



# Annual Mining Report 2024

Reshaping the Mining Landscape: Future  
Transformations and Global Energy Impact

January 2024

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# Contents

The global mining industry has a pivotal role to play in the global green energy transition. The industry supplies the minerals to make green energy possible. It has also historically been a significant part of the global economy that needs to decarbonise.

Geopolitical and economic volatility in 2022 meant that the focus on energy transition minerals was briefly superseded by energy extraction. However, 2023 saw a return to sustainability and decarbonisation. Exploration efforts and government investment have been firmly focused on the supply of energy transition materials.

The industry trend towards consolidation is shown by the consistent increase in M&A value over the past three years. The global investor community is one of the driving forces behind the development of sustainable and ESG goals for individual businesses.

The strategic shift towards sustainability through renewable energy and innovative technologies, has not come cheap and has at times been at odds with the demand from investors for financial resilience. At times, it has also been at odds with the need to meet the demand for energy transition minerals so important for decarbonisation.

We are equipped to help you navigate these challenging and sometimes contradictory demands on your business. You can work with us to establish or improve your corporate reporting, especially when it comes to ESG and decarbonisation.

Whether you are planning to complete a transaction or you are looking for funding or investment, our experienced Mining M&A team have the knowledge of the market that will prove invaluable. Finally, Our commercial advisory experts will help you improve your supply chains and your management of key contracts.

Our Mining team are part of the UK's fifth largest accounting and business services firm. You can rely on us and our colleagues to help to successfully negotiate any of the opportunities and challenges you face.



**Matt Crane** - Head of Natural Resources and Energy

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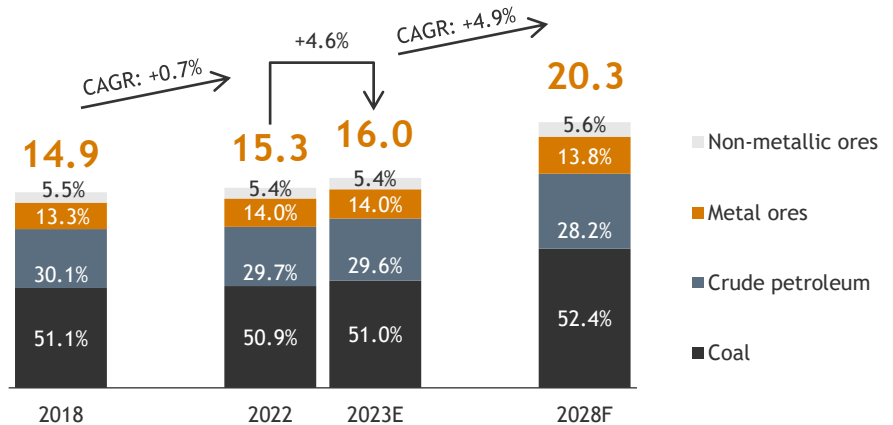
# The mining industry views energy transition metals and sustainability as pivotal focal areas

The challenges of contributing to decarbonisation and meeting societal expectations are driving a profound transformation of the global mining industry. The industry has to become more sustainable but must also address energy security concerns and ensure that commodities are affordable.

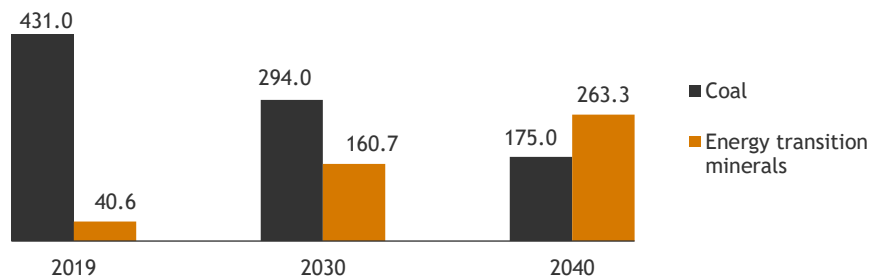
The long-term trend of reducing the preponderance of coal was interrupted in 2022. In fact, coal demand reached a historic peak of 8bn tons driven by both its availability and its relatively low price compared to gas. Most countries, including the EU, US and Japan, saw demand for coal return to the downward trend but China, India and Indonesia continued to drive demand for coal through 2023.

We expect the transformation of the industry to continue apace. The global demand for coal is projected to decrease slightly to 6bn tons in 2030 before falling to just 1bn tons in 2050. Coal will be replaced by energy transition minerals as the main driver of revenue between 2030 and 2040.

Global mining industry size by production volume, in trillion kilogrammes



Revenue from production of coal and energy transition minerals, \$billions



## Key trends in the global mining industry

### Shifting focus to minerals for sustainable energy

Coal dominated production volumes and revenues in 2022. However, the demand for energy transition minerals is driving investments in cobalt, nickel, copper, lithium, zinc, etc.

By 2050, these minerals are projected to exceed coal in terms of revenue by 51%.

### Increased exposure to high-value M&A transactions

M&A activity in the industry has been substantial with an average annual deal value of nearly \$20 bn. While 2021-2023 saw the number of deals per year fall, the total value of deals value grew.

The rise in metal prices provided mining companies with the cash to focus on bigger acquisitions with higher returns.

### Growing investor interest in sustainability

As of 2022, around 70% of investors preferred to avoid investments in mining companies failing to meet their decarbonisation targets. The mining industry is increasingly addressing ESG concerns relating to its operations. The electrification of mining equipment and the use of renewable energy are at the forefront of efforts to achieve net-zero goals.

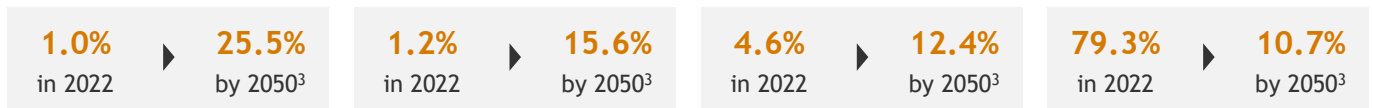
Source: Statista website; McKinsey & Company – Global Energy Perspective 2023 – [October 2023]; IEA – Coal Market Update – [July 2023]; S&P Global – Mining M&A in 2022 – [March 2023]; IEA – The role of critical minerals in clean energy transition – [March 2022]; Accenture – How investors view mining’s new role as a champion of decarbonisation – [2022].

# Green energy technologies will drive transformational changes in metal demand

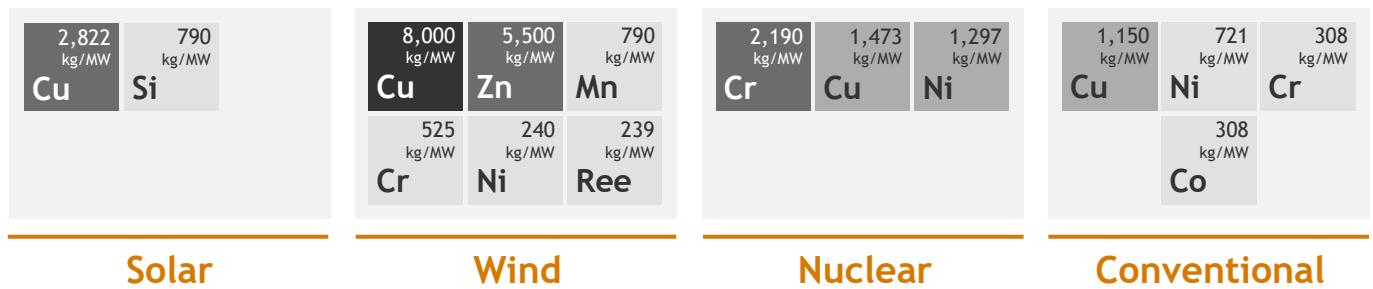
Renewable energy sources are expected to provide 70%-90% of power generation by 2050, with solar energy being the most significant source. The shift to green energy will lead to a massive increase in the demand for a range of metals and minerals including lithium (Li), cobalt (Co), nickel (Ni), copper (Cu) and other rare earth elements (Ree).

These elements are indispensable to the production of electric vehicles, of solar panels, wind turbines and other clean energy technologies such as batteries. By 2040, the total mineral demand from clean energy technologies will at least double<sup>1</sup>.

## Share in the global energy mix<sup>2</sup>, %



## Critical minerals used for power generation, kg/MW<sup>4</sup>



Solar generation is expected to play a pivotal role in the energy transition path, setting to lead the pack, contingent on the availability of copper and silicon. Meanwhile, wind power emerges as a key player, dictating global demand for copper and zinc. Additionally, the increase in EV fleets within the following decades will drive the demand for the commodities required in EV production.

