

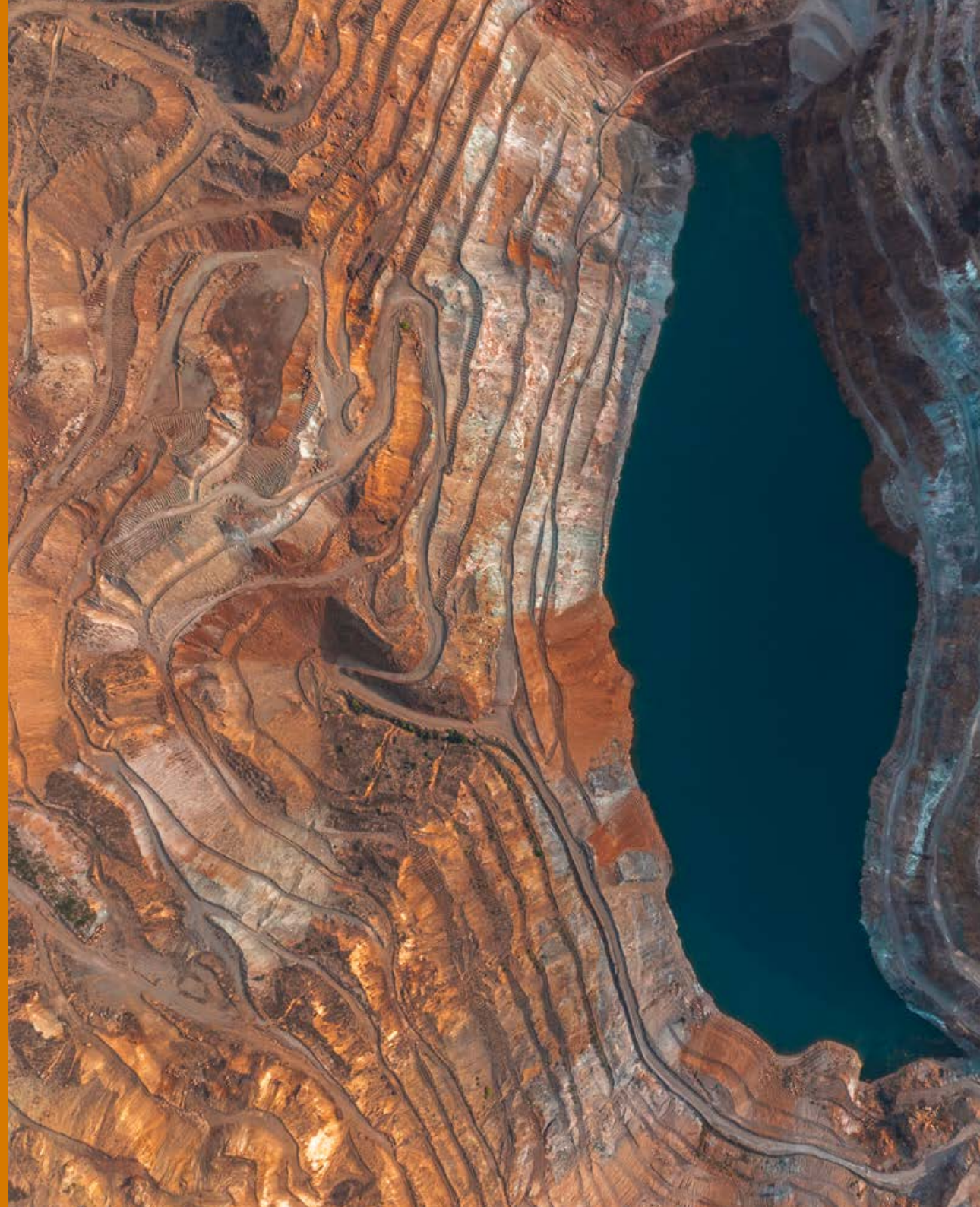
Annual Mining Report 2026

An inflection point for the industry:
critical minerals, sustainability and innovation

IDEAS | PEOPLE | TRUST

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Executive summary

2025 has been an interesting year across the mining industry landscape. Global mining is at an inflection point in which demand for critical minerals underpinning the low-carbon transition, defence spend, transport electrification and large-scale data centres is accelerating. With this drive we are seeing increasing supply expansion, price volatility and scaled government intervention, in particular by the US Government. And, of course we would be amiss not to mention the unprecedented gold price rally, ending the year up 65%, while silver gained an impressive 144% off the back of global geopolitical tensions and the increase in safe-haven demand.

Our Annual Mining report offers a comprehensive overview of the last 12 months which has seen many challenges but above all, has highlighted the global importance of mining. The report identifies the following key takeaways:

Regional focus: Africa is seeking to reposition itself from a raw-materials supplier to a higher-added-value mining hub through export controls, local processing mandates and strategic partnerships. This ambition is somewhat constrained by declining exploration investment as well as regional challenges including rising policy uncertainty, infrastructure and energy bottlenecks and security risks and it will be interesting to see how this develops over the next few years.

Commodity mix changes: In 2025, critical mineral prices diverged driven by uneven supply responses, regulatory intervention and end-market demand resilience. Export controls, production curtailments and logistics normalisation tightened previously oversupplied markets such as cobalt. Meanwhile rapid capacity expansion and softer macroeconomic conditions sustained oversupply in lithium and nickel. The demand for copper continues to grow and is the key driver behind a number of large M&A transactions.

Community engagement: As mining increasingly affects local communities and indigenous lands, effective community engagement has become critical for project viability. Leading mining companies are expanding governance, health, education and livelihood initiatives as a result. However, despite the growing number of initiatives, their impact remains limited. Most players are still not fully addressing community risks.

Technological transformation: AI is widely seen as a driver of innovation across the mining lifecycle, but value remains concentrated in a limited set of high-impact use cases. Productivity gains depend on disciplined execution and integration into core operations. Data readiness, cybersecurity and resource continue to slow down any wider rollout.

In this year's report we have collaborated with a forward-thinking consultancy in AI, Sapient Insight, who have provided some insight on emerging AI technologies across the mining landscape.

As the mining industry continues to take centre stage globally with governments racing to secure supply of critical metals and a continuing gold price rally, 2026 will be certain to be an interesting year ahead. Our Natural Resources team are passionate in helping shape the future of the industry and ensuring your business is best equipped to succeed. We have included a meet the team page at the back of the report and I encourage you to get in touch.



Matt Crane
Audit Partner

UK Head of Natural Resources and Energy



In 2025, demand for critical minerals reflected governments' push for strategic autonomy amid geopolitical uncertainty



Coal demand is projected to peak in 2025 and decline by roughly 20% by 2035 under current policy commitments



In 2025, the African Green Minerals Strategy was adopted to reverse Africa's declining share in global exploration expenditure



In 2025, amid heightened uncertainty, gold's safe-haven appeal strengthened, driving prices up by around 65%



Recycled minerals have a potential to generate around 80% fewer GHG emissions than primary production



In 2025, mining companies have improved their community well-being scores by increasing the number of initiatives

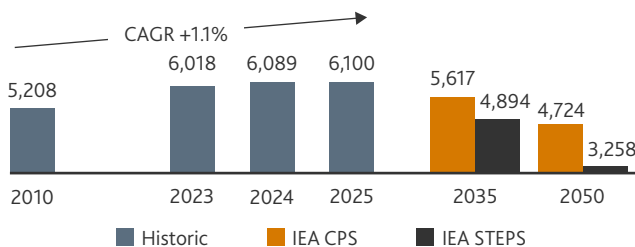
Decarbonisation and technological advances reshape priorities in the global mining industry

Global mining is at an inflection point in which coal consumption volumes are plateauing, while demand for critical minerals underpinning the low-carbon transition, transport electrification and large-scale data centres is accelerating. This is driving supply expansion, price volatility and increased government intervention.

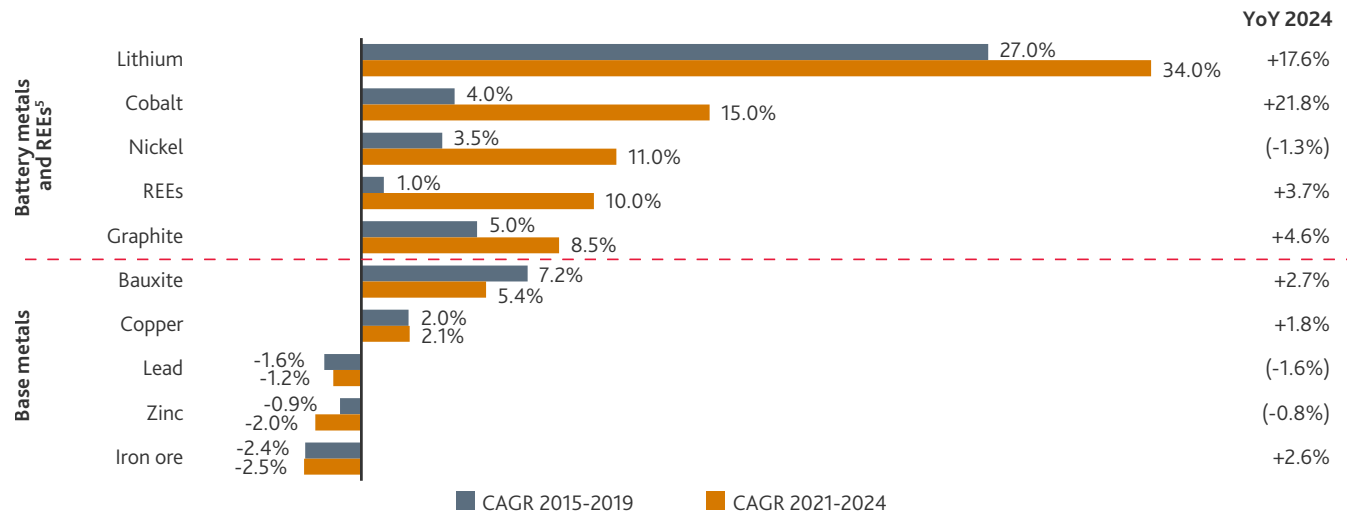
In 2024, total coal consumption rose by 1.2% YoY to a record 6,089 Mtce. The rise was driven by emerging markets while demand in advanced economies continued to decline. The IEA's Current Policy² (CPS) and Stated Policy³ (STEPS) scenarios show global coal demand is set to peak before 2030. STEPS indicates that the turning point has already occurred in 2024–2025.

If governments maintain their policy commitments coal demand should be 20% lower than in 2024 by 2035. However, considering that the final COP30⁴ agreement includes no reference to a fossil-fuel phase-out, the decline in demand may be slower than expected.

Global coal consumption assumptions, Mtce¹



Global minerals production volume dynamics



The significant increase in battery metal production

Global demand for critical minerals rose significantly in 2024, led by a near-30% increase in lithium and 6–8% in other battery metals. The sector demonstrated an ability to expand production more rapidly than traditional metals. In 2025, continued strong project pipelines and rising output from new Indonesian and African operations have kept supply slightly ahead of demand.

Critical minerals exploration slowdown

Despite robust demand expectations, investment in critical minerals exploration lost momentum in 2024. It reached an estimated \$2.5bn globally, increasing by 5% YoY compared with 14% in 2023. Exploration activity levelled off, with higher spending on lithium and copper being offset by reductions in nickel, cobalt and zinc. Weak prices and uncertainty constrained start-up funding, leading to project delays and the risk of future supply shortfalls.

Source: Global Energy Monitor website; IEA website; Energy Institute — Statistical Review of World Energy — [2025]; Mineral Commodity Summaries 2025 Data Release (ver. 2.0) — [April 2025]; IEA — World Energy Outlook — [2025]; IEA — Global Critical Minerals Outlook — [2025]; Media overview

Notes: (1) Million tonnes of coal equivalent; (2) A scenario setting out a pathway for the future of the energy system in which no change in energy-related policies is assumed beyond what is already in place; (3) A scenario based on a wider view of policy, including tabled but not yet adopted measures and official strategies signalling future direction; (4) COP30 is the 30th annual United Nations climate conference, held 10-21 November 2025 in Belém, Brazil, where countries met to negotiate global climate action, review progress under the Paris Agreement and agree on future commitments to limit global warming; (5) Rare-earth elements; (6) Department of Energy (7) Democratic Republic of the Congo; (8) A megadeal is defined as a transaction valued at over \$800m

Decarbonisation and technological advances reshape priorities in the global mining industry



Sherif Andrawes
BDO Australia Partner, Deal Advisory
 Global Natural Resources and Energy Leader

The global mining industry stands at the centre of a world that is more dependent on minerals than at any point in history. Every aspect of modern life, from energy and transport to communication, healthcare and national security, relies on a secure supply of mined materials. Yet, this essential sector is navigating a period of profound transformation as the accelerating energy transition, increased energy demand, and rising geopolitical tensions intensify global competition for critical minerals.

Demand for minerals such as lithium, copper, nickel and rare earths continues to surge as economies electrify and digital infrastructure expands. At the same time, heightened geopolitical uncertainty, the strategic importance of minerals in defence and advanced manufacturing have pushed resource security to the forefront of government and corporate agendas. Nations are increasingly prioritising resilient supply chains and domestic capability, reshaping global investment flows and partnerships.

However, meeting this demand is becoming more challenging. The era of easily accessible, near-surface deposits in traditional stable jurisdictions is largely over. New discoveries are deeper, more remote and more technically complex, requiring greater capital, advanced technology and longer development timelines. Declining ore grades, volatile commodity markets and the rise of resource nationalism further complicate the operating environment. Exploration budgets, while improving, remain uneven, and many explorers face tightening access to capital. The sector must also respond to rising ESG expectations and intensifying competition for skilled talent.


Technology and innovation are central to the industry's ability to overcome these pressures. Automation, digitalisation and advanced analytics are improving efficiency, safety and environmental performance, while leading companies are embedding ESG principles into core strategy. Transparent reporting, responsible practices and meaningful community engagement are now prerequisites for long-term success.

Looking ahead, the mining industry's ability to adapt, by working collaboratively across industry bodies, government agencies and non-traditional partners such as customers and technology providers, will enable the industry to continue to grow.

