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EXECUTIVE GLOBAL INSIGHT

UNCOVERING MINING TITANS

Mapping sustainability, innovation and exploration in 20 global mining giants

The mining industry is crucial to the global economy, supplying essential raw materials for construction, manufacturing, technology and renewable energy. Its importance has grown even further due to the green transition, and this shift has increased the demand for critical minerals like lithium, cobalt, nickel, REEs and copper.

This report was compiled by Business Sweden's mining team and shares the findings of an analysis of key trends and opportunities for Swedish companies within the global mining industry. It focuses on the sustainability, innovation, and exploration agendas of 20 of the largest mining companies worldwide. Sweden is renowned for its advanced engineering solutions and commitment to innovation, positioning it to contribute significantly to the industry's development.

Sustainability efforts vary among mining companies, with ambitious emission reduction targets and regional differences reflecting regulatory environments. The integration of electric equipment, renewable energy and strategic partnerships is crucial for achieving these targets. Significant challenges related to battery capacity, technology, green energy supply and charging infrastructure remain, requiring further research and development, innovation as well as private and public investments.

Evolving industry demands for cleaner operations and long-term profitability require innovative solutions in the areas of electrification, automation, extraction and artificial intelligence (AI). Collaboration with equipment suppliers and start-ups, as well as industry-wide initiatives, are driving technological advancements.

Exploration trends reveal a strategic shift toward critical minerals and enhanced domestic processing capabilities, fundamentally transforming the mining industry's priorities and operations.

Swedish companies can leverage their innovation capabilities to capture multiple opportunities in the global mining sector. They can do this by developing solutions in collaboration with mining companies, building on on decarbonisation requirements, delivering cutting-edge technologies, building relationships with engineering, procurement and construction firms, partaking in industry-wide partnerships and targeting new exploration projects for entry into prime markets.

Business Sweden's team of mining specialists is available to support Swedish companies in capturing these opportunities and maximising success in international markets.

KEY TAKEAWAYS

- Mining companies are making progress on ambitious greenhouse gas (GHG) emission reduction targets, but challenges remain due to technological limitations – as well as lack of green energy supply and an efficient charging infrastructure. Targets vary between companies and while Scope 1 and 2 targets are overall ambitious and mostly followed up on, Scope 3 targets aiming at the entire value chain tend to be less detailed, but gaining in incorporation.

- Safety is a priority and core concern and is driving the development and deployment of electric autonomous vehicles to reduce human involvement in hazardous operations.

- The development of AI and digital solutions is revolutionizing ways of working, leading to immense efficiency improvements within real-time extraction and new project exploration.

- Elevated expectations of innovation output are leading to higher demands on collaboration and co-innovation as mining companies are increasingly co-developing technology with original equipment manufacturers (OEM), partnering with start-ups and entering industry-wide partnerships.

- Reluctance to invest in new technologies because of high financial risk is hindering innovation and development, while company consortiums and risk-sharing models have been identified as potential solutions.

- Governments are taking action to meet rising demand for critical minerals domestically and reduce reliance on external sources. Mining companies' exploration focus is shifting towards critical minerals. Lithium and copper are highly represented among exploration efforts while there is a tendency to divest coal resources. There is also a tendency in increased investments in recycling and refining.

- Swedish companies can capture opportunities in technological innovation to meet sustainability targets, enhance safety and increase both productivity and exploration efficiency.

EXECUTIVE GLOBAL INSIGHT

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ABOUT THE STUDY

This report is based on research and analysis conducted by Business Sweden's mining team in Sweden and the US, using quantitative data as well as interviews conducted in February and March 2025.

Following Business Sweden's publication in April 2024 of a broader mining study, Reinventing the Future of Mining, which explored the geographical dynamics of the mining industry, this report shifts focus towards 20 of the largest mining companies worldwide. Given Sweden's extensive mining ecosystem–ranging from major corporations to small and medium-sized enterprises (SME)–there is a strong demand for deeper insights into the industry.

Major mining companies, including the 20 studied operators, contribute to 47% of the total exploration spending globally[1], underscoring their importance. This report analyses key trends and presents opportunities for Swedish companies related to the mining companies' sustainability, innovation and exploration agendas.

The 20 mining companies were selected based on criteria including global revenue, geographic diversity, and strategic relevance to Swedish firms. Major coal companies were excluded due to limited long-term relevance, while some lower-revenue firms were included for their strategic potential.

A total of 17 interviews were conducted for the report, including 12 mine operators, 2 mining OEMs, and 3 industry organisations.

COMMODITY GROUPS

Critical Minerals
Deemed critical based on economic and strategic needs, especially in the energy transition. Typically include e.g., lithium, cobalt, nickel, copper, REEs, and graphite.

Non-ferrous Metals
Iron-free metals such as aluminum, copper, and zinc.

Ferrous and Ferro-alloy Metals
Iron-based metals such as iron ore and manganese.

Precious Metals
Rare, high-value, and corrosion-resistant metals such as gold, silver, platinum, and palladium.

Fuel Minerals
Energy sources like coal, uranium, oil, and natural gas.

Industrial Minerals
Used for industrial purposes, including e.g., graphite, phosphate, and potash.

Rare Earth Elements
17 metals vital to tech and clean energy; not rare in quantity but hard to extract (e.g., neodymium, lanthanum).

Gemstones
Rare, durable, and decorative minerals like diamonds, sapphires, and emeralds.

OVERVIEW OF THE 20 SELECTED MINING COMPANIES AND THEIR HEADQUARTER LOCATIONS.

Note: Rio Tinto has dual headquarters.

[1] World Exploration Trends 2024, S&P Global, 2024

INTRODUCTION

WHY WE NEED MAJOR MINING COMPANIES

THE CRUCIAL ROLE OF MINING TODAY

Mining plays an essential role in the global economy, with the top 40 mining companies collectively generating $845 billion in revenue in 2023 and up to $792 billion in 2024. It is responsible for supplying raw materials for industries ranging from construction and manufacturing to technology and renewable energy. Mining company operations shape geopolitical dynamics and influence trade and supply chains.

While the mining industry's ability to meet the demand for critical minerals is paramount, sustainable practices are crucial to securing resources for future generations. The transition towards green energy sources depends on the building blocks of a decarbonised economy: lithium, cobalt, nickel, REEs and copper. Beyond extraction, mining drives technological innovation in automation, electrification and resource efficiency, thus shaping the future of sustainable development.

SWEDEN AS A LEADING MINING NATION

As a leading mining producer in Europe and a nation renowned for its advanced engineering solutions and commitment to innovation, the mining industry presents substantial opportunities for Sweden.

Swedish industries, particularly those specialising in green technologies, automation and sustainable mining equipment, are well positioned to contribute significantly to the modernisation of the mining industry. By understanding the evolving needs of global mining companies, Swedish companies can forge strategic partnerships and deliver cutting-edge solutions, thereby strengthening their position in the international market and driving a more sustainable future for the industry. A synergy of historical expertise and forward-thinking innovation will help ensure that Sweden remains a cornerstone of global mining advancement.

Overall, the mining industry is a dynamic sector with significant impact on the global economy and green transition. Understanding the dynamics of leading mining companies is crucial for navigating this complex landscape. This report offers an analysis of key trends shaping the industry related to the sustainability, innovation and exploration agendas of 20 selected mining companies, while also highlighting business opportunities for Sweden and Swedish companies.

INTERNATIONAL FOOTPRINT AMONG MINING COMPANIES

To understand the global mining sector, we must first examine the geographical distribution of the operations and headquarters of the major mining companies.

North America, South America and Australia house a high concentration of the leading mining companies' operations and headquarters. This clustering reflects historical development of the mining sector and the strategic importance of proximity to both financial centres and established mining regions.

North America is home to the headquarters of five of the 20 analysed mining companies, namely Freeport-McMoRan in Arizona and Newmont in Colorado in the United States, Agnico Eagle and Barrick in Toronto, Canada, and Grupo México in Mexico's capital, underscoring the region's established role and access to substantial capital markets.

South America, historically rich in mineral resources such as gold, silver, copper, iron ore, tin and petroleum, is home to Codelco and Vale in Chile and Brazil, respectively. Australia is also a major player in the resources sector, and is home to BHP and Rio Tinto in Melbourne, and Fortescue in Perth.

Mining operations can span more than one continent, revealing a complex network of resource extraction. Countries with significant mining operations include China ($217 billion in mineral production value in 2020), Australia ($121 billion), the United States ($55 billion), Chile ($48 billion), Brazil ($38 billion), Canada ($36 billion) and South Africa ($33 billion)[2]. South America emerges as a particularly attractive region, hosting the majority of the mining companies analysed for this report.

Specifically, operations are widespread in North America (Canada, US, Mexico), South America (Peru, Brazil, Chile, Argentina), Europe (Sweden, Finland), South Africa, and Asia (India, China). Many mining companies have a truly global presence, with activities in numerous countries beyond the location of their headquarters.

THE APEX OF MINING: OPERATIONAL PROFILES

Our analysis reveals substantial disparity in revenue among the 20 mining companies. The concentration of revenue among a handful of mining companies suggests the dominance of a few players.

