, he added, "this leaves a lot of vehicle manufacturers planning significant volumes for a vehicle category that has unknown consumer acceptance, and will

have minimal to no profit" for years.

Reuters compiled the investment data from company statements, investor presentations and regulatory filings.

Global automaker EV & battery investments
Global automaker EV & battery investments

Other surveys have come up with different spending projections. In June, consulting firm AlixPartners said auto industry investments in electric vehicles would reach \$330 billion by 2025.

In 2020, all global automakers combined spent nearly \$225 billion on capital expenditures and research and development, according to AlixPartners.

Tesla Inc (TSLA.O), the world's largest EV manufacturer, appears to be the one company that is selling virtually every vehicle it can build and is readying new multibillion-dollar "gigafactories" near Berlin and Austin that will significantly boost its annual production capacity. In early November, the company was valued at \$1.2 trillion, more than twice the combined value of Volkswagen AG (VOWG_p.DE), Toyota Motor Corp (7203.T), Ford Motor Co (F.N) and General Motors Co (GM.N).

Meanwhile, political and regulatory pressure is building on the world's carmakers to begin phasing out production of fossil-fueled vehicles, including gasoline-electric hybrids, over the next 10-15 years, while ramping up output of full electric models.

A number of countries, from Singapore to Sweden, have said they will ban sales of new combustion engine vehicles by 2030. U.S. President Joseph Biden has said he wants

40% to 50% of sales to be electric vehicles by 2030.

Germany's VW Group, which is still recovering financially from the 2016 Dieselgate emissions cheating scandal, continues to lead the rest of the industry, with more than \$110 billion in EV and battery investment commitments through 2030. Those commitments, which represent more than 20% of the industry total, underpin VW's aggressive rollout plans for millions of EVs in Europe, China and North America over the next decade.

VW's investments, like those of many of its rivals, are aimed at improving the range and performance of batteries and lowering the cost of EVs, as well as expanding battery and EV production across the globe, according to public data released by the companies.

VW and fellow German automakers Daimler AG and BMW AG (BMWG.DE) are planning to spend a combined \$185 billion through 2030, while U.S. automakers GM and Ford expect to spend nearly \$60 billion through 2025.

Chinese automakers, led by VW and GM local partner SAIC Motor (600104.SS), have announced well over \$100 billion in investment targets over the next decade. Japanese automakers lag far behind, with Honda Motor (7267.T), Toyota Motor and Nissan Motor (7201.T) so far publicly committing less than \$40 billion combined.

These investments do not include the tens of billions of dollars being invested in additional production capacity by the world's largest battery companies, many in cooperation with their automaker partners.

ALTERNATIVE BATTERY MINERALS GAIN FAVOR

Due to the explosion of the battery mineral market, the hunt has been on to find and develop more affordable alternatives.

In the past decade there has been a massive global shift towards the utilisation of batteries in an increasingly wide range of applications.

The most notable has been in stored power packs from PV installations to rechargeable batteries for the Electric Vehicle (EV) market that is increasingly putting higher demands on the delivery of critical minerals and metals.

This demand has led to some of these minerals and metals being used in geopolitical manipulation of markets and unpredictable fluctuation of prices.

China has been the major producer, importer and beneficiation centre for most of these battery minerals and metals, dominating the market. In the past four years China has however overplayed their position in the international market.

The response from specifically Western powers has been to seek supply security. The measures taken range from fast-tracking mining operations and the construction of beneficiation plants, to passing legislation that support the circular economy and urban mining efforts, such as the requirement to producers to ensure that metals can more effectively be recovered from devices being recycled.

There have also been steps taken to increase the volumes of recycled electronics to be collected and delivered to recycling plants.

The price of critical minerals and metals are however driven by demand too. The supply shortage and the long ramp-up periods required to bring new mines and processing plants into production has resulted in the prices remaining high.

This has led several high-volume producers to spent increasingly more time and funds on developing alternative that will both ease the bottleneck in supplies and at the same time drive down the cost of batteries.

