



Building the UK's Green Economy: Breaking Down Barriers for Responsible Sourcing of Critical Minerals

CRITICAL MINERALS ASSOCIATION
UNITED KINGDOM (CMA UK)
ENVIRONMENTAL, SOCIAL & GOVERNANCE WORKING GROUP

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About the Critical Minerals Association (CMA)

The Critical Minerals Association (CMA) is a key interlocutor between the UK Government and the critical minerals industry. Its mission is to support the development of socially and environmentally responsible critical mineral supply chains for the UK's strategic security of supply for the Energy Transition, Energy Security, and Green Economy.

The CMA unites industry, academia, and other stakeholders to address challenges in critical mineral supply chains. We enable industry to generate a collective voice when outlining concerns and future recommendations, providing a direct line of communication between industry and government. We aim to improve societal perceptions of the sector by showcasing the economic and social benefits of critical minerals. The CMA also provides the secretariat to the UK's All-Party Parliamentary Group (APPG) on Critical Minerals.

The CMA published 'A Blueprint for Responsible Sourcing' in July 2021, proposing a series of recommendations to the UK Government, centring around opportunities for leadership on ESG in the critical minerals sector, enabling investment, driving collaboration, creating an enabling environment and greater ownership of security of supply. The Blueprint successfully influenced the UK Government's Net Zero Strategy 2021, which featured a Critical Minerals Deep Dive outlining the UK Governments' commitment to publishing a Critical Minerals Strategy in 2022.

Since the publication of the UK Government's Net Zero Strategy 2021, the CMA has convened a series of multi-stakeholder workshops, to find solutions to urgently resolve issues threatening to delay and undermine the delivery of the UK's Net Zero Ambitions.

Acknowledgements

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Purpose of Paper

The purpose of this paper is to build upon the CMA's 2021 ESG recommendations and delve into the challenges and opportunities for the UK to be a leader in responsible sourcing of critical minerals and to inform Government strategy. This paper showcases the barriers which Government can help to break down through the implementation of CMA policy recommendations, and seeks to support policy makers with the solutions needed to lead on ESG of critical minerals. It aims to raise awareness of the importance of ESG in responsible and transparent critical mineral supply chains. The paper supplements the CMA's 2021 ESG paper 'Blueprint' and includes updates to the critical minerals ESG landscape over the past year.

ESG Workshops

In 2022, the Critical Minerals Association led several multi-stakeholder workshops attended by industry, academia, local governments, professional organisations, UK Government Departments including Business, Energy and Industrial Strategy (BEIS), and the Department for International Trade (DIT). The workshops facilitated an open discussion to further develop the recommendations put forward in the CMA's 2021 ESG paper, 'A Blueprint for Responsible Sourcing of Critical Minerals', and identify priority areas that require urgent intervention from the UK Government.

This paper draws on the learnings and outcomes of these multi-stakeholder workshops, including the role of global geopolitics on responsible sourcing, the need for strong international relations and allies with aligned ESG standards, and what this means for the UK's security of supply.

ACCESS TO CAPITAL

If the world is to meet a huge increase in critical mineral requirements, we need more materials and we need a new age of exploration. We will need to invest in new, ESG-compliant mineral extraction projects, and these projects need to be financed. This section considers how we can finance and incentivise ESG-compliant critical mineral supply chains.

ESG STANDARDS – ALIGNMENT AND VERIFICATION

While ESG standards are moving towards alignment, components of ESG still lack agreed definitions and standards focus on different aspects of extraction and/or processing. The innumerable ESG standards can make it difficult for investors, original equipment manufacturers (OEMs), consumers, downstream producers, governments, and other stakeholders to compare and contrast the ESG performance of different mining companies, particularly those of different sizes. Simplifying the landscape into a few aligned ESG standards would save time and resources for all stakeholders. Independent monitoring and assurance of ESG standards should be strengthened. Data expectations should be considered, and provenance and traceability technologies should be more widely adopted. It is important that Government works closely with industry and supports international alignment of ESG standards that are comparable across markets, industries and organisations.

TALENT PIPELINE

The UK's soft power is waning with the decline of geoscience, metallurgy, and mining engineering subject matter experts trained in the UK. Many universities have discontinued mining-related and geoscience courses. Without a talent pipeline of geologists, engineers, and metallurgists, the UK will have to import expertise from other nations to build its critical minerals supply chain. There is also a need to build a talent pipeline of planning officers who understand mineral extraction and processing, as well as encourage the skills development and career pathways for the circular economy of critical minerals.

UK DOMESTIC ENABLING ENVIRONMENT: PLANNING AND PERMITTING

The UK's planning and permitting system is complex, outdated, under-resourced and is not supportive of operators or decision-makers. Exploration companies, consultants, and local planning authorities shared their experience in dealing with critical mineral planning and permitting processes with the CMA, and discussed challenges and opportunities, including barriers to investment.

Abbreviations & Acronyms

APPG	All-Party Parliamentary Group	IFRS	International Financial Reporting Standards
ASI	Assurance Services International	ISSB	International Sustainability Standards Board
BEIS	Department for Business, Energy and Industrial Strategy	LCA	Life Cycle Assessment
BGS	British Geological Survey	LME	London Metal Exchange
CMA	Critical Minerals Association	LPAs	Local Planning Authorities
CMIC	Critical Minerals Intelligence Centre	MSP	Minerals Security Partnership
COP26	United Nations Climate Change Conference 2021	NGOs	Non-Governmental Organisations
COP27	United Nations Climate Change Conference 2022	NIEA	Northern Ireland Environment Agency
DEFRA	Department for Environment, Food and Rural Affairs	NRW	Natural Resources Wales
DIT	Department for International Trade	OEMs	Original Equipment Manufacturers
DPA	Defense Production Act	PCR	Product Category Rules
EA	Environment Agency	REEs	Rare Earth Elements
ESG	Environmental, Social & Governance	RGMP	Responsible Gold Mining Principles
ESI	Environmental and Social Impact Assessment	RMI	Responsible Minerals Initiative
EU	European Union	SBTi	Science Based Targets initiative
FCC	Fluid Catalytic Cracker	SEC	Securities and Exchange Commission
GHG	Greenhouse Gas	SEPA	Scottish Environment Protection Agency
GRI	Global Reporting Initiative	TCFD	Task Force on Climate-related Financial Disclosures
HMLR	Her Majesty's Land Registry	TPI	Transition Pathway Initiative
ICMM	International Council on Mining and Metals	TSM	Towards Sustainable Mining
IEA	International Energy Agency	UK	United Kingdom
ISO	International Organization for Standardization	UKRI	UK Research and Innovation
		UN	United Nations
		USA	United States of America
		WGC	World Gold Council

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Executive Summary

The acknowledgment of the importance of critical minerals to fight climate change was non-existent at COP26. Global leaders did not address reports from the World Bank and International Energy Agency that a low-carbon future will not be possible without minerals.¹ The UK led preparations for COP26 on its shores in Glasgow and this was a unique opportunity for the UK Government to raise awareness of the material requirements of The Energy Transition, and the need for responsible mineral extraction and processing.

The complexity of the geopolitical landscape, monopolisation of certain critical minerals, lack of alignment on environmental, social, and governance (ESG) standards, and projected demand outstripping supply puts the UK's ambitions for Net Zero and a Green Economy at risk. Other governments, notably the USA, Australia and Canada are moving at speed to secure their nations' critical minerals needs for The Energy Transition and energy security, and industry is moving at a much faster pace.

Since the publication of the CMA's 'Blueprint for Responsible Sourcing of Critical Minerals' in 2021, the landscape of ESG, critical minerals and Government policy has evolved rapidly. The UK Government has published strategies on Net Zero 2021, Greening Finance 2021, British Energy Security 2022, Levelling Up 2022, hosted COP26 and mandated the Task Force on Climate-related Financial Disclosures (TCFD). Other recent policies around ESG include the EU Batteries Regulation, EU Corporate Sustainability Reporting Directive, Carbon Border Adjustment Mechanism, US Securities and Exchange Commission Climate Risk Disclosures. Australia, Canada, and the USA have committed billions of funding towards critical mineral supply chains.

Over the past year, the CMA has been delving into its 2021 ESG recommendations in greater depth through multi-stakeholder workshops and expert interviews. This paper supplements the CMA's flagship 'Blueprint for Responsible Sourcing of Critical Minerals' and has considered recent changes to the geopolitical, political, and economic landscape, as well as identified areas for Government action.

There are numerous barriers for the UK and allies to develop responsible critical mineral supply chains to meet Net Zero and Green Economy ambitions. These barriers include access to capital, ESG standards, talent pipelines, and an enabling environment for local economic growth.

Critical mineral supply chains are complex and grapple with additional complexity of ESG and Government policies. Every commodity has different geological origins, extraction processes, environmental contexts, community relations, political contexts. These processes can be water, energy, and fuel intensive and will have environmental and social impacts that can be mitigated through ESG best practice.

The City of London is renowned as a global capital of finance. Without significant investment in critical minerals exploration, upstream, midstream, recycling development, the world will not have sufficient access to the critical minerals needed for Net Zero and the Green Economy. Investors have a key role to play in holding their investments to account to adhere to best practice ESG. The question around who pays for ESG and recognising the cost involved in best practice ESG is key for ensuring a level playing field between junior and major operators.

The UK is home to several international organisations which have developed ESG standards for mineral extraction and processing. While equivalency of ESG standards is starting to take place, too many standards and complex systems remain. Proving that ESG standards have been adhered to through scientific verification, assurance, provenance and blockchain technologies needs further development and international alignment.

The UK is internationally acclaimed for its world class universities and education system. Without the development of a talent pipeline into fields requiring expertise along critical mineral supply chains, such as geoscience, metallurgy, engineering, planning, circular economy, and without the right Government intervention in relevant courses and national curriculums, the UK will miss an opportunity for green job creation.

If the UK wants to attract private investment inwards for its industry and support job creation, particularly in levelling up regions, the UK and Devolved Administrations need to ensure that National and Local Government processes are aligned to National Government strategies, and that areas such as planning and permitting are streamlined to recognise the urgency of the world's critical mineral needs, and to avoid unnecessary delays. The UK cannot be the 'Saudi Arabia of Wind Power' if the planning system for building renewable technologies, and the materials that are needed for them, is driven by political interests. These political interests and uncertainty can be a disincentive for

1. <https://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf>

private investment.

Government has a key role in leading the way towards securing responsible critical mineral supply chains while protecting local environments and communities and this paper focuses on how Government can break down these barriers to develop increased responsible sourcing of critical minerals.

Actions, not words, will determine whether the UK will make the most of its advantages and opportunities to be a leader in responsible sourcing of critical minerals, or if it will fall further behind on the global stage. This paper outlines areas in which decisive action could pivot the UK as a leader in this space.

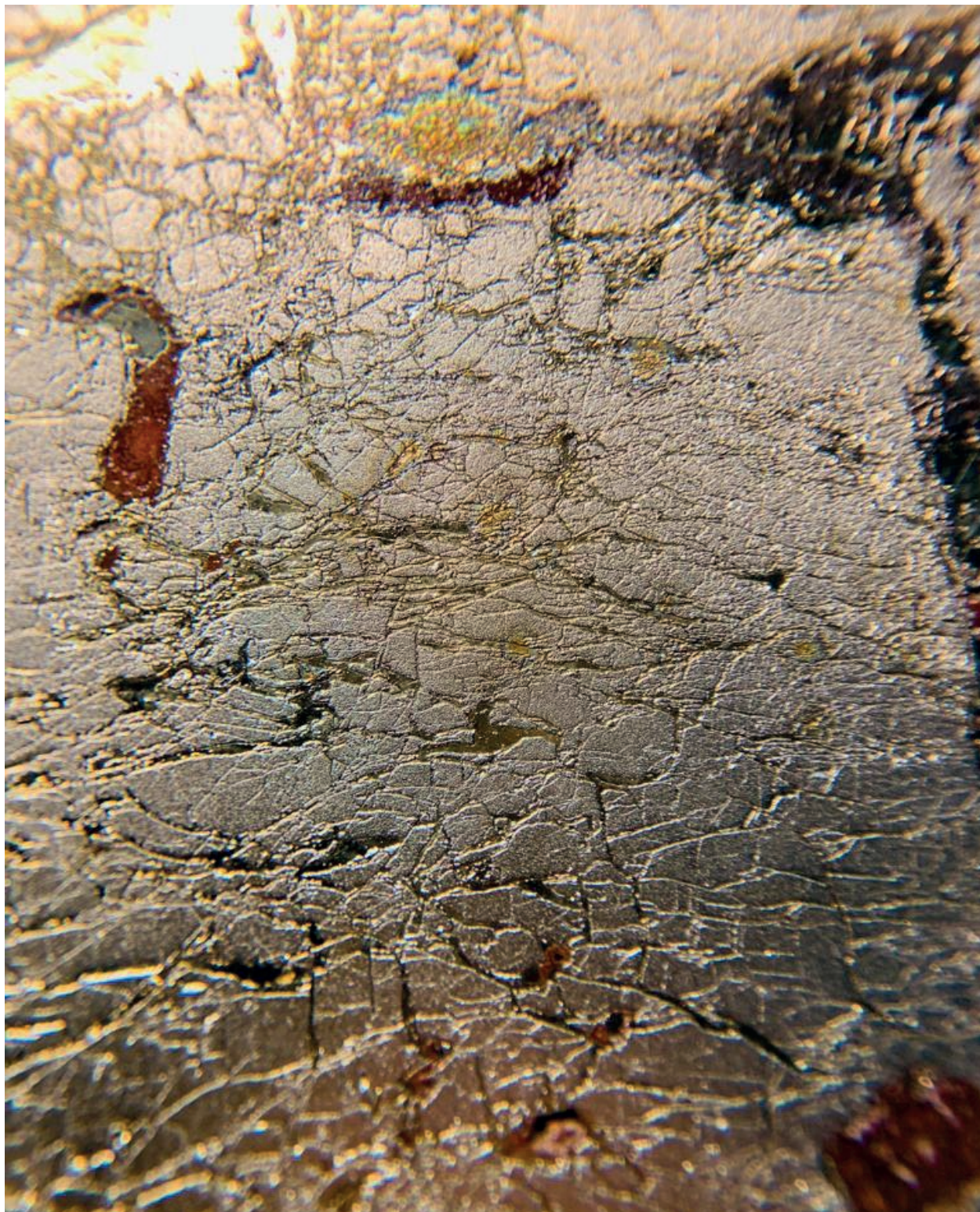


Figure 1: Chalcopyrite - A Copper Mineral. Source: Ben Lepley

Recommendations



1. Provide a Statement of Commitment

Senior leaders in UK Government to issue a statement on the importance of creating responsible critical mineral supply chains and acknowledgement of the demand increase of critical minerals needed for renewable energy and net-zero technologies at COP27. (CMA 2021 Recommendation)



2. Incentivise Investment

UK Government to feature responsible critical minerals exploration, extraction, and processing as part of Government 'Green Finance' initiatives.

