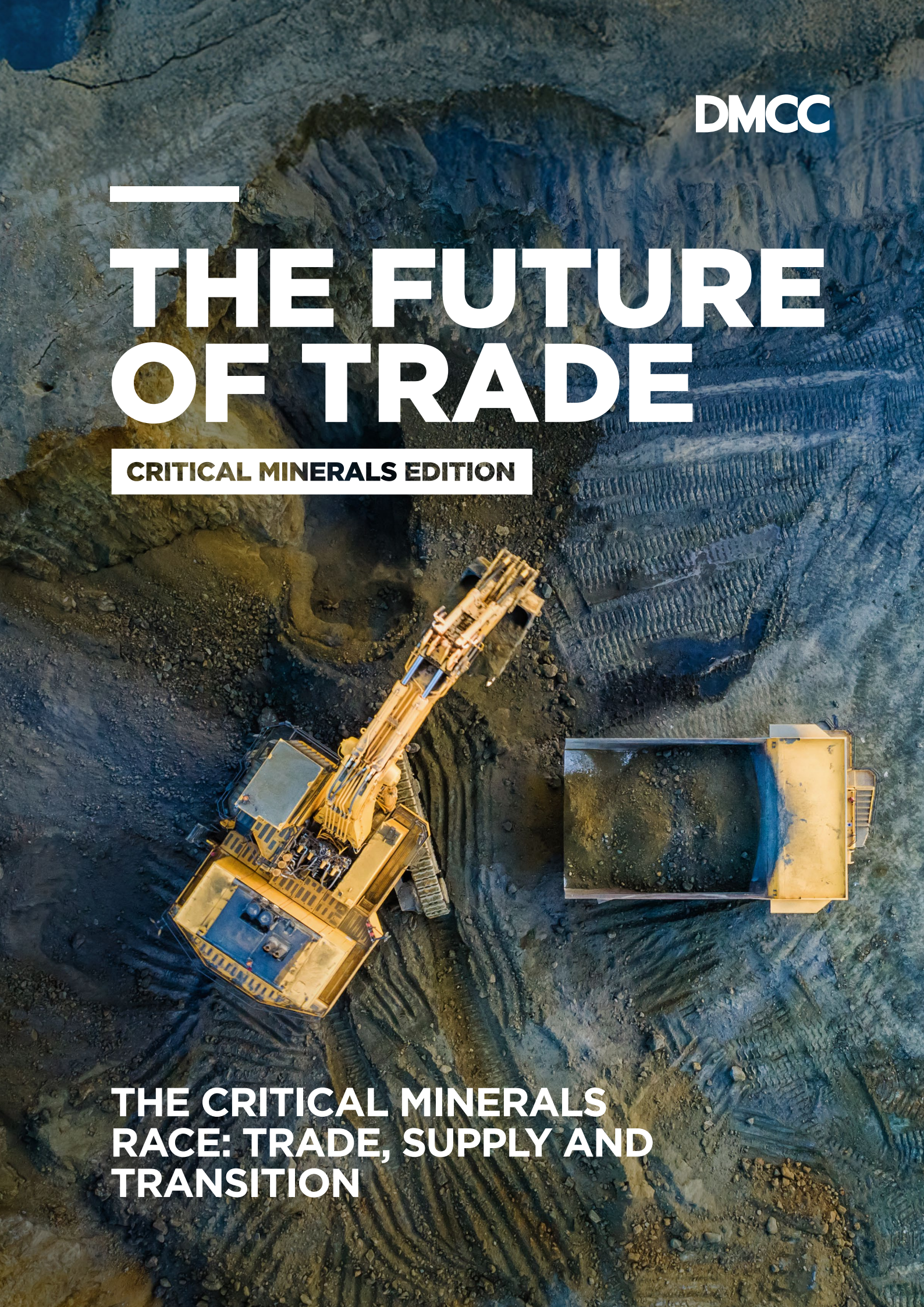
DMCC

THE FUTURE OF TRADE

CRITICAL MINERALS EDITION



THE CRITICAL MINERALS RACE: TRADE, SUPPLY AND TRANSITION

TABLE OF CONTENTS

INTRODUCTION

The global economy is undergoing a seismic shift. The twin forces of digitalisation and the energy transition are fuelling an insatiable demand for critical minerals – resources essential for everything from electric vehicles and renewable energy to advanced computing and defence technologies.

Once nice commodities, these minerals – termed ‘critical’ because of their indispensability to a swathe of industries – are now at the heart of a new geopolitical contest. Nations and industries are scrambling to secure supplies, mitigate supply chain vulnerabilities, and hedge against rising costs.

Unlike traditional hydrocarbon-based systems, clean energy technologies are vastly more mineral-intensive. An electric vehicle requires five times the mineral content of a conventional car. Wind and solar farms demand extensive use of rare earth elements, nickel, silver, and silicon. If the world is to meet net-zero targets by 2050, demand for key minerals such as lithium, cobalt, nickel, and graphite could surge by up to 75 times their 2020 levels.

But the digital revolution and the rapid expansion of AI infrastructure are amplifying this pressure, driving unprecedented demand for high-purity silicon, rare earth elements, and advanced semiconductors. The challenge is not just scaling up supply – it’s ensuring that supply is secure, cost-effective, and resilient.

Introduction

Once nice commodities, these minerals – termed ‘critical’ because of their indispensability to a swathe of industries – are now at the heart of a new geopolitical contest. Nations and industries are scrambling to secure supplies, mitigate supply chain vulnerabilities, and hedge against rising costs.

Introduction

Yet, the critical minerals supply chain is fraught with risks.

Mining is highly concentrated in specific regions, notably China, Australia, Russia, Latin America, and sub-Saharan Africa. China overwhelmingly dominates global refining and processing capacity, while Russia's leading position in nickel, platinum, and other key minerals is a supply risk in light of Western sanctions. Meanwhile, long lead times stretch over a decade, making short-term supply adjustments nearly impossible. These dynamics contribute to an emerging regionalisation of the minerals trade, characterised by shifting alliances and new trade blocs.

These structural vulnerabilities are pushing governments and businesses to rethink their strategies – diversifying supply chains, ramping up recycling and material efficiency, and investing in alternative technologies such as sodium-ion batteries and next-generation solar and wind components.

As a result, geopolitics will play a decisive role in shaping the future of critical minerals.

Competition is inevitable, but opportunities for strategic partnerships are also emerging. The Gulf states like the UAE and Saudi Arabia, with their financial firepower and access to low-cost energy, are positioning themselves as pivotal players. Whether through investments in global mining projects, expanding minerals processing capabilities, or leveraging trade ties with China, Russia, and Europe, the region is set to play an increasingly influential role in the minerals supply chain.

This report examines the evolving landscape of critical minerals – mapping demand trends, identifying key risks, and exploring the geopolitical dynamics that will define this new industrial era.

EXECUTIVE SUMMARY

This publication serves as the first in-depth DMCC report on the global critical minerals trade. Building on unique insights and expert analysis, this Future of Trade special edition delves into the central forces shaping the world of critical minerals, highlighting their pivotal role in the global economy, energy transition, and technological innovation. As industries race to scale renewable energy, AI and next-generation computing, demand for lithium, rare earth elements, and other critical minerals has surged – intensifying geopolitical competition, reshaping supply chains, and driving investment into new extraction and processing hubs. From securing resilient supply networks to navigating shifting trade policies, this report explores the strategies, challenges, and opportunities that will define the future of the critical minerals landscape.

We identify four key themes defining the critical minerals landscape:

A demand surge reshaping global markets

The accelerating shift toward electric vehicles, renewable energy, and next-generation digital infrastructure is fuelling an unprecedented surge in demand for critical minerals. The scale is staggering – by 2050, demand for lithium, cobalt,

The scale is staggering – by 2050, demand for lithium, cobalt, and nickel could soar by up to 75 times 2020 levels.

and nickel could soar by up to 75 times 2020 levels. Nations and corporations must navigate supply constraints, refining bottlenecks, and intensifying competition to secure access to these indispensable materials.