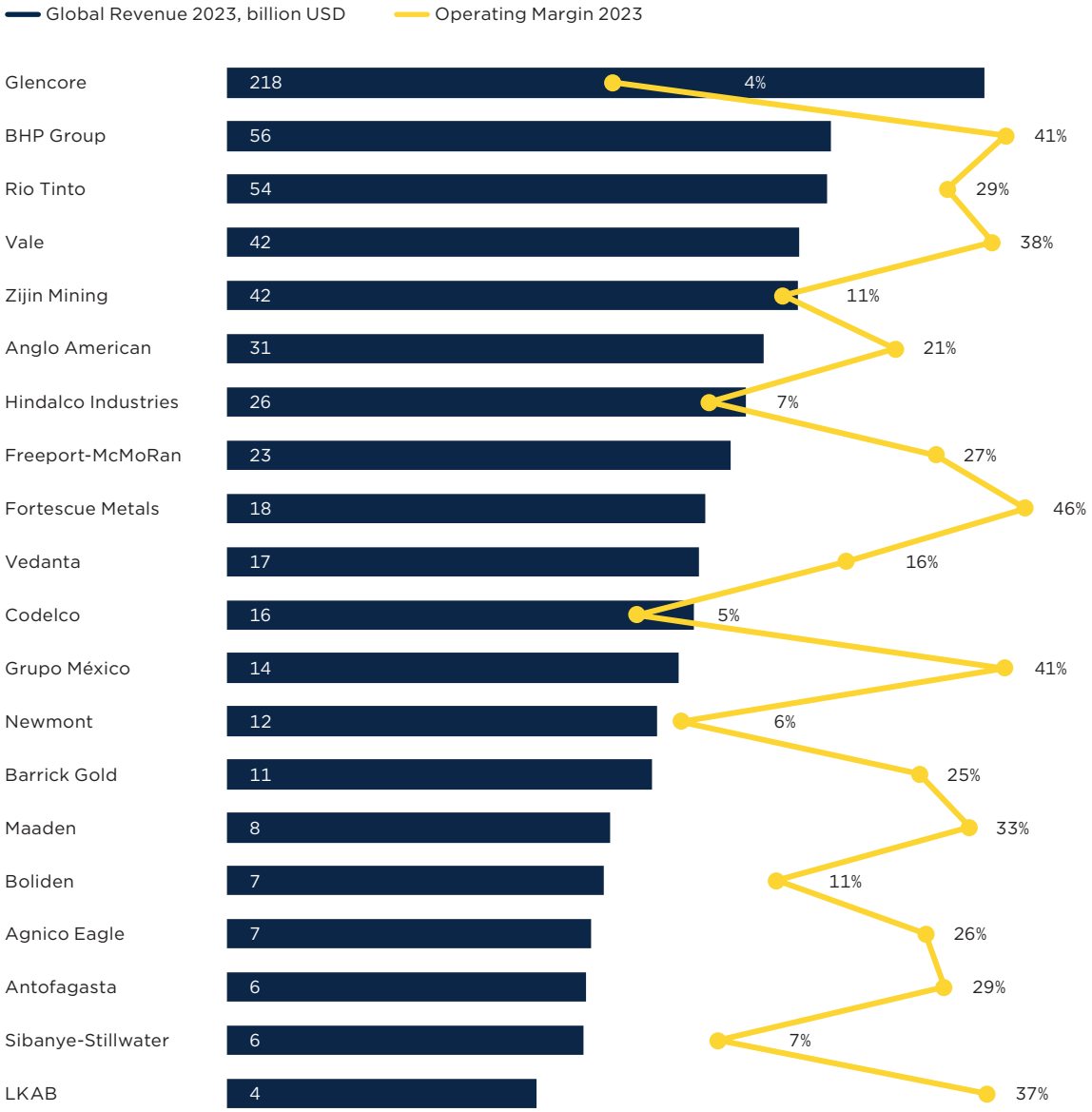
Swiss company Glencore has the highest revenue, almost four times the revenue of BHP and Rio Tinto, who are ranked second and third, respectively. However, it is important to note that Glencore's revenue is not solely derived from mining operations, with a large part being contributions from commodity trading.

The mining companies vary in terms of the scope of their operations as well as size, with revenue varying from $4 billion (Sweden's LKAB) to $218 billion (Glencore). In addition, profitability, as reflected by EBIT Margins of operating earnings over operating sales, also varies considerably between the mining companies. During 2023, Fortescue, BHP and Grupo México showed the highest operating margins among the 20 mining companies. While Glencore had the significantly highest revenue, it demonstrated the lowest operating margin of 4% in 2023.[3]

[2] Mining Contribution Index, ICMM, 2022
[3] Financials, Yahoo Finance, 2024

GLOBAL REVENUE 2023 (BILLION USD) AND OPERATING MARGIN 2023

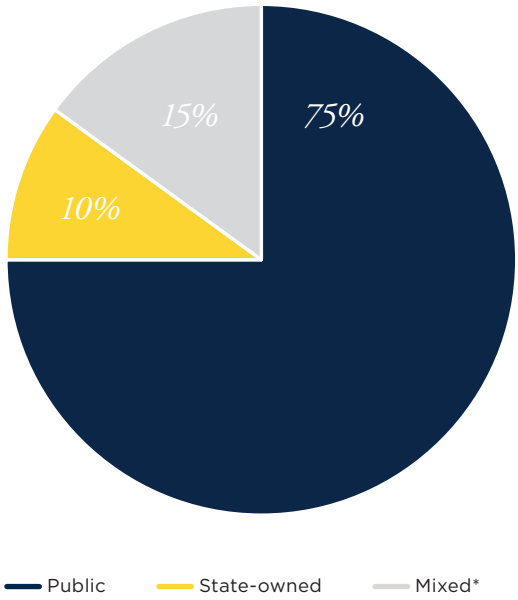
Source: Yahoo Finance, 2023; Annual reports, 2023



The types of mines operated, whether open-pit or underground, mirror the geological characteristics of the deposits and the extraction methods employed. All the 20 studied mining companies operate both open-pit and underground mines. Ownership structures range from publicly traded companies (75%) to state-owned enterprises (10%) and mixed-ownership models (15%).

OWNERSHIP STRUCTURE AMONG THE 20 MINING COMPANIES

Note: *Shared governmental and public ownership structure. Source: Annual reports, 2023 and 2024

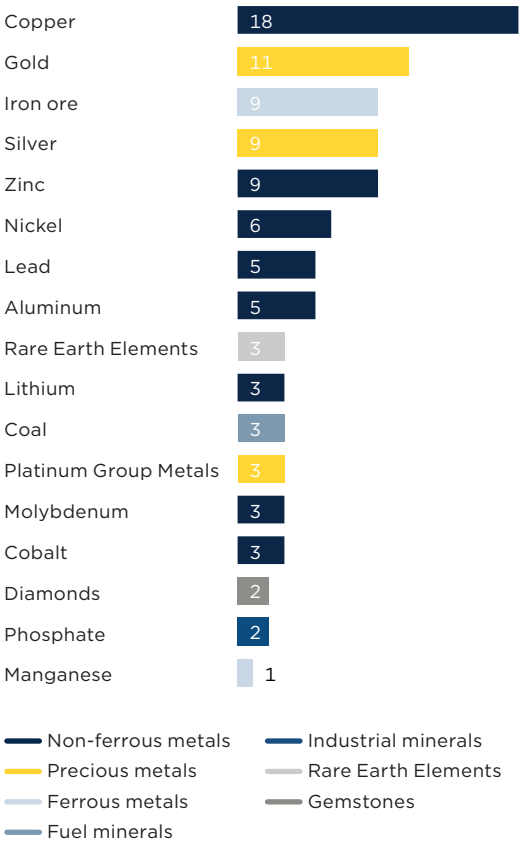


Recent mergers, acquisitions, and joint venture activities reveal the following trends:

- Increased focus on critical minerals, e.g. Rio Tinto acquiring Pennsylvania's Arcadium Lithium to enhance positioning in the lithium market (March 2025)[4] and China's Zijin offering to purchase 25% of lithium miner Zangge Mining, also based in China (January 2025)[5].
- Investments into renewable energy projects, e.g. Vale acquiring Brazil's Aliança Energia, adding hydroelectric and wind generation to its portfolio (March 2024)[6].
- Divesting of coal resources, e.g. BHP divesting Poitrel and South Walker Creek coal mines (May 2022)[7] and Anglo American selling its stakes in the Australian steelmaking and coal company Jellinbah (January 2025)[8].
- Strategic joint ventures for risk sharing, scale and efficiency, e.g. Anglo American and Codelco intending to jointly operate neighbouring copper mines in Chile and enhance operational efficiency (February 2025)[9].

KEY MINED COMMODITIES AMONG THE 20 MINING COMPANIES.

Source: Annual reports, 2023 and 2024; Company websites



COPPER DOMINATES MINING PORTFOLIOS

Base metals (iron, lead, copper, nickel, aluminum and zinc), and precious metals, (gold, silver, platinum, palladium, iridium, osmium, rhodium and ruthenium) dominate the portfolios of the top 20 mining companies.