- a. Encourage investment in ESG-compliant critical mineral projects with advanced decarbonisation strategies to be considered as 'green investments' and viewed as key climate change mitigation investments.
- b. Develop the UK's taxonomy on critical minerals, mineral extraction, and processing, based on the EU taxonomy.
- c. De-risk investment by underwriting and supporting projects of national importance and providing financial assurances to UK companies in instances of unfair international competition.



3. Create an Enabling Environment for Domestic Critical Minerals Projects

UK Government to review the process and legislation of planning and permitting for domestic critical minerals extraction, processing, and recycling to ensure local decision makers are well resourced and experienced, their roles and responsibilities are clarified, and delays are avoided. UK critical minerals projects should also be expected to adhere to international ESG best practices, particularly for areas such as water, waste, and closure plans. (CMA 2021 Recommendation)

- a. National Government to support and coordinate the planning and permitting process for responsible critical minerals extraction, processing, and recycling.
- b. Establish a Coordinating Body or a Mining Agency for Critical Minerals
- c. Establish a coordinating body for companies and investors to have single points of contact in Government to support navigating all of the different national and local government agencies including across devolved administrations (e.g. British Geological Survey, Coal Authority, DEFRA, HMLR, BEIS, DIT, Environment Agency, Scottish Environment Protection Agency, Natural Resources Wales).
- d. Add mining as a category to the Environmental Permitting (England and Wales) Regulations 2016 and Scotland and Northern Ireland equivalents.



4.

Develop an ESG Expert Multi-stakeholder Forum

Develop an expert multi-stakeholder forum dedicated to ESG with ESG experts from industry, academia, NGOs, and Government to collaboratively move towards alignment on ESG standards in extraction, processing, recycling, and the circular economy. (CMA 2021 Recommendation)

- a. UK Government to align with international partners in determining which ESG standards it supports, for different commodities, in collaboration with experts in the ESG Expert Multi-stakeholder Forum. (CMA 2021 Recommendation)
- b. Develop 'Green Premiums' for ESG compliant and recycled critical minerals through the ESG Expert Multi-stakeholder Forum.
- c. Create incentives for the use of verification technologies throughout supply chains to provide information to end consumers.
- d. Develop a process of auditing and regulating the organisations and individuals that 'independently verify' ESG compliance. This could be developed by the ESG Expert Multi-stakeholder Forum and undertaken by a Government Standards Agency.
- e. Create an Innovation Fund for ESG
- f. Set up an Innovation Fund for ESG and process improvements in critical mineral supply chain projects. This fund can also be used to support technology companies with the innovations that help operators to improve ESG performance. (CMA 2021 Recommendation)



5.

Promote Critical Minerals Career Pathways

Career pathways related to critical minerals (geoscience, metallurgy, engineering, circular economy, planning and permitting) to be featured as part of Government 'Green Jobs' initiatives. (CMA 2021 Recommendation)

2. <https://www.iea.org/data-and-statistics/charts/critical-minerals-demand-in-the-net-zero-pathway-2020-2050>

3. <https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>

4. <https://www.euronews.com/next/2022/03/22/elon-musk-opens-tesla-s-new-berlin-gigafactory-eyeing-top-spot-in-europe-s-growing-ev-mark#:~:text=Musk%20has%20said%20ramping%20up,took%20to%20to%20build%20the%20plant.&text=Financial%20analysts%20JP Morgan%20have%20predicted,2023%20and%20500%2C000%20by%202025.>

Critical Minerals and the Path to Net Zero

In a race to meet net-zero agendas, major economies have been pushing ahead to secure critical minerals such as cobalt, copper, lithium, nickel, and rare earth elements (REEs) needed for The Energy Transition.

The demand for critical minerals required for net-zero technologies is expected to increase sixfold from 7.1Mt in 2020 to 42.3Mt by 2050.² However, the International Energy Agency (IEA) has suggested that it takes an average of 16 years to get a mining project from discovery into production.³ A gigafactory can be up and running in two years.⁴ This leaves a problematic time lag.

Without a steady pipeline of new critical mineral extraction, the green industrial revolution will not be delivered at the speed necessary to combat climate change. In the coming decades, demand for critical minerals is expected to outstrip supply by large margins. This poses a significant risk to delivering a just transition, as original equipment manufacturers (OEMs), in desperate need of raw materials, may continue purchasing critical minerals irrespective of responsible sourcing. An energy transition built on environmental damage, child labour, and corruption will be detrimental to the planet and society. Governments have a key role to play in promoting industry best practice ESG standards and incentivising companies to adhere to them.

The Energy Transition needs to be recognised for what it is, a transition, rather than an abrupt halt to fossil fuels without reliable alternatives in place. It is a process, and the outcome of that process will be determined whether critical minerals, the building blocks of renewable energy technologies and the Green Economy, are sourced responsibly or not. Collectively, governments and businesses need to ensure that critical minerals are ESG compliant for a just energy transition.

United Nations Climate Change Conference 2021 (COP26)

COP26 hosted in Glasgow was a great opportunity to showcase UK's leadership on climate change. However, it highlighted that government and policymakers fail to understand that mining and extraction are fundamental to delivering the Green Energy Transition. The disconnect between end-products and raw materials' role in adapting to climate change is exemplified by the UN Secretary-General António Guterres' statement at COP26 :

"We're digging our own graves by burning, drilling, mining deeper".

The world needs to drill and mine deeper than before to access resources previously economically unviable and technologically inaccessible to meet the projected demand for critical minerals. In the race for critical minerals, governments must ensure that companies do this responsibly, in line with internationally recognised industry best practice ESG standards.

A strong emphasis was placed on achieving Net Zero at COP26 without consideration of how to

build net-zero technologies, or what raw materials are required.

The concept of net zero has become blurred with offsetting and carbon neutrality. Different organisations define these terms differently.

In popular understanding, net zero fails to incorporate geological timescales and focuses predominantly on the short-term removal and storage of CO₂. Policymakers need to ensure their focus is on achieving a geological net zero (see Figure 1), for long-term stabilisation of temperatures by lowering the amount of CO₂ emitted into the atmosphere, in the first instance, and balanced removal into carbon sinks, both naturally occurring and carbon capture and storage).

While current net-zero approaches deal with the issue in the short term, policy needs to focus on long-term stabilisation of temperatures to mitigate climate change for future generations. This more robust and future-proof understanding is already being integrated into the corporate landscape, through organisations such as the

5. <https://www.un.org/press/en/2021/sgsm20997.doc.htm>.

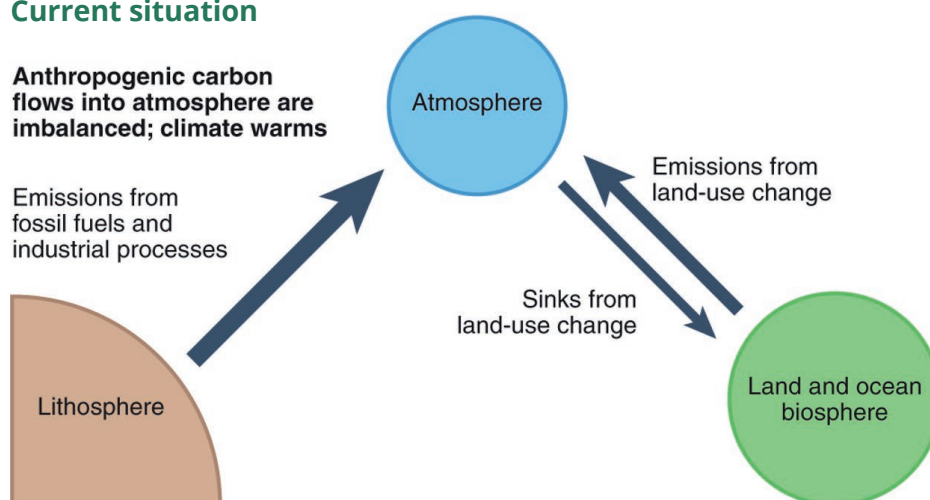
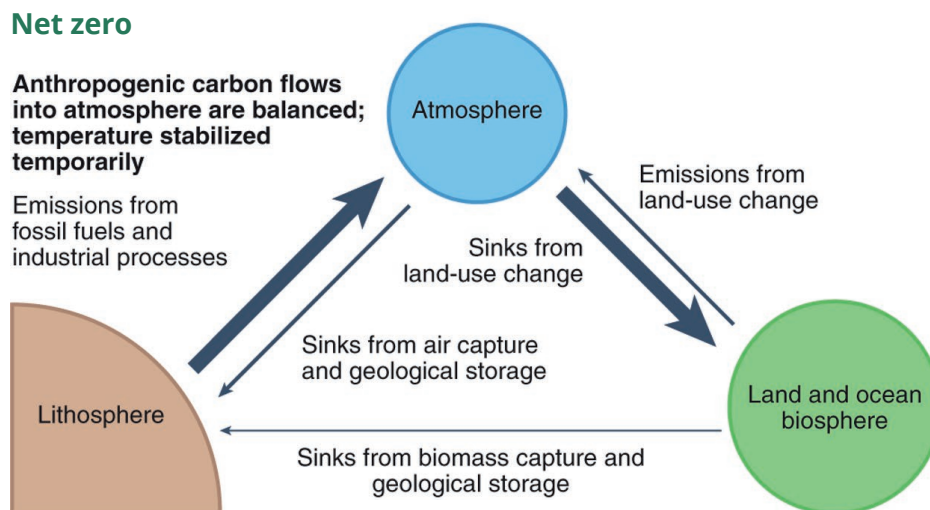
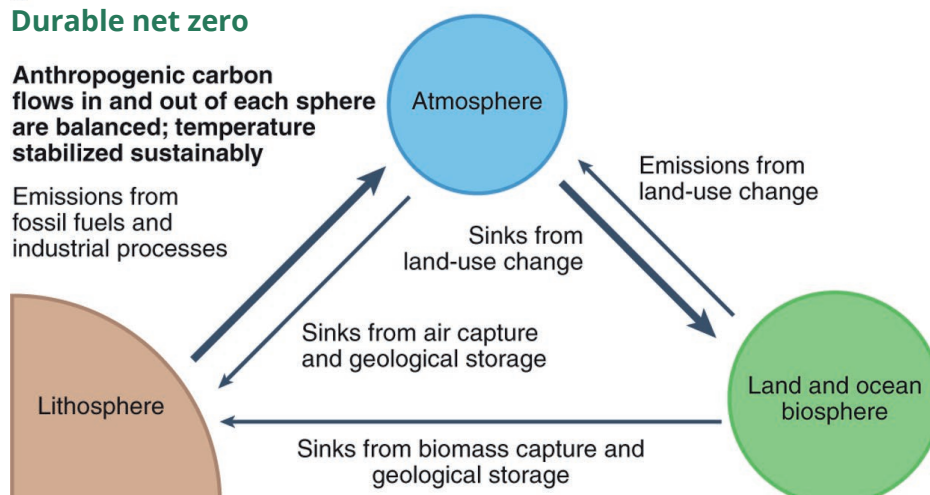
a. Current situation**b. Net zero****c. Durable net zero**

Figure 2- Comparison between the current situation, net zero, and geological net zero. Source: Fankhauser, et al., 2021. Currently, more greenhouse gases are entering the atmosphere than are captured by natural sinks in the biosphere. Under the net-zero model, anthropogenic carbon flows are balanced through offsetting (through carbon capture and geological storage) which temporarily stabilises the temperature. However, under a geological net zero (also called the durable net zero) the carbon flow between the atmosphere, the biosphere and the lithosphere are balanced leading to sustainably balanced temperatures.

Climate Pledge and the Science Based Target Initiative's (SBTi) Net Zero framework, whereby for a business to achieve 'net zero' they must first focus on eradicating all non-hard-to-abate emissions and only then can they offset/ neutralise the remainder.¹¹ In this instance, neutralisation only refers to real, permanent, and socially beneficial offsets and thus provides the first steps for the corporate sector to support geological net zero.