Supply chains under strain

The critical minerals supply chain is defined by deep structural vulnerabilities which underscore the accelerating regionalisation of trade. Extraction is heavily concentrated in a small number of countries, heightening their exposure to

geopolitics and resource nationalism. China's dominance in processing and refining has made it the linchpin of the supply chain and reinforced dependencies. Meanwhile, long lead times for new production – often exceeding a decade from exploration to operational output – constrain the ability to respond to demand surges or supply disruptions. In an era of heightened geopolitical competition, these factors are driving a fragmentation of trade flows, as nations prioritise supply chain resilience and strategic stockpiling.

Governments redrawing the critical minerals map

State intervention in critical minerals is reaching new heights. The U.S. Inflation Reduction Act (IRA) and the European Union's Critical Raw Materials Act are reshaping investment flows, while China's Belt and Road Initiative (BRI) continues to broaden Beijing's access to mineral-rich territories. Resource nationalism is on the rise, with governments tightening export controls and pushing for domestic refining capacity. As policy frameworks evolve, businesses must anticipate shifting regulatory environments that will redefine access and pricing dynamics.

The Middle East's critical minerals play

The Middle East is emerging as a key player in the critical minerals race, leveraging its financial clout and energy advantages. The Gulf states, particularly the UAE and Saudi Arabia, are investing heavily in minerals extraction and processing capacity, both domestically and abroad. Access to low-cost energy gives the region a competitive edge in refining and manufacturing high-value mineral-based products. At the same time, its strategic location and trade links with both producers in Asia and consumers in Europe position it as a crucial hub in the evolving minerals supply chain.

Specific trends highlighted in the report include:

Market trends

Unprecedented demand growth: The clean energy transition and digital revolution are driving an extraordinary surge in critical minerals demand, with lithium, cobalt, and nickel consumption projected to increase by up to 75 times their 2020 levels by 2050.

Rising cost pressures: Mineral price volatility, driven by supply bottlenecks, geopolitical tensions, and environmental regulations, is increasing the cost of clean technologies, impacting EVs, renewables, and digital infrastructure.

Supply chain trends

Supply chain vulnerabilities: Global critical minerals supply chains are highly concentrated, with mining and refining dominated by a few key regions, exposing markets to geopolitical risks, resource nationalism, and supply disruptions.

Long Lead Times and Structural Constraints – Developing new mining and refining operations takes 10-20 years, limiting the industry's ability to respond to supply shocks or sudden demand spikes.

Investment in alternative technologies – Innovation in sodium-ion batteries, material recycling, and AI-driven efficiency is emerging as a key solution to mitigate mineral shortages and reduce reliance on high-risk supply chains.

Geopolitical trends

China's central role: China commands over two-thirds of global refining capacity for key minerals, making it a strategic hub but also a focal point for economic dependencies and diversification efforts by other economies.

Geopolitical realignment: Governments worldwide are redrawing mineral supply chains through new industrial policies, export controls, and strategic alliances, reflecting the broader regionalisation of trade.

Regulatory shifts and trade fragmentation – The U.S. Inflation Reduction Act, EU Critical Raw Materials Act, and China's Belt and Road Initiative are reshaping investment flows, reinforcing regional economic blocs in mineral trade.

The Middle East's rising influence: The UAE and Saudi Arabia are rapidly expanding their role in the critical minerals market, leveraging financial power, low-cost energy, and strategic global partnerships to secure supply chains.

Strategic partnerships and diversification: Tied to the above, companies and governments are actively seeking new trade routes, alternative processing hubs, and co-investments to reduce reliance on single suppliers and secure long-term mineral access.

CHAPTER 1

A DEMAND SURGE RESHAPING GLOBAL MARKETS

Global critical minerals demand will surge alongside the clean energy transition, bringing supply constraints and geopolitical challenges.

CHAPTER I: A demand surge reshaping global markets

The global scramble for critical minerals is intensifying. As the backbone of the energy transition and digital revolution, these resources underpin the next era of economic growth. Demand is rising at an unprecedented pace, with electric vehicles (EVs), renewable power, and digital infrastructure driving insatiable consumption. Yet, supply constraints loom large. The long lead times required to bring new production online, coupled with concentrated mining and refining capacity, threaten to disrupt supply chains, push up costs, and slow the adoption of clean technologies. Addressing these challenges is no longer a distant priority – it is an immediate imperative.

MATERIAL USES AND DEMAND OUTLOOK

The transition to a low-carbon economy is vastly more mineral-intensive than in the hydrocarbon-based era. EVs, for example, require five times more metals than internal combustion engine vehicles, with copper demand tripling and nickel needs soaring twentyfold. Battery technologies rely heavily on lithium, cobalt, manganese, and graphite – materials that are now at the centre of a global supply squeeze.

Renewable energy infrastructure is similarly resource-hungry. Wind turbines depend on nickel and rare earth elements, while solar panels require silicon, semiconductors, and silver. Unlike fossil fuel systems, which consume hydrocarbons continuously, clean energy technologies demand vast quantities of minerals upfront. This shift is already putting immense strain on global supply chains.

CHART 1

Critical Minerals in the Low-Carbon Energy Transition

Select Materials Used in Clean Energy Technologies	Share of Global Use*	Risk Exposure Level: High Costs	Risk Exposure Level: Supply Shortfalls	Risk Exposure Level: Geopolitical Risks	Select Techonologies Impacted
Cobalt, **lithium** and **manganese** are key metals in the cathode of most electric batteries, with **graphite** used in anodes. As battery chemistries evolve, demand for some cheaper metals like manganese is likely to increase at the expense of cobalt.	Graphite: **33%** Li: **27%** Co: **15%**	●	●	●	**EV Batteries**
Rare earth elements like dysprosium and neodymium are used in permanent magnets in rotating electrical equipment, notably including wind turbines and other uses like EV motors.	**16%**	●	●	●	**Wind Turbines, EV Motors**
Copper is a key input across technologies, used for electrical wiring, with demand from the EV and power sectors expected to increase.	**15%**	●	●	●	**Everything**
Silicon, is the main semiconductor material used in solar PV cells, which also use silver and may contain **germanium** and other materials.	Si: **14%** Ag: **10%**	●	●	●	**Solar PV**
Nickel is a key material in the cathode of most electric batteries; other materials, such as sulfur, could be alternatives.	**7%**	●	●	●	**EV Batteries, Wind Turbines**
Aluminum is increasingly used to make vehicles (due to its light weight) and in EV battery packs, and is used in electricity transmission.	**3%**	●	●	●	**EVs, Power Grids**
Tin is used in solder for electrical components. Around 5x more solder is used in EVs than in ICE vehicles.	**2%**	●	●	●	**Everything**
Steel is primarily used in infrastructure and construction, but also has uses in wind turbine towers, automobile bodies and other areas.	**1%**	●	●	●	**Wind Turbines, Vehicle Bodies**

Potential impact on green energy sectors: ● Very High ● High ● Moderate ● Low

Source: Energy Intelligence, industry reports.
Note: *Approximately 2020 share used by clean energy technology

CHAPTER I: A demand surge reshaping global markets

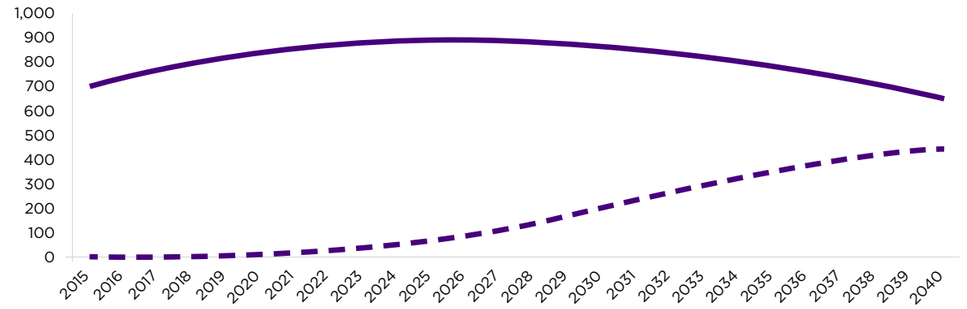
By 2050, passenger EVs are expected to account for 80% of global battery mineral demand, further tightening supply and amplifying geopolitical tensions.