## Total electric vehicle (EV) fleet



## Critical minerals used in electric cars, kg/vehicle



**Au** Gold: In an era of economic unpredictability and global uncertainty, there is an additional trend towards a discernible increase in demand for gold as a secure and highly liquid asset

The recent geopolitical tensions, high inflation, and global energy crisis have driven gold demand to its highest level in a decade, reaching 4.7 thousand metric tonnes in 2022. This surge was primarily attributed to central banks' acquisition of precious metals for portfolio diversification and increased interest from private investors seeking a hedge against high inflation.

Source: Statista website; IEA – Critical minerals Market Review 2023 – [2023]; IEA – Critical minerals Data Explorer – [July 2023]; IEA – The role of critical minerals in the clean energy transition – [March 2022]; World Gold Council website.

Notes: (1) Due to the Stated Policies Scenario; (2) Total global energy mix comprises both unabated and abated fossil fuels, solar, wind, nuclear, hydro, bioenergy and other renewables; (3) Due to the Net Zero Scenario; (4) Kilogram per megawatt.



Top-countries<sup>1</sup> by reserves and production of main critical minerals in 2022<sup>2</sup>



Proportion of  
■ Reserves<sup>3</sup> ■ Mine production<sup>4</sup>

Country	Reserves <sup>3</sup>	Mine production <sup>4</sup>
Canada	Au	Cr
USA	Cu, Ree	
Peru	Cu, Cu, Zn	
Chile	Cu, Cu	
Brazil	Ree, Mn, Ni, Si	
South Africa	Mn, Cr, Au	Mn, Cr
Turkey		Cr
Gabon		Mn
DRC		Cu
India	Cr	
Indonesia	Ni, Ni	
Kazakhstan	Cr, Cr	
Russia	Au, Zn, Ree	Au, Ni, Zi
China	Mn, Zn, Ree, Au	Mn, Zn, Ree, Au
Vietnam	Ree	
Philippines		Ni
Australia	Mn, Zn, Au, Cu, Ni	Mn, Zn, Au, Ree

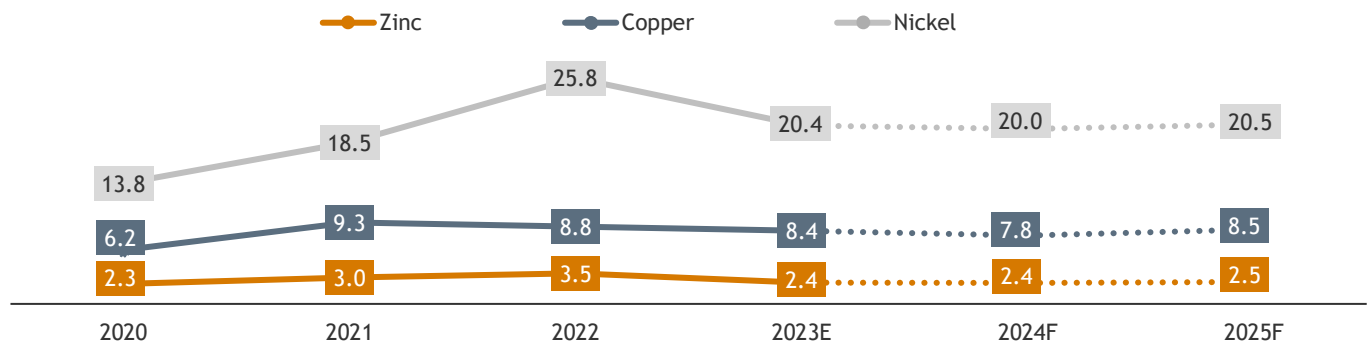
As the demand for and production of clean energy technologies has ramped up, so has demand for those critical minerals that underpin them. In 2021-22, this led to a substantial escalation in exploration spending. There followed an increase in the production of most energy transition minerals, especially rare earth elements, nickel and silicon. Gold also experienced a year-on-year rise in production in 2022, with China, Australia, and Russia still the top suppliers. Zinc was an anomaly as energy prices and a fall in economic activity in China led to fluctuating demand and production.

The result was a surge in global reserves for copper, nickel, rare earth elements, and manganese. Australia and China emerged as the dominant holders of reserves of these energy transition minerals.

Source: Trading economics website; USGS – Mineral Commodity Summaries – [2018-2023]; IEA – Critical minerals Market Review 2023 – [2023]; IEA – Critical minerals Data Explorer – [July 2023]; World Gold Council website.

Notes: (1) Represent each of the Top-3 countries in terms of reserves and mine production as of 2022; (2) Metric tonnes; (3) The country was highlighted in red in case of a higher number of leading positions in critical minerals reserves; (4) The country was highlighted in grey in case of a higher number of leading positions in critical minerals mine production.

Global prices for minerals, \$k per mt



Nickel prices fell significantly in 2023 due to increased production, oversupply, weak demand, and increased production capacity. Growing production in Indonesia and the Philippines will depress prices further in 2024. However, from 2025 onwards production of EV batteries will push up demand and prices.

Copper prices fluctuated due to the lack of solid demand growth in China amidst low investment and construction activity. Prices are forecast to fall further in 2024, reflecting weakening global demand and strong supply growth. Prices should rebound in 2025 as global demand recovers and the green transition intensifies.

Prices dropped in 2023 Q3 and are expected to further fall in 2024 on weak demand and rising inventories. Slowing industrial activity in China and other major economies curtailed demand for zinc. While in 2025 zinc prices are expected to increase due to recovering global demand.



Global price for Gold, \$/t.oz<sup>2</sup>



Average gold prices reached 1,984 \$/t oz in November 2023 and are expected to increase in 2024. Prices should fall again in 2025 as inflation and recession fears fade. However, any escalation of the conflict in the Middle East could result in sharply higher prices due to increased demand for safe-haven assets.

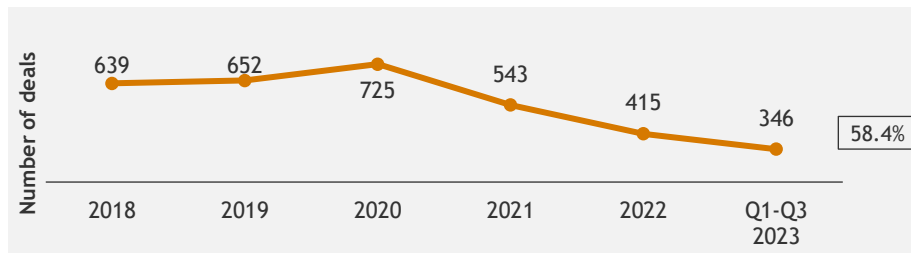
Source: Trading economics website; USGS – Mineral Commodity Summaries – [2018-2023]; IEA – Critical minerals Market Review 2023 – [2023]; IEA – Critical minerals Data Explorer – [July 2023]; World Gold Council website.

Notes: (2) Troy ounce; (3) Average Q3 2023; (4) World Bank's forecast.

# Consolidation for greater value

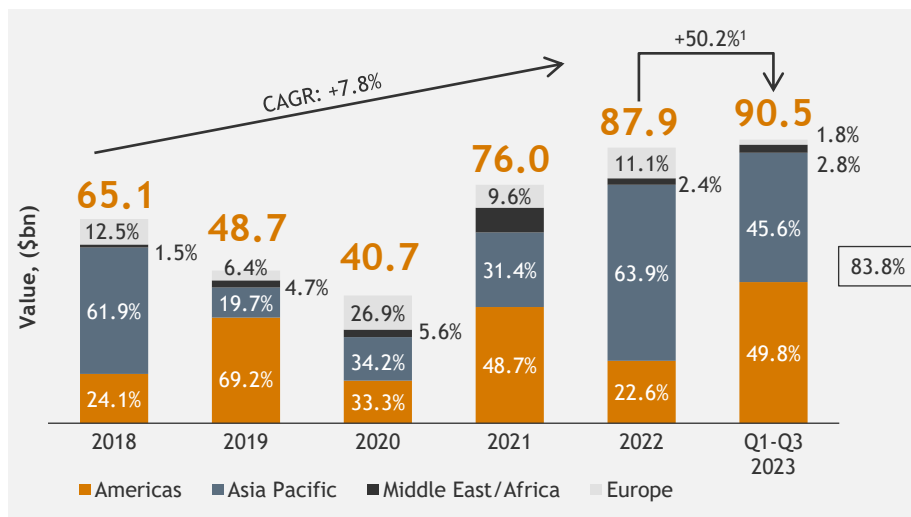
The mining sector is experiencing an upward trend in value. The global economic recovery, elevated prices of premium commodities and the focus on sustainable practices within the industry have all contributed to values increasing since the dip caused by the Covid-19 pandemic.