Growing role of governments

In 2025, governments continued to take a central role in reshaping the mining landscape, with state-backed investment and policy support being crucial to de-risking supply chains, driving new exploration and ensuring control over key strategic resources. For example, the Trump administration has made critical minerals security a key component of its energy strategy.

Key US 2025 initiatives on critical minerals

-  **July – September** US government bought equity stakes in MP Materials, Lithium Americas and Trilogy Metals
-  **August** US DoE⁶ announced \$1bn proposed funding to secure critical minerals supply chain
-  **October** USA and Australia signed an \$8.5bn agreement on REEs⁵ projects to reduce reliance on China
-  **November** US Geological Survey expanded the 2025 List of Critical Minerals to 60 minerals
-  **December** US and the DRC⁷ signed an agreement on critical minerals creating Strategic Mineral Reserve

Rise in the critical minerals' megadeals⁸

Mining M&A, traditionally cyclical, surged in scale and pace from early 2024 to mid-2025. Mining businesses are actively reshaping their portfolios, divesting from older, carbon-intensive or non-core assets while redirecting capital towards future-oriented, transition-critical materials.

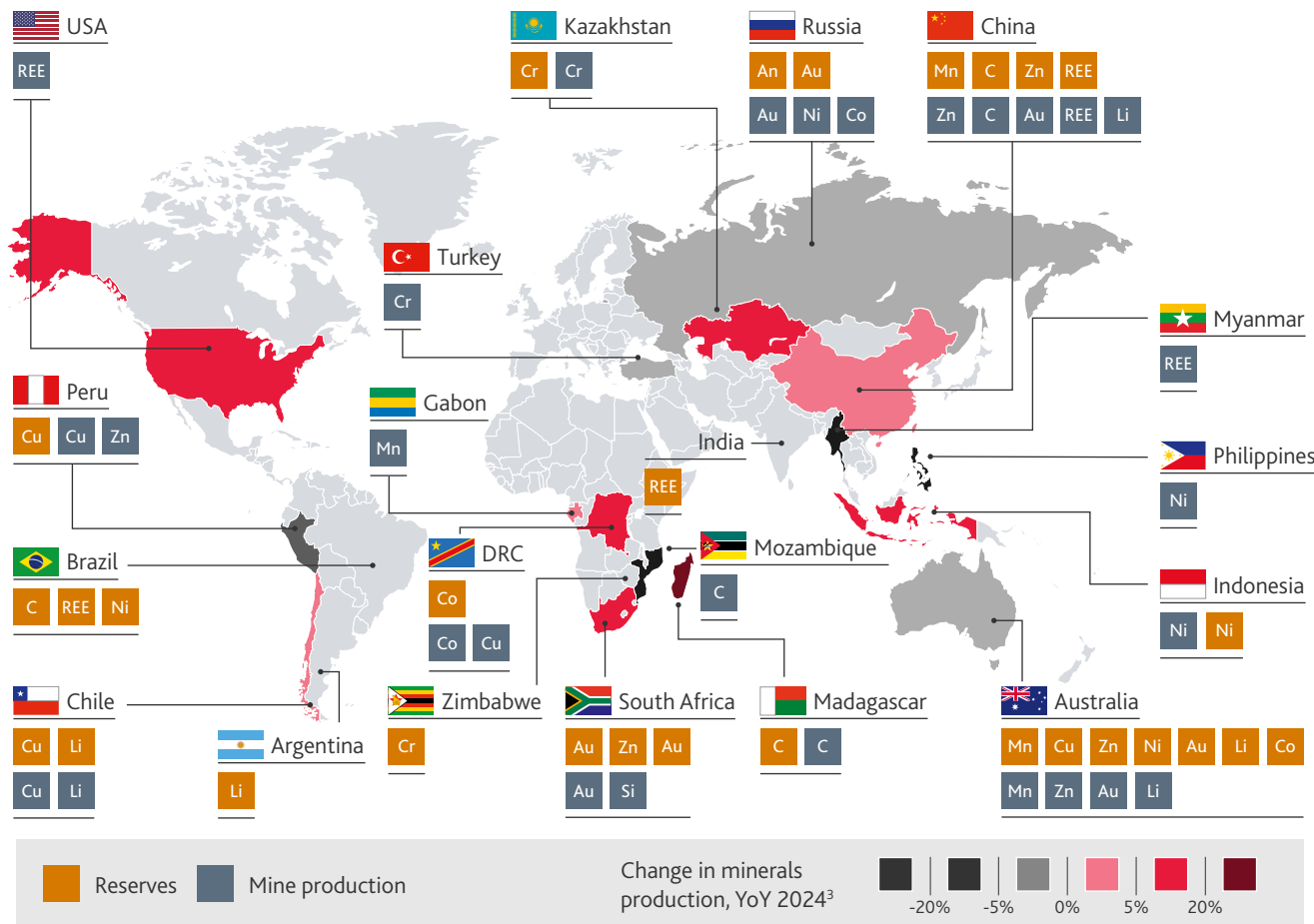
18 Number of megadeals	\$34bn Total value of megadeals	Copper Key commodity	Latin America Dealmaking epicenter
Anglo American /Teck Resources merger			
On 9 September 2025, Anglo American (UK) and Teck Resources (Canada) announced a merger of equals to create a \$53bn global Anglo Teck group, positioned to become a major critical-minerals player with strong copper, iron ore and zinc positions. The merger targets adding around 175,000 tonnes (+0.7%) of additional annual copper production capacity.			

Source: Global Energy Monitor website; IEA website; Energy Institute — Statistical Review of World Energy — [2025]; Mineral Commodity Summaries 2025 Data Release (ver. 2.0) — [April 2025]; IEA — World Energy Outlook — [2025]; IEA — Global Critical Minerals Outlook — [2025]; Media overview

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Top producers' landscape sees major change through project shifts and disruptions

Top countries by reserves and production of main critical minerals in 2024^{1,2}



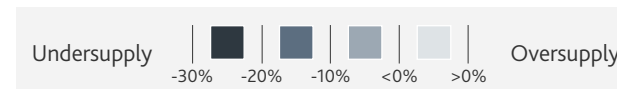
Source: S&P Global website; USGS — Mineral Commodity Summary — [2024]; Media overview

Notes: (1) Represents each of the Top-3 countries in terms of reserves and mine production as of 2024; (2) The selection includes Au, Cu, Zn, C, Cr, Co, Ni, Li, Mn, and REE; (3) Change in the cumulative production of selected materials for which the country ranked among the Top-3; (4) Rare-earth elements

Recent developments in global critical minerals supply in 2024–2025

- June–December 2024**
 After a near-90% lithium price collapse over the past two years, leading producers reduced output and delayed expansions, cutting supply by 100,000 tonnes in 2024 and 228,000 tonnes in 2025.
- January 2025**
 Several US-based projects advanced REEs⁴ production plans, with new development in high-grade Wyoming deposits and multiple sites expanding processing and ramping output to boost domestic supply.
- April 2025**
 In Q1 2025, South32's manganese output fell to 476,000 tonnes, 29.9% below estimates, due to shutdowns at two South African mines and a full halt at its Australian operations.
- September 2025**
 Zinc production at Peru's Antamina mine is expected to rise 67% in 2025. This will offset a 12% drop in copper output as BHP and Glencore work on extending the life of the deposit.
- September 2025**
 Australia's gold sector saw renewed activity as Tennant Mining moved to restart operations in the Northern Territory and PacGold began reviving the White Dam mine in South Australia.
- October 2025**
 Syrah Resources' Balama graphite mine stayed idle under force majeure, supplying only 1,300 tonnes in Q1 2025 vs 20,100 tonnes in 2024. A late-2025 restart lifted output to about 26,000 tonnes.
- November 2025**
 A major pollution leak, and subsequent repair and compensation work, led to a three-month suspension of Congo Dongfang Mining's Lubumbashi sites temporarily cutting local copper and cobalt.
- November 2025**
 Indonesia cut its 2025 nickel-ore quota to approx. 150 million tonnes, down from 272 million tonnes in 2024, to support prices and enforce stricter environmental controls, temporarily tightening ore supply.

Steady demand to lift energy minerals prices in 2026, replacing volatility of 2025



Global price for minerals, \$/mt¹

	Price dynamics	Short-term market developments	Supply-demand gap 2035 ²																								
Battery-related materials ³	<table border="1"> <caption>Battery-related materials prices (\$/mt)</caption> <thead> <tr> <th>Year</th> <th>Li</th> <th>Mn</th> </tr> </thead> <tbody> <tr><td>2021</td><td>51.2</td><td>18.5</td></tr> <tr><td>2022</td><td>71.1</td><td>25.8</td></tr> <tr><td>2023</td><td>46.0</td><td>21.5</td></tr> <tr><td>2024</td><td>26.3</td><td>16.8</td></tr> <tr><td>2025E</td><td>32.8</td><td>15.3</td></tr> <tr><td>2026F</td><td>35.0</td><td>15.5</td></tr> <tr><td>2027F</td><td>35.5</td><td>16.0</td></tr> </tbody> </table>	Year	Li	Mn	2021	51.2	18.5	2022	71.1	25.8	2023	46.0	21.5	2024	26.3	16.8	2025E	32.8	15.3	2026F	35.0	15.5	2027F	35.5	16.0	<p>In 2025, cobalt prices jumped from \$21,500/mt in January to over \$52,000 by late December, following the DRC's February export restrictions and subsequent October quotas. These restrictions significantly reduced China's imports and pushed the market toward balance after years of oversupply.</p> <p>Nickel prices remained weak in 2025 and are expected to average \$15,000/mt by the year-end, as Indonesia's output surges and soft EV demand sustained global oversupply. In 2026, average nickel prices are expected to rise by 1.3%, as output growth slows and stainless-steel demand improves.</p> <p>Lithium prices continued to fall despite solid demand, declining by 85% over two years, particularly as China's economic slowdown caused a massive oversupply. The market is expected to shift into a slight deficit by 2026, with prices recovering modestly to around \$12,000/mt as supply cuts take effect.</p> <p>Manganese prices fell to around \$4,600/dmtu, reflecting improved supply conditions and a return of Australian exports after cyclone disruptions. Large expansion plans in Australia and Ghana are expected to depress prices further in 2026. Although rising defence demand from China and Europe may support prices.</p>	<p>Co</p> <p>Ni</p> <p>Li</p> <p>Mn</p>
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Source: S&P Global website; Reuters website; DeVere website; World Bank — Commodity Markets Outlook — [October 2025]; World Bank — Commodities Price Data (The Pink Sheet) — [October 2025]; McKinsey — Global Materials Perspective 2025 — [2025] Media overview

Notes: (1) All prices are per metric tonne, except magnesium, quoted per dry metric tonne unit (dmtu); (2) The 2023 supply-demand gap for minerals is estimated based on the Global Mining Project (GMP) 2025 projection; (3) Nickel prices and forecasts were sourced from the World Bank, lithium from USGS (historical) and Goldman Sachs (forecast), cobalt from USGS (historical) and S&P (forecast). For magnesium, only historical prices and the H1 2025 average from USGS are shown; (4) World Bank's forecast; (5) Historical neodymium oxide prices (99.5–99.9%, FOB China) were taken from USGS, with forecasts from Canaccord Genuity; (6) Forecasts from UBS, ANZ, Bank of America, Goldman Sachs, HSBC, JP Morgan, Morgan Stanley, Societe Generale, and Standard Chartered

Steady demand to lift energy minerals prices in 2026, replacing volatility of 2025



Jill MacRae
Audit Partner
BDO UK

How the US Government's intervention has changed the market for critical minerals

While the clean energy transition remains the primary growth driver in mining for critical minerals, demand is also increasingly lifted by defence spending. As geopolitical tensions rise, defence spending is emerging as a major demand for critical minerals. These minerals are used in radar, guidance electronics, power wiring and communications. Intensifying supply risks are prompting countries to pursue self-sufficiency and secure long-term access to these minerals.

Specifically, the US Government's intervention in the market for critical minerals has been driven by the need to secure supply chains and reduce dependency on foreign sources.

The US Government has increased funding and support for domestic mining and processing operations. This includes direct funding, grants, loans and tax incentives to encourage companies to develop critical mineral resources within the US. The US has also considered strategic stockpiling of certain critical minerals to ensure availability in times of supply chain disruptions.

However, acknowledging that domestic supply is not enough, the US has sought to establish international partnerships to diversify supply sources and reduce dependency on any single country. This includes collaborations with allies to develop joint strategies for critical mineral supply chains.

These interventions have led to increased US domestic activity in the critical minerals sector, encouraged innovation in mining technologies and have fostered international cooperation.

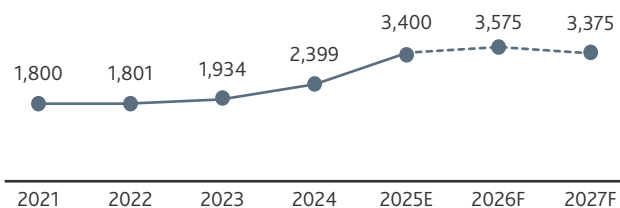
While NdPr pricing has been volatile over the last few years and saw a general decline in 2024, falling below US\$60/kg, driven by increased Chinese supply quotas that outpaced demand growth, pricing increased through 2025 and forecasts show this trend will continue. This is partly driven by trade tensions, such as planned US tariffs on Chinese magnets and ongoing supply disruptions from regions like Myanmar, creating volatility and support for higher prices outside of China. Some US-based contracts, like one with the Department of Defence, have a guaranteed price floor of US\$110/kg, further increasing and stabilising pricing outside of the Chinese market. While geo-political tensions remain and there are many uncertainties across the globe, one thing is clear and that is the US's future strategy for critical minerals will no doubt continue to influence the market.

In 2025, critical mineral prices' dynamics diverged driven by uneven supply responses, regulatory intervention, and end-market demand resilience. Export controls and production curtailments tightened previously oversupplied markets such as cobalt. Meanwhile rapid capacity expansion and softer macroeconomic conditions sustained oversupply in lithium and nickel.