Copper's widespread extraction by 18 of the 20 mining companies indicates both its widespread geological availability and continued demand since it was first mined between 8,000 and 5,000 B.C. In addition to copper, 11 of the 20 mining companies extract gold, and nine extract silver.

These figures affirm the sustained value of precious metals, and point to their importance for use in industrial and technological applications. Here, geological distribution may also be a factor. A significant portion of silver production comes as a by-product of copper, lead and zinc mining, making it attractive for mining companies already engaged in those activities[10].

Only Glencore, BHP and Anglo American have coal in their portfolios, but looking at revenue, they represent half of the six largest mining companies. Iron ore production, an essential component in steel manufacturing, is featured in the portfolios of nine mining companies.

[4] Rio Tinto Completes Acquisition of Arcadium Lithium, Rio Tinto, 2025
[5] Zijin to Buy 25% Stake in Chinese Lithium Miner For $1.87 Billion, Mining.com, 2025
[6] Vale Announces Acquisition Of Stake in Aliança Energia, Vale, 2024
[7] Bhp Completes The Divestment of its BMC Interest, BHP, 2022
[8] Anglo American Agrees Sale of its Minority Interest in Jellinbah for A$1.6 Billion, Anglo American, 2024
[9] Anglo American And Codelco to Unlock Significant Value From Joint Mine Plan for Los Bronces and Andina Copper Mines, 2025
[10] World Silver Survey, The Silver Institute, 2024

UNDERREPRESENTATION OF CRITICAL MINERALS

In contrast to the dominance of base and precious metals in operator portfolios, the prevalence of critical mineral extraction is notably lower for several reasons.

1. The geological scarcity of critical minerals forces mining companies to deal with lower ore concentrations, which results in elevated extraction costs and more complex processing methodologies.

2. The occurrence of many critical minerals is linked to specific, less frequently found geological formations, thereby limiting the number of economically viable deposits.

3. The development of critical mineral mines requires substantial capital investment in specialised equipment and infrastructure, further compounding the financial complexities associated with their extraction.[11]

Among the 20 mining companies analysed for this report, nickel is produced by six companies, cobalt by three, and manganese by Anglo American alone. Lithium extraction is currently limited to Rio Tinto and South Africa's Sibanye-Stillwater, with others, for example Fortescue and Codelco, having announced their intention for future involvement in lithium mining.

[11] The Role of Critical Minerals in Clean Energy Transitions, International Energy Agency

SUSTAINABILITY

DIVERSE APPROCHES TO SUSTAINABLE OPERATIONS

To actively work with sustainability improvements and achieve responsible and sustainable mining operations is lifted as a key priority for the targeted companies for the study. In this section we explore different approaches, trends and challenges to GHG emission reduction as well as other key ESG aspects such as work with gender balance.

EXPLORING REDUCTION OF GHG EMISSION

The mining industry is increasingly focused on reducing GHG emissions to mitigate its environmental impact and align with global sustainability goals. This is reflected in the growing number of mining companies setting ambitious emission-reduction targets, encompassing both direct (Scope 1 & 2) and indirect (Scope 3) emissions.

A significant variation in decarbonisation ambitions is evident among the leading mining companies. Fortescue has the most aggressive target, aiming for net-zero Scope 1 & 2 emissions by 2030. Other leading mining companies with high Scope 1 & 2 reduction targets include Codelco (70%), Rio Tinto (50%), Boliden (42%), and Sibanye-Stillwater (42%) by 2030, Glencore (50%) and Antofagasta (50%) by 2035, as well as Anglo American (carbon neutral) by 2040. All studied mining companies have net-zero or carbon neutrality targets for 2050 at the latest.[12]

Furthermore, regional differences in emission reduction targets are evident. Notably, Asia-based mining companies Vedanta, Hindalco Industries, and Zijin demonstrate more limited short-term goals compared to their global peers. This deviation likely reflects varying regulatory environments and economic priorities across regions.

SCOPE 3: LIMITED TARGETS WITH SIGNS OF PROGRESS

The increasing incorporation of Scope 3 emissions targets, addressing impacts of the entire value chain, represents a critical evolution in the industry's approach to decarbonisation. However, the rigor and detail of these targets vary significantly.

Fortescue, Glencore, BHP, Sibanye-Stillwater, Newmont and Freeport-McMoRan stand out as they are explicitly including scope 3 emissions in their long-term, net-zero emission targets. In contrast, Agnico Eagle and LKAB are still establishing stable data collection and reporting frameworks for Scope 3 emissions, while others are not yet indicating the addition of Scope 3 targets at all. This indicates that these companies are still in the early phases of implementing comprehensive value chain decarbonisation strategies.

Overall, the mining industry is moving towards greater transparency and accountability in emissions management, with a clear trend towards setting and achieving net-zero goals. It is worthwhile noting that the pace and scope of efforts differ, highlighting the ongoing challenges and opportunities in transitioning to a more sustainable mining industry.

[12] Mining companies' annual reports and websites 2023-2025

VARYING RESULTS ON EMISSIONS GOAL

The mining industry's commitment to reducing GHG emissions is evident, though both the pace and extent of progress toward these targets vary significantly among mining companies.[13]

BHP Group has demonstrated exceptional performance, surpassing its 2023 GHG emissions target (based on 2020 baseline) by 2%, outperforming its peers. Conversely, several mining companies have shown fluctuations in their emission reductions with Vedanta experiencing increases in emissions by 9% in 2023, compared to the baseline year of 2020. This variability highlights the challenges in consistently reducing emissions across diverse operational contexts.

Freeport-McMoRan's approach to GHG emissions reporting presents a unique challenge. While it provides detailed reduction targets and performance data at the commodity and operational site level, the absence of a consolidated, company-wide, absolute emissions-reduction figure (based on the 2018 baseline and 2030 target year) limits comprehensive assessment. This reporting strategy, while potentially reflecting operational complexities, hinders direct comparison with peers who provide aggregated emissions data.

Agnico Eagle, Antofagasta, Codelco, Maaden, LKAB, and Zijin have not explicitly reported their absolute GHG emissions performance. This lack of publicly available data limits the ability to assess their contributions to industry-wide decarbonisation efforts.

"We're on track to achieve our 2030 targets by expanding our renewable energy portfolio, introducing renewable diesel and electric haul trucks, building new electric boilers and more. Our partnerships with governments, communities and industry will be critical to our continued innovation and success."

Rio Tinto, USA Team

CONFIDENCE HINGES ON TECHNOLOGICAL BREAKTHROUGHS

Despite variations in reporting, as well as in emission reduction results, confidence exists among industry leaders that long-term sustainability targets can be achieved, driven by and dependent on the availability of decarbonisation technologies. However, discrepancies in performance highlight the need for accelerated action and greater transparency across the sector to ensure consistent and meaningful progress in reducing GHG emissions.

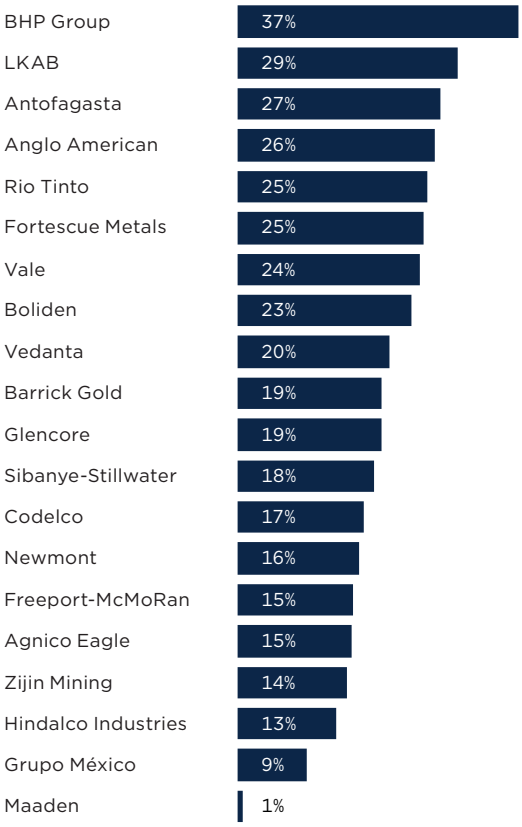
Swedish OEM ABB's 2024 report Mining's Moment builds on interviews with more than 400 industry experts in 18 countries and reveals a critical gap: 53% of mining companies expect significant transformation by 2030, yet 30% are behind decarbonisation targets. This highlights the urgent need for accelerated action to balance sustainability and profitability.[14]

"I think it is feasible with net zero in 2050, but it requires R&D. We are not ready innovation wise today, neither in terms of energy density nor managing the dusty and dirty production, but we can accomplish a lot if we invest."