The chart underscores the acute risk of shortages and price surges, particularly for battery minerals. EV adoption is accelerating, buoyed by falling costs and policy incentives. Proprietary modelling by leading information analytics company Energy Intelligence projects that the global EV fleet will expand eightfold by 2040, with 500 million passenger EVs in the world's five largest markets alone. By 2050, passenger EVs are expected to account for 80% of global battery mineral demand, further tightening supply and amplifying geopolitical tensions.

While batteries dominate mineral demand, other sectors – including heavy-duty transport, stationary storage, and consumer electronics – will add further pressure. Both cathode materials (lithium, nickel, manganese, cobalt) and anode materials (graphite, chips) face sustained supply risks, setting the stage for prolonged price volatility.

CHART 2

Total Passenger Light-Duty Vehicle Fleet (Core Scenario – United States, Europe, China, Japan and South Korea; millions)



Source: Energy Intelligence.

A SUPPLY CHAIN UNDER STRAIN

The race to secure critical minerals is constrained by deep structural vulnerabilities. Mining remains highly concentrated in select regions: Africa (copper, alumina, lithium), Latin America (lithium, copper), Russia (nickel, platinum), Australia (lithium), and China (graphite, silicon, rare earth elements). These geographic realities pose inherent risks, from political instability to resource nationalism.

Refining capacity, meanwhile, is overwhelmingly dominated by China, which controls nearly all rare earth processing and a commanding share of steel, aluminium, copper, and nickel refining. Beijing's dominance is both an economic advantage and a geopolitical lever. For Western economies, securing alternative processing capacity is now a strategic priority, though efforts remain in their infancy. The Middle East, with its access to low-cost energy, is emerging as a potential refining hub, a trend explored in greater depth below in the section on the Gulf's role in the critical minerals value chain.

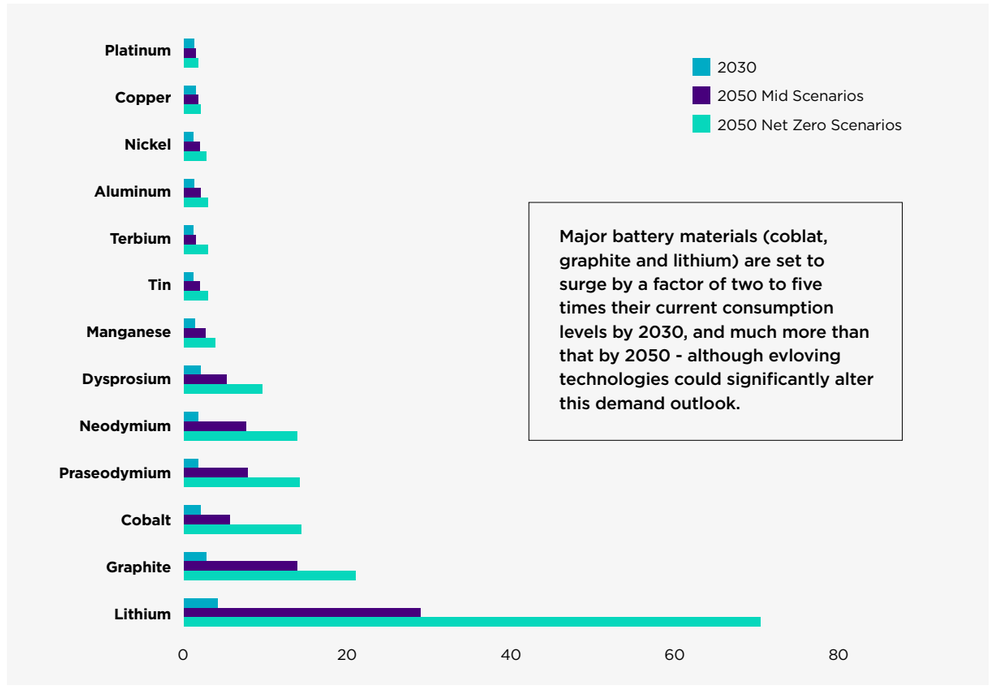
Graphite, lithium, and other battery minerals face the most severe supply pressures. Unlike some metals, these materials have limited substitutes, and demand is set to soar. China's dominance in these markets is a growing geopolitical flashpoint, particularly for the United States and European Union. Projections vary, but industry estimates suggest demand for lithium and graphite could surge by up to 75 times 2020 levels if net-zero targets are realised (see chart below).

For Western economies, securing alternative processing capacity to China is now a strategic priority. The Middle East, with its access to low-cost energy, is emerging as a potential refining hub.

CHAPTER I: A demand surge reshaping global markets

CHART 3

Total Global Mineral Demand Projections (Estimated increase required, shown as multiples of current consumption)



Source: Energy Intelligence, European Commission JRC, ITA, Fast Markets, industry reports.
Note: Chart shows total estimated demand for each mineral/metal, including from clean energy technology uses.

Renewables will add further pressure. Wind power relies on rare earth elements for turbine motors, while solar expansion will drive up demand for silicon and silver. China's entrenched position as the world's leading refiner of rare earths and a dominant player in silicon-based solar panels compounds supply risks for nations seeking to localise production.

Meanwhile, the digital revolution is a minerals-intensive transformation in its own right. Copper (for wiring) and tin (for soldering) will be in growing demand, with industry projections forecasting fivefold increases by 2050. The expansion of cloud computing, 5G networks, and AI-driven infrastructure will only accelerate this trend.

COST DRIVERS AND THE OUTLOOK FOR MINERALS MARKETS

Surging demand, supply bottlenecks, and geopolitical frictions are all driving up mineral prices – raising the cost of the energy transition and digitalisation. The risk of shortages is particularly acute for minerals with long production lead times, tight supply, and few viable alternatives. Copper, lithium, and graphite are among the most exposed, with typical mine development times exceeding a decade.

Environmental regulations, particularly in the United States and EU, add further barriers to rapid supply expansion. The paradox is clear: the same sustainability goals that drive mineral demand also constrain new production, delaying crucial projects and exacerbating shortages.

The paradox is clear: the same sustainability goals that drive mineral demand also constrain new production, delaying crucial projects and exacerbating shortages.

The chart below highlights the sensitivity of EV production costs to material price swings. Semiconductors – essential for sensors and computing – have the greatest impact, with a 10% price increase raising EV costs by 3.5%. Other metals, such as nickel and copper, exert a smaller but still significant influence.

Battery minerals, despite their centrality to EVs, account for a relatively modest share of total production costs. Prices for lithium, graphite, and manganese would have to increase tenfold to meaningfully disrupt adoption. However, price stability is by no means assured.

Innovation could reshape cost dynamics. New battery chemistries, such as sodium-ion technology, could sideline lithium, nickel, and cobalt, reducing dependence on high-risk supply chains.

CHAPTER I: A demand surge reshaping global markets

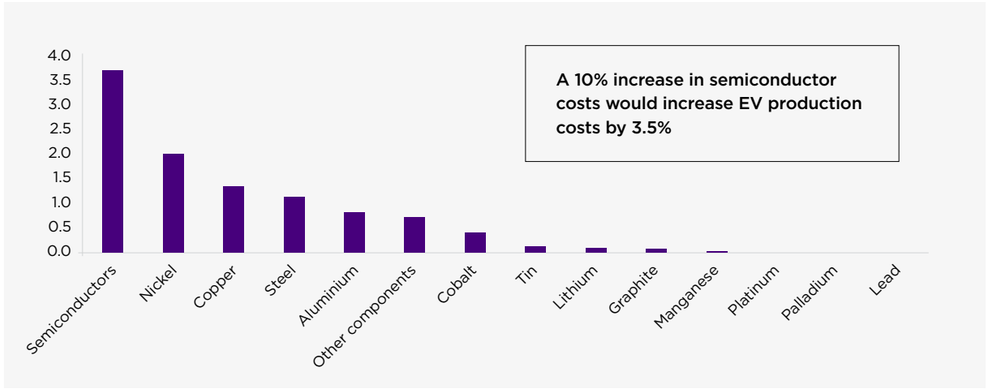
While still in development, such breakthroughs could upend the industry, altering the trajectory of mineral demand and mitigating supply concerns.

Yet, even with technological advances, the road ahead will be marked by volatility. The race for critical minerals is no longer just about economics – it is about industrial strategy, national security, and geopolitical influence.