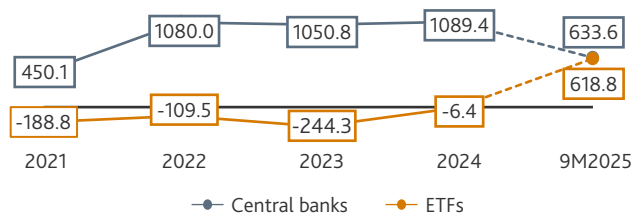
Gold: Continues to be a safe haven with all time highs recorded in 2025, continuing into 2026

Global price for gold, \$/t.oz⁴



According to the World Bank October 2025 forecast, gold prices were expected to hit an all-time high, averaging \$3,400/t.oz in 2025, a 42% YoY increase. However, this forecast has already been overtaken, with spot prices climbing above \$4,345/t.oz in December 2025. The growth was primarily supported by expectations of rate cuts, central bank purchases, and strong gold-backed ETF inflows. While the World Bank projects a slight 5.1% rise for 2026, alternative forecasts⁶ predict sharper increases, ranging from \$3,825 to \$5,055/t.oz, supported by continued central bank purchases and expectations of further US monetary easing amid geopolitical uncertainties.

Gold demand in selected categories, t⁷



As macroeconomic and geopolitical uncertainty intensified, gold strengthened its role as a global safe haven asset. Net central bank purchases have risen sharply (+142% since 2021). 2025 has seen a strong rebound in ETF inflows as investors repositioned in anticipation of monetary easing. This reinforces a broader trend: geopolitical shifts and systemic economic risks are reshaping global demand not only for energy transition minerals but also for traditional reserve assets like gold.

Source: S&P Global website; Reuters website; DeVere website; World Bank — Commodity Markets Outlook — [October 2025]; World Bank — Commodities Price Data (The Pink Sheet) — [October 2025]; McKinsey — Global Materials Perspective 2025 — [2025] Media overview

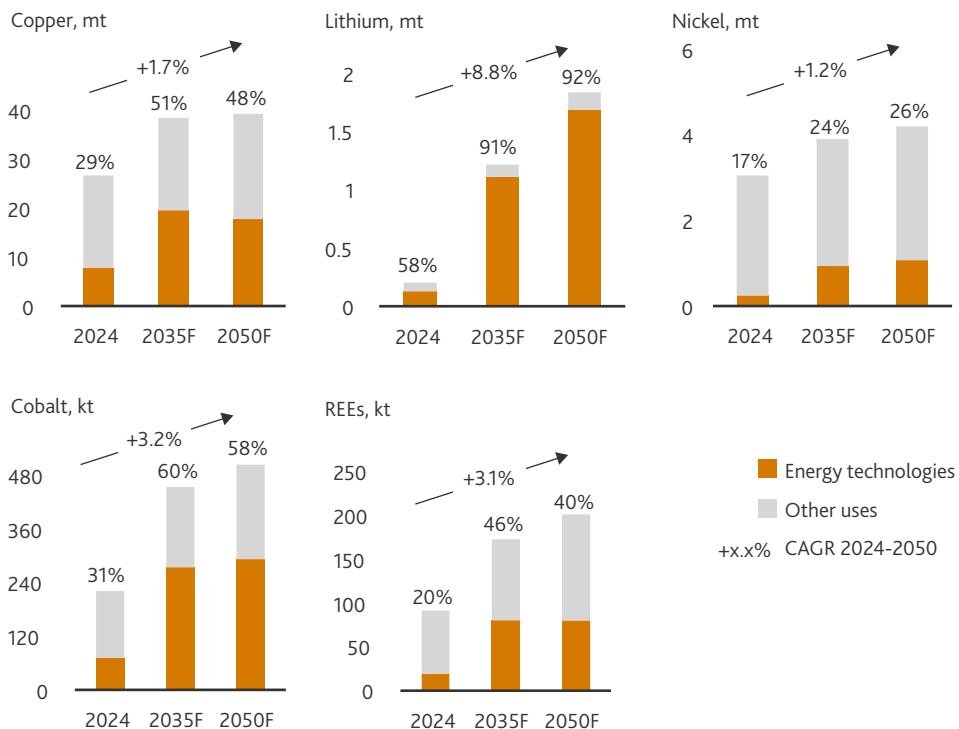
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Defence and data centres set to drive critical minerals demand

The rapid expansion of digital and AI infrastructure and geopolitical tension will combine with the existing needs of clean-energy systems to drive demand for most critical minerals. In the NZE scenario, energy transition minerals show sustained growth, with CAGRs ranging from +1% to +9% through 2050, driving countries to introduce new policies and forge strategic partnerships to ensure long-term access to these minerals.

Global critical minerals demand for the energy transition in the NZE scenario¹



Source: Wood Mackenzie website; S&P Global website; WEF website; World Gold Council website; IEA website; World Bank — Commodity Markets Outlook — [October 2025]; McKinsey — Global Materials Perspective 2025 — [2025]; IEA — Global Critical Minerals Outlook — [2025]; Media overview

Notes: (1) A normative scenario proposed by IEA that shows a pathway for the global energy sector to achieve net zero CO2 emissions by 2050; (2) Unmanned Aerial Vehicle; (3) Demand intensity of materials required in data centers



Defence and data centres set to drive critical minerals demand

Critical minerals use in defence and technology sectors

Defence

<ul style="list-style-type: none"> Radar and sonar Fighter aircraft Actuation motors <p>REEs</p>	<ul style="list-style-type: none"> Autonomous vehicles Drones and UAVs² Portable electronics <p>Li</p>	<ul style="list-style-type: none"> Air defence systems Armoured vehicles Power electronics <p>Cu</p>
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As geopolitical tensions rise, defence spending is emerging as a major demand for critical minerals. These minerals are used in radar, guidance electronics, power wiring and communications. Intensifying supply risks are prompting countries to pursue self-sufficiency and secure long-term access to these minerals.

Data centres

27,000 kg/MW ³	169.0 kg/MW	28.2 kg/MW	12.0 kg/MW
Cu	Zn	REEs	Co

The rapid scale-up of AI and cloud computing is accelerating mineral demand for data centre infrastructure. With capacity expected to grow 2.7x by 2030, consumption of copper (power cables), zinc (structural and thermal management components), REEs (high-performance motors and cooling), and cobalt (batteries) is set to rise sharply.



Government and strategic initiatives to secure access to critical minerals

Ukraine–US Mineral Resources Agreement

In 2025, the USA and Ukraine signed an agreement creating a joint Reconstruction Investment Fund, channeling 50% of future state revenues from strategic natural resources into Ukraine's reconstruction and development. The deal ensures long-term US access to REEs and other critical minerals.

EU Critical Raw Materials Act

In 2024, the EU set 2030 targets to meet at least 10% of minerals' demand from domestic extraction, 40% from EU processing and 25% from recycling. This is to avoid more than 65% reliance on any single supplier. The EU announced 47 Strategic Projects to expand extraction, refining and recycling capacity.

Quad Critical Minerals Initiative

Australia, India, Japan, and the USA launched an initiative to coordinate investment and technology collaboration across lithium, nickel, and REEs. It aims to diversify supply chains and expand regional refining and recycling capacity for strategic industries.

Source: Wood Mackenzie website; S&P Global website; WEF website; World Gold Council website; IEA website; World Bank — Commodity Markets Outlook — [October 2025]; McKinsey — Global Materials Perspective 2025 — [2025]; IEA — Global Critical Minerals Outlook — [2025]; Media overview






Notes: (1) A normative scenario proposed by IEA that shows a pathway for the global energy sector to achieve net zero CO2 emissions by 2050; (2) Unmanned Aerial Vehicle; (3) Demand intensity of materials required in data centers

High demand for critical minerals leads to new challenges, requiring coordinated response

While the clean energy transition remains the primary growth driver in mining, demand is also increasingly lifted by defence spending and the rapid scale-up of AI and data centre infrastructure. At the same time, geopolitical uncertainty, alongside resource nationalism and trade restrictions, is widening the demand–supply gap and increasing the risk of persistent market tightness.

As the world moves toward a low-carbon economy, critical minerals have become essential to clean-energy systems, intensifying competition for supply and accelerating resource nationalism alongside export controls. At the same time, the mining sector faces structural constraints — declining ore grades and rising ESG pressures. This dynamic is widening the supply gap for minerals and elevating them as a focal point of geopolitical rivalry, underscoring the need for coordinated action by governments, industry and mining associations.

Key challenges in the critical minerals market in 2025

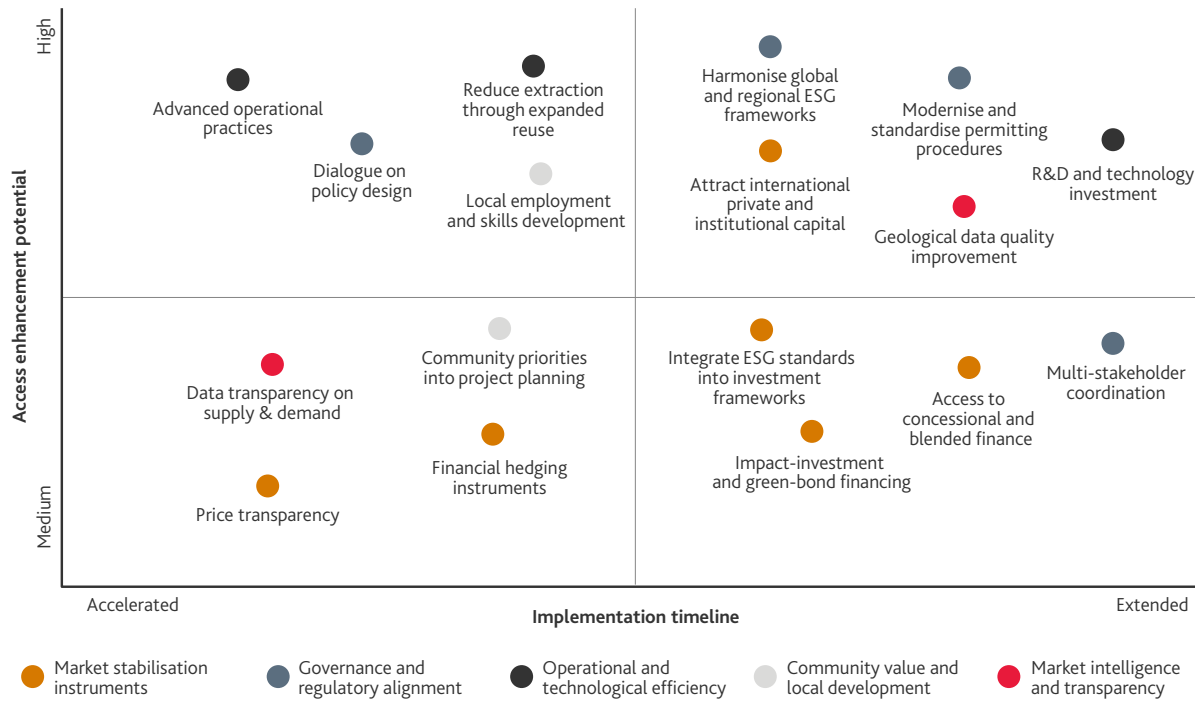
	Challenge	Recent cases
 Geographical concentration	Reliance on a small number of countries for critical mineral extraction and processing increases exposure of supply chains to disruption.	As of 2025, the Top-3 producing countries — China for copper, South Africa for chromium and Indonesia for nickel — collectively hold 30%–90% of global critical-mineral reserves ¹ .
 Resource nationalism and trade restrictions	Governmental efforts to tighten control over natural resources are increasing, especially in resource-dependent countries in Latin America and Africa. Meanwhile tariffs further limit mineral flows.	Investor–state disputes over natural resources reached a 10-year high, with 32 cases ² filed at ICSID ³ — driven largely by conflicts in Peru, Mexico and Indonesia.
 New projects complexity	Long development timelines and weak project pipelines are driven by difficult-to-access deposits, lengthy permitting processes and elevated country risk.	As of 2025, 64% of mining projects face pre-production delays driven by permitting issues (45%), commercial constraints (32%) and stakeholder opposition (26%) ⁴ .
 Ore depletion and declining grades	The depletion of high-grade deposits forces the extraction of lower-grade ores, driving up operating costs and energy consumption.	Glencore reported a 17% drop in copper production and revised its guidance, reflecting lower ore grades at some operations.
 ESG and decarbonisation	Rising pressure to cut emissions, limit environmental impacts and meet social expectations, while remaining profitable, create major challenges.	In 2025, Glencore and Umicore warned that proposed EU occupational limits on workers' inhalation exposure to cobalt, stricter than those in China or the US, could harm Europe's cobalt industry and deter investment.