Different interpretations of net zero creates policy risk where temporary solutions are favoured over long-term geological net zero by policymakers. This approach is not in the best interest of society or the environment. It poses a negative risk to how ESG is viewed by policymakers and places disproportionate focus on offsetting carbon emissions rather than decarbonising raw materials extraction (e.g. oil, gas, metals, minerals) and limiting emissions at source across all industries (e.g. transport, steel, manufacturing, automotive). Policy should focus on supporting the safe and permanent disposal of 1 tonne of CO2 for every tonne generated by fossil fuel use.¹² Offsetting carbon emission by planting trees or purchasing carbon credits is not sufficient for long-term impact. Instead, governments should incentivise decarbonisation of the extractive and

Net Zero Emissions and Carbon Neutrality	"Net-zero carbon dioxide (CO2) emissions are achieved when anthropogenic CO2 emissions are balanced globally by anthropogenic CO2 removals over a specified period. Net-zero CO2 emissions are also referred to as carbon neutrality." ⁶
Carbon Neutral	"Companies, processes and products become carbon neutral when they calculate their carbon emissions and compensate for what they have produced via carbon offsetting projects." ⁷
Carbon Offset	"A carbon offset broadly refers to a reduction in GHG emissions – or an increase in carbon storage (e.g. through land restoration or the planting of trees) – that is used to compensate for emissions that occur elsewhere." ⁸
Carbon-free	"Carbon-free products, services or companies are those that do not generate any carbon emissions during the manufacturing, provision or operational process." ⁹

processing sectors, by supporting mining and processing companies to produce carbon-free products. This enables green technologies composed of critical minerals to have lower carbon footprints.

Geological net zero must be discussed at COP27. Without a geological net zero, meaningful progress towards mitigating climate change will not be made. Governments should focus on how they can support the decarbonisation of the critical minerals sector to prevent carbon footprints from extraction and processing being passed down the value chain to end products.

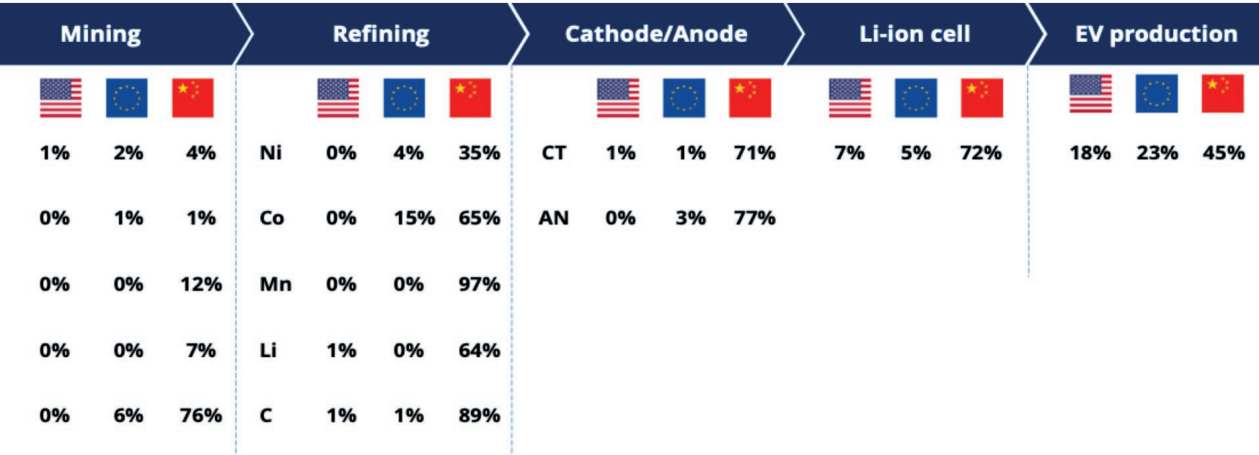
"Achieving net-zero through an unsustainable combination of fossil-fuel emissions and short-term removals is ultimately pointless. Carbon emissions and removals must balance over multi-decadal timescales".

Fankhauser, et al., 2021.¹⁰

6. https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_AnnexI.pdf
7. <https://www.climatepartner.com/en/carbon-neutral>
8. <https://www.offsetguide.org/understanding-carbon-offsets/what-is-a-carbon-offset/>
9. <https://www.climatepartner.com/en/carbon-neutral>
10. <https://www.nature.com/articles/s41558-021-01245-w>
11. <https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf>

Why Critical Minerals Shape the Geopolitical Landscape

Critical minerals supply chains are heavily monopolised. According to Wood Mackenzie, depending on the critical mineral, a single nation controls anywhere between 60-99% of the supply chain (see Figure 2). While single-nation monopolies on extraction typically exist due to geological endowment, China dominates the midstream across several commodities.



Tracking the supply chain of electric vehicles: Infographic commissioned by CMA from Roskill, now Wood Mackenzie.

Figure 3 – China's dominance of the supply chain for battery metals. Source: Wood Mackenzie.

Many critical minerals, regardless of where they are extracted, are shipped to China for processing and refining (see Figure 3). The environmental impact of shipping ore and processed materials back and forth across the globe undermines ESG credentials attached to responsibly extracted critical minerals, especially when more localised, ESG-focused supply chains could be created. Diversification and adherence to industry best practice ESG standards of current supply chains are necessary to move away from China's alleged poor practices including environmental damage¹³ and human rights violations,¹⁴ and move towards greater transparency in supply chains.

China's dominance of the critical minerals industry can be attributed to decades-long foresight via the monopolisation of market pinch points i.e., the midstream, and the "go-out" policy that encourages its enterprises to invest overseas. The policy's unconventional approach includes resource-backed financing and a low level of attention paid to corporate, social, and environmental responsibility by Chinese companies operating abroad.¹⁵

Shipping is a difficult industry to decarbonise and accounts for 2.5% of the world's total CO2 emissions

13. <https://e360.yale.edu/features/china-wrestles-with-the-toxic-aftermath-of-rare-earth-mining>
14. <https://www.hermes-investment.com/ukw/wp-content/uploads/sites/80/2017/11/Hermes-Modern-Slavery-Take-Note-Cobalt.pdf>
15. <https://www.cigionline.org/publications/deeper-look-chinas-going-out-policy/>

NOW CONCENTRATION OF SUPPLY FOR KEY MATERIALS IS UNDER SCRUTINY

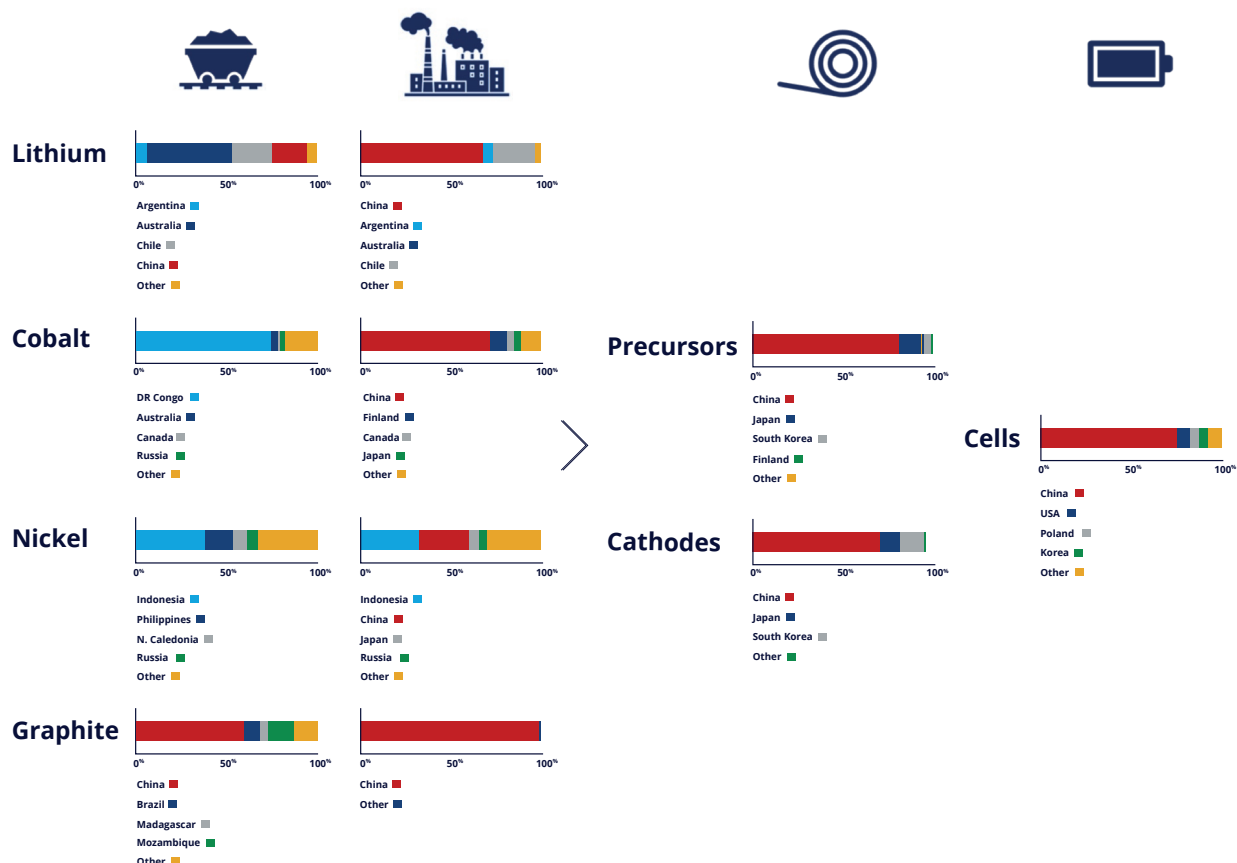


Figure 4 – Where key battery minerals are mined versus where they are processed and refined. Source: Wood Mackenzie.

Chinese Government and industry are also increasingly looking at frontier markets for extraction including Tibet, Afghanistan, Central and Western Africa. This willingness to invest in extraction in countries such as Afghanistan¹⁶ demonstrates a high-risk appetite to meet demand. Western governments often prefer to invest in jurisdictions with ESG-focused values. The US has amended its Defense Production Act (DPA) to include other Western nations, Australia and UK as “domestic” resources to be eligible for US Government funding.¹⁷ This is not surprising as fulfilling investor ESG requirements in frontier regions can be difficult.

The Ukraine-Russia conflict highlights the geopolitical risk of neglecting exploration for critical minerals. Russia produces 7.2% of the global mined nickel supply.¹⁸ Following Russia’s aggression towards Ukraine, the nickel prices on the London Stock Exchange hit the highest ever prices as concerns over supply echoed across industry. Concerns already exist over the ESG impacts of Indonesian nickel mining (37% of annual global production) and market manipulation. The Indonesian government’s ban on nickel exports in January 2021 raised questions on the future of security of supply, as individual nations inflate prices by restricting supply before potentially flooding the market.

End users who are reliant on a steady nickel supply for electric vehicles, electronics, or defence applications will continue to make hard choices, between price and sourcing nickel regardless of ethical considerations due to the lack of alternatives. This trend will persist across commodities as nations race to secure their individual critical minerals needs.

Many exploration projects do not become mines because they do not meet certain criteria, including adequate concentrations of minerals and metals in the ground or social and environmental requirements. Nonetheless, investment into greenfield projects is necessary to increase the chances of finding one deposit out of hundreds that could reach production. Exploration in critical mineral projects wanes and waxes with the cyclical nature of the industry. Bear markets constrict exploration

16. <https://www.bloomberg.com/news/articles/2021-08-24/china-s-eyes-1-trillion-of-minerals-with-risky-bet-on-taliban>

17. <https://crsreports.congress.gov/product/pdf/R/R47124>

18. <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/nickel-producers-confident-they-can-fill-gap-if-russian-supply-is-cut-off-69423564>

budgets as investors steer away from high-risk investments. The solution lies in governments backing and supporting the exploration sector to continue exploring for critical minerals, particularly during cyclical troughs. Where government backing prevails, private sector funding follows.

Without a pipeline of critical mineral projects, the world will continue to face shortages of supply, stalling the development of Net Zero and renewable technologies.

International Race for Security of Supply

Western partnerships are increasingly growing, particularly between allies. These are extending to key economic powerhouses including India, South Korea, and Japan. However responsible extraction should extend beyond these countries, and include more developing and emerging nations, to reflect the global nature of supply chains.

ESG-focused supply chains can become a driver for achieving the UN's Sustainable Development Goals (SDGs) in developing nations. Sourcing critical minerals purely from western nations will not alone meet projected demands. South America, Central Asia and Africa will provide significant proportions of the world's critical minerals use in the coming decades.

The nations that will be the first to successfully create alternative, ESG-focused critical minerals supply chains will be able to transition to the green economy much faster. The US, Australia, and Canada have been particularly active in reshaping and refining their critical minerals lists, and critical minerals strategies, and focusing on providing the funding necessary to grow their domestic critical mineral and manufacturing capabilities.

Given geopolitical uncertainty, monopolisation of the market, and the ongoing Russia – Ukraine conflict, security of supply has become a priority to many nations. Shockwaves of geopolitical disturbances were reflected in LME's controversial decision to cancel nickel trades, raising questions over transparency. The LME since has been sued by Elliot Management, a New York hedge fund, for \$456M.

Despite the publication of its Net Zero Strategy 2021, the UK Government has failed to take decisive action. Some Western nations have begun investing in projects of significant national importance. These projects typically adhere to industry best practice ESG standards.

In June 2022, The US Department of Defense announced that it had signed a \$120M deal with Lynas Rare Earths to build the first rare earths separation facility in the US. Governments are increasingly backing winners to secure a supply in a volatile and unpredictable market. Companies with projects that adhere to industry best practice ESG standards are more likely to reach commercial production faster, as ESG adherence helps to de-risk investment and attract private investors.

Since the publication of the Blueprint, the race to secure critical minerals has accelerated. Figure 4 illustrates the pace at which other nations are willing to commit capital to secure their supply chains.

The nations that fail to secure responsible critical mineral supply chains, whether it is through domestic extraction or partnerships with like-minded and resource-rich nations, will remain reliant on access to a monopolised market, or be forced to source critical minerals from nations with questionable ESG compliance.

Formation of the Mineral Securities Partnership (MSP) in June 2022 between Australia, Canada, Finland, France, Germany, Japan, the Republic of Korea, Sweden, the United Kingdom, the United States, and the European Commission highlights that the geopolitical landscape will shape critical minerals extraction. While this is a commendable partnership, lack of inclusion of strategically significant developing or emerging nations in the MSP may push these developing or emerging nations to form partnerships with China or Russia in exchange for the promise of profit.