The race for critical minerals is no longer just about economics – it is about industrial strategy, national security, and geopolitical influence.

CHART 4

Electric Vehicle Cost Sensitivity (% change to total EV production cost due to a 10% change in select material costs)



Source: Energy Intelligence

CHAPTER 2

SUPPLY CHAINS UNDER STRAIN

China, Australia, Russia, Latin America, and sub-Saharan Africa dominate production across a range of critical materials. However, this concentration exposes markets to geopolitical and economic risks.

CRITICAL MINERALS: SUPPLY CONCENTRATION AND RISK

The green energy and digital revolutions hinge on an unprecedented, mineral-intensive expansion of new energy infrastructure. As global demand for critical minerals accelerates, securing reliable supply has become a strategic priority. Yet, the path to supply security is fraught with challenges, from the geographic concentration of mining and refining activities to financial, logistical, and geopolitical constraints that threaten to disrupt markets. The structural vulnerabilities of these supply chains could delay the energy transition, drive up costs, and deepen economic fragmentation.

THE GEOGRAPHY OF MINE PRODUCTION: A STRUCTURAL RISK

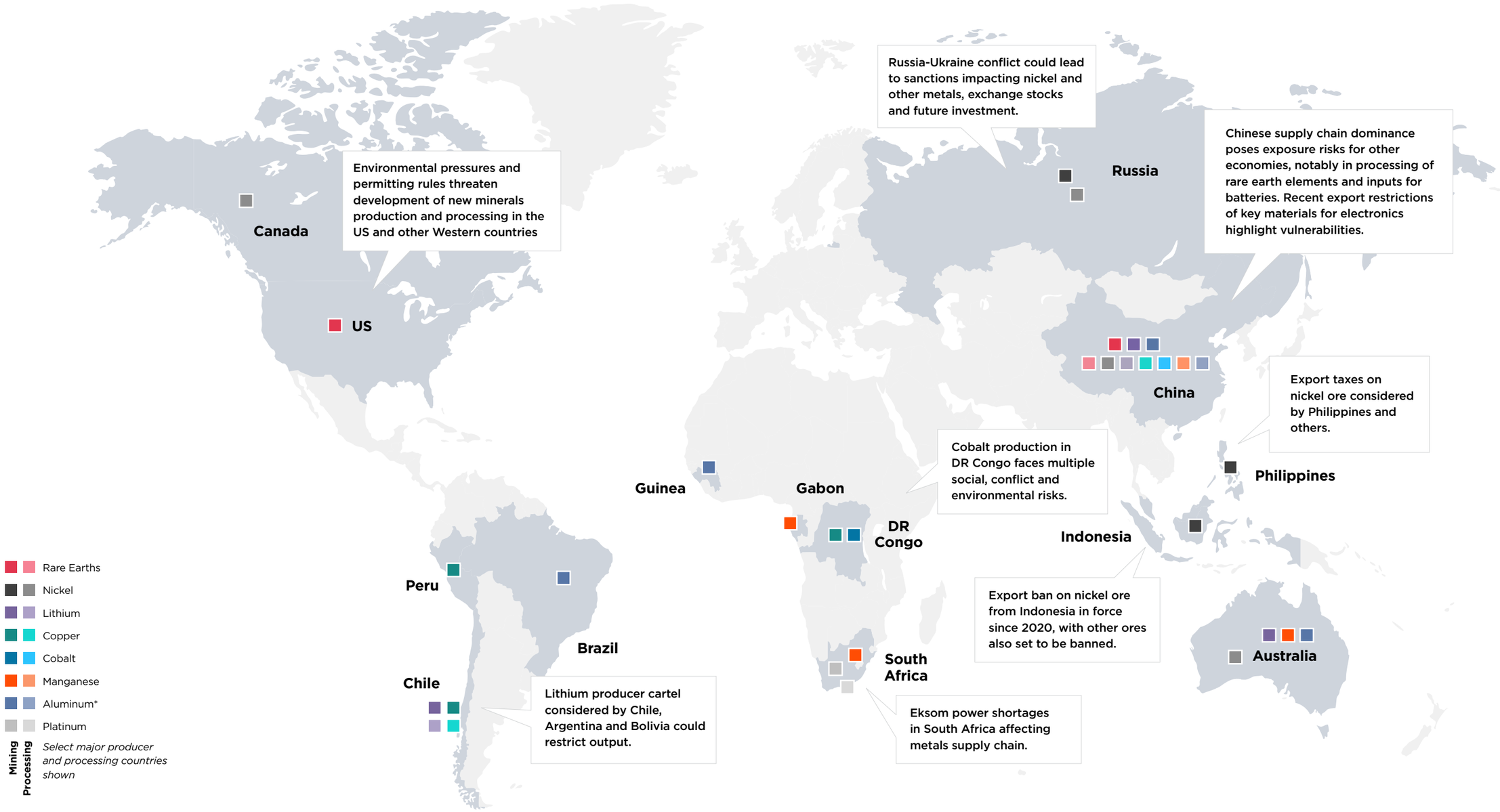
Mineral extraction occurs where natural deposits are concentrated, leading to a supply chain shaped by geology rather than economic efficiency. China, Australia, Russia, Latin America, and sub-Saharan Africa dominate production across a range of critical materials.

However, this concentration exposes markets to geopolitical and economic risks, as supply remains subject to export controls, policy shifts, and political instability.

CHAPTER 2: Supply chains under strain

CHART 5

Global Critical Minerals Supply Concentration



Source: Energy Intelligence.

Note: *For aluminium, mining refers to bauxite, processing refers to alumina production.

The global distribution of mining activity creates asymmetric vulnerabilities. Latin America, the leading source of copper and lithium, is increasingly considering cartel-like supply coordination, raising concerns about price manipulation and export restrictions. Russia's dominance in nickel, platinum, and other key commodities presents a persistent risk for Western markets, where economic sanctions and political tensions could further strain access. These dynamics contribute to an emerging regionalisation of the minerals trade, characterised by shifting alliances and new trade blocs.

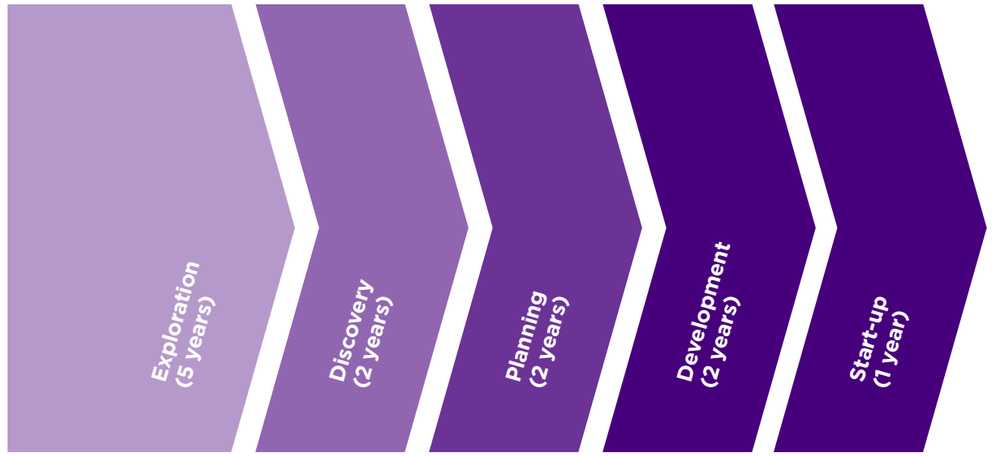
Recent disruptions highlight the fragility of global supply chains. Indonesia's nickel ore export ban, Western sanctions on Russian metals, and rising copper extraction taxes in Latin America have all exerted inflationary pressure on mineral markets.

Additionally, mining has been disrupted by external shocks, from Guinea's war-related interruptions in alumina extraction to pandemic-driven shutdowns in African metal production. The cumulative effect of these disruptions has been supply shortages and price volatility – trends that, if sustained, could slow global decarbonisation efforts.