Mine operator

[13] Mining companies' sustainability reports, annual reports, and websites, 2023-2025
[14] Mining's Moment report, ABB, 2024

SHARE OF WOMEN IN WORKFORCE (%)
Source: Annual reports, 2023 and 2024; Company websites



LOW REPRESENTATION OF WOMEN

Beyond reduction targets, the representation of women within the workforce also serves as a critical metric for evaluating mining companies' commitment to sustainable practices, specifically when it comes to gender diversity. Our analysis reveals significant disparities in this area.

Companies like BHP Group (37%), LKAB (29%), Antofagasta (27%) and Anglo American (26%), demonstrate comparatively higher female workforce participation, signaling a proactive approach to inclusion.

Conversely, Saudi Arabia's Maaden's notably low representation (1%) highlights a substantial gap, followed by Grupo México (9%), suggesting a need for industry-wide progress in fostering gender equality.

Looking at overall industry trends exemplified by the share of women on company boards, the top 500 listed mining companies have increased the number of women on their company boards by almost 13 percentage points, from 4.9% in 2012 to 17.6% in 2022[15]. While still a relatively low number, significant progress has been made in the past decade.

DUAL APPROACH TO RENEWABLE ENERGY

To achieve emission reduction targets, mining companies are increasingly integrating renewable energy into their operations. This transition is primarily happening through two strategies: developing on-site renewable energy projects and entering into power purchase agreements (PPA) with local utility providers.

Several companies are investing in on-site solar farms to directly power their mining activities. For example, Fortescue is constructing a solar farm at its Cloudbreak mine in Western Australia, aiming to eliminate diesel and gas usage by 2030[16]. Rio Tinto completed a solar power plant at its Diavik Diamond Mine in Canada, providing a substantial portion of the mine's electricity during closure work[17].

Joint ventures are also being leveraged: through their Nevada Gold Mines joint venture, Barrick and Newmont completed a large solar power plant in Nevada to supply a portion of their annual power demand[18]. Furthermore, Zijin Mining is planning a large-scale solar plant in Serbia, exemplifying the growing trend of self-generation[19].

In addition to on-site projects, many mining companies are entering into PPAs to secure renewable energy from external sources. These agreements are designed to meet a significant portion of their electricity needs with green power.

Vedanta has expanded its PPA in India to cover over 70% of its total power requirement[20]. Other examples include agreements by BHP to power operations in Australia[21] and Sibanye-Stillwater to power operations in South Africa with wind and solar energy[22]. Codelco also signed a PPA in Chile to supply a significant portion of its energy needs with renewable sources[23].

These initiatives demonstrate a proactive approach to decarbonisation, leveraging both direct investment in renewable infrastructure and strategic partnerships with energy providers.

[15] Women In Mining: How Has The Industry Progressed In The Last Decade?, Mine Australia, 2023
[16] Cloudbreak, Fortescue, 2025
[17] Rio Tinto Completes Construction of its Solar Power Plant at Diavik Diamond Mine, Rio Tinto, 2024
[18] Nevada Gold Mines Completes Construction of 200 Mw Solar Power Plant, Barrick, 2024
[19] Zijin Mining Plans 300 Mw Solar Power Plant in Serbia For Own Needs, Balkan Green Energy News, 2023
[20] Hindustan Zinc Plans to Raise RE Contribution to Over 70% Of Total Power Needs by 2027, The Economic Times, 2024
[21] BMA Set to Operate With 100 Per Cent Of Electricity Needs Under Renewable Power Arrangements, BHP, 2024
[22] Sibanye Stillwater Locks in 140 Mw of Wind Under PPA in South Africa, Renewables Now, 2024
[23] Atlas Renewable Energy and Codelco Sign Landmark 24/7 PPA for the Implementation of a New Solar Project With Battery Energy Storage System in Chile, Atlas Renewable Energy, 2024

CHALLENGES OF GOING ELECTRIC

Ambitious net-zero targets are encountering significant hurdles, primarily from the technological limitations and practicalities of implementation. While there is progress and optimism towards the reduction of operational emissions, industry voices emphasise the need for further R&D and innovation in this area.

A major challenge lies in the limits of available technology concerning equipment capacity. Mining companies highlight the scarcity of commercially viable electric alternatives for heavy-duty machinery, such as large trucks, which are essential to their operations. The high cost of running electrical equipment, coupled with lower capacity compared to traditional machinery, poses a significant barrier.

"Our science-based CO2 reduction targets are based on modern technology, but there are still limits to what electrification can offer – far from all this is in place today. Good battery technology for very large vehicles is still partly missing, and a key challenge is that the productivity and sustainability targets set by key players in the mining sector, build on technologies that are not yet fully there."

CTO, Boliden, Sweden

"One big challenge is the availability of renewable energy in our country; we lack sufficient investments, especially in solar power."

Mine operator, USA

Beyond technological limitations, the lack of green energy supply and charging infrastructure presents another significant obstacle. Mining companies in remote areas with weak or no grid connection struggle to electrify their operations. The availability of green electricity and the necessary charging infrastructure are often lacking, hindering the transition to electric equipment.

"The electrification of mining operations is a process of transformation. Therefore, it is not only necessary to ensure technological viability, but also to have the capabilities, the adaptability of our operations, and a value case that supports these changes over time."

Head of Innovation and Technology, Codelco, Chile

"In Mexico, we do not have the infrastructure for running our operations with batteries. Batteries do not last for as long as equipment that uses diesel does, and we would need to stop the operations while charging the batteries, which would be a big cost."

Mine operator, Mexico

Additionally, economic factors play a crucial role. While the integration of renewable energy sources is essential for decarbonisation, it also entails considerable financial outlay. On-site solar and wind farms, coupled with the necessary energy storage solutions, require extensive land acquisition, infrastructure development and grid integration. For operations in regions with limited grid connectivity or pre-existing energy infrastructure, the costs are amplified, demanding solutions that may not offer immediate returns on investment.

"Codelco has a unified portfolio, where we will start with the electrification of underground mining and progressively move towards more complex electrification scenarios, such as our open-pit operations."

Head of Innovation and Technology, Codelco, Chile

ELECTRIFYING UNDERGROUND OPERATIONS

Despite the above challenges, the confined environment of underground mines offers opportunities for operational efficiencies that directly translate to emissions reductions. Ventilation systems constitute a significant energy consumer, and can be optimised through localised electrification and real-time monitoring.

Furthermore, shorter haul distances within underground mines reduce the energy demands associated with material transport. This contrasts with open-pit operations, where large haul trucks consume substantial quantities of diesel fuel over long distances.

Overall, the mining industry faces a complex set of challenges in achieving its sustainability targets. While technological advancements and investments in green energy and infrastructure are essential, the industry must also navigate economic constraints and explore opportunities to prioritise electrification in areas like underground mining.

"Lack of charging infrastructure is a challenge for electrifying our operations."

Mine operator, India

INNOVATION

INNOVATION IS CRUCIAL TO MEET FUTURE DEMANDS

THE INNOVATION TRENDS SETTING THE STAGE

The mining industry is undergoing a significant transformation, with increasing demands and expectations on mining companies when it comes to emission reductions, operational efficiency and safety. This transformation underscores a reality where innovation no longer is a mere option, but an essential strategy for mining companies seeking to remain competitive and meet evolving demands.

Four focus areas are consistently:

1. Electrification
2. Automation
3. Extraction methods and reprocessing of tailings
4. AI and digitalisation

These focus areas guide research and development priorities and are crucial for meeting growing industry demands. According to the aforementioned report by ABB, 77% of respondents reported that they believe an integrated approach to electrification, automation and digitalisation is essential for the sustainable transformation of the mining industry[24].

ELECTRIFICATION

As one of the most prominent focus areas, electrification is fuelling concentrated innovation efforts. Driven by sustainability and decarbonisation, mining companies are actively transitioning to electric vehicles and equipment as a strategic measure to reduce emissions.

This shift is further reinforced by evolving industry best practices and heightened customer expectations. Capital markets compel mining companies to align with sustainability targets. This pressure comes from two sources: investor and lender demands for sustainable practices, and mining companies' need to strengthen brand reputation. As a result, mining companies are increasingly focusing on electrification as one of many necessary sustainability actions.

Demonstrating mining companies' commitment to electrification, BHP and Rio Tinto have established multiple partnerships with Caterpillar and Komatsu in recent years, most recently in 2024, to test battery-electric haul trucks[25]. Trials will take place in their ore mines in Western

[24] Mining's Moment report, ABB, 2024
[25] BHP & Rio Tinto Partner with Caterpillar and Komatsu, EV Magazine, 2024

Australia as part of broader efforts to achieve net-zero emissions by 2050. Fortescue is also investing heavily in electrification, purchasing $2.8 billion worth of electric mining equipment from Liebherr [26].

Among Swedish OEMs, Sandvik Mining and Rock Technology signed a memorandum of understanding with Vedanta's subsidiary, Hindustan Zinc, in 2022 to deliver a fleet of electric underground mining equipment[27]. Sandvik has also collaborated with mining companies such as LKAB[28] and Barrick Gold[29] to supply battery-electric vehicles for underground mining. Similarly, Epiroc has formed strategic alliances with for example Codelco[30], Boliden[31], and Glencore[32] to provide battery-electric equipment, reinforcing the industry's shift toward more sustainable mining solutions.