The London Metal Exchange (LME) suspended trading in nickel, at the start of Russia's invasion of Ukraine, after the price of the metal doubled to a record \$100,000 (£76,200) a tonne over the course of a day.

19. <https://www.eco-business.com/news/red-seas-and-no-fish-nickel-mining-strains-indonesias-spice-islands/>

20. <https://theconversation.com/indonesias-claim-that-banning-nickel-exports-spurs-downstreaming-is-questionable-180229>

21. <https://www.heritage.org/international-economies/commentary/indonesias-nickel-export-ban-bad-itself-and-global-economy>

TIMELINE: THE RACE FOR CRITICAL MINERALS



Figure 5 – Timeline of government commitment, policy, and investment into critical minerals since the publication of 'A Blueprint for Responsible Sourcing of Critical Minerals', in July 2022.

Shifting the Dial in the UK

The CMA's 2021 Blueprint urged the UK Government to take decisive and urgent action to secure the UK's supply of critical minerals. The CMA's recommendations highlighted key areas requiring government intervention to create an enabling domestic environment to help attract investment into the country and to remove barriers to current projects.

In October 2021, the Department for Business, Energy and Industrial Strategy (BEIS) published the Net Zero Strategy 2021 which included a 'Deep Dive on Critical Minerals'. The Net Zero Strategy mirrored the Blueprint's recommendations and committed to publishing a Critical Minerals List and a Critical Minerals Strategy in 2022.

Since then, the UK Government has:

- Set up a Critical Minerals Expert Committee to advise on the development of the Critical Minerals Strategy;
- Set up the Critical Minerals Intelligence Centre (CMIC) aimed at tracking to provide ongoing intelligence on the supply of and demand for critical minerals;
- Commissioned the British Geological Survey (BGS) to release the UK's Critical Minerals List.

While critical minerals are finally on the government's radar, more still needs to be done.

The release of the UK's Critical Minerals List is a first step. However, "criticality" fluctuates rapidly with evolving market conditions, geopolitical landscape, supply and demand, technological advances, and geological scarcity.

The current 18-strong list omits key critical minerals such as nickel, copper, and manganese that have a geopolitical risk, are crucial to the energy transition, or both. The list should be reviewed on a regular basis to reflect the rapid changes to global markets and geopolitical developments, so as not to disadvantage UK companies exploring for, or looking to produce these necessary critical minerals.

Given the strategic importance of critical minerals to the UK's economy, the CMIC should also be supported by the UK's Ministry of Defence for further funding. Nations such as Australia, US, and Canada recognise the value of effective critical minerals intelligence and have committed billions to it, in comparison to BEIS' commitment of £3.6 million over three years. It is crucial that the CMIC can obtain the latest data to successfully track critical minerals and has sufficient funding to carry this out.

The UK Government can lead on responsible sourcing and set an example to the rest of the world on shifting from a fossil fuel-based to a green economy with ESG best practices as a standard, not a bonus. However, if urgent and decisive action is not taken, the leadership opportunity will be lost to nations already competing to secure supply.

The CMA UK splits critical minerals into three categories:

1. Critical Minerals:

Minerals necessary for the industrial objectives of a country or company. Most of these have supply chain vulnerabilities.

2. Technology Metals:

Necessary for new technology but without immediate supply chain vulnerabilities.

3. Strategic Minerals:

Minerals of strategic importance for a country's security or defence.

Alternative ESG-focused Supply Chain

The complex and volatile geopolitical landscape favours the creation of an alternative ESG-focused supply chain. Downstream companies attempting to operate outside of the currently monopolised system face a significant geopolitical and economic threat. Creating an alternative ESG-focused supply chain would level the playing field for companies entering the upstream and midstream. However, there is currently no financial incentive or legislation for OEMs to buy ESG-compliant raw materials. This move toward ESG compliance will potentially create two competing critical mineral supply chains; one that is cheap and untraceable and another that adheres to industry best practice ESG standards.

The creation of an alternative supply chain will require forward-thinking, and international alignment on a political and corporate level. Responsible sourcing comes with a price premium. Governments will need to support the industry with the following:

- **International alignment on comparable ESG standards** – although standards are moving towards alignment, the variety of frameworks can make ESG difficult to navigate. Governments subscribing to the creation of an ESG-driven supply chain will need to work together to align on standards that are fit for purpose and ensure responsible sourcing, without prohibiting business or speed of production.
- **International Competition** – some nations can flood the market quickly with cheap feedstock driving commodity prices down. This can bankrupt juniors adhering to industry best practice ESG standards. This can be mitigated with a combination of government underwriting ESG-compliant projects (from exploration through to mining, and processing) to prevent bankruptcy during market fluctuations and the creation of a Green Premium.
- **Monopolisation of midstream processing and refining** – when feedstock is shipped to and processed in nations such as China, where the processing can be energy-intensive (fuelled by coal), ESG credentials stemming from responsible extraction of a specific commodity are undermined. Responsible processing is as important as responsible extraction. Western governments will need to collaborate to set up midstream sites in the UK, EU, USA, Canada, and Australia to address the security of supply. Processing and refining should ideally take place as close to an extraction site as possible.
- **Verification and Assurance of ESG** – it is difficult to verify ESG claims without data-backed track-and-trace technologies and external audits. Scientific verification and satellite technology paired with blockchain can help prevent and tackle greenwashing, but it is costly. This could tip the benefit-to-cost ratio for OEMs.



Figure 6: Manganese exploration site in Botswana. Source: Giyani Metals Corp.

1. Access to Capital

The UK's corporate governance is internationally renowned. London is home to the London Stock Exchange and many of the world's listed mining companies. However, the UK can do more in terms of its minerals governance and incentivising investment in domestic critical minerals extraction.

Significant investment into critical minerals projects is essential to create a pipeline of projects reaching commercial production at a steady rate. Without an influx of capital into critical mineral projects, it will not be possible to meet the projected demand for the needs of the energy transition.

Investment in mineral extraction is currently not considered a 'green' investment, even in cases where companies can demonstrate high adherence to international industry best practice ESG standards. The move towards ESG compliance has largely been driven by the financial sector to minimise the negative risk associated with poor practices. More needs to be done to incentivise investment into critical mineral projects through the following:

- Investment in ESG-compliant critical mineral projects with advanced decarbonisation strategies should be considered 'green investments' and viewed as key climate change mitigation investments.
- Mining needs a separate category in the EU/UK taxonomy for sustainable activities, to recognise the complexities of the sector in minimising environmental impact.
- Investors should recognise the future opportunities of investing in companies with strong decarbonisation strategies, low carbon assets and an understanding of future risks.
- The decarbonisation interdependencies of mineral extraction and processing and other key sectors (e.g. agriculture, steel) need to be considered holistically by investors, governments and consumers.
- The UK Government needs to recognise the financial costs of ESG implementation, verification, assurance, and reporting and to support junior companies in attracting investment by creating a level playing field between independent and Government-backed companies with differing resources.
- Government should work with stakeholders to develop a 'Green Premium' for ESG-compliant mineral extraction, processing, and recycling projects with strong decarbonisation strategies.
- Government should de-risk investment by underwriting projects of national importance and improving government processes to create an enabling environment for the sector to attract investment.
- Comparable ESG standards will help drive investment decisions and encourage investors and financial institutions to fund critical minerals projects.

Decarbonising Mineral Extraction and Processing

Investors should recognise the future opportunities of investing in companies with strong decarbonisation strategies, low carbon assets and an understanding of future risks. UK Government has demonstrated its leadership by driving transparency and putting pressure on financial institutions and large organisations to improve company performance on climate change mitigation, decarbonisation, climate adaptation and resilience through the Task Force on Climate-related Financial Disclosures (TCFD). Disclosures on climate action are revealing how advanced or behind companies are in decarbonising.

Some miners are decarbonising their mines and planning net-zero mining projects. Decarbonisation requires huge capital investment to achieve Paris-aligned decarbonisation and this will not happen overnight. Investment in ESG-compliant critical mineral projects with advanced decarbonisation strategies should be considered 'green investments' and viewed as key climate change mitigation investments.

Forward-looking investors should see opportunities in decarbonising their investment portfolios, and those that fail to do so will risk being left behind. Companies with decarbonisation strategies, low carbon assets,

and an understanding of climate risks, are valued by investors. Decarbonisation should be a board-level priority to attract investment.

The Task Force on Climate-related Financial Disclosures (TCFD) provides a framework for disclosures that helps investors to distinguish between leaders and laggards and understand the progress companies are making with their climate action. The TCFD requires reporting on governance, strategy, risks and metrics for climate mitigation, decarbonisation and climate adaptation, and resilience.

Investors rate companies on the maturity of their reporting, and certain investors will only invest in companies that meet the higher levels of reporting. Other investors may invest in any company regardless of its maturity of reporting and will then put pressure on the company to make improvements.

The TCFD helps investors and miners by providing a common language and forces companies to be transparent to attract investment. By mandating

TCFD disclosures, the UK Government has demonstrated its leadership by putting pressure on financial institutions to improve company performance on climate change mitigation, decarbonisation, climate adaptation/ and resilience.

It is powerful when everyone is speaking the same language. While the TCFD does not currently have enforcement mechanisms, it has influenced several new initiatives, e.g. the International Sustainability Standards Board (ISSB), and led to consistency, for example in annual reports. Now that there are climate-related disclosures in place, it is important to continue work on specific issues based on ESG (see definitions on p. 94) and nature-related disclosures, for example on biodiversity and water.

Other regulations that will drive the need to decarbonise supply chains all the way back to the material's source include the EU Corporate Sustainability Reporting Directive and the EU regulatory framework for batteries .

TCFD Related Initiatives

US SECURITY AND EXCHANGE COMMISSION (SEC)

The US Securities and Exchange Commission (SEC) has recently proposed rules to enhance and standardise climate-related disclosures for investors. These proposed rules would require climate-related disclosures to feature in registration statements and periodic reports. Scope 1 & 2 emission disclosures would be required, and scope 3 emissions would also be required if the Greenhouse Gas (GHG) emissions are material or if the registrant has set a GHG emissions target or goal that includes Scope 3 emissions. The SEC's proposed disclosures are similar to other broadly accepted disclosure frameworks, such as the TCFD.

INTERNATIONAL SUSTAINABILITY STANDARDS BOARD (ISSB)

In November 2021, the International Financial Reporting Standards (IFRS) Foundation Trustees announced the creation of the International Sustainability Standards Board (ISSB) to 'deliver a comprehensive global baseline of sustainability-related disclosure standards.' In March 2022, the ISSB launched a consultation on its first two proposed standards. One of these, the Exposure Draft IFRS S2 Climate-related Disclosures (Climate Exposure Draft) builds on the TCFD recommendations.

THE TRANSITION PATHWAY INITIATIVE (TPI)

The Transition Pathway Initiative (TPI) is a global initiative led by asset owners and supported by asset managers, which assesses companies' preparedness for a low-carbon economy and supports investors to align their portfolios with the Paris Agreement goals. With 125 investors pledging support to the TPI, it represents \$40 trillion in combined assets under Management and Advice. It is aligned with the TCFD (see Figure 5). The initiative was established in 2017 by the Church of England National Investing Bodies and the UK's Environment Agency Pension Fund.

In November 2021, TPI produced a 'Carbon Performance assessment of diversified mining: Note on methodology.' The TPI Carbon Performance assessment is influenced by the Sectoral Decarbonisation Approach (SDA) which recognises that different sectors face different challenges in the low-carbon transition and uses modelling output from the International Energy Agency (IEA).

The Sustainable Stock Exchanges 'Model Guidance on Climate Disclosure' has flagged the TPI's four levels of TCFD alignment staircase as a way in which companies can set objectives for their climate-related disclosure journey. This uses information disclosed through TCFD to rank companies on the maturity of their reporting. The London Stock Exchange has also produced a Climate Governance Score and Tool based on the TPI to rank companies' level of TCFD alignment.

Compliance with the Taskforce on Climate-related Financial Disclosure (TCFD) requires different disciplines including finance, environmental and governance to work together.

The long-term time horizons required in TCFD planning and scenario analysis is nothing new to the mining sector. Many of the datasets required to measure and monitor both the impact of climate on the business and the impact of the business on climate change have been collected by mining operations for many years.

TCFD compliance can be relatively simple for mining operations that are open to including climate change as a driver of potential threat and opportunity within its business.

See Satarla's Case Study – 'Guidance for mining companies – how to construct a typical TCFD' on p. 91 for more detail.

TPI's Four Levels of TCFD Alignment

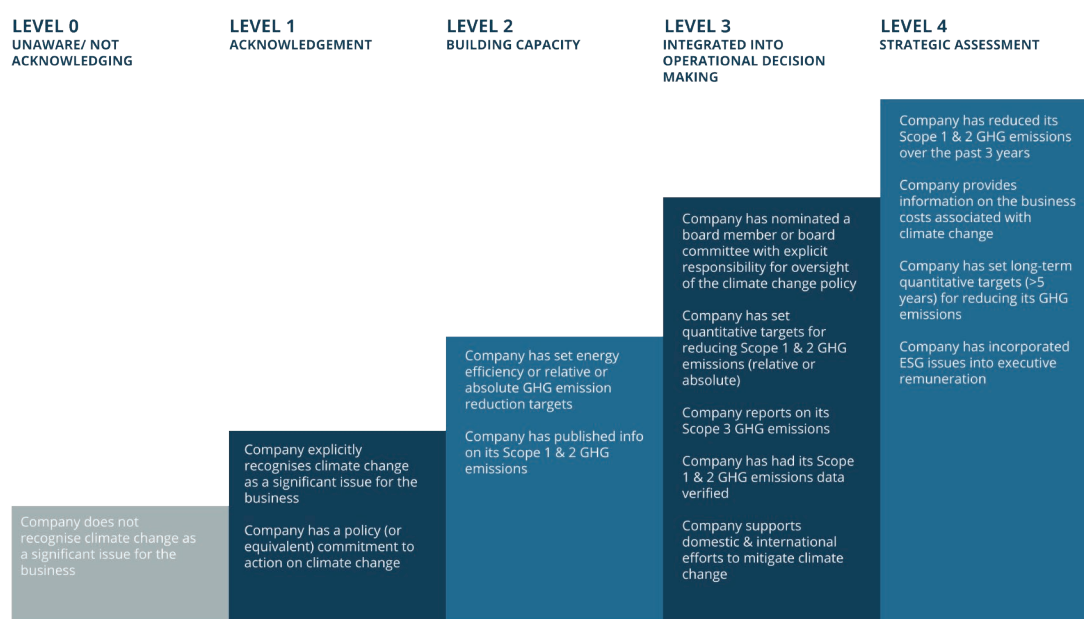


Figure 7 – TPI's four levels of TCFD alignment. Source: TPI.