Source: WEF — 10 ways the world can improve access to minerals for the energy transition — [2024]; WEF — Securing critical minerals for energy transition requires collective action — [2024]; S&P Global — Critical minerals sourcing rises against trade troubles — [2025]; White & Case — Mining & metals 2025: Poised on the chessboard of geopolitics [2025]; IEA — Global Critical Minerals Outlook — [2025]; ERM — Mission Critical: Resilient mines for a modern society — [2025]; Media overview

Notes: (1) Based on the IEA data; (2) According to the law firm DLA Piper information about disputes lodged so far in 2025 with the World Bank arbitration body, over everything from oil and gas to gold, uranium and lithium; (3) International Centre for Settlement of Investment Disputes; (4) According to ERM's analysis of an S&P dataset covering 226 major pre-production capital projects globally (launched between 2015 and 2025), where critical minerals and gold were the primary commodities; (4) The matrix has been developed based on a two-dimensional approach assessing the impact on critical mineral access and time implementation. Pathways to address challenges were identified through the analysis of reports and regulatory initiatives across five thematic areas

High demand for critical minerals leads to new challenges, requiring coordinated response

Pathways to address current critical mineral challenges⁴



Source: WEF — 10 ways the world can improve access to minerals for the energy transition — [2024]; WEF — Securing critical minerals for energy transition requires collective action — [2024]; S&P Global — Critical minerals sourcing rises against trade troubles — [2025]; White & Case — Mining & metals 2025: Poised on the chessboard of geopolitics [2025]; IEA — Global Critical Minerals Outlook — [2025]; ERM — Mission Critical: Resilient mines for a modern society — [2025]; Media overview

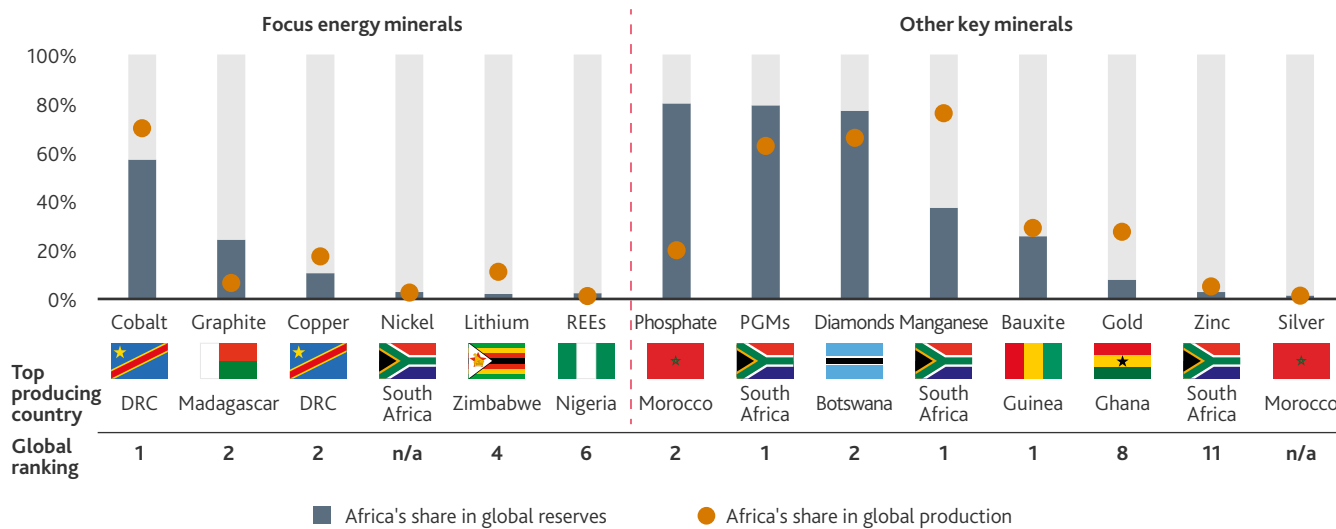
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Rich in key mineral resources, African mining sector is taking steps to capture greater value

Africa's importance in supplying energy transition-critical minerals will reflect expected sixfold surge in demands for some by 2050. In February 2025, the African Union launched the African Green Minerals Strategy¹, which provides a framework to position Africa as a leading global supplier of critical minerals. To prevent a recurrence of the resource curse, in which resource-rich countries experience limited diversification and weaker development outcomes despite their abundant mineral wealth, commodity strategies must prioritise value creation, industrialisation and sustainable development.

Africa's share in the global minerals reserves and production in 2024



In 2024, Africa accounted for 70% of global cobalt output, 17% of copper, and 11.1% of lithium production. 2025 saw increased diversification as Lesotho announced plans to move beyond diamonds into REEs³ and Nigeria partnered with South Africa to explore lithium and zinc.

Source: S&P Global website; Reuters website; IEA website; USGS — Mineral Commodity Summaries 2025 Data Release — [April 2025]; IEA — Global Critical Minerals Outlook — [2025]; Media overview

Notes: (1) African Green Minerals Strategy provides a roadmap for harnessing Africa's mineral wealth to drive value addition at source, regional industrialisation, and climate resilience; (2) Platinum group metals; (3) Rare-earth elements; (4) Energy transition minerals; (5) Emirates Global Aluminium, a UAE-based integrated aluminium producer; (6) Africa Finance Corporation



Elisee Kiluba
Managing Partner
BDO East Africa

African mining industry Critical Minerals: Driving the Global Energy Transition

Africa holds vast mineral resources that are critical to the global economy and the development of green technologies. The growing demand for critical minerals is reshaping priorities and driving significant investment in the African mining sector.

Historically, Africa's mining industry relied heavily on fossil fuels and minerals such as copper as its primary source of revenue. Today, the sector is undergoing a major transformation, shifting toward the extraction of strategic minerals essential for the global energy transition such as cobalt, lithium, manganese and rare earth elements vital for battery technologies and renewable energy systems.

With abundant resources and emerging local value chains, Africa is positioning itself as a key player in the global energy transition. However, this innovation-driven dynamic comes with critical governance and sustainability challenges.

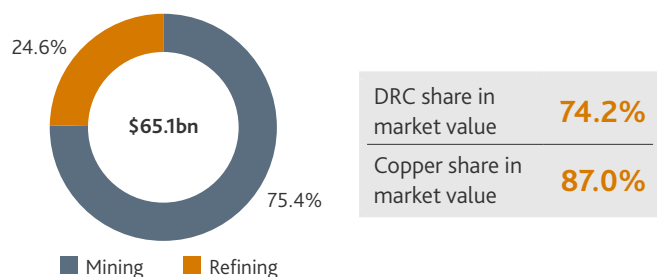


Partnership as the catalyst for growth

The mining industry's success in Africa depends on collaboration across the entire value chain. By forging strong partnerships between governments, businesses, investors, communities and innovators, we create an ecosystem that thrives on shared knowledge and resources. For example, joint ventures between mining companies and local suppliers not only strengthen supply chains but also empower communities through skills development and job creation. These partnerships break down silos, foster innovation, and enable us to navigate complex challenges together building a resilient, inclusive future for mining. United efforts lead to shared success, proving that progress is truly achieved through partnerships."

Rich in key mineral resources, African mining sector is taking steps to capture greater value


Africa's market value of key energy minerals in 2024





In 2024, Africa's ETM⁴ output was worth approx. \$50bn at the extraction stage but only \$16bn after refining, mainly from the DRC's copper refining. Although the continent has the resources needed for lithium batteries, just 10% of the total value from mine to finished product remains in Africa.

African governments initiatives to strengthen and localise minerals' value chains


National frameworks and mechanisms to retain more economic value domestically



 In September 2025, the DRC introduced a quota system for cobalt; limiting exports to under half of 2024 production levels to strengthen global prices while accelerating domestic value creation.


 In June 2025, Zimbabwe announced it would ban lithium concentrate exports from January 2027, following earlier restrictions on raw ore exports, in order to reduce reliance on exports to China.

 In June 2025, Gabon declared that exports of crude manganese would be banned starting 1 January 2029, as part of a national policy to promote local processing and value addition.

Strategic public-private partnerships and integrated development corridors

 In July 2025, Ghana cancelled a \$1.2bn bauxite lease with a local firm to seek partnerships with major international companies, including EGA⁵ and Chinese investors.

  In June 2025, AFC⁶ secured a \$290m loan from Italy to finance the Lobito Corridor rail-and-port link connecting mineral-rich zones in Zambia and the DRC to Angola's coast.

 In February 2025, Botswana and De Beers agreed a new 10-year sales deal and a 25-year diamonds mining license extension, committing to support diversification, jobs and local growth.

Africa is seeking to reposition itself from a raw-materials supplier to a higher-added-value mining hub through export controls, local processing mandates and strategic partnerships. This ambition is constrained by declining exploration investment as well as regional challenges including rising policy uncertainty, infrastructure and energy bottlenecks and security risks.

Source: S&P Global website; Reuters website; IEA website; USGS — Mineral Commodity Summaries 2025 Data Release — [April 2025]; IEA — Global Critical Minerals Outlook — [2025]; Media overview

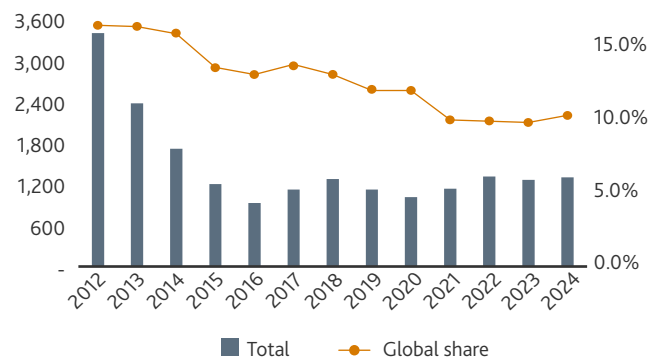
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Africa must tackle political unrest, power supply and skills shortages to boost exploration

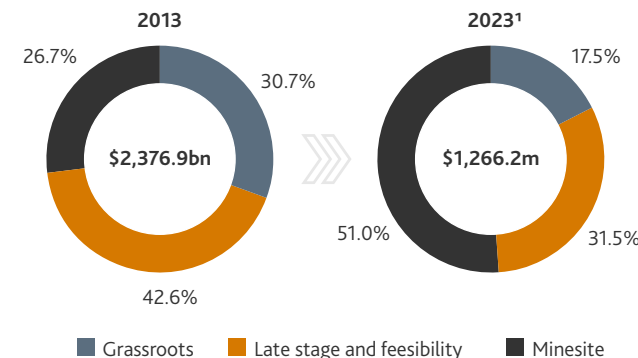
African mineral exploration remains underfunded despite offering amongst the best investment returns per dollar. The region's share in global exploration spending declined, from 16.6% in 2012 to just 10.4% in 2024, amounting to \$1.3bn of spend in 2024. The share of grassroots investment also decreased by 13.2 p.p., suggesting reduced appetite for risk and innovation.

The inherent complexity of investing in mining is further exaggerated by higher risks in Africa. Unlocking investment is essential to not only support the global energy transition but also to generate local economic value through job creation, infrastructure development and revenue retention. Mining should be contributing to a more sustainable and inclusive future for the continent.

Africa's mineral exploration, \$m



Exploration investment in Africa by stage



Source: S&P Global — Africa Mining by the Numbers — [2024]; CSIS — Underexplored and Undervalued: Addressing Africa's Mineral Exploration Gap — [2025]; IEA — Global Critical Minerals Outlook — [2025]; WEF — Securing Minerals for the Energy Transition: Finance for Southern Africa — [2025]; Fraser Institute — Annual Survey of Mining Companies 2024 — [July 2025]; OECD — Africa's Development Dynamics 2024 — [July 2024]; Media overview

Notes: (1) Latest available data; (2) To quantify the degree of exposure, key risks were evaluated across the Top-3 producing countries for selected critical mineral, including cobalt, graphite, copper, nickel, lithium, rare earth elements (REEs), manganese, bauxite, and zinc; (3) The United States International Development Finance Corporation; (4) Permits included those for gold, iron ore, bauxite, uranium, rare earths and other minerals; (5) According to the Fraser Institute's 2025 Annual Survey; (6) As of 2020 latest available data by OECD



Jacques Barradas
Audit Partner
BDO South Africa

Unlocking Africa's mineral value creation potential

The time is ripe for Africa to not lose out on the Energy Transition Critical Minerals ('ETCM') boom. One of the major constraints in processing, refining and beneficiating ETCM's is the security of power to operate these plants and processes.

In recent past major African economies such as South Africa, Nigeria, Angola and the DRC to only name a few suffered from a lack of consistent security of power to run plants and processes of such nature.

Governments now have more sustainable options thanks to advances in technology such as large scale solar and hydro-electric power schemes coupled with battery storage to securing of power through Independent Power Projects ('IPP's').

Due to the remote location of many of the mines, African mining has always been at the forefront of technology in order to access resources. Mines across the African continent have developed projects that generate power in excess of 1 GW with matching scale battery storage capacity. This is sufficient to run large plants and processes for the refinement of ETCM's.

'Stronger together: Progress through partnerships'

It is through such power and infrastructure projects, that highlight that in order to elevate the growth of mining in Africa, there needs to be collaboration by governments, businesses, investors, communities and innovators. In uniting, we can collectively work towards the goal of building a stronger industry and continent together by harnessing the power of a strong mining value chain.

Our reality: As an industry we are Stronger together when breaking down silos and working collaboratively.

Our mission: To achieve the greatest progress through partnerships by unlocking transformative solutions. A single, aligned industry of empowered people across the ecosystem enables us to navigate complexities, embrace innovation, and secure a resilient, inclusive future for mining. United efforts lead to shared success!

Africa must tackle political unrest, power supply and skills shortages to boost exploration

Key challenges in the African mining sector

Challenge	Extent of critical minerals exposure ²	Recent cases
Political instability		Mozambique's ongoing insurgency forced Australia's Syrah Resources to suspend operations at its Balama graphite mine in December 2024, triggering a \$150m loan default with the US DFC ³ .
Transportation barriers		By July 2025, over 85% of South Africa's land freight was carried by road, as rail freight fell by 15% over 15 years amid chronic vandalism and poor rail maintenance.
Energy access		Zimbabwe's second-largest PGM producer, Mimosa Mining Company, reported a 1% YoY decline in output in FY2025, driven by intermittent regional power disruptions that affected plant throughput.
Policy uncertainty		In October 2025, Mali's military-led government revoked over 90 mining exploration permits ⁴ issued between 2015 and 2022, heightening regulatory uncertainty, compliance risk and investor caution.
Innovation lag		South Africa is losing valuable mining investments to more technologically advanced nations, ranking 68th out of 86 jurisdictions by investment attractiveness in 2024 ⁵ .
Skill deficit		In Central Africa, with an average of 4.5 years of schooling and only 18% of students completing secondary education ⁶ , limited human capital continues to hinder productivity and local participation.

Meeting rising mineral demand increasingly involves extraction on or near indigenous and communal lands. Early and genuine collaboration with communities can reduce risks and generate shared benefits.

In July 2025, Ghana unveiled major mining law reforms to tighten license rules and boost local benefits. The reforms shorten lease terms, limit investor stability agreements and require companies to allocate a share of revenue to community projects.

Source: S&P Global — Africa Mining by the Numbers — [2024]; CSIS — Underexplored and Undervalued: Addressing Africa's Mineral Exploration Gap — [2025]; IEA — Global Critical Minerals Outlook — [2025]; WEF — Securing Minerals for the Energy Transition: Finance for Southern Africa — [2025]; Fraser Institute — Annual Survey of Mining Companies 2024 — [July 2025]; OECD — Africa's Development Dynamics 2024 — [July 2024]; Media overview

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Measures to lower financial, regulatory, and social barriers that constrain investment in Africa

Innovative financing tools



De-risking structures, guarantees, and blended finance can attract capital for critical minerals, while stakeholders must ensure investments also deliver broader development and improved living conditions.