## M&A activity in the global mining industry



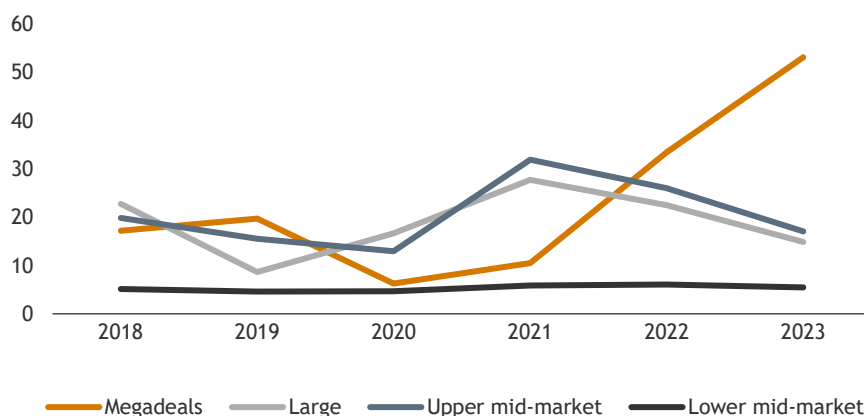
## Top-3 countries as of Q1-Q3 2023<sup>1</sup>

Australia	76	+28 Deals
Canada	74	+7 Deals
China	52	+6 Deals



Canada	\$37.1 billions	+462.1%
Australia	\$29.8 billions	+204.1%
China	\$8.9 billions	(-62.4%)

## M&A activity by size of the deal



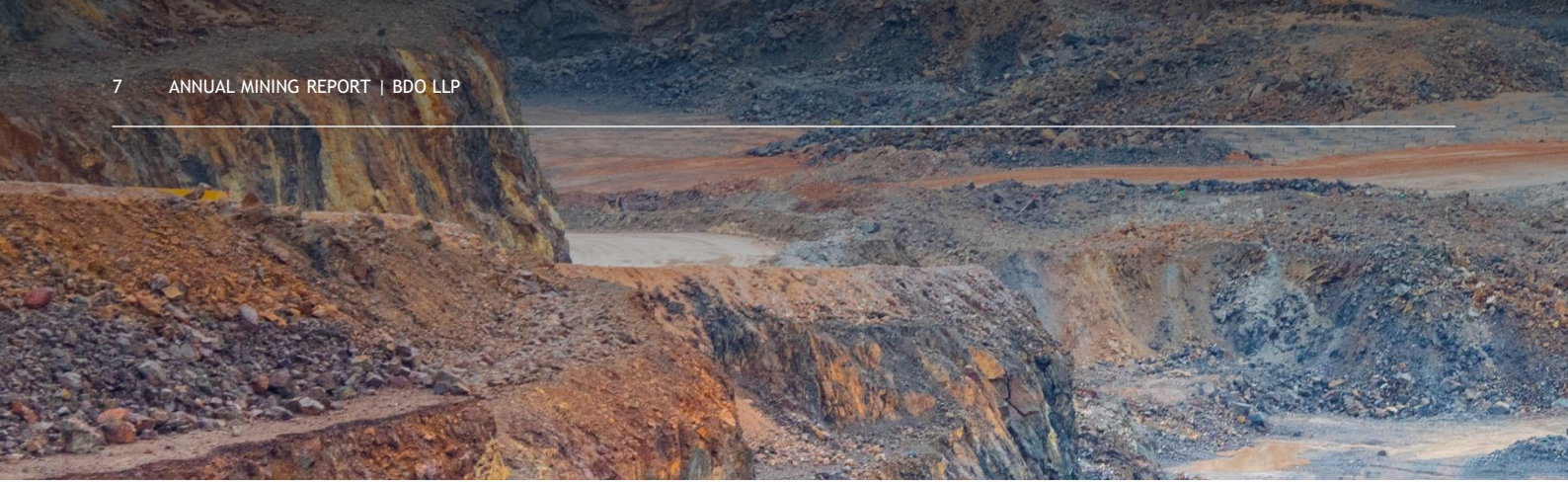
Over the past five years, M&A activity in the global mining industry has experienced two contrasting dynamics; increased deal values and falling numbers of deals. The overall value of M&A deals exceeded \$90bn in the first three quarters of 2023 compared to just over \$40bn in 2020. This is partly explained by the substantial increase in megadeals<sup>4</sup>.

Meanwhile, the number of deals has fallen<sup>3</sup> from a high of 725 in 2020 to just 346 in the first three quarters of 2023. The rise in the number of deals has been largely driven by the mid-market<sup>2</sup>.

Our experience is that there lots of opportunities in the market as larger mining groups both chase diversification into critical metals and need to divest. Our Corporate Finance and Deals team have been using their knowledge and expertise to support some of these deals.

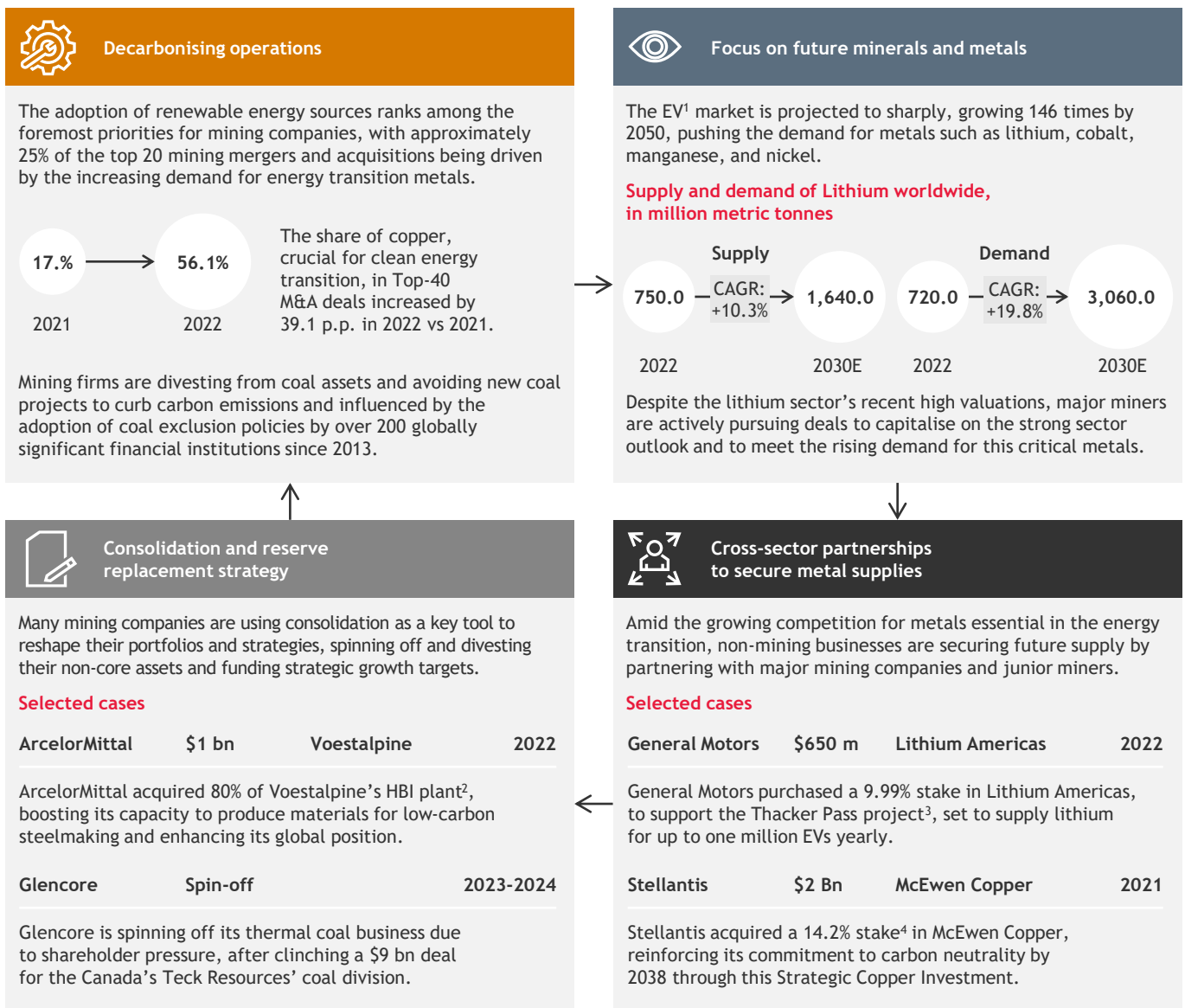
Source: Which&Case website; Evalueserve – Outlook: M&A Trends in the Mining Sector – [2021].

Notes: (1) Compared to Q1-Q3 2022; (2) Deals for \$0.1-1.0 bn; (3) Deals for \$5.0-99.0 m; (4) Deals for more than \$5.0 bn; (5) Deals for \$1.0-5.0 bn.



Many of the M&A deals<sup>1</sup> we have seen in the sector are being driven by the focus on sustainability. This includes decarbonising operations, business consolidation and partnerships to secure the supply of minerals increasing in demand.