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Mining in the EU/UK Taxonomy for Sustainable Activities

The EU taxonomy for Sustainable Activities is a classification system that establishes a list of environmentally sustainable economic activities. However, mining has been left out of the EU's taxonomy (except under the circular economy) as it is seen as a complicated sector, and ESG compliant mining is not yet seen as 'green'. The EU is expected to include mining in the taxonomy once it has developed the evidence base to comprehensively map it. But it is problematic that key frameworks are leaving mining out despite its role in decarbonisation.

The UK Government strategy 'Greening Finance, A Roadmap to Sustainable Investing' explains how the UK is implementing the EU taxonomy for Sustainable Activities, which it helped to design as a former member state. This UK Sustainable Investing Roadmap promotes investor stewardship as crucial to the energy transition and puts pressure on investors and financial institutions to disclose in the public domain. Investors should "actively monitor, encourage, and challenge companies by using their rights and direct/indirect influence to promote long-term, sustainable value generation" and "consider withholding capital if firms are not seen to be taking adequate action to support the transition to net zero".

The UK could look to understand when 'mining' will feature in the EU taxonomy and support the development of a category on critical minerals and mineral extraction and processing for the taxonomy. If the EU timelines do not meet the UK Government's strategic plans for secure and responsible critical mineral supply chains, the UK could develop its own taxonomy on critical minerals and mineral extraction and processing. This could be based on the EU taxonomy and the UK could collaborate with the EU to help fill any knowledge gaps on the impact of mining on sustainable activities. This taxonomy for critical minerals should also include 'social' aspects of operations, for example, conflict, fair labour practices, and resettlement.

Interdependencies of Supply Chains and Decarbonisation

Critical minerals supply chains are linked to many other sectors, which have their own decarbonisation needs. The interdependencies of mineral extraction and processing and other key sectors (e.g. agriculture, steel) need to be considered holistically. The mineral extraction and processing sectors are not requesting decarbonisation support (in the same way that the agriculture, steel, and cement sectors are). The inter-dependency for this sector related to the decarbonisation of other sectors is poorly understood and poorly mapped. This is a strategic risk to the Energy Transition. The decarbonisation interdependencies of mineral extraction and processing and other key sectors (e.g. agriculture, steel) need to be considered holistically by investors, governments and consumers.

Consideration of the interdependencies between different sectors across supply chains is particularly relevant for Scope 3 emissions. Scope 3 emissions are important because whole supply chains need to decarbonise, beyond direct operations, to have any real impact on climate change. Nigel Topping, UNFCCC's High-Level Climate Action Champion said, "supply-chain decarbonization will be a 'game changer' for the impact of corporate climate action. Addressing Scope 3 emissions is fundamental for companies to realize credible climate change commitments".

Large organisations aligning with TCFD need to disclose Scope 3 emissions. UK Government could further develop its guidance and data on how to make good quality scope 3 emissions disclosures. To calculate scope 3 emissions, companies need proxy data to be able to map out where their scope 3 emissions are in the supply chain, much of which is either unavailable or behind very expensive paywalls, limiting access for innovative sectors or SMEs. In the future, companies might start requiring their suppliers and purchasers to declare information about their carbon footprints. 3 emissions are produced by customers (e.g. coal-powered mills in South Africa).

Major mining companies' Scope 3 emissions are up to 47x greater than their Scope 1 & 2 emissions combined (see Figure 6). This is because Scope 3 emissions include transportation and downstream processing, and mining companies can produce commodities for sectors which are hard to decarbonise (e.g. steel) and some Scope 2

Scope 3 emissions dwarf scope 1 and 2 for the diversified miners

Thermal power, steel and aluminium uses drive high indirect emissions

Diversified miners' Scope 3 emissions relative Scope 1 and Scope 2 combined

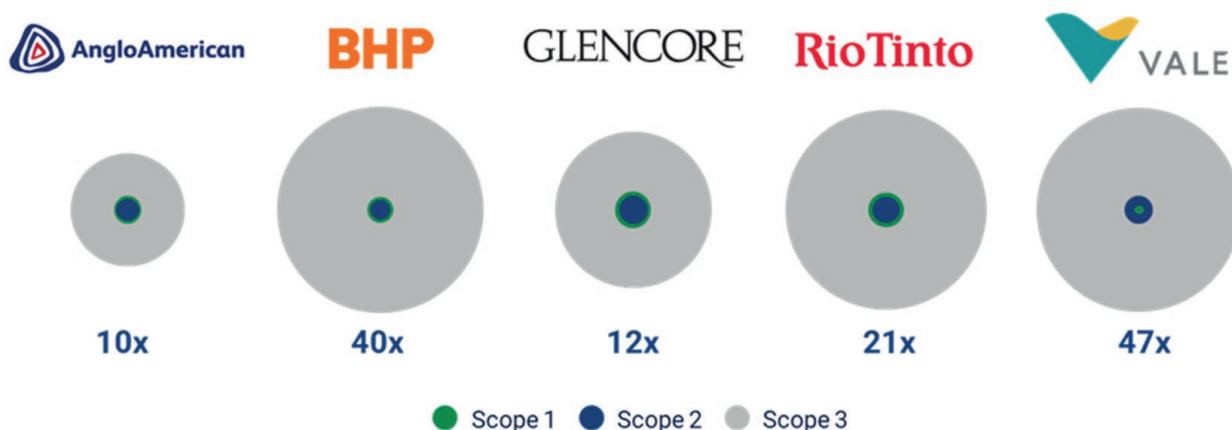


Figure 8 - Comparison of scope, 1,2 and 3 emissions for major miners. Source: Wood Mackenzie.

Understanding the interdependencies of different sectors in supply chains for decarbonisation is critical for mineral extraction, processing, and refining which are energy and fuel-intensive sectors. There are different ways for investment funds to move their investment strategies towards Net Zero. Net-zero investment strategies can involve divestment from high-carbon assets, such as thermal coal. While companies should be incentivised and pushed towards low carbon energy sources, immediate divestment from well-run companies providing high-carbon energy sources without access to alternatives does not recognise the 'transition' in the Energy Transition, particularly in jurisdictions without easy access to low carbon energy.

While some investment funds are incentivising companies to off-load thermal coal it remains the only viable source of energy in countries such as South Africa, where renewable alternatives are not yet feasible. There must be an element of *transition* in the Energy Transition and that it may be necessary to accept a short-term continuation of high-carbon energy sources especially if they are critical to industry and energy security, and are in line with the country's Intended Nationally Determined Contributions (INDCs).

Investors, e.g. the Church of England Pension Fund, have increasingly excluded assets such as thermal coal on ethical grounds. Legal & General Investment Management (LGIM)'s 2022 Policy on Coal states, 'exclusions will be applied to those companies that generate 20% or more of their revenues from coal mining and extraction. These policies are important to incentivise future investment into renewable and low-carbon energy.

However, the risk is that if ethical investors are compelled to offload their high-carbon assets, they lose the ability to influence how these companies are run, and companies that are well run and adhere to ESG standards may be replaced by rogue companies that do not adhere to industry best practice ESG standards. More sophisticated tools which recognise the importance of transitioning away from high-carbon energy sources, while enabling ethical investors to remain influential in steering these assets towards best practice ESG, would be helpful.

Investors and Risks

Investor strategies are increasingly focused on investing in future-focused metals, particularly those relating to electric vehicles and renewable technologies (e.g. lithium, nickel, cobalt, copper) and those that support the Sustainable Development Goals (SDGs).

Investors do not want to be exposed to negative risk (e.g. jurisdiction, bribery, corruption) and adherence to industry best practice ESG standards reduces that risk. Funds investing in ESG can take an active part in building ESG programmes and opportunities across extraction, processing, and recycling. Active investment has risen as some investors have lost confidence in the mineral extraction sector's ability to solve ESG challenges quickly enough.

After the Brumadinho disaster in 2019, investors

have been seeking alignment with banks and insurers. Rio Tinto's procedures were shown to be inadequate following the destruction of the Juukan Gorge aboriginal caves. There is some excellent individual good practice in industry, but sector-wide there is still a lot of work to be done. Investors now need to support independent site-level verification for confirmation and assurance of best practices.

A well-governed company will give a higher degree of confidence to investors, as it is less likely to have a confidence-destroying event. The tolerance of boards that are not dealing with improving ESG will be short-lived. The 'Governance' element of ESG is important in this regard.

GOVERNANCE

The "Governance" in ESG directly deals with responsibility and accountability yet is poorly defined by environmental and investment practitioners. There are many statements about "G" and ESG but there is not necessarily global understanding. At a company level, governance, at its most basic, is how well a company is managed and overseen, its values and ethics (CMA, 2021).

Another aspect of Governance is the government's responsibility to govern and ensure that adequate legislation and guidance exists to ensure that companies along the critical minerals supply chain are accountable for their actions. This is particularly important in ESG where self-disclosure is rarely verified by third parties. In a system with a multitude of standards, frameworks and guidelines, greenwashing can easily occur both by negligence and with intent to deceive investors and/or inflate stock prices.

Compliance with environmental legislation (country of registration and host country) and international standards is a significant part of governance, yet the lines become blurred as to what constitutes good governance. There is a need for collective, global understanding

of G and its integration with E and S.

Rating systems that companies can use to assess ESG performance are not necessarily geared towards mining and can result in apparently poor performance. S&P Global assess governance performance through (1) structure and oversight, (2) code and values, (3) transparency and reporting, and (4) cyber risk and systems. The Digbee ESG Tool is specifically designed for exploration and mining, tailored to evaluate a company on both corporate and project(s) level but is not yet an industry-wide go-to.

A tiered approach should be applied to governance:

- with government at the highest level, providing legislative support;
- investors acting as responsible stewards;
- company boards actively working with executives;
- and executives ensuring that governance cascades to site level.

Many jurisdictions are amenable to investment if the nation has a well-established mining sector, the national and local government is supportive, and there is no risk of nationalisation. There are nonetheless several jurisdiction risks for investors, which include:

- Political stability
- Corruption
- Cost of capital
- Conflict and/or cross-border conflict
- Security of tenure
- Lack of robust government systems

As resources become more difficult to extract, the mining world will need to explore in higher risk jurisdictions. This can make implementation and verification of best ESG practices more difficult and would mean investors would need to adopt a higher risk appetite. Industry and Government will need to consider how to manage these risks and whether certain ESG conditions need to be met.

The industry is increasingly venturing into frontier markets in pursuit of high risk and high return projects. There is concern that more frontier regions, unspoilt by human activity, such as Greenland may be targeted at a high cost to the environment. It is crucial that countries and companies entering frontier regions do so while operating to best practice ESG standards.

Remote areas often lack access to renewable energy sources, and can be in areas of undisturbed biodiversity, water-scarce regions, or areas of conflict on a local or national level. Junior exploration companies can lack the resources, finance, and expertise to demonstrate how they are meeting industry best practice ESG standards. This becomes even more difficult in hard-to-operate frontier regions, giving foreign government-backed companies the advantage, with their additional resources, in exploring uncharted territories.

Attractive jurisdictions will increasingly include areas where a project can be easily decarbonised. Access to cheap renewable energy makes the Nordic region an attractive jurisdiction. This could be a UK asset/ strength as the UK is committing to decarbonising its energy, which is attractive for investors and miners who will have greater scope to develop a net-zero project. The UK has legally committed to reducing GHG emissions to net zero by 2050.

Tungsten West has encountered barriers to developing wind power at its Hemerdon site in Devon, UK. The National Planning Policy Framework for England and Wales states that any new wind turbine in England must be on a site designated for wind in a local plan and have met the planning concerns of the local community and therefore have its support. Read case study on p. 84.

While UK Government strategies commit to transitioning to renewable energy, in practice, the UK planning and permitting system can create barriers for companies that want to develop renewable technologies, such as wind turbines on industrial sites. Changing societal perceptions around wind turbines on industrial sites is also key. (See Tungsten West's case study on p. 84).

De-risking Investment

Commodity prices generally follow mining super cycles and are prone to market fluctuations. During economic downturns, when prices crash rapidly, many junior exploration companies fail to stay afloat. Attracting investment during cyclical downturns is difficult as investors are unwilling to commit capital to high-risk ventures. However, the demand for raw materials does not decrease as fewer deposits are found. Less investment in exploration results in fewer mines coming on stream, constricting supply.

Some investors are still opting to commit capital to traditionally more stable commodities (i.e. those less vulnerable to drastic market fluctuations). The investment in exploration for precious metals such as gold, silver, platinum, palladium, rhodium, ruthenium, iridium, and osmium is approximately 20 times higher than the amount invested in other metals such as lithium, cobalt, rare earth elements needed for the energy transition. Figure 7 shows the difference in exploration investment for different commodities. More investment in critical minerals is needed.