Long project lead times compound these risks. Mining ventures require extensive financing, regulatory approvals, and infrastructure development, with typical timelines ranging from five to 20 years. This is particularly problematic in North America and Europe, where stringent environmental policies and public opposition have hindered new mining projects. Without regulatory adjustments, these constraints will likely sustain high prices and supply deficits in the years ahead.

CHART 6

Average Mining Lead Times



Source: Energy Intelligence, IEA, industry reports.

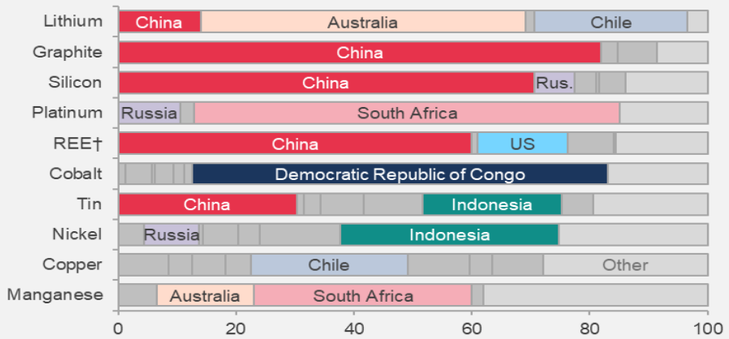
Typical total: 12 years or more

PRODUCTION AND REFINING: CHINA'S DOMINANCE, SUPPLY RISKS AND OPPORTUNITIES

Mining alone does not guarantee a stable supply of critical minerals – refining capacity is an equally pivotal factor. Despite not being the world's largest miner of several key resources, China dominates refining, particularly for cobalt, nickel, and copper. This strategic advantage is the result of government-backed industrial policies, strong domestic demand, and favourable environmental regulations.

CHART 7

Critical Metals: Mine Production, Select Major Producers* (2021, % of global total)



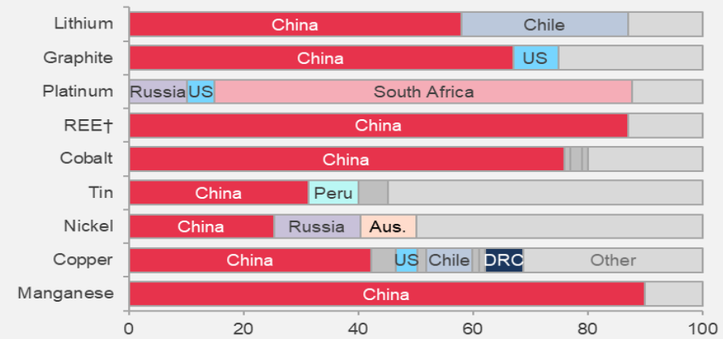
Source: USGS, Energy Intelligence

In recent years, China has strengthened its grip on the refining sector through selective import policies, favouring high-grade ore and phasing out low-concentration scrap metals. This shift has opened opportunities for other regions, notably Africa and Southeast Asia, to expand their refining industries. Meanwhile, the Middle East is emerging as a potential refining hub, leveraging its access to low-cost energy to process alumina, aluminium, and steel more competitively.

However, the concentration of refining activity in a handful of locations presents a systemic supply risk. Western economies are actively seeking to diversify refining capacity in response to concerns over environmental shutdowns, export restrictions, and trade disruptions. Yet, despite political rhetoric, investment in alternative refining facilities remains limited. The high capital intensity of refining operations – particularly for complex processes like rare earth element separation and uranium enrichment – has constrained the pace of diversification efforts.

CHART 8

Critical Metals: Refinery, Select Major Producers* (Latest year, % of global trade)



Source: USGS, ITA, IEA, industry sources, Energy Intelligence.

OTHER CHALLENGES: LOGISTICS AND INFRASTRUCTURE

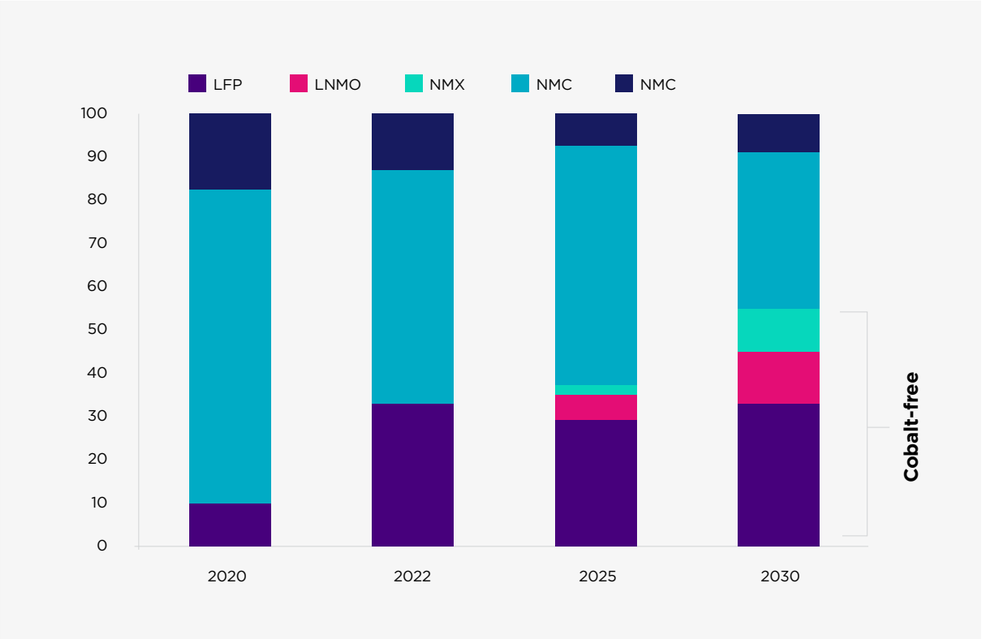
Even when minerals are successfully mined and refined, efficient transport and trade infrastructure remain critical. Supply chain disruptions can emerge from logistical constraints as much as from resource scarcity. The spikes in lithium and nickel prices in recent years have underscored the significance of smooth transportation networks.

However, China's influence extends beyond extraction and refining. It dominates global logistics for critical minerals through its extensive lending and infrastructure projects, particularly under the Belt and Road Initiative (BRI), which allow Beijing to influence supply routes.

While the EU and United States have announced policy initiatives to develop alternative supply corridors, progress has been slow. Political hesitation, funding gaps, and a lack of strategic coordination have hindered implementation. Renewed U.S.-China trade tensions under President Donald Trump's second term could accelerate these efforts, but absent substantial financing, they remain aspirational for the time being.

CHART 9

Base Battery Chemistry Types (%, global new capacity)



Source: CRU, Energy Intelligence.
Note: LFP: lithium iron phosphate; LNMO: lithium nickel manganese oxide; NMX: lithium nickel manganese; NCA: lithium nickel cobalt aluminium oxide.

MITIGATING SUPPLY RISKS: INNOVATION AND MATERIAL SUBSTITUTION

Technological innovation is becoming an essential tool for mitigating supply risks. From advanced battery chemistries to next-generation solar and wind technologies, industry players are racing to reduce reliance on scarce materials, enhance efficiency, and lower costs. The success of these efforts will not only shape the trajectory of the global energy transition but also determine the extent to which mineral supply bottlenecks will constrain economic growth.

Technology offers a solution to mineral supply constraints. In solar energy, manufacturers are developing larger panels while AI-driven solar tracking and integrated battery storage are enhancing performance and lowering costs.

BATTERY INNOVATION

The push for alternative battery chemistries is gathering pace. Cobalt, long a cost driver in lithium-ion batteries, is being phased out in favour of nickel-rich formulations, while manganese and iron-based batteries are emerging as lower-cost alternatives. Sodium-ion technology – touted as a potential breakthrough – eliminates lithium dependency entirely, relying instead on more abundant sodium, though commercial-scale deployment remains a challenge. Meanwhile, silicon and sulphur-based anodes are being developed as potential substitutes for graphite, further diversifying supply options.

Beyond material substitution, advances in solid-state batteries offer the promise of higher energy density, faster charging, and longer lifespan – potentially disrupting current supply chains by requiring fewer raw materials per unit of storage. These innovations could fundamentally reshape demand dynamics for lithium, nickel, and other battery minerals in the coming decade.