**M&A trends in mining**



Source: GlobalData – Mining Industry Mergers and Acquisitions Deals by Top Themes in 2022 – [2023]; Evalueserve – M&A Trends in the Mining Sector – [2021]; Lithium Americas – Corporate presentation – [2023]; IEEFA – 200 and counting: Global financial institutions are exiting coal – [2023]; Visual Capitalist – The Lithium Rush: Can We Meet Tomorrow's Lithium Demand? – [2023]; Stellantis website; Statista website; General Motors website; Mining Technology website












Notes: (1) Electrical vehicles; (2) Hot Briquetted Iron plant, located near Corpus Christi, Texas; (3) The largest known lithium resource in the USA; (4) Increasing its ownership to 19.4% stake of McEwen Copper, a subsidiary of Canadian mining company McEwen Mining.



# Gold and copper driving the largest M&A deals

Current M&A activities have the potential to have a lasting impact on the industry as it creates large, global mining conglomerates. Expanding global market share remains the primary motive for major M&A deals. However, sustainable development is also becoming a crucial driver for such activity with reduced carbon emissions and increased use of clean energy driving a lot of M&A activity over the past two years.

## Top-5 M&A deals by value in the mining industry since 2022

<p><b>Cannington project – \$19.2 bn</b> <span style="float: right;">Mar 2023</span></p> <p> </p> <p>Metals<sup>1</sup>: Copper, Gold</p> <p><b>Coolabah Metals acquired the Cannington Project in Queensland, Australia, encompassing two exploration licences spanning 113.4 square kilometres from Thomson Resources Ltd. Despite the proximity to the silver, lead, and zinc deposits of the Cannington and Pegmont mines, the primary focus within the Cannington project pertains to Brumby. This copper-gold project exhibits a spatial correlation with a robust magnetic high, suggesting its interpretation as an Iron Oxide Copper Gold (IOCG) style target. This strategic move aimed to enhance Coolabah's position in exploring the promising tenements under its ownership.</b></p>	<p><b>Newcrest Mining Ltd – \$19.1 bn</b> <span style="float: right;">Feb 2023</span></p> <p> </p> <p>Metals<sup>1</sup>: Gold, Copper</p> <p><b>Newcrest Mining Limited consists of six operating mines in total (two – in Australia, two – in Canada, two – in Papua New Guinea), and one mine under construction in Australia. The acquisition of Newcrest Mining allowed Newmont, already the world's biggest gold miner, to expand its global scope of mining operations further. Such a strategic move aimed to strengthen Newmont's position through a combination of high-quality operations, projects, and reserves concentrated in low-risk jurisdictions, as well as to support decades of safe, profitable, and responsible gold and copper production.</b></p>	
<p><b>OZ Minerals – \$6.4 bn</b> <span style="float: right;">Dec 2022</span></p> <p> </p> <p>Metals<sup>1</sup>: Copper, Nickel</p> <p><b>BHP acquired OZ Minerals, known for its copper, gold, and silver projects in Australia, to strengthen BHP's copper and nickel portfolio. This strategic move aims to address the rising demand for critical minerals crucial for EVs<sup>2</sup>, wind turbines, and solar panels, thus supporting clean energy generation.</b></p>	<p><b>Polyus – \$6.3 bn</b> <span style="float: right;">Apr 2022</span></p> <p> </p> <p>Metals<sup>1</sup>: Gold</p> <p><b>AKROPOL GROUP LTD acquired a 29.99% stake in the PJSC<sup>3</sup> Polyus, a fully-owned subsidiary of Wandle Holdings Limited, with gold mines in Russia.</b></p>	<p><b>Yamana Gold – \$4.8 bn</b> <span style="float: right;">Nov 2022</span></p> <p>  </p> <p>Metals<sup>1</sup>: Gold, Silver</p> <p><b>Pan American Silver (PAAS) acquired all shares of Yamana Gold Inc. after Yamana Gold sold its Canadian assets to Agnico Eagle Mines Limited. PAAS aimed to expand its Latin American presence by adding Brazil and Chile and to boost silver and gold production.</b></p>

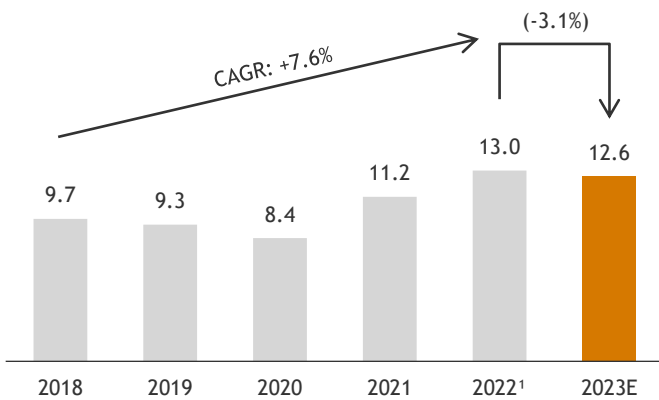
Source: Coolabah metals website; Newcrest Mining Limited website; OZ Minerals website; GlobalData Mining Intelligence Center; BHP – Completion of OZ Minerals acquisition – [2023]; War & Sanctions website; Pan American Silver website; Media overview.

Notes: (1) Primary mining focus of the acquiring company; (2) Electric vehicles; (3) Public Joint Stock Company; (4) It might be speculated that selling and donating all his shares by Mr Said Kerimov could be a result of sanctions imposed on him.

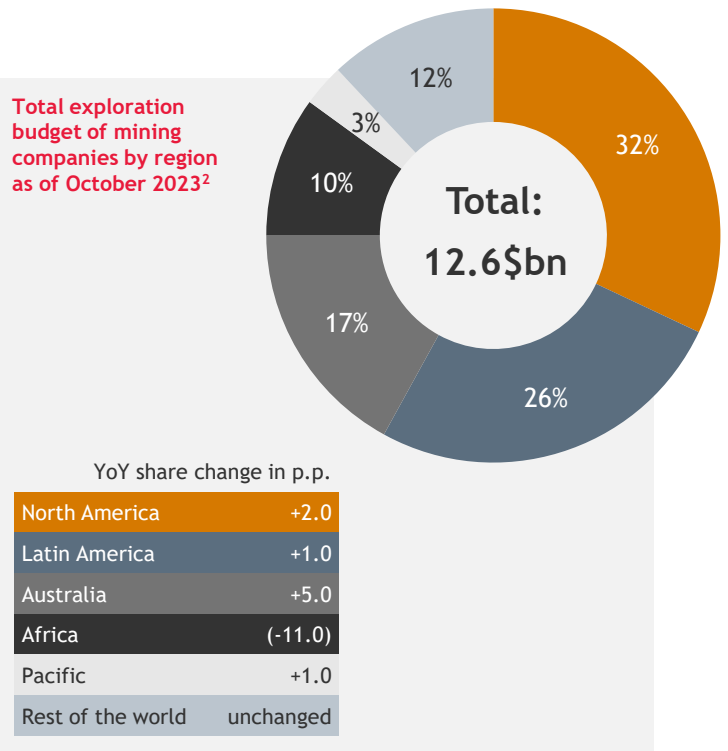
# Mining companies struggle to fund exploration

The growing pace of the green energy transition around the globe has created a need for new exploration to boost the production of energy transition minerals. As global demand for critical minerals is expected to almost quadruple by 2030, mining companies focused on finding these resources. The single biggest obstacle has been funding.

Total exploration budget of mining companies around the globe (\$bn)<sup>1</sup>



Total exploration budget of mining companies by region as of October 2023<sup>2</sup>



In 2022, the surge in metal prices and favourable financing conditions led to a significant increase in exploration budgets, which reached a nine-year record. However, significant political risks, such as tax pressure, rising interest rates, and sovereign debt crises, affected the role of Africa as an exploration destination. In addition, a 32% YoY drop in Russia's exploration budget due to its invasion of Ukraine is behind the considerable decline in the value of exploration budgets for the "Rest of the world" region.

Out of the top five targeted metals<sup>3</sup>, the exploration budget for lithium experienced the most rapid growth, rising by 88% YoY in 2022. This rise can be attributed to lithium's pivotal role in battery production, essential for storing electricity from solar and wind power plants. Nonetheless, Gold remained a primary focus for mining companies due to its robust operating leverage, representing 53% of the total exploration budgets in 2022.

Despite the number of mining companies conducting exploration activities increasing by 2% YoY in 2023, the total exploration budget of these companies worldwide is estimated to have declined. The reduction in budgets for exploration projects is caused by the weaker financial contribution of junior mining companies and a return in metal prices to pre-2021 levels, affecting the availability of cash flow for investments.

Yearly funds raised by mining companies<sup>4</sup> as of June 2023

**\$5.3 bn** YoY (-18.5%)

Estimated total capital spending of mining companies in 2023

**\$104.2 bn** YoY (-4.0%)

In 2022, exploration activity became less important for investors in capital allocation. Specifically, almost 30% fewer investors cited the importance of a mining company's exploration endeavours compared to the solidity of its financial position. The tendency of investors to receive near-term share buybacks instead of waiting for a long-term investment return led to a gradual decline in funds raised by mining companies during 2022-2023.