The global sales revenue of electric mining vehicles is expected to grow at a CAGR of 32% from 2024 to 2044, according to a report from UK-based marketing intelligence firm IDTechEx[33], yet significant challenges remain. This requires further R&D investments, particularly due to battery capacity limitations for larger vehicles and high equipment costs. With current technology, electrifying underground mining operations is a feasible goal, whereas open-pit mines, with their extensive fleets, require further technological advancements.

"Electrification is key to our medium- and long-term plan, but it represents a challenge that requires changes to existing infrastructure and operating methods."

Mine Operator, Latin America

"Canadian mine operators are increasingly focused on the electrification of their operations — including fleets, trucks, and underground equipment. The key questions they're asking are how to make this transition economically viable, and what forms of government support are available to help enable it. This presents a strong opportunity for Swedish companies to bring forward the technologies and equipment that can support a shift away from diesel-powered systems — toward solutions that are more sustainable and cost-effective."

Vice President,
Economic Affairs and Climate Change,
Mining Association of Canada, Canada

AUTOMATION

Complementing the electrification focus, automation is rapidly gaining traction. Companies are increasingly adopting autonomous and remote-operated machinery to remove personnel from hazardous environments, enhancing safety as well as productivity, particularly in complex underground mines.

Automation is a way of addressing the global issue of labour shortages. According to the Society for Mining, Metallurgy and Exploration, more than 220,000 mine workers in the United States are expected to retire by 2029[34]. Meanwhile, in South Africa, mining companies struggle to hire skilled employees despite high unemployment rates[35].

Several Swedish industry players are collaborating with mining companies to automate operations. For example, Epiroc will provide BHP with autonomous drill rigs for its iron ore mine in Pilbara in Western Australia. The advanced technology will enable BHP mining companies to control the equipment from its operations centre in Perth, located over 1,000 kilometres away[36].

Scania and Fortescue are jointly developing and validating a fully integrated autonomous road train solution to improve efficiency and safety in their haulage operations[37]. Lastly, Volvo Group and Rio Tinto entered a strategic partnership in 2022 to pilot sustainable autonomous hauling solutions[38].

The development of autonomous and electric vehicles is progressing in parallel, as most autonomous machines also are electric.

"We are planning to have an autonomous fleet at our new mine site. There are many reasons for this, for example that US salaries are very high, and that the industry is highly unionized."

Mine operator, USA

"At ABB, we are on a mission to help industries outrun – leaner and cleaner. In mining, we are considering three main areas when developing new solutions: productivity, safety, and sustainability"

Global Head of Communications,
BL Mining, ABB, Switzerland

[26] Fortescue Signs US$2.8 Billion Green Equipment Partnership With Liebherr for Zero Emission Mining Solutions, Fortescue, 2024
[27] Sandvik to Supply Underground BEV fleet to Hindustan Zinc, Sandvik, 2022
[28] Sandvik Partners With LKAB to Trial BEV Truck and Loader, Sandvik, 2021
[29] Sandvik Secures Order of Underground Battery Electric Vehicles For BHP Jansen Potash Project in Canada, Sandvik, 2022
[30] Reimagining the Future of Mining, Epiroc, 2023
[31] Epiroc Wins Large Mining Equipment Order Including Battery and Automation Solutions From Boliden in Sweden, Epiroc, 2023
[32] Epiroc Wins Large Battery-Electric Equipment Order for New All-Electric Mine in Canada, Epiroc, 2022
[33] Electric Vehicles in Mining 2024-2044, IDTechEx, 2024
[34] Why the U.S. has a serious mining worker shortage, CNBC, 2023
[35] Mining's inability to absorb youth raises questions about its sustainability, Engineering News, 2023
[36] Epiroc wins large order for autonomous surface mining equipment in Australia, Epiroc, 2025
[37] Fortescue and Scania collaborate to develop autonomous mining road train, Fortescue, 2024
[38] Rio Tinto and Volvo Group partner for low-carbon materials supply and pilot sustainable autonomous hauling solutions, Rio Tinto, 2022

EXTRACTION METHODS & REPROCESSING TAILINGS

Ore grades are declining on a global level, with high-grade deposits becoming increasingly rare, requiring mining companies to process larger ore volumes to maintain production levels[39].

The demand for raw materials continues to rise and ore grades in operating mines are declining, but permitting times to open new greenfield mines remain long and risky. This is forcing mining companies to seek solutions to re-process tailings and streamline extraction methods in current mines[40].

Driven by productivity and cost efficiency demands, innovation to improve extraction efficiency and enhancing tailings reprocessing is crucial for mining companies' competitiveness.

One example is how BHP is fighting declining ore grades in the world's largest copper mine, Escondida, in Chile[41]. The mining giant is using AI recommendations and machine learning to increase the mine's copper recovery.

"We are currently working with educational institutions to see if there are ways to re-process tailings to extract minerals from them."

Director of Sustainability,
Grupo Mexico – ASARCO, USA

"We are working with solutions for how critical minerals can be extracted from tailings. If the ore grades are 4%, this means that 96% is waste. Increasing the ore concentration would be a great opportunity to streamline material handling processes."

Mine operator, India

ARTIFICIAL INTELLIGENCE & DIGITALIZATION

Growing digitalisation efforts are enabling remote monitoring, data collection and predictive maintenance to streamline operations and improve decision-making. Complementing this, AI plays a critical role in predictive maintenance, mineral extraction optimisation, and analysing large datasets to improve safety and operational performance.

These advancements are enhancing efficiency not only at existing mine sites but also in exploration. AI also serves as the backbone for autonomous systems, interpreting complex data to enable smarter and safer mining operations.

According to the Mining Technology website, leading AI adopters within the mining industry include BHP, Rio Tinto, Freeport-McMoRan, Fortescue and Barrick Gold[42].

Freeport-McMoRan is using AI to increase copper production in its existing mines to avoid long and risky permitting times that come with opening new mines.[43] Another example is Barrick Gold's use of AI for predictive maintenance in one of its gold mines in Nevada.[44] Thanks to sensors and machine learning, equipment problems can be detected before they fail to avoid downtime. Swedish SME ReVibe Energy has supported Codelco to reduce inefficient screening and unplanned downtime in its Gabriela Mistral copper mine in Chile by installing monitor systems to enhance predictive maintenance and screening efficiency[45].

"Digitalisation is a key innovation area, but a lot is about how digitalisation interacts with other dimensions of innovation – it is important to have a system approach and holistic thinking."

Strategic Innovation Alliance Lead,
Epiroc, Sweden

[39] Declining Ore Grades: How to Boost Efficiency at Ageing Copper Plants, Mipac, 2024
[40] How Next-level Innovation is Helping depleting Ore Grades, Mining Technology – Worley, 2021
[41] AI Helps BHP Fight Declining Grades at Biggest Copper Mine, Mining.com, 2023
[42] Leading AI Companies in the Mining Industry, Mining Technology, 2024
[43] Freeport-McMoRan: Unlocking New Mining Production Through AI Transformation, McKinsey Digital, 2024
[44] Barrick Gold: Turning Data Into Gold, Aveva, 2021
[45] Success Story: Gabriela Mistral Mine, ReVibe Energy, 2025

RISING FOCUS ON CO-INNOVATION

Innovation in the mining industry is occurring as part of a broader ecosystem of technological and operational advances across multiple sectors. Companies are increasingly recognising that collaboration is key to driving meaningful advancements.

One significant trend is the growing practice of co-developing technology with OEMs. Instead of purchasing ready-made machinery, mining companies are working closely with their suppliers to develop customised solutions. For example, in collaboration with Epiroc and ABB, Boliden recently managed to successfully deploy a fully battery-electric trolley truck system on an underground mine test track in Sweden[46]. Another example is Vale and Epiroc's collaboration in Canada, where the partners are developing and testing automation, electrification and digitalisation solutions to enhance safety and productivity[47].

These co-development methods allow for the creation of integrated systems and holistic approaches, leading to improved efficiency and coordination. Long-term relationships with suppliers are becoming more common, fostering joint technology development and real-world testing.

Beyond major OEMs, mining companies are also creating partnerships with start-ups and SMEs. Vedanta is frequently partnering with start-up companies in India, and other mine operators are co-developing solutions together with SMEs. These collaborations bring fresh perspectives and specialised expertise, enabling the development of customised solutions that address specific industry needs. Early-stage collaboration ensures that the solutions are not only innovative but also practical and relevant for a mine's operations.

"Collaboration is part of future mine planning for our company, where mine planning becomes deeper and more coordinated, with more integrated systems. Even the companies that deliver equipment are collaborating more closely. We work closely with our core suppliers over time to 'make them better,' so to speak. Many suppliers test their systems with us, leading to joint technology development."

CTO, Boliden, Sweden

INDUSTRY-WIDE COLLABORATION ACCELERATES INNOVATION

There is a growing emphasis on industry-wide collaboration models. Public-private partnerships are emerging, with companies and governments working together on integrated mining operations. This is particularly evident in the Nordics, led by Finland and Sweden, where the triple-helix model involving academia, industry and government, is a key driver of innovation.