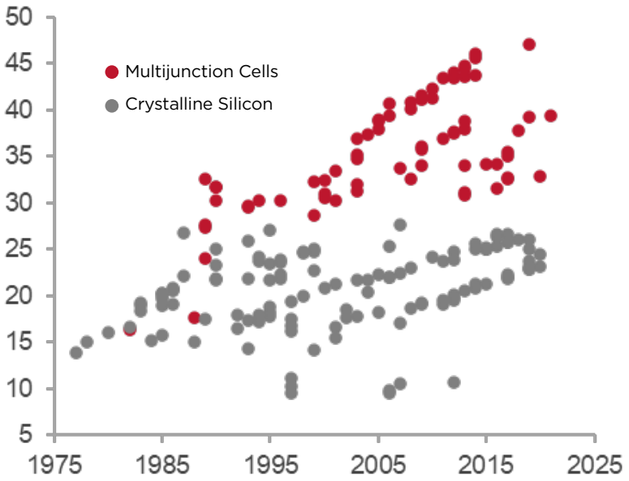
SOLAR INNOVATION

The solar industry, a major consumer of high-purity silicon, silver, and rare earths, is undergoing rapid transformation. Manufacturers are shifting toward larger-format solar panels, thinner silicon wafers, and multijunction cells, which extract more energy while using fewer materials – as chart 10 below shows. Perovskite solar cells, which have the potential to surpass traditional silicon in efficiency, are attracting increased investment – though scaling up production remains a hurdle.

AI-driven solar tracking is further boosting efficiency, enabling panels to dynamically adjust to sunlight conditions, thereby maximising energy output while reducing the number of panels required. Meanwhile, integrated battery storage is smoothing intermittency issues, ensuring that power from solar farms can be more effectively dispatched to grids that can reduce reliance on fossil-fuel backup power.

CHART 10

Solar Panel Efficiency by Technology (Efficiency %)



Source: NREL, Energy Intelligence

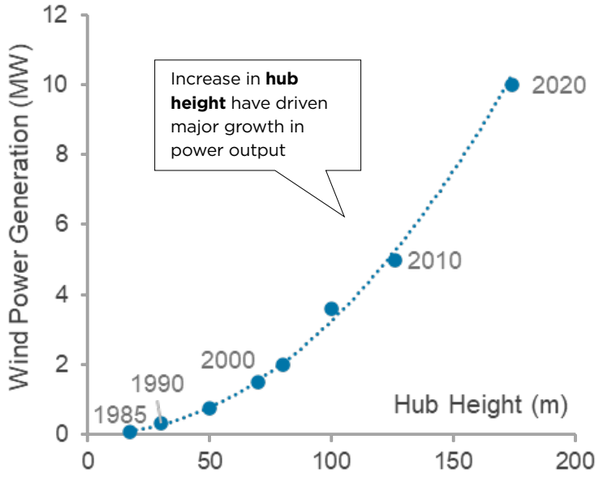
WIND INNOVATION

Wind turbine manufacturers are similarly pursuing efficiency gains through larger turbines with longer blades and taller towers, maximising energy output while reducing material intensity (see Figure 11 above). This, in turn, lowers demand for critical minerals such as neodymium and dysprosium, which are used in permanent magnet generators.

At the same time, research into rare earth-free motor technologies is gaining momentum, with companies exploring ferrite-based and superconducting magnet alternatives. Advanced composites, including carbon fibre and thermoplastic resins, are also being integrated into turbine blades, improving durability while decreasing reliance on heavier, metal-intensive materials.

CHART 11

Wind Turbine Height to Power Generation Output



Source: NREL, Energy Intelligence

Advanced composites are being integrated into wind turbine blades, improving durability while decreasing reliance on heavier, metal-intensive materials

CHAPTER 3

GOVERNMENTS REDRAWING THE CRITICAL MINERALS MAP

China's dominance in critical mineral supply chains, built through years of strategic investment and industrial policy, has forced other economies to reassess their positions and develop countermeasures.

At the heart of Beijing's advantage lies the Belt and Road Initiative (BRI), an expansive investment programme that has granted China privileged access to mineral resources across Latin America, Africa, and beyond. By financing infrastructure in exchange for raw materials, China has entrenched itself as a central player in the global minerals trade, controlling both extraction and refining capabilities at an unrivaled scale.

Recognising the vulnerabilities associated with China's hold over these essential resources, other economies are moving swiftly to secure alternative supply chains. The United States, through the Inflation Reduction Act (IRA), has sought to incentivise domestic production while forging partnerships with key allies. Meanwhile, the EU, Canada, Australia, India, and Japan, are strengthening ties through bilateral agreements aimed at reducing their dependence on Beijing's mineral infrastructure.

CHAPTER 3: Governments redrawing the critical minerals map

SUPPLY-SIDE EXPANSION VS. DEMAND-SIDE ADAPTATION

Governments are pursuing two principal strategies to fortify their mineral security: expanding domestic production and refining capacity or mitigating exposure through efficiency gains and material substitution.

Resource-rich nations such as the United States and Australia are deploying supply-side measures, offering direct financial support, easing regulatory barriers, and accelerating licensing reforms to facilitate private sector investment. These efforts aim to enhance self-sufficiency and reduce geopolitical risk in supply chains.

Conversely, economies with limited domestic reserves, such as those in the EU, are emphasising demand-side policies to curb reliance on foreign suppliers. These include incentives for material recycling, funding for research into alternative technologies, and promoting the development of more resource-efficient industrial processes.

Governments are pursuing two principal strategies to fortify their mineral security: expanding domestic production and refining capacity or mitigating exposure through efficiency gains and material substitution.

CHAPTER 3: Governments redrawing the critical minerals map

CHART 12

Critical Mineral Policy Measures

POLICY	DESCRIPTION
Financial Support	Financial support measures involve subsidies and/or tax credits to accelerate critical minerals production and support development of the EV battery supply chain. Commonly used by China, and more recently by the US.
Reducing Production Barriers	Reducing production barriers, such as access to finance, permitting and exporting are common measures. Some governments (like Canada and Australia) are relaxing rules to speed up development of new mineral production and encourage the development of supply chains.
Anchoring Demand	Providing clarity on future demand with policy support and targets (as in the US IRA* package) and market mechanisms can lower the cost of financing for new production and accelerate company investment plans.
Encouraging Recycling	Increasing recycling and cutting waste is being encouraged by governments, particularly by net importers of materials (as in Europe) with tighter regulations and the standardization of components and equipment.
Supporting Alternative Materials	Developing alternative materials, potentially using plastics or carbon-based compounds, could help mitigate against future supply crunches for some minerals. Countries in the Middle East, with advantages in these areas, have implemented policies and allocated funding to encourage these new materials, but information on this activity remains limited.
Stockpiling	Stockpiling of critical materials is common, particularly rare earths (which have many non-energy uses, including in defense equipment). The US, China, Japan and others have long stockpiled key minerals to manage potential supply shortages.
Demand Reduction	Reducing demand for minerals, by improving efficiency and lifetimes of equipment, is common in industry (primarily to save money) and is actively encouraged by some governments via tax credits and subsidies.

Source: Energy Intelligence.

COMPETING VISIONS FOR MINERAL SECURITY

United States: Rebuilding Domestic Capacity and Strengthening Alliances

The United States has taken a proactive stance in securing its mineral supply chain, with the IRA representing a landmark effort to incentivise domestic extraction and processing. Under the legislation, mining firms extracting any of the 50 designated critical minerals qualify for a 10% production credit, while EV manufacturers are required to source an increasing share of battery materials from U.S. mines, recycling plants, or allied nations. By 2027, the mandate will reach 80%, marking a decisive shift in how the U.S. approaches mineral security.

European Union: Diversification and Strategic Partnerships

The EU has responded with the Critical Raw Materials Act, which sets ambitious targets for mineral self-sufficiency by 2030. The policy framework aims for 10% of critical minerals to be sourced from domestic extraction, 40% from processing within the bloc, and 25% from recycling. While the act lacks direct financial incentives, individual EU member states and non-EU partners such as Norway are driving initiatives to secure trade agreements and bolster domestic industrial capacity.