Difficulties in raising funds, coupled with construction delays and the lack of approval for new projects, are expected to result in a nearly 26% reduction in total capital spending of mining companies in 2027 compared to 2023.

We have worked with clients in the mining sector improve their control and reporting environments as key step to addressing this shift in attitude by investors.

Source: S&P Global Commodity Insights; Reuters website; S&P Global – Corporate exploration strategies 2023 – [October 2023]; S&P Global – World exploration trends 2023 – [March 2023]; Accenture – How investors view mining's new role as a champion of decarbonisation – [2022].

Notes: (1) Estimation of S&P Global as of October 2022; (2) Includes maritime countries to the south of China and island countries and archipelagos in the Pacific; (3) Includes lithium, nickel, copper, gold, and silver; (4) Based on the data from junior and intermediate mining companies around the globe.

# Governments endorse the mining industry to guarantee the provision of critical minerals



In recent years, global state support for critical mineral extraction has almost doubled globally, both in terms of subsidies and policies. The need for an abundant and sustained supply of energy transition minerals, despite geopolitical and economic volatility, has driven this more interventionist approach.

Government are trying to encourage diversification of the current highly concentrated supply chain from emerging markets.

Governments are, therefore, actively investing in the exploration, development, and production of domestic critical mineral resources and launching incentives to support innovation in the mining sector.

Government’s support of critical minerals in selected countries, as of 2022

Selected countries	Public investments <sup>1</sup>	Direct financing <sup>2</sup>	Tax incentives	Innovation funding
Australia	Available	Available	Available	Available
Canada	Available	Available	Available	Available
Chile	Available	Not available	Available	Available
China	Available	Not available	Available	Available
DR Congo	Available	Not available	Available	Available
Ecuador	Available	Not available	Available	Available
The EU	Available	Available	Available	Available
Japan	Available	Available	Available	Available
South Africa	Available	Available	Available	Available
The UK	Available	Available	Available	Available
The USA	Available	Available	Available	Available

Available (Orange) Not available (Grey)

## Selected government investments in the mining industry

**Australia** 2023

Investment of **\$57.1 bn** by 2030 to support critical mineral projects and secure their new supply chains.

**The UK** 2022

Funding research projects of 16 mining companies, totalling \$8.2 m, to strengthen critical mineral supply chains over 2022-2025.

**France** 2022

Public support of **\$1 bn** to critical mineral projects, in which 50% are grants and 50% are equity investments.

## Selected government incentives for innovations in the mining industry

**Japan** 2022

Establishment of a special **tax credit** for critical mineral exploration, which covers 100% of expenses.

**The USA** 2022

Setting a clean vehicle credit of up to **\$7,500** per vehicle to accelerate the adoption of EVs by companies.

**Canada** 2022

Introduction of a new 30% tax credit for setting up electric and hydrogen equipment by mining companies.

While some countries are striving to build new secure supply chains, resource-rich countries have continued to disrupt existing ones by nationalising critical mineral assets or placing export restrictions on them. In the last two years, Mexico has nationalised its lithium assets, Namibia and Zimbabwe have banned lithium exports and China has restricted gallium exports. The OECD has identified a fivefold increase<sup>3</sup> in export restrictions on critical raw materials over the past decade, highlighting the need for changes in the current supply model.

Source: Official governments’ websites; IEA – Critical Mineral Market Review 2023 – [July 2023]; OECD – Raw materials critical for the green transition – [April 2023]; IEA – Critical Mineral Policy Tracker – [November 2022].

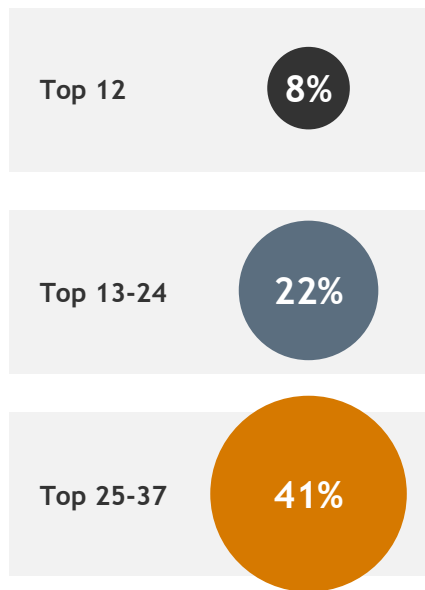
Notes: (1) Public equity investments in private companies or projects; (2) Financing projects through grants or loans; (3) According to the ‘Raw materials critical for the green transition’ study of the OECD from April 2023, covering the period of 2009-2020.

# Achieving net-zero emissions by 2050 will cost \$2tn

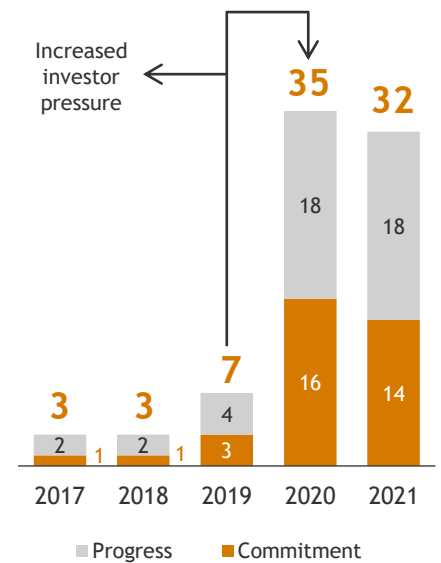
The focus on ESG-linked debts is expected to accelerate from 2024 onwards as the most of green projects initiated by mining companies were only at the development or pilot stage during 2020-2023. The required investments range from \$250 m to \$5 bn per project. In total, the mining industry will need approximately \$2tn of investment to achieve net-zero by 2050. Meanwhile, a decarbonised mining industry will be highly energy-intensive, raising concerns about its ability to provide the resources needed for the world's energy transition.

Mining companies continue to explore the possibility of issuing green debt to attract investors to finance ESG projects. Although the number of green debt transactions in the mining industry grew considerably over 2019-2021, it accounted for only 2% of the total number of deals across all industries around the globe in 2021. Thus, to increase ESG funds, mining companies started to link their debts to specific projects as opposed to general goals.

Average increase in ESG results<sup>1</sup> of Top-37<sup>2</sup> mining companies globally in 2022 vs 2020



Number of net-zero goal announcements in the mining sector globally



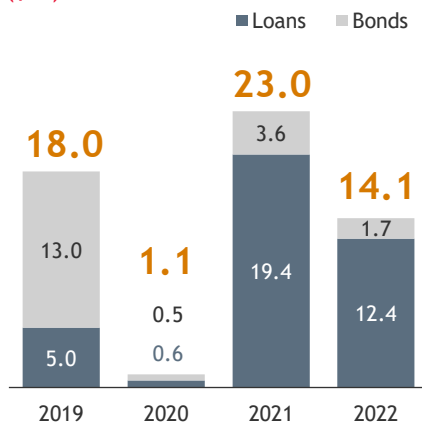
Top-3 risks for the mining sector in 2023 vs 2022, % of respondents<sup>3</sup>

**18%** Inflationary cost pressures  
+14 p.p.

**16%** Geopolitics  
+16 p.p.

**11%** ESG  
-13 p.p.

Sustainability-linked finance (SLF)<sup>4</sup> issuance by the global mining industry, (\$bn)



Private sector investors are also imposing their sustainability demands on the mining sector as it is indispensable for the global energy transition. In 2022, 59% of investors pressed mining companies to pursue decarbonisation and address the industry's poor reputation on ESG issues. For instance, CO<sub>2</sub> emissions from the mining industry account for 4% to 8% of the world total. This creates nearly \$3tn in economic burden.

Mining companies worldwide have been steadily improving their ESG performance.

In 2022, the sector scored 55 out of 100, one of the highest scores across all sectors. The number of 'decarbonisation progress' announcements by mining companies grew

nine-fold from 2017 to 2021. These developments mean the ESG-related risks have dropped from first to third in the mining industry's risk ranking.

BDO is developing its ESG expertise and services to help mining clients ensure they have the right data to help them address both their environmental impact and their reporting against ESG targets.

**BDO has increasingly helped mining companies align their financial strategies to ESG targets and enhance sustainability-linked funding opportunities.**

Source: ING website; Wood Mackenzie website; White & Case LLP – Mining & Metals 2023: Lifting the fog of uncertainty – [January 2023]; Elsevier – Journal of Cleaner Production – [August 2022]; Responsible Mining Foundation – RMI Report 2022 – [February 2022]; Accenture – How investors view mining's new role as a champion of decarbonisation – [2022].