Other mining companies, such as Vale, are looking to the Nordics for inspiration, as these collaborations are creating more coordinated, long-term innovation ecosystems, where knowledge and resources are often shared to accelerate progress.

"Sweden is rather unique in how it uses triple helix approach in innovation projects. The engagement and demand for collaboration and exchange during these projects drive acceleration and produce valuable results and learnings. Additionally, the mindset to include small startups and SMEs that often bring new technological solutions, helps to validate several important perspectives and scale the solution in the early stages. The new strong trend is to use collaboration projects in the early stages to also secure the system and holistic perspectives."

Strategic Innovation Alliance Lead, Epiroc, Sweden

VALE

Case example of how Vale is working with innovation Hubs to foster collaboration with industry players.

- Vale has established Innovation Hubs to foster collaboration with startups, research institutions, and technology providers.
- Key technology areas include:
  - Autonomous operations
  - Digital transformation
  - Sustainable mining technologies
  - Tailings management

Source: Technology, Vale, 2025

[46] Boliden, Epiroc and ABB Make First Battery-Electric Trolley Truck System for Underground Mining a Reality, Epiroc, 2024
[47] Epiroc and Vale Base Metals Bolster Mine Safety and Innovation, Epiroc, 2024

FINANCIAL RISKS AND RESISTANCE TO CHANGE

Despite the clear need for innovation, mining companies face hurdles that can delay progress. A major obstacle is reluctance to invest and take on financial risk. What factors contribute to this risk aversion, and how can it be mitigated?

One major driver of risk aversion is the uncertainty related to regulatory and permitting aspects. The risk of regulatory obstacles and long permitting timelines at any stage create unpredictability about investment returns and discourage funding for new projects.

"The biggest risks we take when making investment decisions in the US are always the risks related to permitting."

Mine operator, USA

Financial risk concentration is another substantial driver of reluctance. Mining innovation requires substantial capital with long payback periods, exacerbated by commodity price volatility, leading to high financial risks. Companies often hesitate to take on both exploration and technology risks simultaneously, opting for safer bets in terms of technology and slowing innovation. With limited risk-sharing mechanisms, companies often bear the financial burden alone, stalling progress and new initiatives.

"Returns on large-scale innovation investments are often uncertain, making it challenging for individual mining companies to shoulder the risk alone. Consortiums—where multiple companies share both the investment and the upside—have become an increasingly attractive model. By focusing on the highest-potential technologies, these collaborations help de-risk the process, accelerate development timelines, and make innovation investments more financially viable—all while bringing transformative solutions to market faster."

CEO, Rethink Mining, Canada

Resistance to change proven methods is another barrier, especially in long-life mines where established practices dominate. Strategic investment timing is crucial to overcome this challenge, as integrating new technologies early in greenfield projects is easier than retrofitting them into existing operations. Moreover, mining companies want to adopt new technologies as followers, rather than first movers; the technology should preferably have a track record and be tested by other industry players first.

"One big challenge with developing and deploying new technologies is to get acceptance into the market – the main challenge is not with the mine operators, but with the EPCs. They don't want to take risk – they will want to use what they are familiar with and used to."

Mine operator, Australia

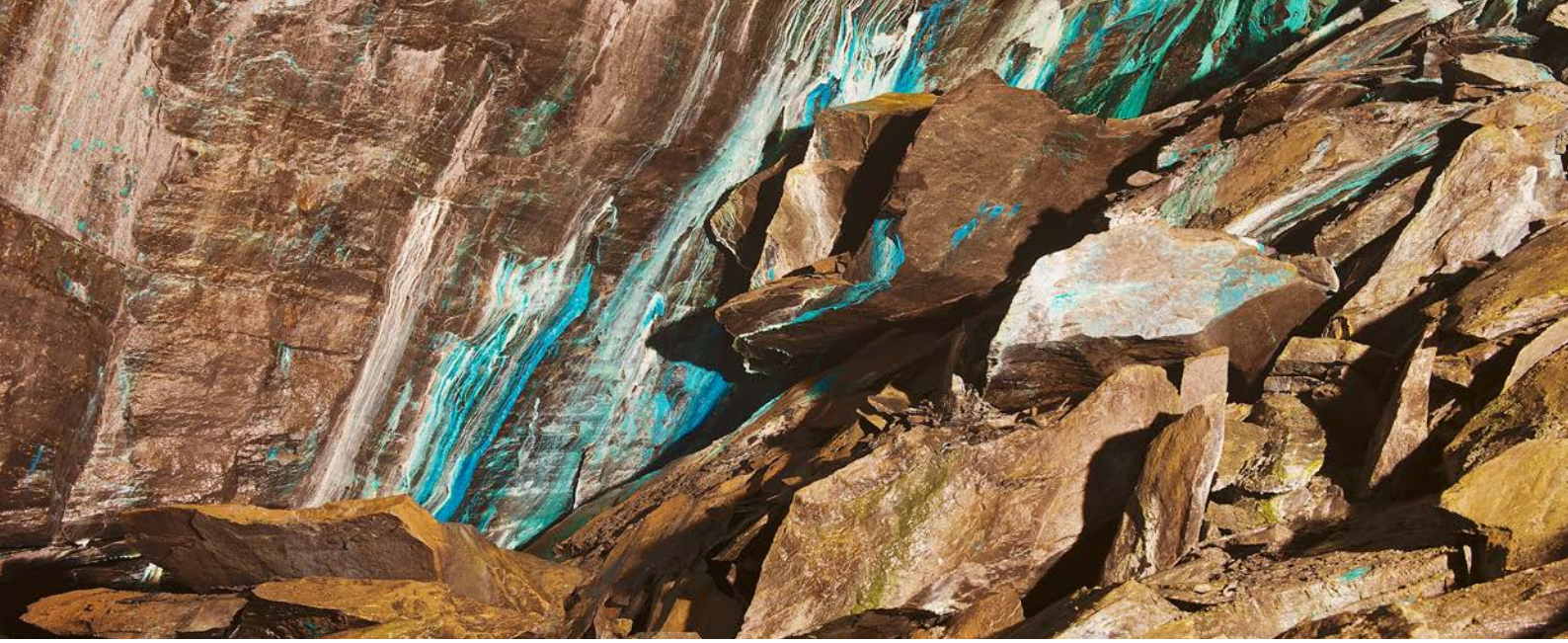
EXPLORING RISK-SHARING MODELS

A potential solution to overcome these challenges is the introduction of risk-sharing models. Industry consortiums allow mining companies to pool expertise and co-invest in high-cost innovations, distributing financial risks.

Collaboration and risk-sharing among engineering, procurement and construction (EPC) firms, OEMs, solution providers and mining companies during mine development can further balance both financial and technological risks, fostering greater investment confidence. While the mining companies are the end users, EPCs typically have a critical influence on decision making, for operational as well as new mines.

A notable example of company consortium efforts is the Canada-based, global initiative called ReThink Mining. The organisation brings together around 30 world-leading mining companies, OEMs, solution providers, associations and investment specialists under a single umbrella organisation[48]. When a company identifies a technology that is too costly or risky to pursue alone, ReThink Mining forms a consortium to share investment costs and expertise. A consortium recently developed a solution that cuts energy use in ore crushing by 60%.

[48] ReThink Mining, 2025



MEMBERS OF RETHINK MINING AMONG THE 20 STUDIED MINE OPERATORS:

AGNICO EAGLE · BHP · NEW BOLIDEN · CODELCO · GLENCORE · LKAB · Newmont · RioTinto · VALE

SIX WINDOWS OF OPPORTUNITY

Through discussions with 20 mining companies and industry experts, we have identified specific technologies, partnership models, and sales approaches where Swedish companies can capture business opportunities:

- Technologies to improve battery intensity, automation and AI.
- Technologies to improve seismic performance.
- Technologies to create value from waste products and mine dust.
- Technologies for low-carbon explosives.
- Partnerships to develop solar cells using minerals.
- Importing equipment to Canada that is manufactured in other countries than the US, due to tariffs on US products in Canada.

EXPLORATION

EXPLORATION FOCUS AND DYNAMICS IS SHIFTING

SLIGHT DECLINE IN GLOBAL EXPLORATION BUDGETS

With Chile, Mexico, Peru, Brazil and Argentina as key contributors, Latin America represented the largest global exploration budget in 2023 at $3.4 billion. Canada accounted for the second highest exploration spending at $2.4 billion, followed by Australia ($2.2 billion) and the US ($1.6 billion).[49]

The global exploration budget of nonferrous metals experienced a 3% decline from 2022 to 2023, decreasing from $13 billion to $12.8 billion[50]. The main reason for the drop is that junior miners struggle to access funding, decreasing their spending in early-stage, higher-risk projects[51].

While major mining companies, including the 20 companies analysed for this report, contribute nearly half of the total exploration investments globally, junior miners account for 42%of exploration budget spending, underscoring the crucial roles of both major and junior miners in driving resource discovery[52].