Reduction of cobalt and lithium demand (Alternative battery minerals gain favour)

The London Metal Exchange cobalt price has slumped to a three-month average of USD34,180 per tonne in March 2023, compared with a four-year high of USD82,000/t in May 2022, with lows for cobalt prices are not far from the low USD26,000/t price average of 2019.

The slowing of EV sales growth and battery production, combined with the resulting pressured prices of cathodes in mainland China, is expected to place a cap on cobalt prices for the remainder of

this year.

The subdued demand can be attributed to the elimination of subsidies offered to new buyers by the Chinese government since 2010.

Demand for cobalt in batteries within consumer electronics such as laptops and phones will remain low in light of the global economic slowdown the persists. It was noted that worldwide smartphone shipments declined by 9.7% year-on-year in the third quarter of 2022, to 301-million units.

In contrast to EVs, the demand for electronics is projected to recover and increase during the course of the year.

There is also a pivoting preference towards reduced cobalt or cobalt-free battery chemistries is likely, which will drive cobalt prices downward in the future.

Producers are increasingly producing lithium-iron-phosphate (LFP) batteries, which are cobalt-free, safer and less expensive. There is also a push to develop lithium sulphur cathodes, which will further decrease reliance on the Chinese market for supply.

A major driver has been concerns around ethical sourcing of cobalt in the DRC. The new hub for cobalt production is Indonesia, indicated to increase their global contribution from 5% to 20 by 2030.

Lithium has however not escaped the downturn either. Prices of lithium carbonate, the benchmark product, have halved between November 2022 and March 2023. Chinese automaker, Nio, indicated that it foresees lithium prices will quite likely drop to around 200 000 yuan or lower in Q4.

Lithium supply is suggested to be heading for a major increase this year as a wave of expansions and new projects go operational. However, it remains to be seen if these projects will produce as expected in the light of spodumene prices slumping too.

Alternative battery minerals (Alternative battery minerals gain favour)

Active development of battery packs that would use lithium-ion and sodium-ion cells, to supply to the EV market, is happening. Sodium is more abundant and offers potential safety benefits over lithium, it however does not have the same energy density, which at the moment means it will not be able to drive as far as a Li-ion battery pack installed EV.

Sodium-ion batteries can leverage the same manufacturing processes as the lithium-ion industry. This means a notably shorter Research

and Development phase and using off-the-shelf equipment to manufacture.

The use of similar materials and components, including electrolytes and separators, to aluminum current collectors, suggests it could also benefit from the existing economies of scale.

At the moment, Na-ion batteries are more expensive than Li-ion batteries, due to low volumes and underdeveloped supply chains.

The main challenge that would need to be addressed is the lower energy density. This means any vehicle using an Na-ion battery would need heavier batteries for the same amount of kilowatt-hour capacity.

Na-ion batteries at the moment has 25% lower capacity compared to current LFP battery packs. The steep decrease in lithium prices may also impact on the cost benefits of the Na-ion battery packs.

The upside potential however is the potential for material savings and energy-density improvements, halving costs in future.

The major advantages to sodium-ion include a more geographically diverse distribution of raw materials. It is also non-flammable and perform well at low temperatures in contrast to Li-ion batteries.

A prototype has been developed by HiNa Battery Technologies and installed in the JAC Sehol E10X electric car, which has only sodium-ion cells. These cells use sodium-iron-manganese-copper cathodes and have an energy density of 140 watt-hour per kilogram.


The other metal that comes with an expensive price tag is the REE permanent magnets used in EVs. There has also been concerns around environmental and health risks.

China is also the dominant REE producer and in 2020 shocked the market by reducing the volumes of REE being produced and exported.

This led the market to seek alternatives to REE and reduce reliance on commodities that can be most susceptible to excessive price variations. China accounts for around two-thirds of REE mining and 85% of refining of the ore into permanent magnets for the market.

Development of alternative to permanent REE magnets have focused on the production of ferrite magnets, made of iron and mixed with barium and strontium, which both are more widely available globally and cheaper to produce. The downside is that the use of these magnets will come with a weight or efficiency penalty.



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