Community participation



Effective stakeholder and community engagement ensures local benefits while investment in skills and human capital supports jobs, training and enterprise growth.

Developing industrial clusters



Developing industrial clusters and local benefits can drive Africa's industrialisation, create high quality jobs and strengthen energy security. It can also make the continent a clean energy leader.

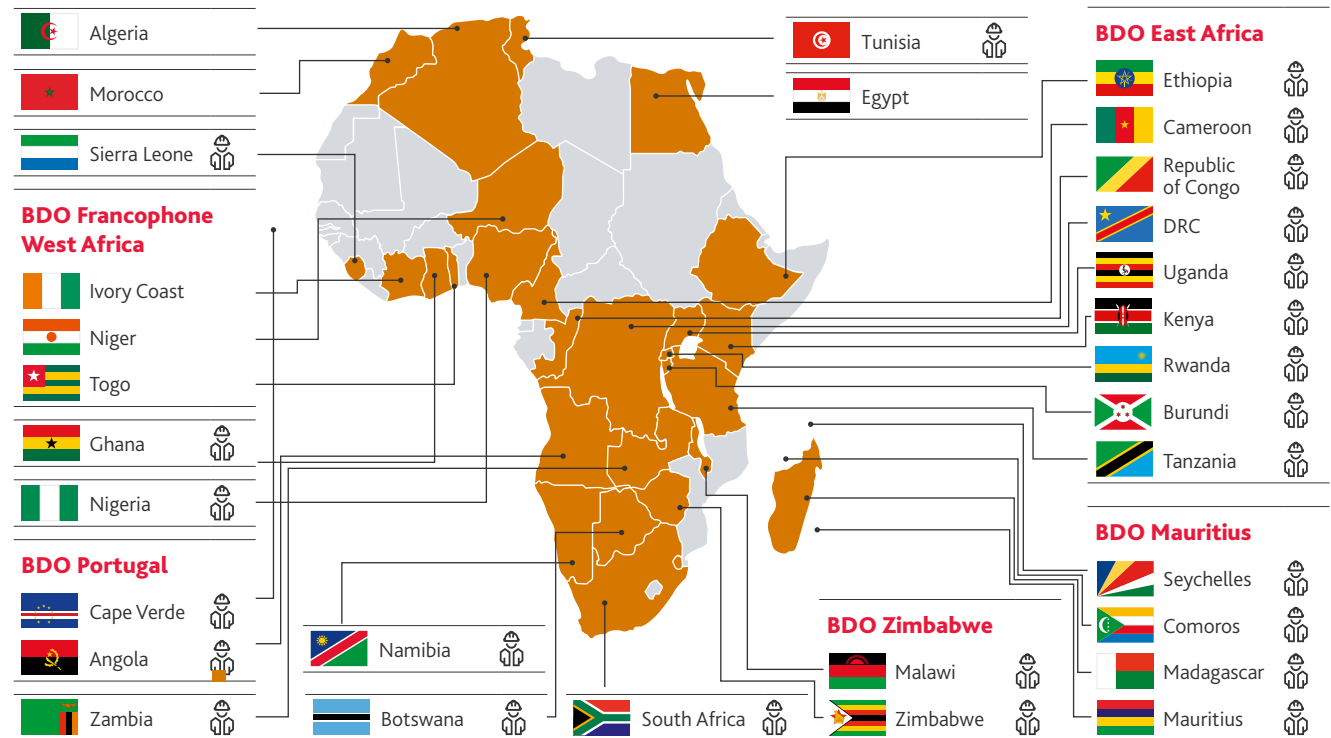
BDO is strengthening its mining expertise across Africa to address evolving sector's needs

We play a growing role in Africa's mining sector by supporting projects across the full lifecycle. In a region with high potential and operational complexity, we focus on integrity, governance and sustainable growth. We continue to build out our footprint through recent network additions in the Republic of Congo, the DRC and Burundi.

Service offering

Audit & Assurance | Tax Advisory & Planning | Transaction Advisory | Operational Efficiency | Sustainability & ESG | Digital transformation | Risk Management

Dedicated energy and natural resources practice



BDO participation at recent mining conferences



Consolidated and simplified ESG reporting in mining is crucial for long-term value creation

ESG reporting frameworks have played a crucial role in helping mining companies quantify and communicate their contributions to sustainability. The expanding number of frameworks and reporting requirements has created fragmentation, making it harder for companies to measure and convey their real impact. The Consolidated Mining Standards Initiative (CMSI) marks an important step forward. Its final public consultation launched in October 2025. Streamlined approaches like the CMSI could form the basis for a unified reporting system that reduces administrative burden while preserving accountability and transparency.

Timeline of developments in the Consolidated Mining Standard Initiative

- October 2024** The CMSI published a draft consolidated standard, governance model, assurance process and related reporting policy. Stakeholders were encouraged to provide their views during a 60-day public consultation.
- September 2025** Partners of the CMSI announced the publication of the Governance Model, designed to balance participation across companies and stakeholders affected by mining activities.
- October 2025** CMSI partners announced the final public consultation for the Consolidated Mining Standard before the documents are finalised.

Reporting on selected ESG metrics by 20 major¹ mining companies in 2024

		YoY 2024
Emissions and energy consumption		
Energy consumption	20	→
Total Scope 1+2 GHG emissions	20	→
Renewable energy consumption	20	→
Scope 3 emissions	19	→
GHG intensity	9	↑ +1
Water		
Water consumption	16	↑ +1
Water reuse and recycling	16	↑ +1
Land		
Land area rehabilitated	12	→
Land area disturbed	12	→
Waste		
Waste generation	19	→
Recycled waste	12	→

↑ ↓ → Increase/decrease/no change in ranking

Analysis of ESG reporting of the leading mining companies in 2023 indicated that some of them either did not report on sustainability at all or had only voluntary and selective reporting with inconsistent metrics. This did not change notably in 2024, with only minor improvements in reporting with regard to GHG intensity, water consumption and water reuse and recycling.

To maintain strategic focus amid rising expectations, mining companies must shift from reactive compliance to an integrated approach built on transparency, standardisation and collaboration. As new regulations and standards come into effect, high-quality ESG reporting becomes critical in strengthening public confidence that critical minerals mining can be sustainable and transparent.


Source: WEF website; CMSI website; OnestopESG website; IEA — Critical Minerals Policy Tracker — [May 2025]; IEA — Global Critical Minerals Outlook — [2025]

Notes: (1) The 20 major mining companies are Albemarle, Anglo American, Barrick, BHP, Boliden, Codeco, First Quantum Minerals, Freeport-McMoRan, Glencore, Gold Fields, Grupo México, Newmont, OCP Group, Rio Tinto, Sibanye-Stillwater, SQM, Teck Resources, Tianqi Lithium, Vale, and Zijin; (2) Based on the interviews of industry leaders and sustainability experts at the African Mining Week (AMW) 2025


Consolidated and simplified ESG reporting in mining is crucial for long-term value creation

ESG frameworks and decarbonisation initiatives are expanding but their impact remains constrained by inconsistent reporting, limited effectiveness and slow progress in circularity. Scaling recycling, consolidating ESG standards and embedding sustainability in core operational decisions are emerging as critical levers to reduce emissions and close the commitment–effectiveness gap.


Key priorities in the mining ESG standards development²

Consolidating standards 


Focus on aligning global frameworks, harmonising tailings, water and emissions disclosures, and strengthening comparability of mine-site reporting.

Integrated reporting 

Connects ESG performance with production and financial outcomes, embedding climate risks, rehabilitation liabilities and site-level data into corporate disclosures.

Geopolitical context 

Navigating resource nationalism, ensuring transparent sourcing in high-risk regions, and complying with tightening US–EU rules on critical minerals.

Value creation 

Demonstrating how ESG improves productivity, lowers decarbonisation costs, supports communities, and strengthens long-term licence-to-operate.

Source: WEF website; CMSI website; OnestopESG website; IEA — Critical Minerals Policy Tracker — [May 2025]; IEA — Global Critical Minerals Outlook — [2025]

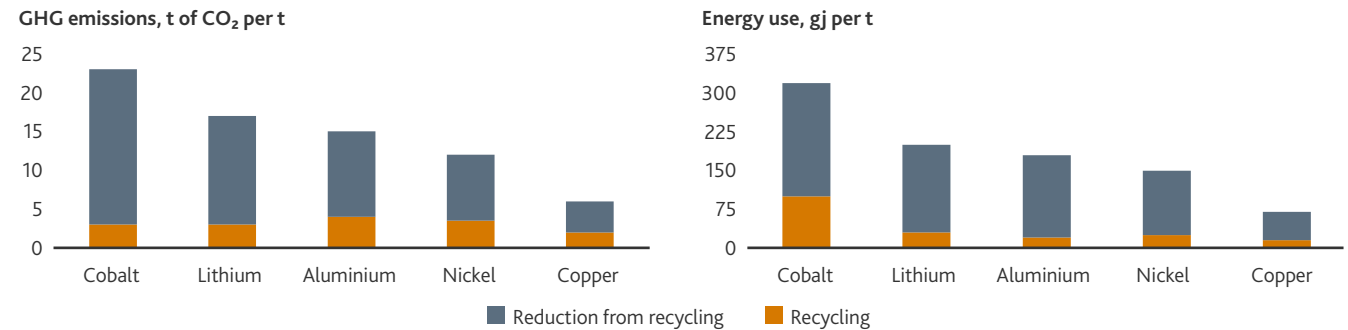
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Boosting recycling levels can significantly advance decarbonisation in the mining sector

Most decarbonisation efforts in the global mineral supply chain prioritise technological efficiency and low-carbon production. The role of recycling remains comparatively undervalued, despite its substantial potential to reduce emissions, lower energy consumption and decrease the need for new mining. On average recycled minerals generate 80% less GHG emissions than primary production. Recycled nickel emits 85% less GHG and recycled copper 75% less. Copper recycling requires just 15% of the energy needed for primary processing.

Comparison of emissions from recycled and primary production of minerals



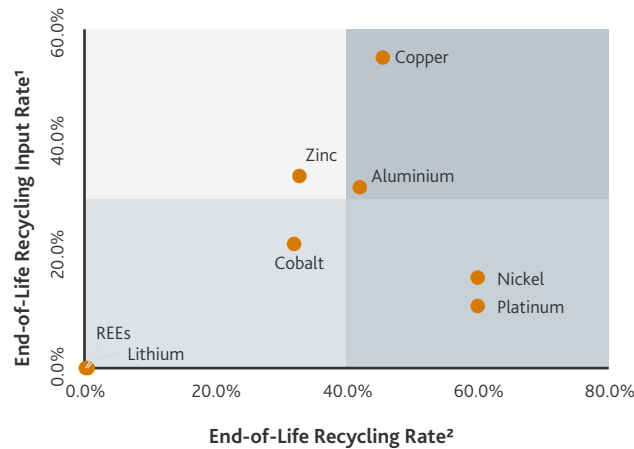
Source: WEF website; WRI website; Eurostat website; IEA — Global Critical Minerals Outlook — [2025]; IEA — Recycling of Critical Minerals — [2024]; International Copper Association — Copper – the pathway to Net Zero — [2023]; Companies' website; Media overview

Notes: (1) Measures the share of total metal production coming from end-of-life recycled materials; According to Eurostat data 2022; (2) Measures the share of metals contained in end-of-life products that is recovered, indicating the efficiency of the full recycling chain; According to IEA data 2023; (3) End-of-Life Recycling Rate; (4) Zero-waste solution for e-scrap recycling



Boosting recycling levels can significantly advance decarbonisation in the mining sector

Recycling performance of selected minerals



Cu Copper, with an EOL-RR³ of 46%, already shows how effective recycling can offset emissions from primary production and enhance circularity.

Ni Nickel, despite high EOL-RR, still has low secondary input shares due to long product lifecycles. Scaling nickel recycling will become a major decarbonisation opportunity as end-of-life batteries enter the waste stream.

Li **REE** Lithium and REEs have near-zero recycling rates, reflecting technology constraints and weak collection systems. Given their critical role in the energy transition, the lack of scalable recycling infrastructure increases supply-chain emissions and dependency on primary extraction.

Strengthening recycling performance — particularly for lithium, nickel, and REEs — will be essential to decarbonisation across the mining sector.

Mining company case studies in recycling

Glencore



Glencore has advanced its EU Critical Minerals Recycling Strategy by allocating \$2.8bn — around 15% of its 2024 capex — to expand nickel and cobalt recycling and modernise key assets. These include the Sudbury smelter where upgrades reduced emissions by 22% and increased recycled-material throughput.

Teck Resources



In 2024, Teck Resources began evaluating a lithium-ion battery-recycling plant in British Columbia. It will process around 35,000 tonnes of battery material per year, equivalent to batteries from roughly 140,000 electric vehicles. The project reflects Teck's strategic push into circular economy solutions.

Rio Tinto



In 2025, Rio Tinto joined a US-based e-waste recycling project by investing alongside Mitsubishi Materials Corporation and others to acquire a minority stake (10%–15%) in Exurban⁴. The initiative includes plans to build a \$340m facility in Indiana to recover copper, gold and silver from electronic waste.

Source: WEF website; WRI website; Eurostat website; IEA — Global Critical Minerals Outlook — [2025]; IEA — Recycling of Critical Minerals — [2024]; International Copper Association — Copper – the pathway to Net Zero — [2023]; Companies' website; Media overview

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Increasing ESG commitments and actions but effectiveness remains low

Top-10 leading companies in the Responsible Mining Index+, 2025



Industry assessments³ of the largest mining companies show a persistent gap between commitment, action, and effectiveness. Improving ESG performance, particularly in areas of limited effectiveness such as economic development and mine lifecycle management, is essential. Mining companies should set measurable ESG targets that close the commitment–effectiveness gap, strengthen transparency to build stakeholder trust, and consistently adopt and share leading practices.