SPENDING BY MINERAL (CANADA) 2022

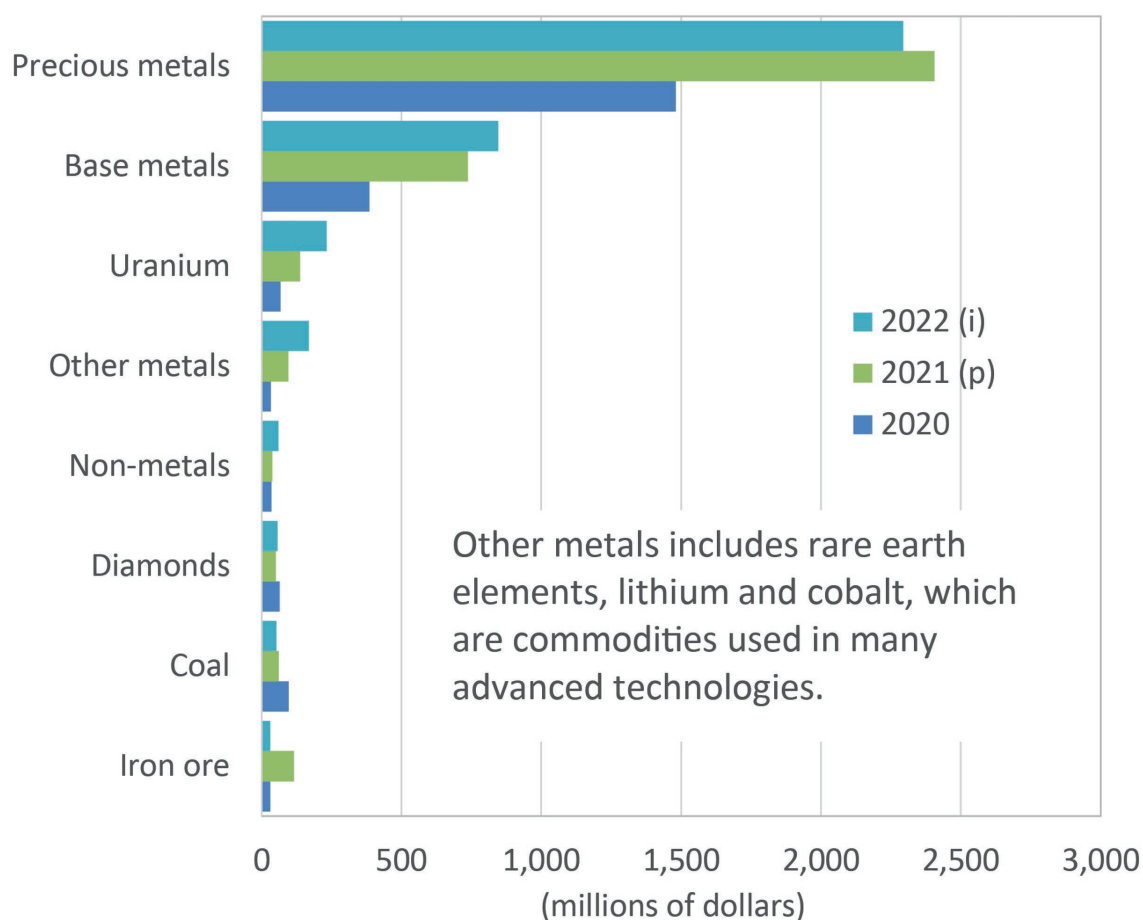


Figure 9 - Spending by Mineral 2022. Source: Natural Resources Canada.

Mineral extraction and processing industries are competitive and monopolised. Some critical minerals are traded on stock exchanges, while many such as REEs are traded privately. In both cases, commodity prices are vulnerable to market manipulations. Government-subsidised companies can operate on the lowest margin costs, which undercut Western companies trying to adhere to industry best practice ESG standards. Some nations flood the market quickly with cheap feedstock and drive commodity prices down to eliminate competition. Future market manipulations can bankrupt juniors adhering to industry best-practice ESG standards. ESG compliance is capital intensive and upfront expenditure is difficult to justify for junior explorers before a deposit has been identified. However, the ability to demonstrate ESG best practice is key to attracting investment.

Currently, UK companies competing on the international market are at a disadvantage in comparison to other government-backed companies due to a lack of support. Examples of government backing include strategic investment into Lynas Rare Earths by the Japanese Government, Australian Government backing of Iluka, and significant support by the US Government into MP Material's Mountain Pass Project including a \$35M contract.

In 1998, Cornwall's last working tin mine, South Crofty, closed. The mine was unable to compete following the collapse of the tin price as China and South America projects came online. At the time of closure, the UK Government failed to see the strategic importance of a domestic supply of tin and refused to contribute towards a rescue package. The lack of foresight and policymakers' understanding of supply security poses a risk to the delivery of a green energy transition.

In a world racing to decarbonise, the lack of a healthy pipeline of critical minerals projects and mines reaching production can significantly delay the energy transition. The UK Government can de-risk and incentivise investment by underwriting ESG-compliant projects (from exploration through to mining, and processing) and, the creation of a Green Premium, for all commodities in the alternative ESG-focused supply chain. This will accelerate projects of national importance that would otherwise be significantly delayed or fail to attract sufficient private investment and level the playing field for junior operators.

Access to Capital – UK Domestic Projects

There are several barriers to investment in UK domestic companies focusing on mineral extraction, processing, and/or recycling. The UK needs a supportive enabling environment for these sectors, and companies would benefit from:

- UK Government Critical Minerals Strategy and Statement of Commitment
- Widely accessible, up-to-date, geological data on prospectivity
- Support through mineral rights, planning, and permitting processes
- A single point of contact in government through a Coordinating Body or Mining Agency to simplify the multiplicity of government agencies to engage with
- The UK being internationally competitive from an operating cost perspective and to facilitate the implementation of low cost, low carbon economic fuel and power for operations
- The ability for critical minerals extraction, processing, and recycling companies, particularly start-up companies, to apply for existing government grants and schemes by widening eligibility criteria (e.g. Enterprise Investment Scheme)
- Government financial support and guarantees to companies facing unfair international competition and significant price fluctuations as a “safety net” option, to be invoked should market prices drop below the trigger level
- Reduced trade barriers to enable companies to access key export markets free of encumbrance to business
- UK banking sector to support mineral extraction companies in accessing basic banking services



Figure 10: Source: Tungsten West

Who Pays for ESG?

Currently, there is no consensus on who pays for the cost of implementing industry best practice ESG standards. Many agree that adhering to best practice ESG standards is the cost of doing business, hence this cost should be financed by investors or shareholders. Investors are also accountable for ESG through stewardship laws and should also be paying for it. Increasing expectations around ESG reporting and assurance will come with additional costs. Innovation is a mechanism for

companies to improve their ESG performance but requires capital. Junior companies are expected to pay for ESG compliance with fewer resources than major companies. Major companies that can commit more capital to deliver industry best-practice ESG could be more attractive to investors, which risks side-lining junior companies' ability to attract capital. Figure 8 demonstrates the different costs of ESG.

WHO PAYS?

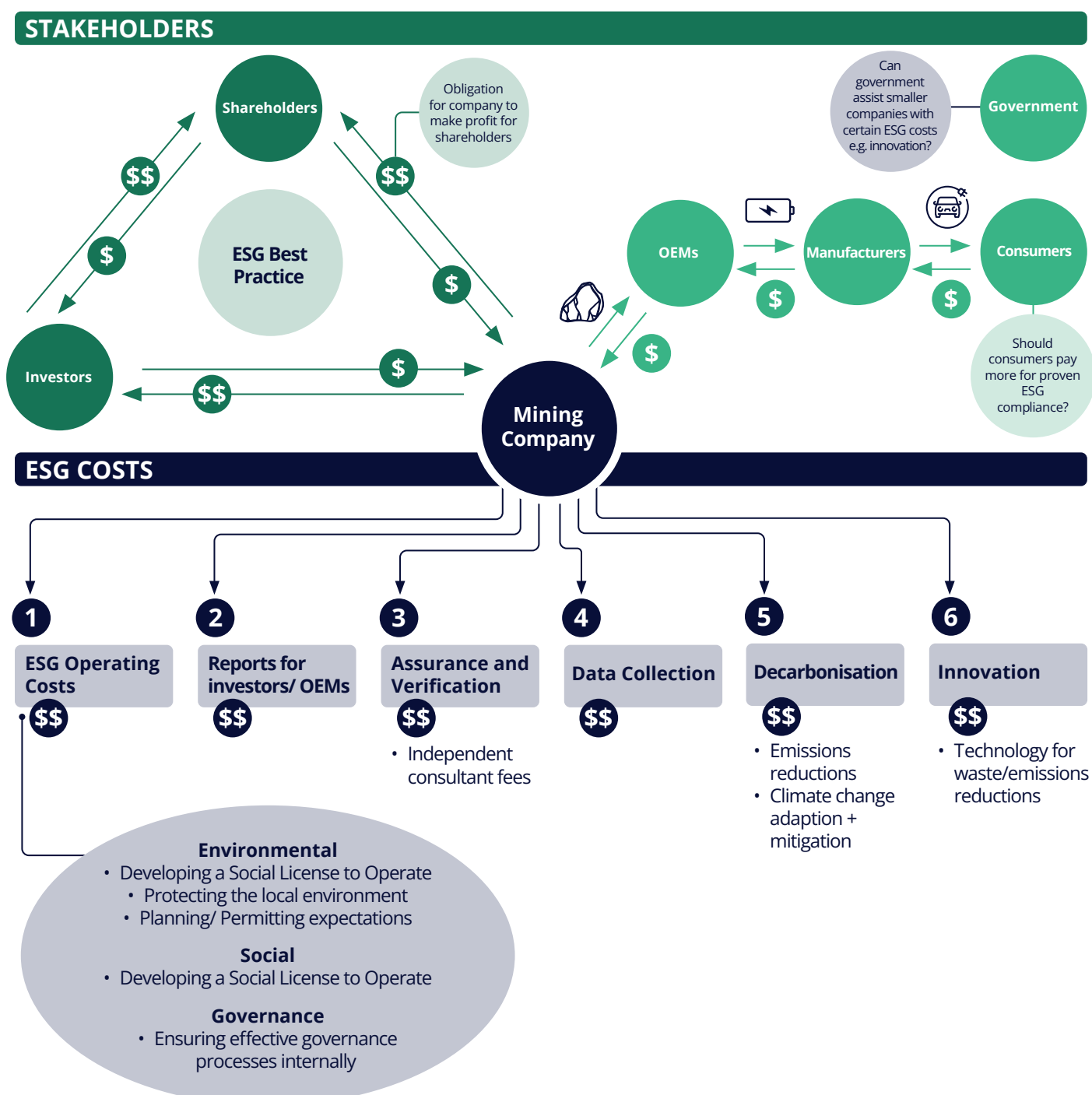


Figure 11: Who pays for ESG? This diagram outlines the different costs for ESG, and the stakeholders who will have to pay for them.

THE POSITIVE EXTERNALITIES OF ESG

ESG compliance amongst domestic companies can create positive externalities that support government objectives. Companies operating overseas that demonstrate good ESG compliance support international development and foreign aid objectives, by providing opportunities to local communities. The government should allow ESG-compliant businesses to thrive by honouring its responsibilities to ensure that legislation, planning and permitting, taxes, subsidies, and research grants are not prohibitive to industry. See Figure 9.

ESG & Market Failures

Critical minerals extraction and processing can produce positive and negative economic externalities. Companies should be held accountable for the negative externalities (e.g. poor ESG practice), and also be recognised by society and government for the positive externalities (e.g. good ESG practice) they create.

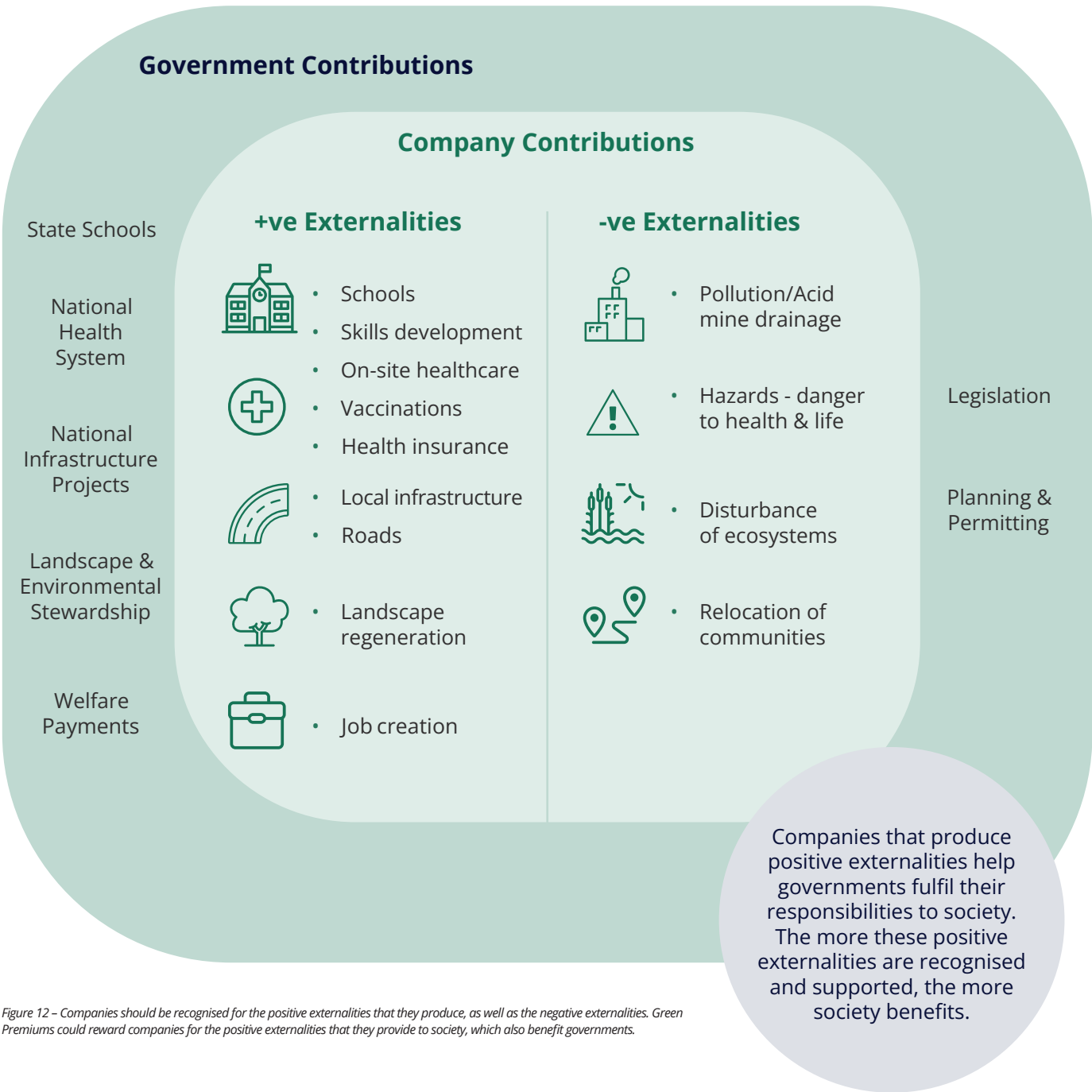


Figure 12 – Companies should be recognised for the positive externalities that they produce, as well as the negative externalities. Green Premiums could reward companies for the positive externalities that they provide to society, which also benefit governments.