While the overall exploration budget decreased, certain commodities saw substantial growth. In line with the green transition, global exploration budgets for lithium, copper, nickel and REEs grew from 2022 to 2023, with lithium exploration spending standing out the most, surging by 77%.

Despite a 9% decrease in its exploration budget due to gold, Canada's exploration spending on lithium and nickel increased by a remarkable 120% and 38%, respectively. Similarly, lithium exploration in Latin America saw an 86% increase, but copper remains the most explored metal in the region.[53]

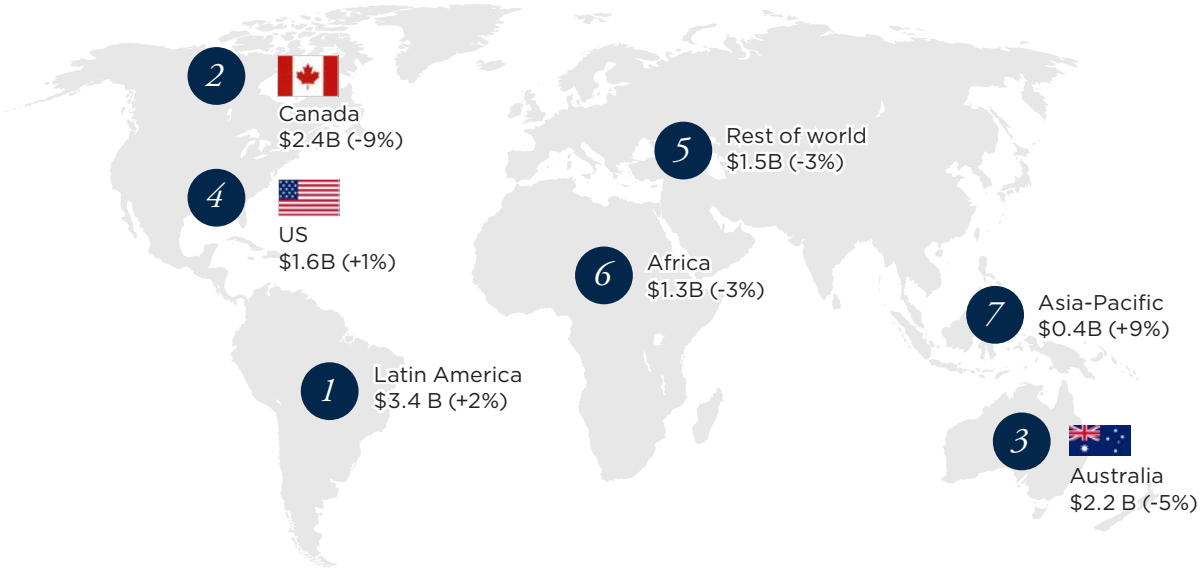
In contrast, traditional commodities like gold saw a decline in exploration spending between 2022 and 2023. Australia, for example, witnessed a 21% decrease in gold exploration from 2022 to 2023[54], aligning with global trends. However, gold prices had by early 2025 increased by over 40% since January 2024[55].

Lithium exploration has grown remarkably in recent years, yet challenges remain. For example, Sibanye-Stillwater recently dropped its plans to invest in the Rhyolite Ridge lithium project together with Ioneer in Nevada, due to a price plunge of the metal[56].

[49] World Exploration Trends 2024, S&P Global, 2024
[50] World Exploration Trends 2024, S&P Global, 2024
[51] Global Exploration Budget Fall as Junior Tighten Belts: S&P, Mining.com, 2025
[52] World Exploration Trends 2024, S&P Global, 2024
[53] World Exploration Trends 2024, S&P Global, 2024
[54] World Exploration Trends 2024, S&P Global, 2024
[55] Gold Prices Are Forecast To Rise Another 8% This Year, Goldman Sachs, 2025
[56] Sibanye Pulls Out of US Lithium Project After Price Slump, Reuters, 2025

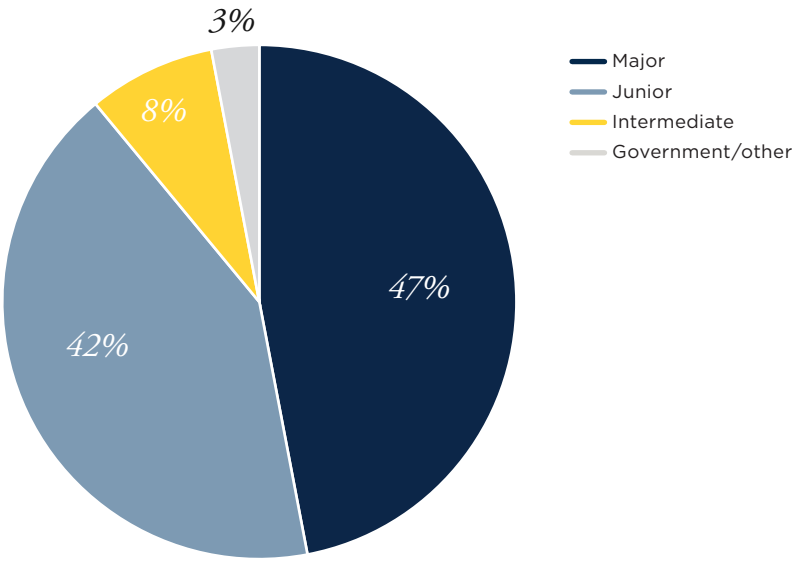
TOTAL EXPLORATION BUDGET BY REGION OR COUNTRY, RANKED 1-7

Billion USD, 2023 (change year over year, 2022-2023). China and India included in "Rest of World"
Source: World Exploration Trends 2024, S&P Global, 2024



EXPLORATION BUDGET SPENDING BY COMPANY CATEGORY, 2023

Source: World Exploration Trends 2024, S&P Global, 2024



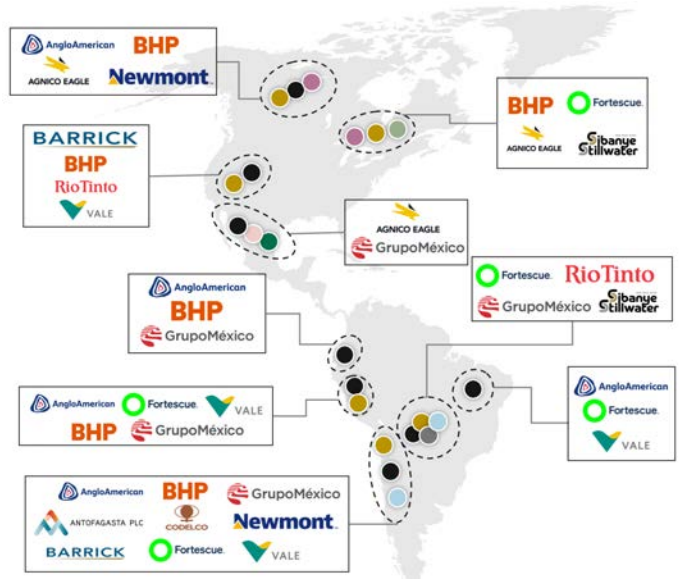
KEY EXPLORATION HUBS INCLUDE AMERICA AND AUSTRALIA

Looking at key exploration hubs among the 20 mining companies, it is evident that exploration projects are happening all around the world in a range of commodities with a strong emphasis on gold, silver, copper and lithium.

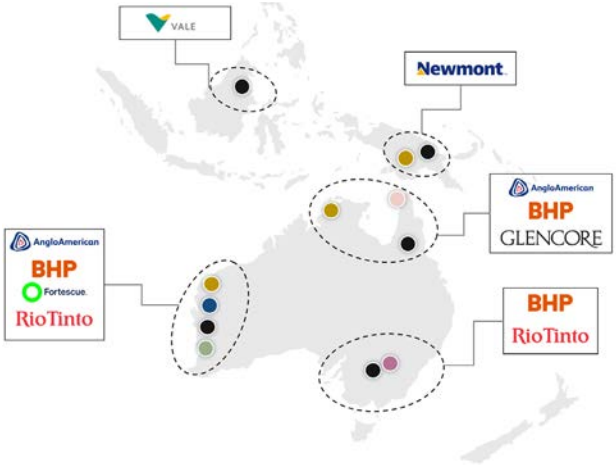
The most evident hubs among the 20 mining companies are well aligned with global exploration budgets; Latin America, led by Chile, Argentina and Peru; Northwestern and Southeastern Canada, Southwestern US, and Northern, Western, and Southeastern Australia, are all homes for many of the mining companies' exploration projects.