Companies pioneering in sustainable initiatives
↑ ↓ → Increase / decrease / no change in ranking
■ Commitment ■ Action ■ Effectiveness
⋯ Top-25 average

Source: Companies' websites; Companies' sustainability reports; RMI — Responsible Mining Index+ — [2022, 2025]; Media overview

Notes: (1) The Responsible Mining Index+ Report 2025 is an evidence-based assessment of the transparency of 25 large mining companies' policies and practices on economic, environmental, social, and governance issues. The 2025 edition is the latest available data; (2) The company's place in the Overall Corporate Result rank, which reflects company's measures to prevent, avoid, and mitigate the impact of its operations on natural resources and ecosystems; (3) According to the RMI+ 2025 results; (4) The Global Living Wage Coalition is a knowledge-action partnership with the goal of achieving of improved wages and standards of living.

Increasing ESG commitments and actions but effectiveness remains low

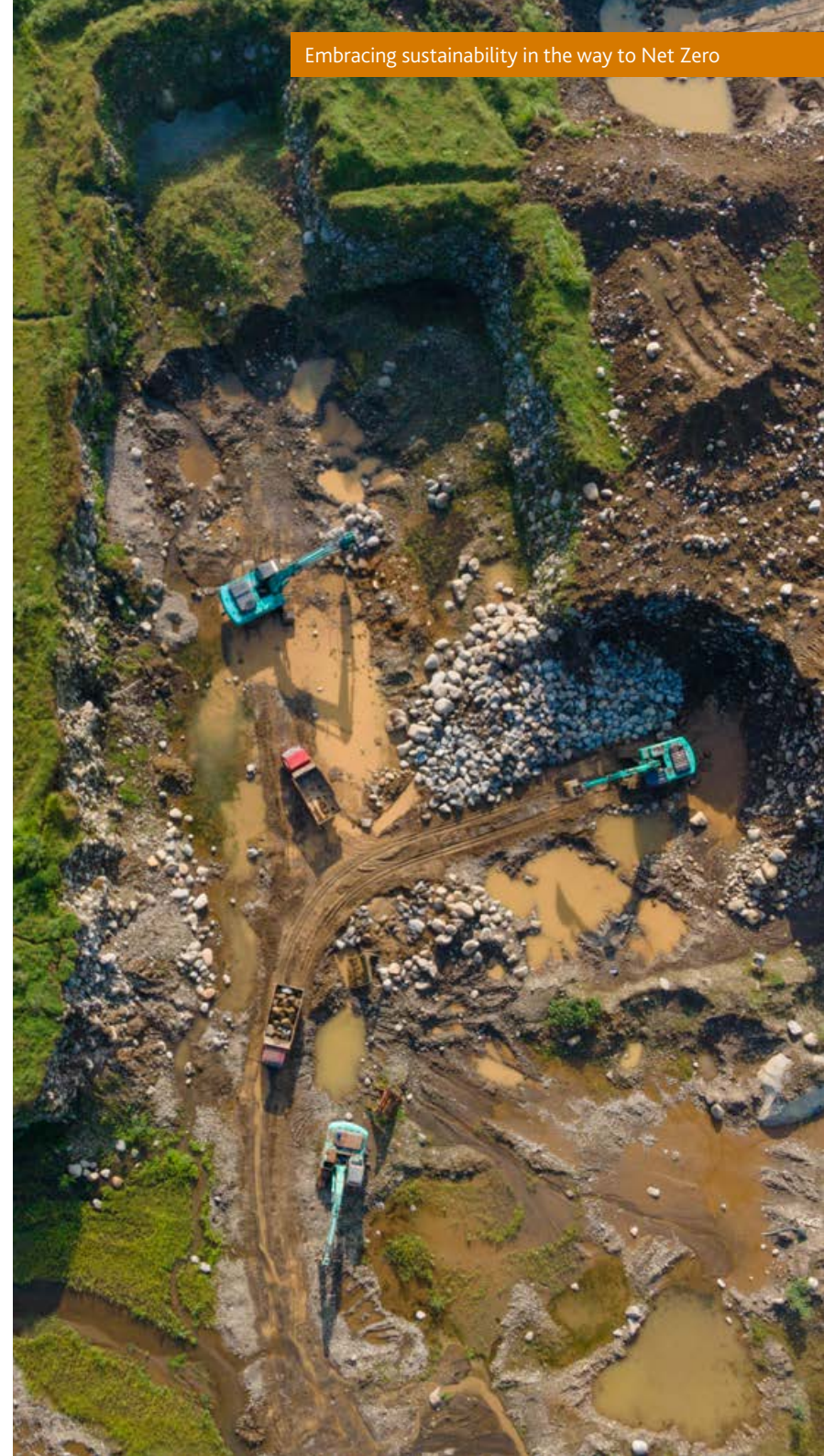
Sustainability performance areas, prioritised by required level of improvement

Economic development	Mine lifecycle management	Working conditions	Environmental responsibility
<ul style="list-style-type: none"> ▶ National and wider regional procurement. 	<ul style="list-style-type: none"> ▶ Circular material management. 	<ul style="list-style-type: none"> ▶ Worker recourse. 	<ul style="list-style-type: none"> ▶ Noise and vibration ▶ Climate change and energy efficiency.
<ul style="list-style-type: none"> ▶ Collaborative R&D ▶ National and regional industrial development planning. 	<ul style="list-style-type: none"> ▶ Emergency preparedness ▶ Project approval processes ▶ Mine closure viability. 	<ul style="list-style-type: none"> ▶ Living wage ▶ Non-discrimination and equal opportunity. 	<ul style="list-style-type: none"> ▶ Water management ▶ Hazardous materials treatment ▶ Biodiversity management.
<ul style="list-style-type: none"> ▶ Strengthening the national skills base. 	<ul style="list-style-type: none"> ▶ Mine project lifecycle management. 	<ul style="list-style-type: none"> ▶ Occupational health and safety ▶ Elimination of forced labour. 	<ul style="list-style-type: none"> ▶ Tailings management ▶ Environmental stewardship.

■ Critical ■ Moderate ■ Sufficient

Source: Companies' websites; Companies' sustainability reports; RMI — Responsible Mining Index+ — [2022, 2025]; Media overview

Notes: (1) The Responsible Mining Index+ Report 2025 is an evidence-based assessment of the transparency of 25 large mining companies' policies and practices on economic, environmental, social, and governance issues. The 2025 edition is the latest available data; (2) The company's place in the Overall Corporate Result rank, which reflects company's measures to prevent, avoid, and mitigate the impact of its operations on natural resources and ecosystems; (3) According to the RMI+ 2025 results; (4) The Global Living Wage Coalition is a knowledge-action partnership with the goal of achieving of improved wages and standards of living



Increasing ESG commitments and actions but effectiveness remains low

Cases of mining companies pioneering in sustainability

Pioneers

Scope 3 emissions reduction



In 2025, Anglo American partnered with the University of Birmingham and Cambridge Future Tech to launch PeroCycle, a venture focused on commercialising carbon-recycling for steelmaking to reduce Scope 3 emissions.

Water stewardship



In 2025, Newmont reported a 7% reduction in fresh-water withdrawals from its 2018 baseline and a 17% reduction at water-stressed sites, achieved through higher water recycling (71%) and improved process-water management.

Circular economy



Vale's 'Waste to Value' program applies circular-economy principles by converting tailings into usable products. In 2024, it produced 12.7 million tonnes of iron ore from circular sources and aims to reach 10% of annual production by 2030.

Emerging leaders

Post-closure planning



Barrick is committed to transfer the three Kibali hydropower stations in the DRC to government authorities, to provide access to energy for local communities after the end of mining operations.

GHG emission reduction



CODELCO is advancing fleet electrification, including electric buses for transporting workers and the first electric underground loader at El Teniente, which is expected to reduce annual GHG emissions by more than 400 tonnes.

Ensuring a living wage



Grupo México, Gold Fields and Vale adopted living-wage policies aligned with the Global Living Wage Coalition⁴, moving beyond minimum-wage standards – an emerging leading practice in Global South regions where wages are often insufficient.

Source: Companies' websites; Companies' sustainability reports; RMI — Responsible Mining Index+ — [2022, 2025]; Media overview

Notes: (1) The Responsible Mining Index+ Report 2025 is an evidence-based assessment of the transparency of 25 large mining companies' policies and practices on economic, environmental, social, and governance issues. The 2025 edition is the latest available data; (2) The company's place in the Overall Corporate Result rank, which reflects company's measures to prevent, avoid, and mitigate the impact of its operations on natural resources and ecosystems; (3) According to the RMI+ 2025 results; (4) The Global Living Wage Coalition is a knowledge-action partnership with the goal of achieving of improved wages and standards of living

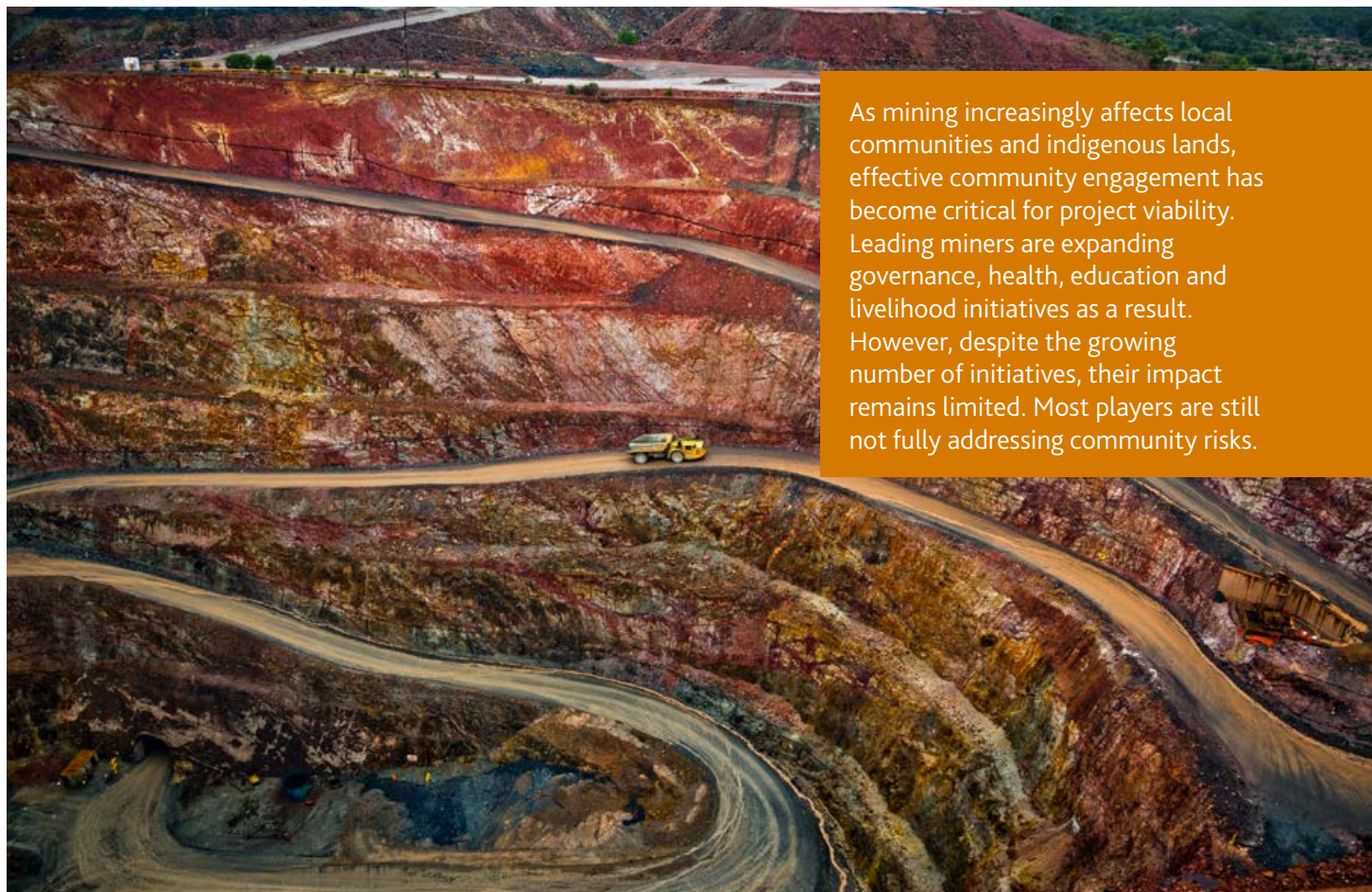
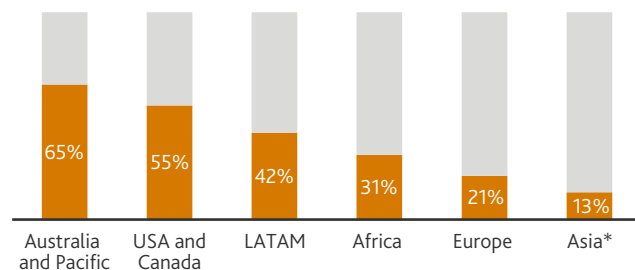


Mining communities recognise positive impact of companies' ESG initiatives

About 43% of energy transition mineral projects are located on or near formally recognised Indigenous or local community lands.

Poor relationships can trigger disputes and cause operational delays. Despite approaches varying significantly across regions, 58% of communities report positive interaction with mining companies through regular engagement.

Share of ETM mines intersecting local and indigenous community lands in 2025¹



As mining increasingly affects local communities and indigenous lands, effective community engagement has become critical for project viability. Leading miners are expanding governance, health, education and livelihood initiatives as a result. However, despite the growing number of initiatives, their impact remains limited. Most players are still not fully addressing community risks.