Many countries operate under a mixed economic system combining free markets with government intervention, and public enterprises with private enterprises. Free markets operate through self-interest, supply and demand, and prospects of profit. Some governments protect their citizens and create an environment to enable the functioning of these markets. Often, there are failures from both the market and government sides.



1. MARKET FAILURE

a failure of the market and price equilibrium to account for externalities, particularly negative externalities or to recognise the positive externalities.

- a. A negative externality occurs when the production and/or consumption of goods leads to a cost to a third party (e.g. water, air pollution).
- b. A positive externality occurs when the production and/or consumption of goods leads to a benefit to a third party (e.g. road, infrastructure development).



2. GOVERNMENT FAILURE

a failure of government to protect its citizens or create an environment conducive to market functioning.

Industry should be held accountable for the negative externalities that are produced but also be rewarded for the positive externalities that contribute to society. Equally, the government needs to overcome internal inefficiencies and politics to provide the most conducive environment for efficient market functioning.

Currently, companies are rightly being held to account by the media and society for areas in which they demonstrate poor ESG practice, but they are not publicly recognised for the positive work that they do. A Green Premium that integrates recognition of the positive externalities, in terms of societal and environmental benefits produced by mineral extraction and processing companies, would further incentivise companies and investors to see the value of ESG.

Green Premiums could reward companies for the positive externalities that they provide to society, which also benefits governments, if there is consumer uptake of potentially more expensive, but responsibly sourced products.

Green Premiums

While there is still work to be done on the mineral extraction and the processing sector's ESG, the industry is often not recognised for the ESG work they do. ESG requires additional costs (e.g. investment in tailings technologies) that do not necessarily lead to immediate added value financially. Investing in ESG means accepting lower immediate returns and paying higher costs to do mineral extraction. As the markets have not adjusted yet to value the companies that do invest in the best ESG practices, these companies can be disadvantaged while waiting for manufacturers to start requiring responsibly sourced materials.

Investors forecast that manufacturers will eventually pay a premium for proven responsibly sourced materials. Off-take agreements are also increasingly mentioning premiums. However, these premiums do not yet exist.

If OEMs and consumers remain attracted to the cheapest options that compromise on responsible sourcing, the pressure then moves on to companies, and ultimately investors, to pay more for ESG best practice. Price premiums on responsibly sourced materials would help reward the companies that are adhering to industry best practice ESG standards. There needs to be a consumer appetite for ESG compliance as they will ultimately pay a premium for ESG-compliant end-products.

Green Premiums do not yet exist with sufficient weighting. Green Premiums would enable consumers to choose to pay more for 'fair-trade' equivalent critical mineral products and would disadvantage companies

that are operating with poor ESG standards.

To be eligible for a Green Premium, a body would need to verify that the companies are adhering to high ESG standards across the board, and to demonstrate compliance with as many different ESG criteria as possible. There could also be different tiers of Green Premiums based on the level of ESG compliance a company has achieved. This could be linked to an ESG rating system (as proposed in CMA's 2021 ESG Paper, 'A Blueprint for Responsible Sourcing of Critical Minerals').

The government's role in Green Premiums could involve tax reductions or subsidies for companies demonstrating proven adherence to best practice ESG standards, or could involve a legal obligation on OEMs to procure materials from ESG compliant sources (the impact of such a policy on an OEM's global competitiveness would need to be considered). Relevant government agencies (e.g. Treasury, BEIS) should start a dialogue with relevant ESG and critical mineral experts. An ESG Expert Committee formed of ESG experts, industry, investors, academia, and, government could develop the framework of Green Premiums.

International alignment on Green Premiums is key so that UK companies are not disadvantaged if they are expected to pay higher prices for goods with Green Premiums rather than choosing the lowest-priced goods from the international market.

Green Premiums would enable the highest ESG standard-compliant materials to be valued and priced as such, and would reward ESG best practice and deter companies who shirk their responsibility towards the environment and local communities.

Recommendations - Access to Capital

The CMA recommends that the UK Government:



1. **Promote the development of Green Premiums for ESG compliant and recycled critical minerals through the ESG Expert Multi-stakeholder Forum.**

Create incentives for the use of verification technologies throughout supply chains to provide information to end consumers.



2. **Develop the UK's taxonomy on critical minerals, mineral extraction, and processing, based on the EU taxonomy.**

Support the development of an EU taxonomy on critical minerals and mineral extraction, and processing to align taxonomies. This taxonomy for critical minerals could also include 'social' aspects of operations, for example, conflict, fair labour practices, and resettlement.



3. **Encourage investment in ESG-compliant critical mineral projects with advanced decarbonisation strategies to be considered as 'green investments' and viewed as key climate change mitigation investments.**



4. **Consider the interdependencies of mineral extraction and processing and other key sectors (e.g. agriculture, steel) holistically with regards to decarbonisation as part of COP27.**



5. **Recognise the financial costs of ESG implementation, verification, assurance, reporting and support junior companies in being able to attract investment by creating a level playing field between independent and foreign Government-backed companies with differing resources.**



6. **De-risk investment by underwriting and supporting projects of national importance and providing financial assurances to UK companies in instances of unfair international competition.**



7. **Improve its internal processes (e.g. planning and permitting) to create an enabling environment for the domestic sector to attract investment.**

2. Talent Pipeline for the Energy Transition

The UK cannot deliver the energy transition without significant extraction of critical raw materials – and the UK cannot responsibly produce these raw materials without qualified professionals and scientists, including geoscientists, engineers, and metallurgists. There has been a dramatic decline in the number of young people entering the mineral extraction and processing industry, and in the places available for them to study.

The societal disconnect between end products and raw materials poses a risk to the energy transition as civil society fails to understand that critical minerals are needed for net-zero technologies and that raw materials must be extracted, and processed, before they can end up in wind turbines, EVs and solar panels. If we want to have a meaningful impact on the planet, and prevent past mistakes from re-occurring, then we must teach children about minerals and earth sciences, what the earth is made of, and what natural resources are necessary for technology, science, medicine, and climate change. Society, young people, and investors all need to understand the importance of critical minerals for climate change mitigation (see Figure 10).

The UK Government has not yet educated future generations about responsible raw material extraction. The negative media coverage of the Whitehaven metallurgical coal mine in Cumbria alongside protests highlights the lack of understanding around the production of renewable technologies. Metallurgical coal is essential for steel production, which is a key component of wind turbines. The UK Government has a role in educating the public and helping the young people who want to fight climate change to redirect their efforts to supporting a just energy transition.

Many critical mineral companies engage with civil society as part of obtaining a social license to operate (SLO). This occurs before any on the ground exploration takes place, encompassing mine development, production, processing, and refining. Some companies are doing excellent work to educate communities and school children on where critical minerals come from. However, it should not fall on individual companies to fill gaps in the National Curriculum.

If the UK wants to develop expertise, innovation, and new businesses for critical minerals supply chains, it needs to build a talent pipeline of people skilled in geosciences, engineering (including mining, geotechnical, civil, electrical, mechanical, and processing engineering) and metallurgy.

The UK needs to incorporate critical minerals, geoscience, mineral processing and engineering (including mining, geotechnical, civil, electrical, mechanical, and processing engineering) into sustainability education initiatives and strategies. These should be recognised as Green Jobs to incentivise more young people to pursue these highly technical and rewarding jobs.

The UK was once world-renowned for training people to work in mineral extraction across the world. This brought enormous soft power, as UK geoscientists, metallurgists, and engineers went to work abroad, and international students would bring their influential UK university experience back home. As the saying goes: 'A mine is a hole anywhere in the world with a Cornishman at the bottom of it!'

Less Common Metals (LCM), Prospex Institute and Xplore! worked together to create and deliver workshops to Year 5 and 6 children at Childer Thornton, Whitby Health and Ysgol Rhos Helyg primary schools. By covering the six steps of the supply chain in a fun and interactive way LCM was able to teach children about mining, extraction, and separation, crushing, heating and moulding alloys, production of permanent magnets and, permanent magnets in EVs. See case study on p. 70.

Green Jobs - "employment in an activity that directly contributes to, or indirectly supports, the achievement of the UK's net-zero emissions target and other environmental goals, such as nature restoration and mitigation against climate risks." – BEIS Net Zero Strategy 2021

Unfortunately, the number of mining-related university courses in the UK is in decline, and without these skillsets, the UK will lack the ability to identify new geological potential, develop a mine, process minerals, and build recycling and midstream plants, without importing talent from elsewhere. Geoscientists and engineers are already on the UK's shortage occupation list.

The CMA has published 'A Talent Pipeline' paper in May 2022 which dives into the challenges facing the critical minerals sector, barriers to social mobility in higher education, and the solutions to securing the UK's green future.

Minerals Planning

Mineral planning should be promoted as an exciting career opportunity, through educational opportunities, sponsorship, intern positions and the creation of a pool of 'industry experts' who could be utilised by local planning authorities with less knowledge of mining and minerals applications and operations. Mineral planning officers should be included in the UK Government's initiatives on Green Jobs, and upskilling as part of Levelling Up.

Mineral planning is an essential part of the process to enable the extraction of vital minerals for low carbon technologies. While mineral planning as a career may not be seen as the most attractive or enticing aspect of planning, it is just as rewarding and can make a real difference by tackling important issues such as climate change. Planners within local authorities are key to ensuring delivery of those vital minerals, however not all authorities are well resourced or have the necessary skills to deal with mineral planning applications in a timely fashion. Mineral planning authorities need experienced and qualified planners to ensure an adequate supply of minerals to meet the needs of society and the economy.

Mineral operations can also have significant impacts on the environment and communities, therefore mineral planning requires a unique set of skills. However, often because of budgetary pressures, these skills are fading within many mineral planning authorities. Coupled with the volume and complexity of information and workloads, it is becoming increasingly difficult for organisations to recruit and retain qualified planners, especially those with specialist mineral planning knowledge and experience. Many local authority planners now deal with a varied caseload, some of which may involve minerals planning. This is particularly the case in unitary authorities where the planning function covers housing, transport, business, environment, minerals, and waste.

authorities can come from a variety of backgrounds, whether this is geology, environmental science or planning. Having a healthy interest in minerals is advantageous; and specialist mineral planning skills and knowledge are generally gathered 'on the job' rather than through formal education. However, with the departure (through redundancy or retirement) of more experienced and senior staff, there is the potential for significant knowledge gaps which are difficult to fill as opportunities for learning and development are limited.

Like many of the minerals found in the UK, minerals planners are scarce and innovative solutions will be needed to ensure planning authorities are suitably resourced to enable vital mineral resources to be exploited. Generally, minerals planning is not taught through formal planning courses. This deficiency in courses is widely acknowledged and has been raised in planning schools across England many times.

Other possible solutions to bridge the gap in specialist mineral planning knowledge and skills could be to develop mentoring programmes and staff exchanges within the minerals industry so that valuable knowledge is shared between the public and private sectors. Another solution could be the sharing of resources between mineral planning authorities which would allow teams of qualified and knowledgeable planners to undertake strategic minerals planning or provide advice and expertise to other authorities when the need arises.

The UK's experts in mining are ageing, and there has been little interest in ensuring that younger generations of planners are equipped to deal with complex projects such as mine sites. Minerals planning is not taught as part of planning degrees. Most mineral planners have 'learnt on the job'. Local authorities are experiencing difficult financial circumstances and resourcing is a major issue.

CRITICAL MINERALS NEEDED FOR CLIMATE CHANGE MITIGATION

Society, young people and investors need to recognise the necessity of sourcing critical minerals responsibly to build the technologies needed for climate change mitigation.

1. Society

Everyone in society needs to recognise that critical minerals are needed in all aspects of life. We should all embrace the opportunities of local economic growth and development created by responsible sourcing of critical minerals. Society can encourage Government to make realistic plans to meet future demand gaps and ensure that responsible mineral extraction forms the foundation of a Just Energy Transition, decarbonisation of transport, and innovation in technology.

2. Young People

Critical mineral supply chains offer exciting career pathways and opportunities to develop and extract minerals and metals for climate change mitigation technologies, and help reduce the environmental and social impacts of mineral extraction and processing.