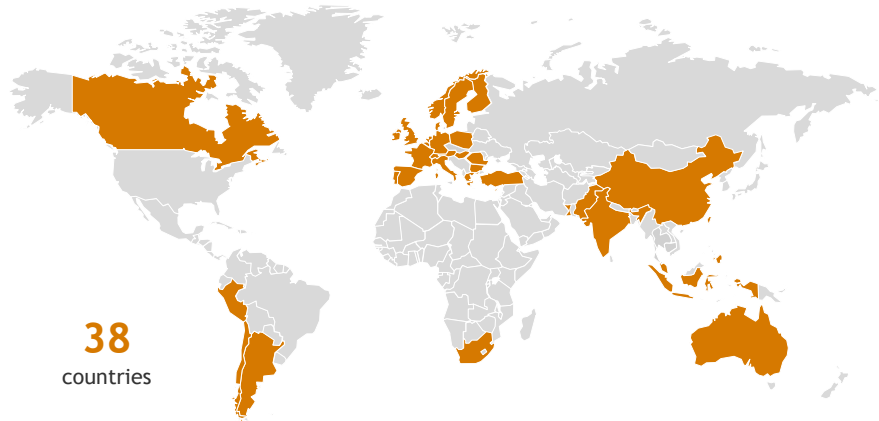
Notes: (1) Out of 100% score based on commitment and management of ESG topics; (2) By ESG results as of 2020, among Top-37 mining companies by market capitalisation around the globe; (3) According to the Mining & Metals survey conducted by White & Case LLP among 156 mining decision makers worldwide in January 2023; (4) Borrowings linked to environmental or social goals.

# Lack of specific ESG reporting standards dents investor confidence

71% of investors<sup>1</sup> cite the inconsistency and incompleteness of data as the most significant barrier to ESG investments across all industries. The lack of industry specific standards and regulations make collecting the “right” data challenging.

The increasing number of ESG disclosure requirements, up by 74% globally over the last four years, have been focused on ethical business behaviour rather than single standardised approach to reporting. There are global sustainability initiatives that attempt to engage companies in standardised ESG reporting but they also struggle to ensure audits and completeness of data.

Countries worldwide with a mandatory ESG disclosure, as of November 2023



## Key global initiatives for ESG reporting



Global Sustainability Standards Board (GSSB)



Sustainability Accounting Standards Board



UN Global Compact

Selected ESG themes	Share of companies <sup>2</sup>
● GHG emissions	72.0%
● Water management	70.5%
● Workplace health & safety	70.0%
● Energy management	63.5%
● Business ethics	57.0%
● Waste	50.0%
● Biodiversity	50.0%
● Impact on local communities	47.0%
● Air quality	45.0%

ESG pillars: ● Respect for the Planet ● Respect for People ● Respect for Prosperity

The lack of a defined and mandatory ESG reporting standard for mining allows companies to neglect industry-specific indicators. For instance, as of October 2022, only 36% of mining companies disclosed their energy intensity by volume of ore mined. In another example, most mining players provide general corporate reporting rather than site-specific disclosures. This is an issue given the diversity of stakeholders and impact across different mining sites.

In June 2021, the GSSB approved the GRI<sup>3</sup> Sector Standards Project for Mining as part of its GRI Sector Programme. The aim is to develop 25 specific and material ESG topics that reflect the mining industry'. The Sector Standard is expected in Q4 2023. Endorsement by the G20 and strong investor means that it may become mandatory in many jurisdictions from 2025.

ESG reporting standardisation may lead to new challenges for the mining companies. Collecting the necessary ESG data will require a substantial investment in AI technologies, CO<sub>2</sub> emissions calculation, and software solutions for collecting ESG data. We have been providing clients with strategic advice on designing and implementing cost-efficient ESG reporting frameworks and data solutions that mitigate risk exposure.

Source: Global Sustainability Standards Board website; Glacier Media Group website; Swiss Finance Institute – The effects of mandatory ESG disclosure around the world – [November 2023]; BNP Paribas – ESG Global Survey 2023 – [September 2023]; MineSpider AG – The most commonly used ESG Metrics in the Metals and Mining Sector – [October 2022].

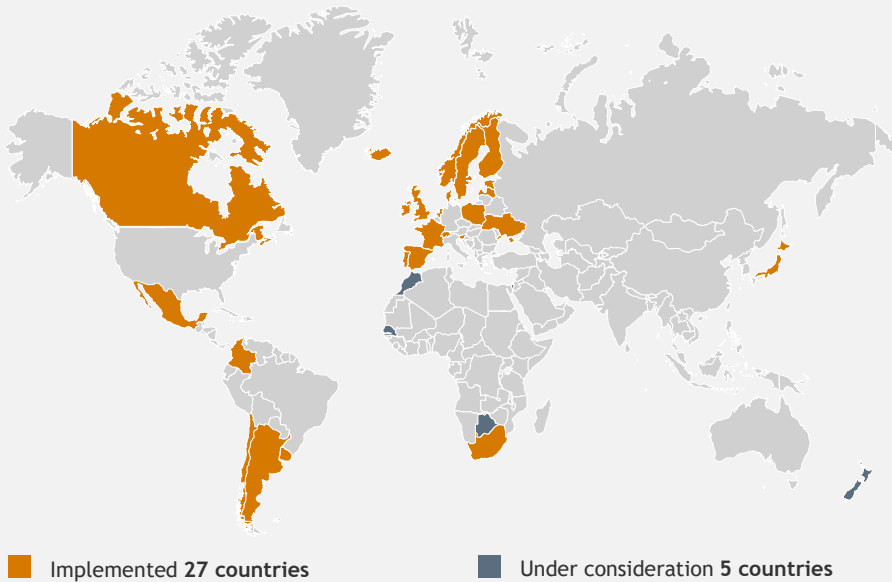
Notes: (1) According to BNP Paribas survey in 2023 among 420 institutional investors around the globe; (2) Share of companies reporting based on annual reports of 22 large mining companies selected by MineSpider AG from different metal groups; (3) Global Reporting Initiative; (4) The experts of Glacier Media Group; (5) The intergovernmental forum comprising largest economies around the globe.

# A global carbon tax and demand for critical minerals

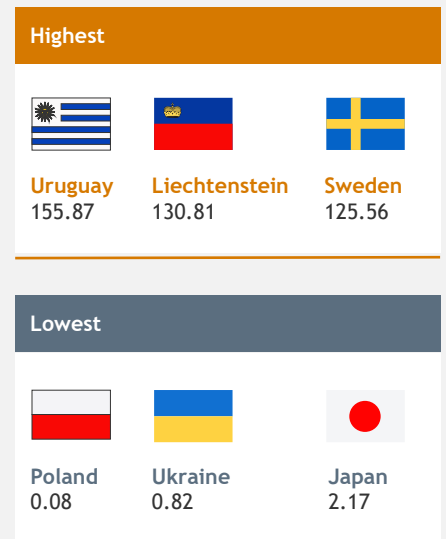
Since 1990, governments have introduced a range of carbon pricing initiatives including carbon taxes<sup>1</sup>, emission trading system<sup>2</sup>, carbon credits<sup>3</sup> and others. There has been further raft of such measures in the last ten years all designed to help achieve net-zero emissions by 2050. The carbon tax is the most contentious carbon pricing instrument for mining companies, as the value of mining products per tonne of CO<sub>2</sub> is higher than other industrial outputs and this affect the mining sector’s appeal to investors.

In 2023, only five of the 27 countries that have implemented carbon tax are mining leaders in terms of production value<sup>4</sup>. Mining companies in those five countries are concerned about the carbon tax is affecting their competitiveness while companies in other countries fear and further expansion of carbon taxes in their jurisdictions.

Countries worldwide with a carbon tax implemented or under consideration, as of 31 March 2023



Top-3 countries worldwide by carbon tax price, \$ per tonne of CO<sub>2</sub>



On the other hand, the introduction and extension of carbon taxes in new jurisdictions should accelerate the green energy transition and demand for energy transition metals. It is also true that mining of energy transition metals is less energy intensive and so less sensitive to carbon taxes.

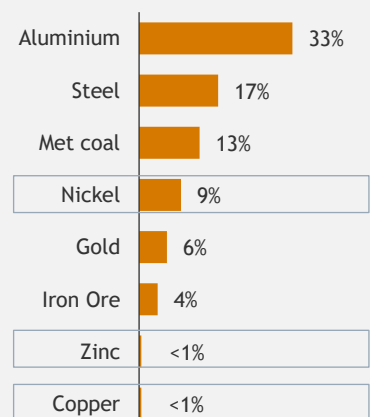
For instance, the production of copper and nickel yields \$1,111 and \$740 in revenue per one ton of CO<sub>2</sub> emissions, respectively, while coal generates only \$74 in revenue per ton of CO<sub>2</sub>.