Source: Companies' websites; Companies' annual integrated and/or sustainability reports; S&P Global — Community matters: Mining, local engagement and the race for critical energy transition minerals — [2025]; Media overview

Notes: (1) Based on the S&P Global analysis of comments recorded in the S&P Global Market Intelligence Metals and Mining Property dataset. Data for Asia is inconclusive; (2) Based on the analysis of 375 community-related initiatives of the Top-15 mining companies in community wellbeing performance, including Albemarle, BHP, Boliden, Buenaventura, CODELCO, Gold Fields, Grupo Mexico, MMG, NMMG, Newmont, OCP, Rio Tinto, Sajin, Sibanye Stillwater, Vedanta; (3) The bubble size indicates the number of community-related initiatives in each region and category across the Top-15 companies; (4) Chile's National Lithium Strategy

Mining communities recognise positive impact of companies' ESG initiatives

Community-related initiatives of the top mining companies worldwide by region and type in 2024²

Category	LATAM & Caribbean	Africa	Australia & Pacific	Asia	USA & Canada	Europe	Category share	Top three types of initiatives
Education, skills and capacity building	●	● ²	●	●	●	●	18.2%	<ul style="list-style-type: none"> Scholarships and higher-education pathways STEM trainings and workforce readiness School support, literacy programmes.
Governance, partnerships and transparency	● ¹	●	●	●	●	●	15.6%	<ul style="list-style-type: none"> Dialogue mechanisms Human rights due diligence Public policy participation.
Indigenous empowerment	●	●	●	●	●	●	15.1%	<ul style="list-style-type: none"> Cultural heritage and language preservation Indigenous partnership agreements Indigenous employment and economic inclusion.
Social investment and community development	●	●	●	●	●	●	15.1%	<ul style="list-style-type: none"> Local infrastructure and facility development Cultural and social cohesion Economic empowerment programmes.
Infrastructure and basic services	●	●	●	●	●	●	10.0%	<ul style="list-style-type: none"> Water, sanitation, and essential utilities Public service facilities Transportation, roads and community mobility.
Economic inclusion and local enterprise support	●	●	●	●	●	●	10.0%	<ul style="list-style-type: none"> Local SME and supply chain development Local employment increasing Agricultural and rural livelihoods development.
Environment, climate and biodiversity	●	●	●	●	●	●	8.2%	<ul style="list-style-type: none"> Ecosystem restoration and species conservation Water stewardship and resource management Decarbonisation and environmental monitoring.
Health, safety and wellbeing	●	●	● ³	●	●	●	7.9%	<ul style="list-style-type: none"> Health services and medical support Emergency response and risk-prevention Wellbeing, recreation and youth protection.
Region's share	35.0%	22.3%	15.9%	13.8%	8.2%	4.9%		

● Bubble size indicates the number of community-related initiatives³

Source: Companies' websites; Companies' annual integrated and/or sustainability reports; S&P Global — Community matters: Mining, local engagement and the race for critical energy transition minerals — [2025]; Media overview

Notes: (1) Based on the S&P Global analysis of comments recorded in the S&P Global Market Intelligence Metals and Mining Property dataset. Data for Asia is inconclusive; (2) Based on the analysis of 375 community-related initiatives of the Top-15 mining companies in community wellbeing performance, including Albemarle, BHP, Boliden, Buenaventura, CODELCO, Gold Fields, Grupo Mexico, MMG, NMMMC, Newmont, OCP, Rio Tinto, Sajin, Sibanye Stillwater, Vedanta; (3) The bubble size indicates the number of community-related initiatives in each region and category across the Top-15 companies; (4) Chile's National Lithium Strategy

1 Latin America & Caribbean

Latin America's mining regions experience frequent social conflict and low community trust due to past grievances and weak state oversight. In response, mining companies increasingly prioritise governance, partnerships, and transparency to strengthen ethical conduct and improve coordination with stakeholders.

In 2025, Codelco and SQM advanced their partnership under CNLS⁴, strengthening state oversight and community engagement in the Antofagasta Region.

2 Africa

In Africa, initiatives aim to expand access to quality learning, strengthening youth employability and improving teaching and digital competencies across communities. Collectively, these actions strengthen human capital and long-term employability in regions where skills development is critical for inclusive growth.

In July 2025, UNESCO and the OCP Foundation signed a \$6.2m partnership agreement from 2025-2028, to advance African higher education, AI and heritage.

3 Australia & Pacific

In 2024, health, safety and wellbeing initiatives of mining companies centred on crisis response, support for vulnerable groups and expanded mental-health and community-safety services. These actions are especially relevant in Australia, where remote mining regions face limited access to essential support services.

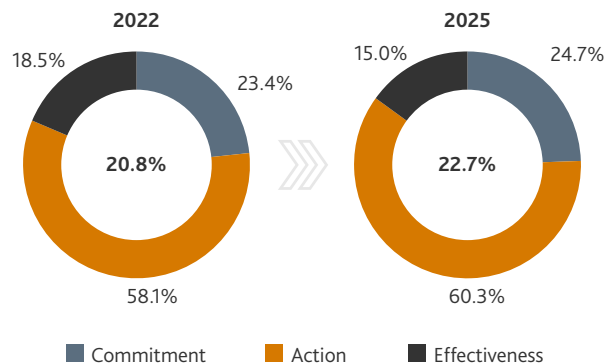
In 2025, BHP supported community health and wellbeing in Western Australia through targeted social investment, including funding for local healthcare services.

Providing value to local communities key to building trust and maintaining a lasting social mandate

Since 2022, mining companies have improved their community well-being scores by increasing the number of initiatives. However, the relative effectiveness of the actions has declined.

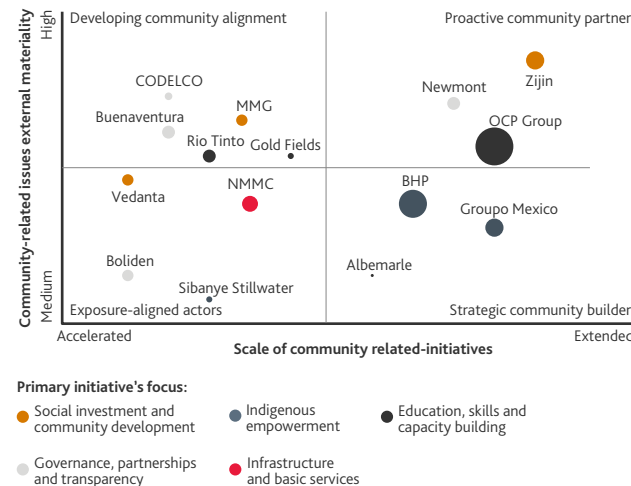
Comprehensive and accountable engagement remains uncommon across the sector. Many companies still treat communities mainly as a risk factor rather than as long-term partners, creating a gap between minimal, compliance-driven interactions and genuine, dialogue-based cooperation aimed at building trust and shared value.

Average community wellbeing score among the top mining companies¹



Average community wellbeing score among top mining companies^{2,3}

In 2024, most mining companies rated the external impact materiality of community matters as high. However, only a few companies undertake initiatives in proportion to the level of materiality. Even the strongest performers by number of initiatives or scale of investment often concentrate disproportionately on one or two themes, leaving other critical community needs unmet.



Examples of mining communities driving economic wealth

When well managed and supported by effective collaboration with local partners, mining can raise living standards by boosting regional and national GDP, generating employment and expanding infrastructure.

Carajás (Pará State), Brazil

Carajás is home to Vale's vast iron-ore complex, the largest open-pit mine in the world and a core driver of Brazil's mining economy. Mining accounts for about 17% of Pará's GDP, with the Carajás system generating major employment, supplier development and infrastructure investment. In Carajás, Vale supports communities by financing local rail transport, investing in local procurement and funding poverty-reduction programmes that assist around 51,000 people in Pará.

Tarkwa, Ghana

Gold mining has long been a major economic engine for Tarkwa, with operations led primarily by Gold Fields. The sector contributes over 50% of Ghana's export earnings, creates substantial local employment, stimulates small business growth and strengthens road networks, water systems and public services. For Gold Fields in 2024, 204 employees and 1,248 contractors came from the Tarkwa host community, meaning 75% of the workforce was local.

Source: Companies' websites; Companies' annual integrated and/or sustainability reports; RMI — Responsible Mining Index+ — [2022, 2025]; S&P Global — Community matters: Mining, local engagement and the race for critical energy transition minerals — [2025]; Media overview

Notes: (1) Based on the Responsible Mining Index, Community wellbeing component; (2) Based on the analysis of 375 community-related initiatives of the Top-15 mining companies in community wellbeing performance, including Albemarle, BHP, Boliden, Buenaventura, CODELCO, Gold Fields, Grupo Mexico, MMG, NMMC, Newmont, OCP, Rio Tinto, Saji, Sibanye Stillwater, and Vedanta; (3) The size of the bubble indicates the amount of the company's community investments in 2024, \$m

AI has moved beyond pilots, now driving measurable gains across the mining lifecycle

AI is becoming the defining technology for the next decade of mining, with 74% of employees expecting major operational change¹ and 59.4% of companies ready to adopt it². The sector is moving from pilots to systematic integration across the value chain, using AI to speed up geological interpretation, improve plant efficiency and optimise or automate equipment, as seen at Freeport-McMoRan, Vizsla Silver and Anglo American.

Stage	Share of mining professionals recognising the AI's value area ¹	Use cases
Exploration and feasibility	Drone exploration 13.9%	Target identification VerAI AI targeting helped Conquest Resources (copper and gold) hit mineralised zones in three of four drill targets, cutting target-to-drill from years to months.
	Blast prediction 13.9%	Resource estimation Maptek DomainMCF software used by Havilah Resources (copper, gold, cobalt, iron ore) cut resource modelling from weeks to hours.
	Auto exploratory drilling 10.6%	Feasibility analysis In 2024, Vizsla Silver (silver) used ML rock-mass categorisation for drill-core stability analysis, revealing improved mine-design assumptions for feasibility.
Design and planning	Complex mining solutions 34.3%	Mine planning and geotechnical design Anugerah Berkah Sejahtera (andesite and sand) mine used rock-slope modelling to maintain high safety levels with a 30m wall.
	Smart mining 31.3%	
	Geotech prediction 17.8%	Infrastructure, environmental and waste design Jabal Sayid Mine (copper) implemented ML-optimised ventilation and achieved a 31.2% reduction in electricity consumption.
	Planning and scheduling 10.6%	
Construction and installation	Inspection robots 15.8%	Site works and equipment setup In 2024, Hexagon's Drill Assist (geo-spatial tech group) used ML to optimise blasthole drilling setup, boosting productivity by 30% and lowering cost per foot by 24%.
	IT and mining education 10.6%	Support facilities and commissioning In 2024, Newcrest (gold and copper) trialed a private 5G network to provide low-latency connectivity required to commission remote control telemetry at Cadia Valley.
	Equipment/method selection 10.4%	
Extraction and processing	Operational efficiency 48.5%	Extraction and waste management In 2024, Sandvik (mining equipment supplier) applied AI-based predictive maintenance via its Remote Monitoring on surface drills to cut unplanned downtime and support multi-rig autonomous control.
	Monitoring systems 44.8%	
	Waste reduction 29.9%	
	Increased productivity 21.2%	Processing and tailings management In 2023, Freeport-McMoRan (copper) applied AI at the Bagdad concentrator to lift throughput 10% in one quarter and copper recovery by 1 p.p., while halving planned capex for upgrades.
	Behaviour monitoring 20.8%	
	Autonomous LHD/drilling 15.8%	
	Autonomous mines 13.4%	Transport, logistics and monitoring In 2024, Komatsu Modular Mining (equipment manufacturer) applied real-time AI ore characterisation integrated with DISPATCH and ProVision to auto re-route trucks.
	Predictive maintenance 6.1%	
	Supply chain prediction 3.0%	
Closure	Improved air/water quality 13.4%	Tailings and environmental monitoring In 2024, Anglo American (multi-mineral) applied AI-supported remote sensing at its tailings facilities to detect early-warning risk signals and reduce the need for on-site inspections.

Source: McKinsey website; Reuters website; MDPI website; S&P Global website; Science Direct website; Global Mining Review website; GlobalData — The impact of AI on the mining sector — [2024]; Discover Applied Sciences — A survey study on the adoption and perception of artificial intelligence in the mining industry — [2025]; Media overview

Notes: (1) According to the survey of employees working in major mines globally, by GlobalData conducted in March-May 2024, n=46; (2) According to the survey of Discover Applied Sciences in the adoption and perception of AI by mining industry professionals conducted in September–October 2024, n=71; (3) Operational technology

AI has moved beyond pilots, now driving measurable gains across the mining lifecycle

AI is widely seen as a driver of innovation across the mining lifecycle, but value remains concentrated in a limited set of high-impact use cases. Productivity gains depend on disciplined execution and integration into core operations. Data readiness, cybersecurity, skills and organisational adoption continue to slow down any wider rollout.

Challenges faced by mining companies in AI implementation¹

Mining has moved beyond the 2022–2023 AI hype peak into a value execution phase. The industry investors acknowledge that capturing value from AI requires secure data use, robust digital foundations and operational adoption. McKinsey indicates that GenAI could unlock major productivity but only about 5% of companies earn 10% or more of their EBIT from AI. Most digital investments deliver less than one third of the expected impact. In response, mining companies are shifting from experimentation to targeted, high-impact use cases and scaling only once ROI is proven.

Challenges		Solutions	
Privacy and security	46.3%	▶ OT3 network segmentation	▶ Data-governance framework.
Cultural resistance	37.3%	▶ Human-in-the-loop oversight	▶ Task-specific digital training.
Poor data infrastructure	34.1%	▶ Private LTE/5G infrastructure	▶ Unified data platform.
Skills gap	32.9%	▶ Internal academy for skills	▶ Vendor-assisted upskilling.
Technical complexity	26.8%	▶ Cross-site standard platform	▶ Modular AI building blocks.
High cost	26.8%	▶ Proof-of-value pilots	▶ ROI-based scaling.

Source: McKinsey website; Reuters website; MDPI website; S&P Global website; Science Direct website; Global Mining Review website; GlobalData — The impact of AI on the mining sector — [2024]; Discover Applied Sciences — A survey study on the adoption and perception of artificial intelligence in the mining industry — [2025]; Media overview

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AI in mining

Marking the shift from reactive incident response to proactive threat prevention
Written by Rory Horgan, CEO Sapiient Insight



AI is transforming industries by automating hazardous and monotonous tasks and leveraging data to allow humans to focus on higher cognitive processes. Although AI encompasses various technologies, it effectively enhances human capabilities with advanced digital agents. In mining, AI is integrated across the value chain, from exploration to market forecasting, improving safety, efficiency, and environmental impact. Companies like Rio Tinto and BHP use AI for autonomous operations, while KoBold Metals employs AI to innovate mineral exploration by mapping underground deposits.