CHAPTER 3: Governments redrawing the critical minerals map

Middle East: Positioning for the Energy Transition

Long reliant on hydrocarbons, the Middle East is now pivoting toward critical minerals as part of broader economic diversification efforts. Saudi Arabia and the UAE, in particular, are emerging as key players in the sector, leveraging their financial clout to secure strategic investments both at home and abroad.

Saudi Arabia, with an estimated $2.5 trillion in untapped mineral reserves, is injecting $182 million into mineral exploration and has forged agreements with the U.S., Egypt, and Russia to expand its role in global supply chains. Meanwhile, the UAE has pursued high-profile deals with resource-rich nations such as the Democratic Republic of Congo and Zambia, including a $1.9 billion stake in a Congolese mining project via one of its sovereign wealth funds. Both Gulf nations are also exploring lithium extraction, with national oil companies leading feasibility studies.

CHAPTER 3: Governments redrawing the critical minerals map

CHART 13

Select Critical Minerals Policy Initiatives

	Overview	Direct Financial Support	Reducing Production Barriers	Anchoring Demand	Encouraging Recycling	Supporting Alternative Materials	Stockpiling	Demand Reduction
China	The Belt and Road Initiative provides extensive political and financial support for China to effectively control the global supply chain and transportation routes.	4	4	4	3	2	3	3
US	The US IRA provides tax credits of up to $7,500 per EV to support domestic critical mineral and battery production. Additional support is given for the production of semiconductors and REE.	3	2	4	3	2	2	3
Europe	Europe heavily restricts mining development and has limited mineral resources; many governments are instead focusing efforts on encouraging recycling and reducing demand.	1	1	4	4	2	1	4
Japan & S. Korea	Both Japan and South Korea are keen to diversify the source of their mineral imports and encourage more recycling.	3	0	3	3	1	4	4
Canada	Canada's Critical Mineral Strategy provides $3 billion of funding to support new mineral and battery production.	2	2	3	1	1	0	0
Australia	Australia's Critical Mineral Strategy focuses on ramping up domestic mine and refinery production, with funding of over $2 billion via the Northern Australia Infrastructure Facility (NAIF).	2	2	2	1	1	0	0

Source: Energy Intelligence.

Level of current policy support: None/Unclear · Limited · Moderate · Extensive · Very Extensive

CRITICAL MINERALS AND SEMICONDUCTORS

As we outlined in DMCC's Future of Trade 2024 report, 'Decoupled and Reconfigured', the global race for semiconductor supremacy has become a key front in the escalating geopolitical rivalry between the United States and China. With policymakers increasingly viewing semiconductors as a national security priority, critical minerals – essential to chip production – are now at the centre of a broader strategic contest.

As the chip war intensifies, critical minerals will become an even more potent geopolitical weapon. Countries that control these resources will wield strategic influence over the broader digital economy, AI, and military technologies.

China's dominance in refining key materials such as gallium, germanium, and rare earth elements has given it a powerful lever in the ongoing 'chip war'. In response to U.S. export restrictions on advanced AI chips and semiconductor manufacturing equipment, Beijing has imposed strict controls on critical mineral exports, threatening to disrupt global supply chains. Given that the U.S. share of global semiconductor manufacturing has fallen to just 12% in 2023, Washington is now urgently seeking to rebuild domestic production capacity while diversifying supply chains away from Chinese-controlled minerals. Meanwhile, the cycle of tit-for-tat retaliation between Washington and Beijing may also worsen under the second Trump Administration.

The 2022 CHIPS and Science Act, which allocated $52.7 billion in federal subsidies, underscores the scale of the U.S. response. However, raw materials remain a key vulnerability. The United States and its allies – including the EU, Japan, and South Korea – are now accelerating efforts to secure alternative sources of refined critical minerals, including investments in mining and processing infrastructure in Australia, Canada, and Africa. The Middle East, particularly the UAE and Saudi Arabia, is also emerging as a potential refining hub given its low-cost energy and strategic trade ties.

China, for its part, is doubling down on self-sufficiency, rapidly expanding its domestic semiconductor industry despite U.S. restrictions. It is investing heavily in state-backed chip manufacturing, while forging deeper mineral trade relationships with resource-rich nations in Africa, Latin America, and Central Asia under the BRI.

As the chip war intensifies, critical minerals will become an even more potent geopolitical weapon. Countries that control these resources will not only shape the future of semiconductor manufacturing but also wield strategic influence over the broader digital economy, AI, and military technologies. The growing fragmentation of global trade suggests that the race over critical minerals is only just beginning.

THE RACE FOR SUPPLY CHAIN RESILIENCE

As governments race to redraw the critical minerals map, the stakes extend far beyond economic competition. The global energy transition hinges on reliable access to these resources, making mineral security a central pillar of industrial policy for the decades ahead. China's entrenched position in refining and logistics will not be easily displaced, but the flurry of policy interventions across North America, Europe, and the Middle East signals a broader realignment. Whether through reshoring, strategic alliances, or technological innovation, the world's major economies are engaged in an increasingly urgent contest to secure the minerals that will define the future.

CHAPTER 4
THE MIDDLE EAST'S CRITICAL MINERALS PLAY

The Middle East is emerging as a strategic player in the global critical minerals trade, leveraging a mix of legacy mining operations, nascent industries, and substantial overseas investments. While not a dominant producer of critical minerals, the region is increasingly positioning itself as a vital hub for mineral processing, supply chain investment, and end-use manufacturing.

A handful of countries – led by the UAE and Saudi Arabia – dominate the Middle East and North Africa (MENA) region's critical minerals landscape. Their approaches vary, but a common thread is a shift from merely extracting raw materials to securing greater value through processing and advanced manufacturing.

CHAPTER 4: The Middle East's critical minerals play

THE UAE AND DUBAI: A FINANCIAL AND PROCESSING HUB

The UAE's strategy revolves around securing critical minerals abroad and developing domestic processing capabilities. Sovereign wealth funds have led major acquisitions, particularly in Africa. In 2023, International Holdings Company (IHC), through its subsidiary International Resource Holdings (IRH), agreed to acquire 51% of Zambia's Mopani copper mines for $1.1 billion. Meanwhile, Titan Lithium, a UAE-based firm, plans to construct a $1.4 billion lithium processing plant to produce battery-grade lithium carbonate and hydroxide.

Dubai is also emerging as a global hub for mining finance and trade, bolstered by its logistics infrastructure and the annual Mining Show, the largest industry gathering in MENA and much of Asia. Its strategic location at the nexus of East and West, coupled with world-class infrastructure and an investor-friendly regulatory environment, has made it a natural hub for commodities trade that is now rapidly emerging as a pivotal centre for the critical minerals that underpin the energy transition and next-generation technologies.

Unlike traditional mining powerhouses, Dubai's significance in the sector does not come from resource endowment but from its ability to aggregate, refine, and facilitate trade. Through free trade zones and commodity-focused initiatives, it has established itself as a preferred base for global miners, traders, and industrial players seeking a neutral and efficient platform for conducting business.

THE UAE'S ENERGY ADVANTAGE

Processing critical minerals is energy-intensive, and Dubai's access to abundant, low-cost energy – bolstered by the UAE's investments in renewables and nuclear power – offers a competitive edge. As geopolitical tensions and environmental regulations drive up processing costs elsewhere, Dubai's ability to offer reliable, cost-efficient energy is an increasingly attractive proposition.

Meanwhile, the shift towards regionalisation of mineral trade is amplifying the UAE's importance of such energy-rich hubs. With the United States and Europe seeking to reduce reliance on China's refining dominance and emerging markets aiming to capture more value domestically, Dubai's ability to serve as a neutral intermediary is becoming more pronounced.

DMCC: A CRITICAL MINERALS TRADE FACILITATOR

The UAE's strategic location and energy advantages have bolstered the role of regional players. At the heart of Dubai's commodities trade is DMCC – the Dubai Multi Commodities Centre – which counts over 25,000 companies across physical commodities and technology. Its vast international business district serves as a magnet for multinational corporations, investors, and innovators seeking access to global supply chains from a strategic base.