Mining companies specialising in energy transition metals may have more to gain than lose by supporting the introduction of a global carbon tax. It would likely stimulate additional demand for their products and compliance would further demonstrate their commitment to sustainability to investors. Nonetheless, even these companies will have to address their own energy consumption and green energy transition.

Source: The World Bank Carbon Pricing Dashboard; S&P Global website; Wood Mackenzie website; The University of British Columbia website; Cox, B., Innis, S., Kunz, N.C. – The mining industry as a net beneficiary of a global tax on carbon emissions – [February 2022].

Notes: (1) Direct price on carbon by defining a tax rate on CO<sub>2</sub> emissions; (2) An emissions trading system allowing emitters to trade their emission units; (3) CO<sub>2</sub> reduction from project-based activities; (4) According to ‘Mineral Commodity Summaries’ of USGS, launched in 2023; (5) Based on the Wood Mackenzie estimation in July 2021.

Growth in marginal cash costs<sup>5</sup> due to a global carbon tax of \$150 per tonne CO<sub>2</sub> required to achieve net-zero goal

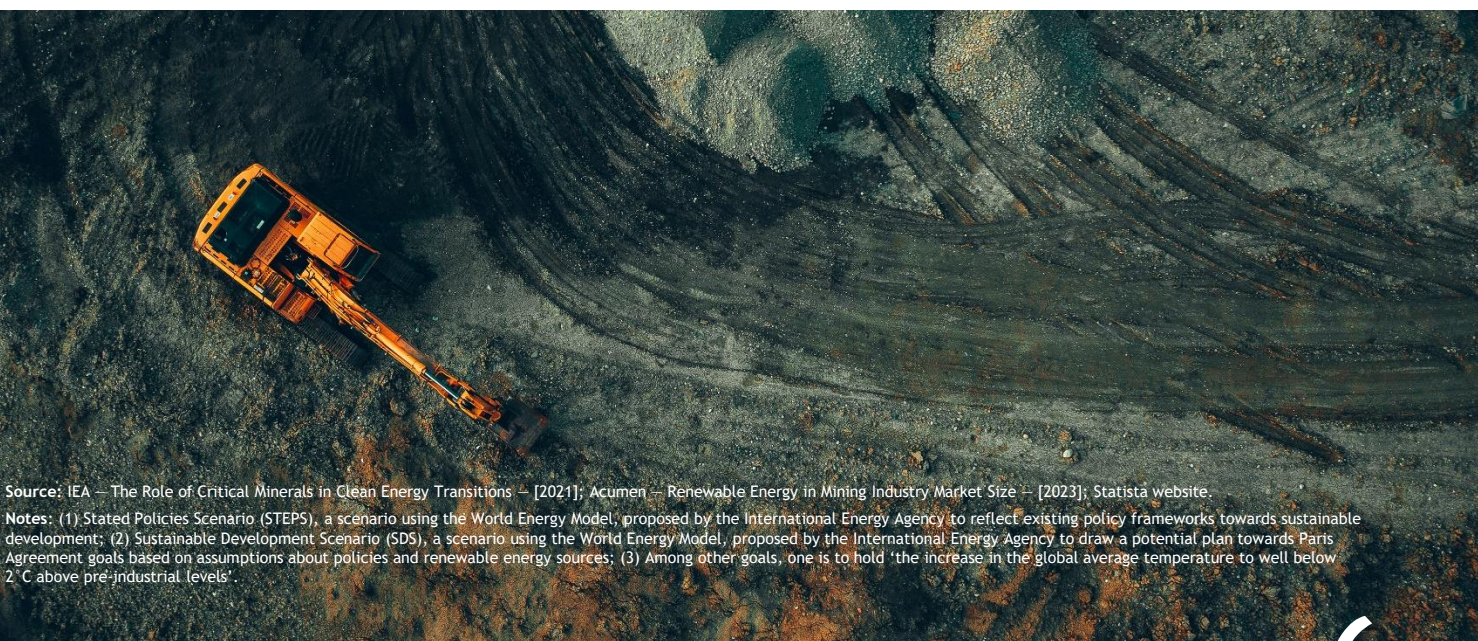
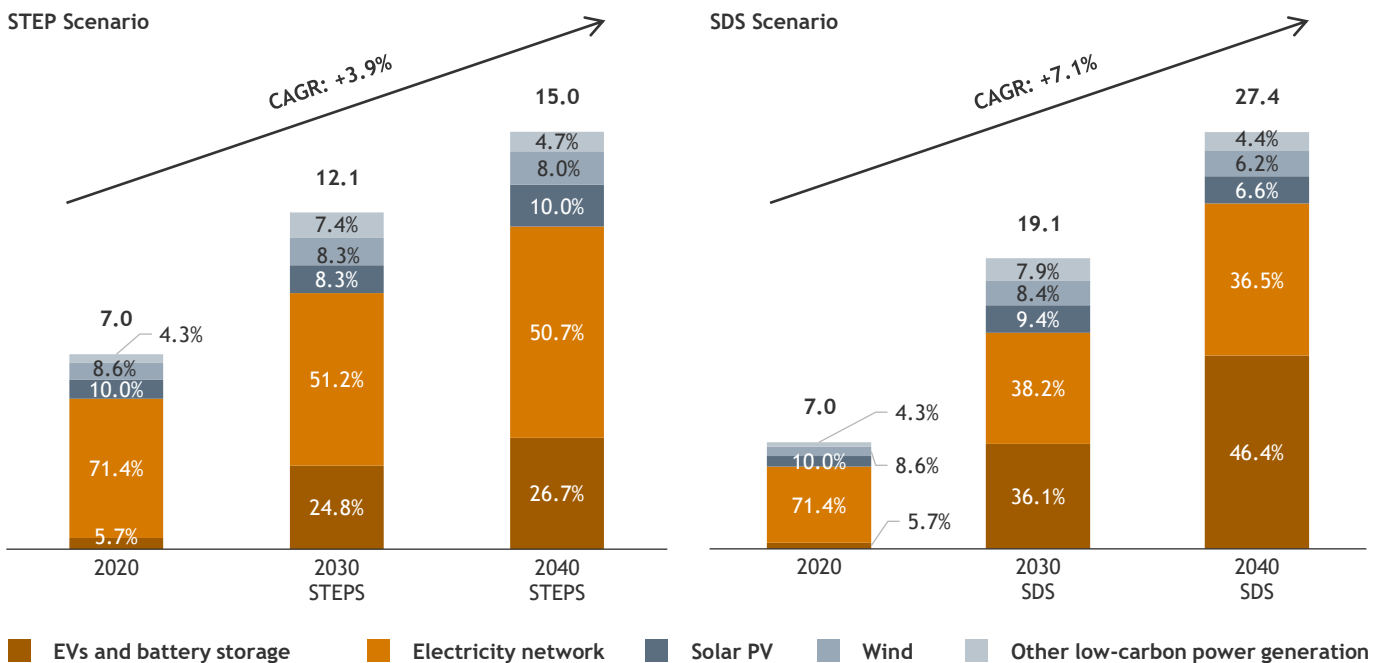


# A vital role in a sustainable future

According to the STEPS<sup>1</sup> scenario, which reflects the impact of countries’ existing policy frameworks and those that were officially announced, total mineral demand from clean energy technologies is expected to double by 2040. The SDS<sup>2</sup> scenario which maps a route to 2040 to align Paris Agreement goals<sup>3</sup> based on assumptions about policies and renewable energy sources, predicts a quadrupling of demand. In this second scenario, E-mobility and battery storage are expected to contribute approximately half of the mineral demand growth from clean energy technologies in the coming decades.

Graphite, copper, and nickel are projected to dominate mineral demand by weight by 2040, while lithium experiencing the fastest growth rate, with demand increasing by over 40 times in the SDS scenario.

**Total critical mineral demand for clean energy technologies by scenario, Mt**



Source: IEA – The Role of Critical Minerals in Clean Energy Transitions – [2021]; Acumen – Renewable Energy in Mining Industry Market Size – [2023]; Statista website.  
 Notes: (1) Stated Policies Scenario (STEPS), a scenario using the World Energy Model, proposed by the International Energy Agency to reflect existing policy frameworks towards sustainable development; (2) Sustainable Development Scenario (SDS), a scenario using the World Energy Model, proposed by the International Energy Agency to draw a potential plan towards Paris Agreement goals based on assumptions about policies and renewable energy sources; (3) Among other goals, one is to hold ‘the increase in the global average temperature to well below 2 °C above pre-industrial levels’.