These enterprise level data integration solutions account for a significant portion of money spent on and attention paid to AI in mining, and deservedly so. The realised and forecasted financial implications are massive. The efficiencies already created through AI data integration, throughout the value chain, are driving forecasts. In 2025, the market for AI in mining is forecast at \$35bn, a number eclipsed by the supposed future value of the market over the next 10 years (\$828bn).

Given the ubiquity of the AI in data integration and efficiency it is difficult to know where to look next. One very interesting and immediate application of AI in mining is specifically computer-vision, machine learning and multi-modal sensor networks. These are leading to a slew of smart surveillance technology companies whose tools are deployed or in testing at mines across the world. New, agile AI companies are emerging, processing various data streams in real-time to enhance security, health, safety, and operations.

They innovate by upgrading legacy monitoring systems into intelligent ones that detect anomalies and predict issues before human operators can. By integrating CCTV feeds with IoT sensors, these platforms provide rapid, actionable intelligence without requiring significant capital investment. These technologies are cost-effective, leveraging existing systems for substantial gains. This dynamic sector, featuring companies like Specter, Realm Alliance, and Augur, could significantly impact the industry if their model prevails.

Specter: Military-grade situational awareness

Specter, founded by veterans from Anduril, SpaceX, and Tesla, tackles security challenges in mining, such as breach detection and theft prevention. It monitors operational parameters and safety hazards using rugged wireless sensors with high-resolution cameras. These sensors work 24/7 and include deterrent features like speakers and LED lights. Specter's AI-powered software offers customizable detection rules and real-time alerts, transforming sites with minimal sensors into smart surveillance networks that automate issue detection and response.

Augur: Transforming legacy CCTV into operational

IntelligenceAugur, developed by ex-Palantir engineers and UK armed forces veterans, enhances mining operations by integrating AI with existing CCTV systems, eliminating the need for new hardware. This approach transforms legacy sensor networks into real-time operational intelligence platforms, addressing health, safety, security, and efficiency challenges. Augur monitors PPE compliance, detects intrusions, and automates issue detection, reducing manual monitoring. Its forward-deployed engineers work directly with mining teams to quickly implement tailored, risk-based configurations for specific sites.

Realm Alliance: Software-first mining intelligence

Realm Alliance enhances mining operations by transforming existing infrastructure into intelligent systems through software deployment, without requiring new hardware. Implemented globally in mining and agriculture, and led by Alma Risk in the UK, the platform integrates with current camera networks, sensors, and data sources to enable real-time monitoring and predictive analytics. This approach identifies issues like conveyor misalignment and mechanical wear, accelerating time-to-value while leveraging existing investments.

The path forward

The convergence of physical monitoring represents the comprehensive modernisation mining operations require as they deploy autonomous equipment, implement remote operations centres, and integrate IoT sensors throughout value chains. These AI platforms enable mining companies to scale monitoring and protection capabilities without proportionally scaling human workforces, addressing skilled labour challenges while improving consistency and response times across their operations.

The shift from reactive incident response to proactive threat prevention fundamentally changes risk profiles for mining operations, enabling companies to identify and mitigate issues before they result in injuries, production disruptions, or commodity losses. As the mining sector becomes increasingly digitised, these intelligent monitoring systems will prove essential to maintaining operational continuity, workforce safety, and asset protection across global operations.

Who are Sapiient

Sapiient Insight advises clients on opportunities and risks to their interests. Through digitised human networks and open-source analytical software we discover verified, novel and relevant information. Delivered as actionable insight, we offer our clients a competitive advantage, helping them to make better, faster decisions.

Technology key to vision of zero harm

Mining and quarrying is one of the three most hazardous sectors globally, with one of the highest fatal occupational injury rates across all industries. Injury rates have improved over time but the progress remains gradual, partly due to persistent everyday incidents rather than large-scale accidents. The situation is further strained by the growing prevalence of illegal mining. For instance, in 2025, at least 78 informal miners died after months trapped in an abandoned gold mine in South Africa.

State of occupational safety and health in mining industry in 2024¹

Mining and quarrying is also the third most harmful industry for workers worldwide, owing to mechanical and structural hazards, respiratory and chemical exposure, and psychological pressures.

Mining and quarrying has the second-highest rate of occupational safety and health training, behind the utilities sector. However, there is still significant room for improvement.

21% of workers in the mining and quarrying sectors have been harmed at work in the past two years

43% of workers in mining and quarrying have never received occupational safety and health training

Technologies can significantly improve mining safety, particularly by reducing person-vehicle interaction risks. However, 89% of respondents^{2,3} from the industry reported a disconnect between corporate and mine site teams regarding innovation and progress. This gap can hinder technology adoption, making close communication with on-site staff essential.

Potential improvement in mining with technologies

Underground operations

Drones for hazards identification



Robots for laying explosion



Material handling

IoT wearable tech for health monitoring



Autonomous conveying system



Training

VR simulation training platforms



Apps for mental health check-ins



Prediction

LiDAR-based imaging and mapping



AI-based platform for risk assessment



■ Mechanical & Structural ■ Respiratory & Chemicals
■ Physical & Sanitary ■ Psychological & Social

Safety in mining, despite gradual improvements, continues to be affected by routine incidents, particularly mobile-equipment interactions and geotechnical events. Central safety frameworks are sometimes less effective at the site level which slows progress in harm reduction. Technology is increasingly used to reduce exposure and enable earlier intervention.

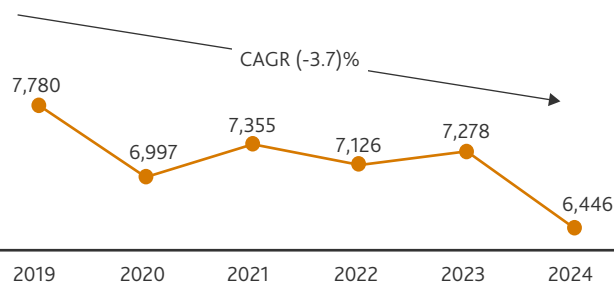
Source: ICMM website; ILO website; ICMM — Safety Performance Report — [2024]; I4 Mining — How the Mining Sector can Achieve Zero Harm with Industry 4.0 Technology — [2021]; Axora — Mining Technology Trends — [2023/2024]; Media overview

Notes: (1) According to the Lloyd's Register Foundation World Risk Poll mining workers conducted in 2023 across 142 countries, n=147,000; (2) Compared to 82% in 2022; (3) According to Axora's survey of senior decision-makers from metals and mining companies globally conducted from March 2023 to April 2023, n=160; (4) The report is based on data from 24 ICMM members



Technology key to vision of zero harm

Number of total recordable injuries for ICMM company members⁴



Periodic operational incidents delay the mining industry's progress towards attaining a zero-harm environment, making it a long-term goal. In 2024, ICMM members recorded 6,456 injuries with 42 fatalities (36 in 2023) despite a centralised approach to critical control management. A significant share of incidents involved mobile-equipment interactions and fall-of-ground events, often caused by workers entering hazardous zones. Despite that, the overall figures show a downward trend. To further reduce incident rates, industry players must actively exchange knowledge, best practices, and innovative solutions to raise safety standards worldwide.

Source: ICMM website; ILO website; ICMM — Safety Performance Report — [2024]; I4 Mining — How the Mining Sector can Achieve Zero Harm with Industry 4.0 Technology — [2021]; Axora — Mining Technology Trends — [2023/2024]; Media overview

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Recent practices for ensuring employee health and safety in the global mining industry

Antofagasta Minerals
Collision-avoidance safety tech

Antofagasta installed sensor-based Collision Avoidance Systems across all mobile equipment, enhancing operator alerts and supporting a continued reduction in potential safety incidents.

BHP
Field-leadership safety

BHP strengthened frontline safety by standardising BOS Role Confirmations, a routine that improves coaching, verifies risk controls and drives more consistent and high quality field safety engagement.

Ok Tedi Mining
Predictive fatigue management

Ok Tedi deployed Readi fatigue-prediction wearables for 635 operators, enabling early interventions, cutting in-cab fatigue alerts and improving the safety of haul-truck operations.



How BDO can help

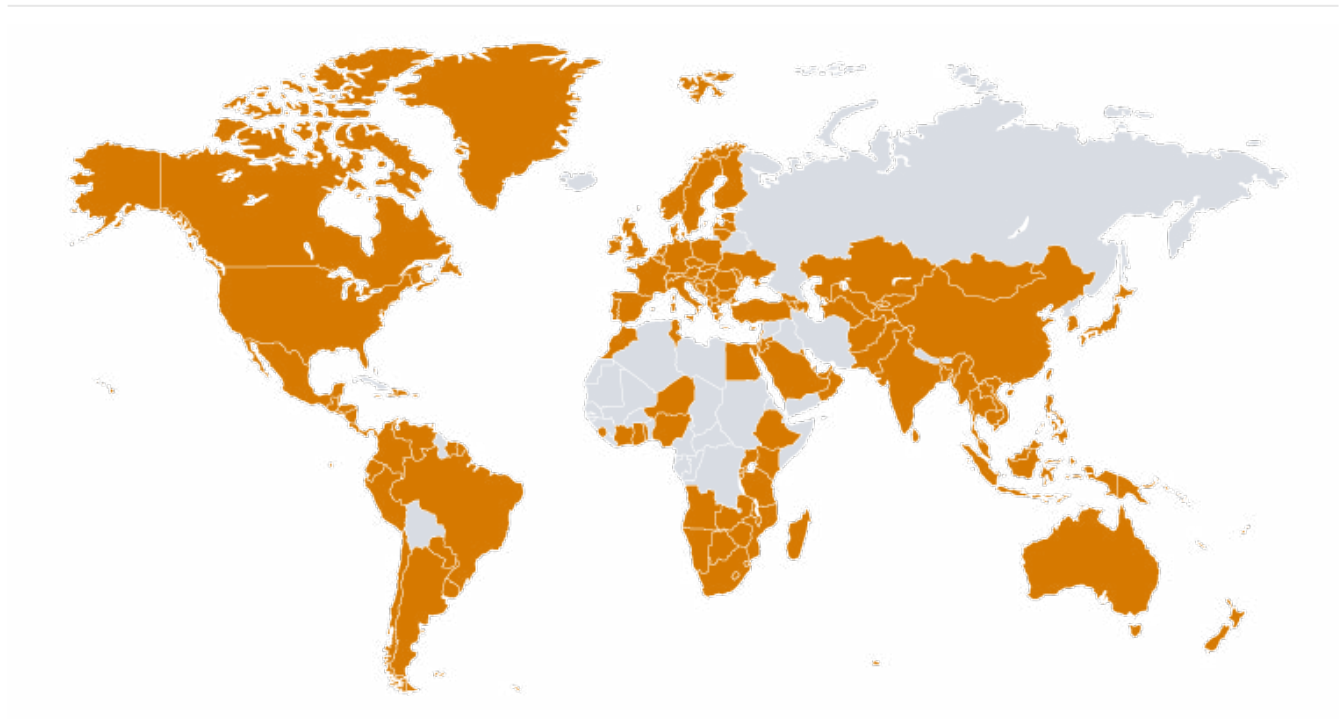
Our dedicated team of natural resources and energy specialists work across all parts of our business including audit, tax, corporate finance, forensics and advisory.

The services and facilities provided by the natural resources services sector are truly diverse and the companies operating within it have an international footprint. This diversity and international focus sit squarely within BDO's skill set.

BDO's international reach ensures we can provide professional services to sector companies in a way that mirrors their own corporate structures and operations.

Key facts about the BDO International natural resources practice

- ▶ The natural resources sector is deeply international in nature. As a result, at BDO we treat our international natural resources team as a key priority sector for our global network
- ▶ 'Centres of Excellence' in the UK, North and South America, Australia, UAE, China and South Africa
- ▶ 100+ partners across the world who work exclusively within the natural resources sector.



BDO INTERNATIONAL

US\$16 billion 2024/2025 REVENUE
INCLUDING ALLIANCE FIRMS
US\$11 billion MEMBER FIRMS

169
 COUNTRIES &
 TERRITORIES

870 OFFICES
94,900 STAFF

All numbers updated as of 10 December 2025

Meet the Natural Resources and Energy team

At BDO, we have 100+ partners across the world who work exclusively within the natural resources sector. Below are the details of the team who contributed to this report. If you would like to discuss any of the content in this report or want to connect with any of our experts, please do get in touch.

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Glossary of terms

\$/t.oz	Dollars per troy ounce
\$/dmtu	Thousands of dollars per metric tonne
\$/mt	Thousands of dollars per dry metric tonne unit
AI	Artificial Intelligence
Mtpa	Million tonnes per annum
CAGR	Compound annual growth rate
CPS	Current Policies Scenario
US DoE	United States Department of Energy
EOL-RR	End-of-Life Recycling Rate
ESG	Environmental, social, and governance
ETM	Energy transition minerals
EVs	Electric vehicles
GDP	Gross domestic product
GHG	Greenhouse gases
Gj per t	Gigajoules per tonne
ICMM	International Council on Mining and Metals
IEA	International Energy Agency
GHG	Greenhouse gases
Gtce	Gigatonne of coal equivalent
HIV	Human immunodeficiency virus
HSE	Health, Safety, Environment
ICMM	International Council on Mining and Metals
IEA	International Energy Agency
IoT	Internet of things
Kg/MW	Kilogramme per megawatt
LHD	Load-Haul-Dump

LiDAR	Light Detection and Ranging
LTE	Long Term Evolution
Mt	Metric tonnes
Mt Li	Metric tonnes of lithium content
Mtce	Million tonnes of coal equivalent
MW	Megawatt
NZE	Net Zero Emissions
OT	Operational technology
REE	Rare Earth Element
STEPS	Stated Policies Scenario
T of CO₂ per t	Tonnes of CO ₂ emitted per tonne
UAV	Unmanned Aerial Vehicle
VR	Virtual Reality
Elements	
Au	Gold
C	Graphite
Co	Cobalt
Cr	Chromium
Cu	Copper
Li	Lithium
Mn	Manganese
NdPr	Neodymium-Praseodymium
Ni	Nickel
REEs	Rare Earth Elements
Si	Silicon
Zn	Zinc



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