OVERVIEW OF EXPLORATION HUBS AND TYPES OF COMMODITIES EXPLORED IN EACH HUB, BASED ON THE 20 MINING COMPANIES

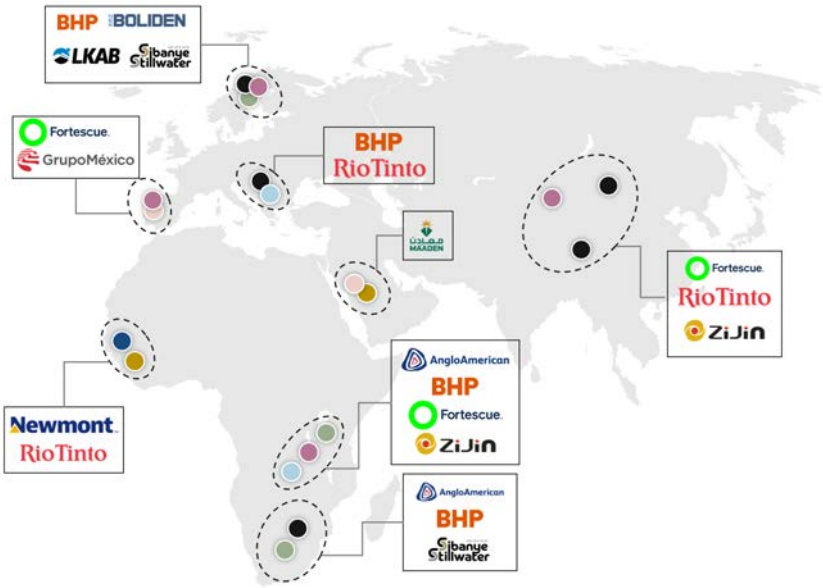
Americas region



Oceania and Southeast Asia



Europe, Africa, Middle East and Asia



Example commodities under exploration

- Copper
- Gold
- Iron ore
- Lithium
- Mixed minerals
- Nickel
- Polymetallic
- Silver
- Sulphide

Source: Annual reports, 2023 and 2024; Company websites

Note: Pins do not represent exact locations nor number of projects. For polymetallic and mixed minerals, the exploration is for various commodities and not 1-2 specific. Polymetallic refers to ores that can contain several elements, such as lead, zinc, copper, gold, silver and cadmium. Mixed minerals refer to a mix of minerals such as diverse critical minerals and REEs.

CRITICAL MINERALS TAKE THE SPOTLIGHT

One primary exploration trend is how the increasing demand for critical minerals is reshaping exploration. The green transition fuels the need for minerals like lithium, cobalt, nickel and REEs, prompting a focus on securing stable supplies.

As critical mineral production currently is highly geographically concentrated, with China accounting for 60% of the production of REEs and the DR Congo supplying 70% of the world's cobalt[57], some governments are increasingly prioritising domestic extraction to reduce reliance on external sources.

In August 2024, the Chinese government imposed global export limits on the strategic metal antimony used in military applications as well as in batteries[58]. Later the same year, it also imposed restrictions on critical minerals exports specifically to the US, banning minerals with dual military and civilian applications[59]. These two recent incidents underscore the need for increased domestic extraction.

Established in 2022 and consisting of 14 countries and the European Union, the Minerals Security Partnership exemplifies global efforts to secure a stable supply of raw materials and accelerate development of diverse critical mineral supply chains[60].

There is increased focus among the 20 mining companies on exploration and joint venture activities related to critical minerals. With operations currently focused on iron ore, Fortescue is focusing its exploration efforts on copper, lithium and REEs[61]. Furthermore, in efforts to enhance their lithium footholds, Rio Tinto acquired Arcadium Lithium for $6.7 billion in March 2025[62], and China's Zijin offered to purchase 25% of the lithium miner Zangge Mining for $1.9 billion in January 2025[63]. Similarly, Codelco has entered a partnership agreement with lithium producer SQM to jointly exploit lithium deposits in Chile and increase the government's involvement in lithium production[64].

While exploration for critical minerals is surging among the top 20 mining companies, coal reports an opposite trend, with companies step by step divesting their coal resources. For example, in 2025, Anglo American completed the sale of its stakes in the Jellinbah joint venture, an Australian steelmaking coal business, to concentrate on its core business consisting of copper, iron ore, and crop nutrients. In 2022, BHP divested its coal mines in Queensland as a step towards reducing reliance on fossil fuels[65].

RAMPING UP DOMESTIC PROCESSING AND REFINING

There is a strategic shift towards developing domestic processing and refinery facilities. Today, China is responsible for the refining of 90% of REEs and 60-70% of lithium and cobalt[66]. This dominance gives China significant geopolitical leverage as these minerals are crucial for applications related to the green transition, military and technology.

To mitigate foreign dependency and ensure supply chain resilience, the US and the EU are investing in domestic processing capabilities. This trend is reflected among mining companies, such as the BHP spinoff South32, developing on-site processing facilities to enable domestic processing and reduce foreign dependence. This indicates a move towards integrated domestic mineral supply chains, at a time when geopolitical tensions are rising.

AI IS DRIVING EXPLORATION EFFICIENCY

Another key trend is the integration of AI to enhance exploration efficiency. AI's ability to analyse complex geological data quickly identifies promising deposits with better accuracy, significantly reducing exploration timelines and costs. At operational mine sites, AI refines drilling plans by assessing subsurface data, improving precision and minimising unnecessary drilling. As typical example is the joint venture formed by Ivanhoe Electric and Maaden in 2023 enabling the use of AI-driven data analytics to process exploration data, improving the efficiency and accuracy of mineral discovery in Saudi Arabia[67].

[57] Energy Technology Perspectives 2023, International Energy Agency, 2023
[58] China to Limit Antimony Exports in Latest Critical Mineral Curbs, Reuters, 2024
[59] China Imposes Its Most Stringent Critical Minerals Export Restrictions Yet, Center for Strategic & International Studies, 2024
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[64] Codelco and SQM Enter Lithium Partnership Agreement in Chile, Mining Technology, 2025
[65] BHP sheds More Australian Coal Mines in $1.35 Billion Deal, Mining.com, 2021
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[67] Saudi Mining Giant Maaden Invests in Ivanhoe Electric Plus Forms Exploration JV, International Mining, 2023

CONCLUSION

PRIME TIME TO LEVERAGE SWEDISH MINING EXPERTISE

Swedish companies can play a crucial role in helping global mining companies adapt to shifting market demands – using new technologies and strategic partnerships to accelerate sustainability, innovation and exploration.

The vast ecosystem of Swedish solution providers to the mining industry has the unique opportunity to leverage advanced technologies, strategic partnerships and early engagement. Here is an overview of key market needs:

SUSTAINABILITY

Mining companies have set ambitious GHG emission targets for 2040-2050, and while progress is being made, challenges remain. Technological and equipment limitations, insufficient green energy supply, and inadequate charging infrastructure for fleet electrification are key obstacles. To accelerate the transition, more R&D and innovation is required, as well as access to renewable energy.

This presents an opportunity for Swedish companies specialising in sustainable mining solutions or green energy supply to offer advanced technologies, collaborate on R&D, and position themselves as key partners in decarbonising the industry.

INNOVATION

Driven by the need for decarbonisation, increased productivity and enhanced safety, mining companies' innovation priorities include electrification, automation, digitalisation, and AI, as well as developing enhanced methods for extraction and reprocessing of tailings.

By building partnerships with mining companies and local mining ecosystems, Swedish companies can co-develop customised solutions that address specific operational needs.

EXPLORATION

Driven by green transition goals, mining companies are shifting exploration efforts towards critical minerals like copper and lithium, while maintaining interest in gold and silver, and divesting their coal resources. Exploration projects are globally distributed, with key hubs in Latin America, Canada, Australia, and the US.

Instead of focusing on specific geographies, Swedish companies should concentrate on following key mining companies across regions, leveraging industry networks and expert recommendations to secure long-term partnerships.

6 KEY OPPORTUNITIES

1 **Proactive GHG Emission Support:** Mining companies face intensifying regulatory pressure to reduce emissions. Swedish companies should monitor sustainability metrics and funding initiatives to identify opportunities for innovative solutions. Suppliers can gain advantage by investing in emission reduction initiatives and positioning as partners in Scope 1, 2, and 3 reduction efforts.

2 **Strategic exploration:** New exploration projects offer prime market entry opportunities, unencumbered by established supplier relationships. Early engagement allows integration from the outset, fostering long-term partnerships and competitive advantage.

3 **Diversified technology solutions:** Market potential exists beyond conventional equipment for Swedish companies specialising in advanced technologies, including green on-site energy, AI, decarbonisation solutions, battery improvements, low-carbon explosives, waste utilisation, water handling, seismic performance, and dust management.

4 **Collaborative innovation:** Strategic partnerships with mining companies drive tailored solutions. Sweden's collaborative model between universities, government, and industry can influence global approaches and facilitate new business partnerships.

5 **Targeting EPC firms:** Engineering, Procurement and Construction companies significantly influence mine development and technology selection. Establishing relationships with these firms facilitates access to major projects and mining companies.

6 **Development-focused engagement:** A collaborative development approach is essential for developing advanced technologies, where tailor-made solutions can be co-developed by equipment or solutions providers and mining companies. Understanding customer needs and building close partnerships can lead to the creation of customised solutions.

BUSINESS SWEDEN CAN SUPPORT YOU

Business Sweden's team of mining specialists have helped many Swedish companies across the mining value chain to capture opportunities and maximise success in international markets.

We can help you analyse new market opportunities, reach out to potential partners, accelerate sales, develop go-to-market strategies, and build your presence overseas.

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