# Mining plays a vital role in the transition to green energy and sustainable growth globally cont.

Mining companies will play a crucial role in supporting the transition to clean energy and decarbonisation despite their own carbon emissions. This importance is underscored by their global supply of essential raw materials necessary for the renewable energy technologies' advancement and deployment, as well as via:



Incorporation of renewable energy sources to reduce reliance on fossil fuels and cut carbon emissions



Innovation in extraction and efficiency improvement to reduce the overall carbon footprint of the extraction process



Promotion of recycling within the mining industry to reduce the need for continuous extraction of new resources

The global use of renewable energy in the mining industry is expected to rise at a CAGR of +8.4% over 2022-2032, reaching \$3.4 bn by 2032. Asia-Pacific dominates the renewable energy market in mining comprising 39.2% of the total market. This dominance can partly be attributed to the region's significant demand for minerals and metals and the region's favourable solar and wind resources. Europe will continue to be the fastest-growing region of the renewable energy market in the mining industry during 2023-2032. Solar energy is the type of renewable energy that showed significant growth over recent years due to improved solar technology and decreased costs.

### Selected key players of the global renewable energy market in the mining industry

 <b>ABB</b>	 <b>ABB</b>
 	 
 	 
 	 





# Renewable energy is key to sustainable, cost-effective mining

The usage of renewable energy sources in the mining industry allows mining companies to lower carbon emissions, increase energy efficiency on mine sites and make mining operations cheaper, as well as support and promote sustainable development globally by creating a circular economy in the mining sector, while providing more employment opportunities for engineers. Advancements in renewable energy technologies, such as thin-film cells and bifacial panels in solar tech, as well as floating offshore and vertical-axis turbines in wind energy, expand the range of clean energy options available for mining sites.

## Renewable energy sources in the mining industry

↑ +XX.X% = Change YoY

### 1. Solar

In 2023, the solar energy complex of the Brazilian mining company Vale's Sol do Cerrado reached a full installed capacity of 766MW, supplying 16% of all the energy consumed by Vale in Brazil.



1.2 TW<sup>2</sup> ↑ +25.0% Global installed solar capacity in 2022.

### 2. Biodiesel

In 2022, Rio Tinto, partnered with Neste and Rolls-Royce to trial Neste MY Renewable Diesel in a haul truck, aiming for a 75% reduction in GHG emissions.



84% GHG emissions reduction, using palm oil biodiesel vs fossil diesel<sup>4</sup>.

### 3. Wind

Over 2023-2024, Seriti Resources, headquartered in South Africa, plans to invest in a 155 MW wind farm that will cover 75% of power for its Mpumalanga coal mines.



975.6 GW<sup>2</sup> ↑ +11.4% Global installed wind capacity in 2023<sup>3</sup>.

### 4. Geothermal power

In 2023, Indonesian firms Archi Indonesia and Ormat Geothermal Indonesia assessed a Toka Tindung site for a 30 MW renewable project feasibility.



16.1 GW ↑ +1.8% Geothermal power generation capacity<sup>5</sup>.

### 5. Hydro

In 2023, Swedish company Mine Storage partnered with UK-based Anglesey Mining to explore designs for a 15 MW operational pilot pumped storage at the Grängesberg mine.



1.4 TW ↑ +2.7% Global hydropower capacity in 2022.

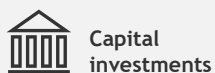
### 6. Hydrogen fuel cells

In 2020, Australian firms BHP and Fortescue, UK-based Anglo American, and Canadian Hatch formed the Green Hydrogen Consortium to boost renewable hydrogen production.



600.0 GW ↑ +109.7% Global Electrolysis capacity<sup>6,7</sup>.

## Challenges in implementing renewable sources



Capital investments

The high upfront costs of adopting green energy pose a financial challenge for mining companies.



Renewables availability

Solar and wind renewable energy's intermittent nature presents challenges in ensuring a stable power supply for mining.



Energy storage

Time-specific generation of renewable energy requires substantial energy storage.



Retraining the workforce

Shifting to green energy means retraining workforces, a significant human resource challenge.

Source: IEA – The Role of Critical Minerals in Clean Energy Transitions – [2021]; WWEA – Half-year Report 2023: Additional Momentum for Windpower in 2023 – [2023]; IEA – Hydropower Special Market Report – [2021]; IHA – 2022 Hydropower Status Report – [2022]; IEA – Biofuels in Emerging Markets – [2023]; ThinkGeoEnergy website; Statista website.

Notes: (1) Terawatt; (2) Gigawatts; (3) As of June 2023; (4) According to the IEA Bioenergy report 2023; (5) As of 2022; (6) As of 2021; (7) For hydrogen production.

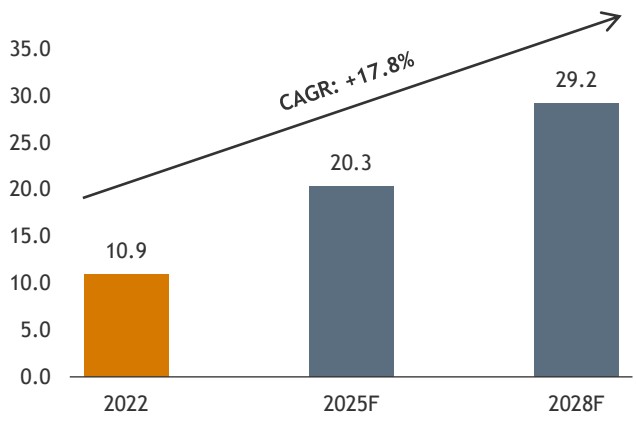
# Innovative technologies key to overcoming main challenges



Mining companies are turning to new technologies to help them overcome the main challenges they are facing such sustainability, competition, cost optimisation and the need to improve exploration activities. The introduction of AI, the switch to e-mobility, the use of drones, and the automation of processes will allow mining companies to improve their operations by nearly 50%.

Despite the tremendous opportunities arising from technology adoption, only 10% of mining companies worldwide introduced at least one technology in 2021. This level makes the mining industry 30% to 40% less digitally mature than other industries.

**Global smart mining market size (\$bn)**



# Selected advanced technologies for mining companies



AI



The advanced analytics and predictive capabilities of AI can optimise the entire value chain of miners. For example, mining companies that have deployed AI improved their mining output by nearly 20% and reduced CO<sub>2</sub> emissions by 15% to 30%.

GOLDCORP



2019

Goldcorp Inc., a Canadian gold producer, partnered with IMB<sup>1</sup> to predict the gold reserves at the Red Lake mine in Ontario, Canada, using AI software.



EV



Mining companies tend to decarbonise by purchasing new mining EVs or electrifying existing diesel vehicle fleets. Electrification can reduce energy costs of mining companies by up to 70%, although it increases electricity consumption by 175%.

BOLIDEN



2023

Boliden AB, a Swedish mining company, has started its long-term collaboration with the Volvo Group<sup>2</sup>, receiving two EVs for underground mining.



Drones



To streamline exploration activities and avoid involving employees in hazardous work, the mining industry leverages the power of drones. By replacing piloted aircraft with drones, mining companies could save nearly 90% of their costs per hour of working.



2023

Newcrest Mining Limited, an Australian mining company, started using advanced drones<sup>3</sup> in 2023 to locate broken parts of equipment at its mines.



Process automation



Over 2020-2022, more than 48,000 patents on automated systems were granted to miners globally. Self-drive ore tracks, automated drill rigs, autonomous railways, control systems and other robotic solutions are the most innovative trends in the mining industry.



2023

Anglo-American PLC, the UK-based mining company, will deploy the autonomous haulage system of Komatsu<sup>4</sup> in 2024 to enhance safety and productivity.

### Selected benefits from technology adoption

- Higher energy-efficiency
- Better use of capital
- Cost reduction
- More effective exploration
- Faster working process
- Improved safety
- Decarbonisation
- Selected cases

### Key challenges for technology adoption



Raising the required budget for investments



Attracting or training people to deploy and use technology



Obsolete legislation on the use of technology in mining



Balance of the protection of human rights and the replacement of staff with technology.



By improving the economic and environmental conditions of the mining industry's production, the introduction of technologies can trigger more social challenges. To maintain the right balance of alignment with ESG issues, mining companies should consider using consulting firms to help them develop successful strategies.

Source: Baker McKenzie website; McKinsey & Company website; IMARC Group website; Global Data website; S&P Global website; Companies' websites; Hitachi ABB Power Grids – The smart mine blueprint – [2021]; BCG – Racing towards a digital future in metals and mining – [February 2021].

Notes: (1) The US-based technology company; (2) Sweden automotive manufacturer; (3) Drones with introduced onboard computer, magnetometer, and control software, provided by Latvian technology company, SPH Engineering; (4) Japanese manufacturer of construction and mining equipment.

FOR MORE INFORMATION:

**Matt Crane**  
Audit Partner

UK Head of Natural Resources & Energy

matt.crane@bdo.co.uk  
+44 (0) 7929 332 677

**Julia McCullagh**  
Tax Partner

Natural Resources & Energy

julia.mccullagh@bdo.co.uk  
+44 (0) 7890 552 503

**Gareth Jones**  
Advisory Partner

Natural Resources & Energy

gareth.l.jones@bdo.co.uk  
+44 (0) 7790 897 195

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