At the core of DMCC's value offering are its dedicated ecosystems spanning key industrial segments, including critical minerals, and counting over 3,200 companies involved in energy and energy trading, over 1,500 in precious metals and 1,300 in precious stones. DMCC's Tradeflow system, meanwhile, provides an online platform for registering ownership of commodities and their subsequent transfers, while several vaults and

a refinery grid for precious metals manufacturers support the wider trading infrastructure.

Its location and size give it a unique edge in the emerging regionalisation of critical minerals trade.

Beyond commodities, DMCC is rapidly expanding into advanced technologies, with a new ecosystem for Artificial Intelligence having launched in 2024. These sectors, which are driving global demand for lithium, rare earths, and high-purity silicon, are directly linked to the critical minerals economy. By fostering innovation in these fields, DMCC is not just facilitating mineral trade – it is actively shaping the industries that will define future demand.

SAUDI ARABIA: INTEGRATING MINING INTO VISION 2030

Saudi Arabia's approach blends domestic extraction with active overseas acquisitions. State mining giant Ma'aden and the Public Investment Fund (PIF) established Manara Minerals in 2023 to secure critical minerals abroad. Its largest deal to date was a $2.5 billion investment for a 10% stake in Vale Base Metals, a major producer of nickel, copper, cobalt, and platinum group metals. Manara was also in talks in late 2024 to acquire 10% of First Quantum Minerals' Zambian copper and nickel assets.

Domestically, Saudi Arabia is investing heavily in midstream capacity. Aramco has partnered with a local firm to pilot direct lithium extraction (DLE) from oilfield brine – an ambitious move that could reshape the Gulf's role in lithium production. Riyadh is also eyeing the EV sector, with the state-backed Ceer aiming to produce 500,000 EVs annually by 2030. In 2023, Ceer awarded a $1.3 billion contract for an EV production plant, signalling its commitment to domestic manufacturing.

CHAPTER 4: The Middle East's critical minerals play

By fostering innovation in AI and energy, DMCC is not just facilitating mineral trade - it is actively shaping the industries that will define future demand.

OMAN AND MOROCCO: STRENGTHENING DOMESTIC EXTRACTION

Oman and Morocco are leveraging their mineral endowments to grow extraction and processing capabilities. Oman's state-backed Minerals Development Oman (MDO) has ramped up copper projects, breaking ground on the country's largest copper concentrate project in November 2024. The plant is set to begin full operations in 2027, complementing MDO's redevelopment of two additional copper mines.

Morocco has drawn interest from Chinese battery makers, including BYD, though a large-scale battery plant has yet to materialise. However, with established vehicle manufacturing and proximity to Europe, Morocco is well-positioned to expand its critical minerals processing capacity.

REGIONAL DEMAND FOR CLEAN TECHNOLOGIES

While the Gulf states are investing in minerals, their demand for critical resources is also growing, driven by renewable energy and EV ambitions. Saudi Arabia and the UAE have set national EV adoption targets, with the UAE's updated energy strategy anticipating that EVs and hybrids will constitute 5% of light-duty vehicles by 2025, and up to 13% by 2030. Saudi Arabia has set a more ambitious goal: 30% EV penetration in Riyadh by 2030.

Government procurement is playing a pivotal role in boosting demand. In the UAE, 20% of government vehicles are now electric, while Saudi Arabia has committed to purchasing up to 100,000 EVs from Lucid Motors, a company in which the PIF holds a majority stake.

Beyond EVs, other industries – such as military production – are driving demand for critical minerals. The UAE's defence sector is prioritising local procurement and integrating decarbonisation initiatives, increasing the need for solar and battery technologies.

While the Gulf states are investing in minerals, their demand for critical resources is also growing, driven by renewable energy and EV ambitions.

POLICY SUPPORT AND INDUSTRIAL STRATEGIES

State-backed investment vehicles and policy initiatives are reinforcing the region's role in the global critical minerals trade. Abu Dhabi's Economic Vision 2030 prioritises metals as a core component of economic diversification. The UAE's extensive network of African port concessions strengthens its position as a global logistics hub for mineral trade.

Saudi Arabia's Vision 2030 designates mining as one of the four key sectors under its National Industrial Development and Logistics Program (NIDLP). Ma'aden, the state mining firm, is spearheading what could be the world's largest exploration programme. In October 2024, the Saudi Ministry of Industry and Mineral Resources invited bids for its seventh round of exploration licenses, covering seven new sites.

Oman, which places minerals and energy under a single ministerial portfolio, has similarly prioritised mining as a pillar of economic diversification. In November 2024, Muscat launched its third mining bid round, focusing on nickel and copper deposits. The government has signed agreements with MDO and Oman Chromite Company to develop major concessions.

STRATEGIC IMPLICATIONS

As competition intensifies for a share of the global critical minerals market, Middle Eastern nations are refining their approaches. Saudi Arabia and Oman, endowed with mineral reserves, are scaling up mining operations and developing midstream and downstream processing capabilities. The UAE and Morocco, with more limited domestic reserves, are leveraging overseas investments and industrial expertise to position themselves as key nodes in the global supply chain.

The region's growing footprint in critical minerals is likely to reshape trade dynamics, linking the Middle East more closely with African resource hubs and Asian manufacturing centres. As energy transition policies accelerate worldwide, the Middle East's role in the critical minerals economy will only become more pronounced.

KEY RECOMMENDATIONS FOR GOVERNMENT

Leverage public-private partnerships (PPP):
States seeking to maximise the value of their mineral resources should explore PPP models to enhance technological capabilities and attract private investment. This approach can ease fiscal pressures while enabling state-owned enterprises to access expertise and financing that might otherwise be out of reach.

Expand exploration efforts:
PPPs can also play a crucial role in unlocking new mineral reserves by facilitating exploration activities. By sharing financial and operational responsibilities with private sector partners, governments can accelerate the discovery of critical resources while mitigating risks to state budgets.

Invest in demand-side innovation: Governments should prioritise research and development initiatives aimed at reducing reliance on scarce minerals. Advancements in alternative technologies – such as sodium-ion batteries – could help stabilise supply chains while positioning early adopters as leaders in emerging industries.

Diversify trade relationships and strategic partnerships: Given the volatility of global supply chains, both resource-rich and resource-dependent nations must diversify their trading relationships. Reducing overreliance on a small number of producers or consumers will help mitigate geopolitical and trade-related risks.

Deepen strategic ties and presence in the Middle East:
Governments should deepen engagement with Middle Eastern economies as they expand their role in the critical minerals market. Sovereign wealth funds and state-backed firms from the region are increasingly influential in securing upstream assets, while low-cost energy resources create competitive advantages in refining and processing. Bilateral agreements, joint ventures, and technology-sharing initiatives will be key to building resilient, globally integrated critical mineral supply chains.

Attract investment in processing capabilities:
With mineral refining capacity concentrated in certain markets, economies – particularly in the Middle East – should capitalise on their access to cost-effective natural gas and renewable energy to attract investment in midstream processing. Strengthening domestic refining capabilities will enhance supply chain resilience and support industrial diversification.

KEY RECOMMENDATIONS FOR INDUSTRY AND INVESTORS

Hedge against supply risks:
Companies must actively manage exposure to critical mineral price volatility through futures markets, long-term contracts, and strategic stockpiles. Direct partnerships with upstream operators can further insulate firms from supply shocks.

Diversify investment portfolios:
Investors should spread risk by funding a mix of domestic and international critical mineral projects, particularly in emerging regional hubs for clean technology and industrial decarbonisation.

Develop downstream industries:
Expanding investment into battery manufacturing, solar cells, and other renewable energy technologies will not only strengthen demand for critical minerals but also enhance regional industrial ecosystems.

Strengthen government and public sector engagement:
As competition for resources intensifies, corporate strategies should prioritise relationships with key governments to navigate risks such as resource nationalism, trade shifts, and policy changes in key producing and processing markets.

Help shape a supportive regulatory environment:
Industry and investors should collaborate with governments to create clear, competitive regulations that encourage critical mineral investment while aligning mining policies with broader industrial and sustainability goals.

Invest in new extraction technologies:
Industry players, particularly state-backed firms and national oil companies (NOCs), should support emerging extraction methods, such as direct lithium extraction (DLE), to expand supply while diversifying their portfolios beyond oil and gas.

DMCC

Developed in collaboration with Energy Intelligence

futureoftrade.com