Career Pathways

- Chemical Engineer
- Commodity Analyst
- Community Relations Manager
- Driller
- Environmental Scientist
- ESG Consultant
- Explosives Engineer
- Geochemist
- Geologist
- Geophysicist
- Geotechnician
- Geotechnical Engineer
- Government Planning Officer
- Hydrogeologist
- Metallurgist
- Mining Engineer
- Plant Manager
- Processing Engineer
- Surveyor
- Tailings Engineer

3. Investors

Investment is needed to explore for critical minerals and develop processing, refining and recycling facilities. Investors should view responsible critical mineral supply chain investments as part of their climate change mitigation portfolios and ensure companies are adhering to industry best practice environmental, social and, governance standards.

Wind Turbines



- Aluminium (Al)
- Cobalt (Co)
- Copper (Cu)
- Manganese (Mn)
- Molybdenum (Mo)
- Rare Earth Elements (REEs)

Geothermal



- Chromium (Cr)
- Nickel (Ni)

Hydrogen



- Nickel (Ni)
- Platinum Group Metals (PGMs)

Electricity Networks



- Copper (Cu)
- Germanium (Ge)
- Tin (Sn)

Electric Vehicles and Energy Storage



- Cobalt (Co)
- Copper (Cu)
- Graphite (C)
- Lithium (Li)
- Manganese (Mn)
- Nickel (Ni)
- Rare Earth Elements (REEs)
- Silicon (Si)
- Tin (Sn)

Solar Panels



- Aluminium (Al)
- Copper (Cu)
- Gallium (Ga)
- Germanium (Ge)
- Indium (In)
- Nickel (Ni)
- Tellurium (Te)
- Tin (Sn)
- Silicon (Si)
- Zinc (Zn)

Figure 13 - Society, young people, and investors all need to understand the importance of critical minerals for climate change mitigation.

Future ESG Leaders

ESG professionals come from a range of backgrounds. Traditionally many ESG professionals have a background in environmental or social science, however, as the emphasis on ESG within the mining sector is increasing there is a growing number of people transitioning across to ESG from other roles within the industry. The breadth of what is required from ESG professionals is also expanding, as the scrutiny on responsible supply chains and project impacts increase.

Diverse skill sets are required, and professionals must be willing to embrace new approaches and technologies to innovate and ensure projects are being delivered most responsibly, maximising positive environmental and social impacts. Skills required can include lifecycle assessments, understanding of the circular economy, traceability and verification of supply chains using blockchain, and effective communication.

Responsible supply chains and associated responsible mining practices are becoming increasingly important. A project's ESG credentials must be proven to secure a social license to operate (SLO) as well as investment. As projects develop beyond exploration and must fulfil rigorous planning and permitting requirements, there is a need to work with specialists, often consultants, who have the relevant environmental and social expertise. However, at the exploration stage, it's often geoscientists who are first on the ground, and the first impressions they make can influence a project for years to come.

There is an increasing need to train geoscientists to appreciate social and environmental considerations – yet traditional geoscience degrees often neglect this vital aspect of the job. Similarly, environmental, or social science graduates may not have the technical understanding of the challenges that the mining industry faces.

A geology degree arms young professionals with a host of transferrable skills applicable to many jobs, projects, and alternative industries. Knowledge of rocks, minerals and ore deposits is needed to contextualise climate change impacts of many end products, how they are made, and what is used to make them. For example, the environmental impact of nickel going into batteries depends heavily on the ore it's extracted from and how easy it is to do this. Some ores require intensive chemical processing or huge quantities of electricity to liberate, and all this feeds into an environmental impact assessment.

Engineers and people with geo-backgrounds who understand the processes of how particular raw material products are made are essential in combating the potential negative environmental impacts of the industry. These metals and materials are crucial for our planet's future and their extraction does not have to be harmful to the planet. We can reuse and recycle essential metals with clever circular material engineering, operate low-impact mine schedules, opt to use less harmful chemicals to process materials, electrify our equipment, and produce batteries in areas with renewable energy. All these insights require knowledge of the basic mineral product or process, and an ESG perspective.



Source: Giyani Metals Corp.

Recommendations - A Talent Pipeline

The CMA recommends that the UK Government:



- The UK Critical Minerals strategy to clearly explain the connection between critical minerals with climate change and outline its commitment to supporting responsible supply chains.**

Engage with university leaders to ensure that these courses continue to run, particularly at universities which enable students from lower socio-economic backgrounds to level up.

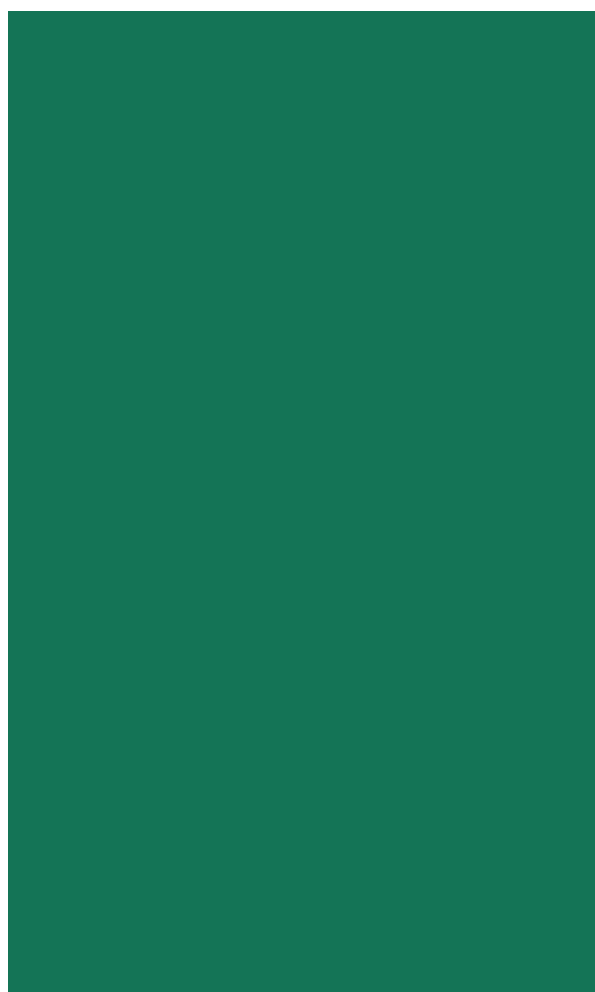


- Include the importance of critical minerals and geoscience, engineering, and metallurgy in the sustainability and climate change strategy for education.**

Ensure the geoscience, engineering, and metallurgy community is represented at the Government industry groups working on green jobs - Green Jobs Taskforce, Cross-Cutting Delivery Group, Trailblazers.



- Remove financial barriers to university courses for lower socio-economic background students by extending postgraduate loans to cover the full costs of tuition and providing bursaries to support to cover costs of fieldwork and equipment.**



3. ESG Standards

The innumerable ESG standards can make it difficult for investors, OEMs, consumers, downstream producers, governments, and other stakeholders to compare and contrast the ESG performance of different mining companies, particularly those of different sizes. While existing standards overlap on most issues, each standard will be slightly different in its expectations depending on its intended use. It is important to note that different standards serve different purposes. Investors and stakeholders requiring a specific ESG standard means companies may have to dedicate additional resources to meet different criteria and spend considerable time reporting on this. Simplifying the landscape into a few aligned ESG standards would be helpful to save time and resources for all stakeholders. The CMA's 2021 ESG paper's appendix highlights the many different ESG standards and regulations.

SRK Consulting has created the following table which subjectively groups different ESG standards to demonstrate the use of the standards by different stakeholders. These don't necessarily correlate well with one another. There are six groupings:

1. Overarching – Initiatives are driven at a high global level and that influence both government and corporate requirements

2. Disclosure – Demand for disclosure is driven by the financial markets/ institutions

3. Lender standards – Demands from debt and corporate financing

4. Responsible mining/ sourcing – Initiatives that provide visibility along the supply chain

5. Issue-specific – Initiatives that are technical and focused on specific issues

6. Regional initiatives – Initiatives that affect certain regions (e.g. EU)

Organised view of some key mining industry ESG standards					
Overarching	Disclosure	Lender standards	Responsible mining/ sourcing	Issue specific	Some regional initiatives
<u>United Nations Initiatives</u> UN Global Compact UN Sustainable Development Goals UN Guiding Principles on Business and Human Rights UN CEO Water Mandate	<u>Non-financial/ sustainability reporting initiatives</u> Global Reporting Initiative (GRI) Sustainability Accounting Standards Board (SASB) International Integrated Reporting Framework EU Corporate Sustainability Reporting Directive	<u>Equator Principle Financial Institutions</u> Equator Principles IFC Performance Standards World Bank Environmental, Health and Safety Guidelines	<u>Industry led initiatives</u> International Council for Mining and Metals (ICMM) Principles Towards Sustainable Mining (TSM) Responsible Gold Mining Principles (RGMP)	Voluntary Principles on Security and Human Rights (VPSHR) Global Industry Standard on Tailings Management (GISTM) International Cyanide Management Code (ICMC) International Atomic Energy Agency (IAEA) Safety Standards IAEA Best Practice in Environmental Management of Uranium Mining World Health Organisation Standards Business and Biodiversity Offsets Programme Standard on Biodiversity Offsets World Bank's Climate and Forest Smart Mining initiatives	European Green Deal EU Sustainable Finance Action Plan, including the EU Taxonomy Regulation and the EU Sustainable Finance Disclosure Regulation (SFDR) African Mining Vision Economic Community of West African States (ECOWAS) West African Economic and Monetary Union (WAEMU)
<u>Other international bodies</u> International Labour Organisation (ILO) Conventions Organisation for Economic Co-operation and Development (OECD) due diligence for responsible supply chains	<u>Climate specific disclosure</u> Taskforce on Climate-related Financial Disclosures (TCFD) Carbon Disclosure Project (CDP)	<u>Specific requirements of development banks</u> AfDB Environmental and Social Assessment Procedures EBRD Performance Requirements Asian Development Bank guidelines	<u>Supply led initiatives</u> The Responsible Jewellery Council (RJC) Code of Practices (COP) Aluminium Stewardship Initiative CopperMark & Responsible Minerals Initiative Responsible Steel Standard Responsible Minerals Initiative (RMI)		
<u>International Standards Organisation</u> ISO Standards (14000 environment, 45000 health & safety, and 31000 risk) and ISO Guidelines (26000 social responsibility)	<u>Other disclosure initiatives</u> Extractives Industry Transparency Initiative (EITI) Disclosure of specific TSF information on the Global Tailings Portal		<u>Third party led initiatives</u> Initiative for Responsible Mining Assurance (IRMA) Responsible Mining Foundation		

Figure 14 - ESG standards and governance frameworks 2022. Source: SRK Consulting (UK) Ltd.

One size does not fit all. Stakeholders will have to pick and choose what they are reporting on, for example, some standards cover risk mitigation, net-zero impact etc. Depending on where an organisation is located and what it is producing, different 'issues' in ESG standards may be more or less applicable. In addition, different ESG requirements may be applicable for smaller vs larger mining companies, exploring vs producing companies, and different companies across the supply chain. Risks may also be different at mining and other stages of the supply chain.

International Alignment on ESG Standards

There is a growing need for better alignment between governments on ESG Standards. International alignment will prevent duplication and contradicting initiatives on ESG standards. This will help to focus all stakeholders on the importance of working together to move towards simplified, effective, verifiable, and high-quality ESG practice in critical mineral supply chains. The UK Government should assess and understand the work that is being done by the EU on ESG standards and legislation in critical mineral supply chains. Time and resources must not be wasted on duplicating efforts and reinventing the wheel. Once an assessment of existing initiatives has been done, the UK can identify gaps and opportunities.

Global standards are a way to avoid operators adhering to the lowest common denominator. Investors and operators all over the world have different regulatory contexts and apply different regional best practice standards. Investors and government should seek assurance that minimum standards of disclosure and practice are being met and are good enough to avoid disasters in the mining industry.

There is material coming out in the EU and Germany on responsible sourcing legislation. Legislation in Europe is recognising ESG schemes. The UK should review these and align them where applicable. Companies would prefer aligned legislation, as otherwise, they have to work through multiple pieces of legislation with only slight differences. For example, as the EU was debating a former draft of due diligence legislation, multiple EU countries came up with their own legislation. This meant companies had to spend more time and resources doing paperwork to cover small differences in each legislation. The UK Government should decide on whether to align on legislation that is already underway internationally.

Global ESG Standards – Equivalency of ESG

The mining industry and many key stakeholders are aware that the proliferation of ESG standards brings challenges. Several organisations are starting to work together on alignment, for example, through equivalency frameworks showing where one standard can satisfy the requirements of another. For example, the Towards Sustainable Mining (TSM) responsible sourcing supplement helps

companies to meet TSM in addition to five other standards (e.g. ICMM Mining Principles, World Gold Council (WGC) Responsible Gold Mining Principles (RGMPs), and Responsible Minerals Initiative (RMI) Risk Readiness Assessment (RRA)). ICMM is committed to finding alignment, including through their work on publishing equivalency benchmarks with other standards including TSM, Copper Mark and Assurance Services International (ASI). This is a step towards greater convergence and consolidation, which would lead to improved ESG performance and reduced audit burden. Convergence is happening but will take some time.

There are different ESG standards for different reasons. Ultimately it comes down to process, performance, or disclosure. These are not necessarily linked. Some address how a company performs and others address what a company must disclose. There is additional complexity regarding location, phase of mining, and stage in the supply chain. ESG Standards can also be broken down into the following activities (see Figure 12):

PROCEDURAL

Procedural standards explain the process that a company has to go through to identify important ESG risks and gaps that need to be filled. Examples of procedural standards include the IFC Performance Standards, Environmental Social Impact Assessments, and ISO Standards.

PERFORMANCE

Performance standards evaluate how well a company has done what it has committed to do. Examples are the Global Industry Standard on Tailings Management.

DISCLOSURE

Disclosure is the process by which a company reports on material ESG risks for the company, and how it addresses these.

ESG STANDARDS

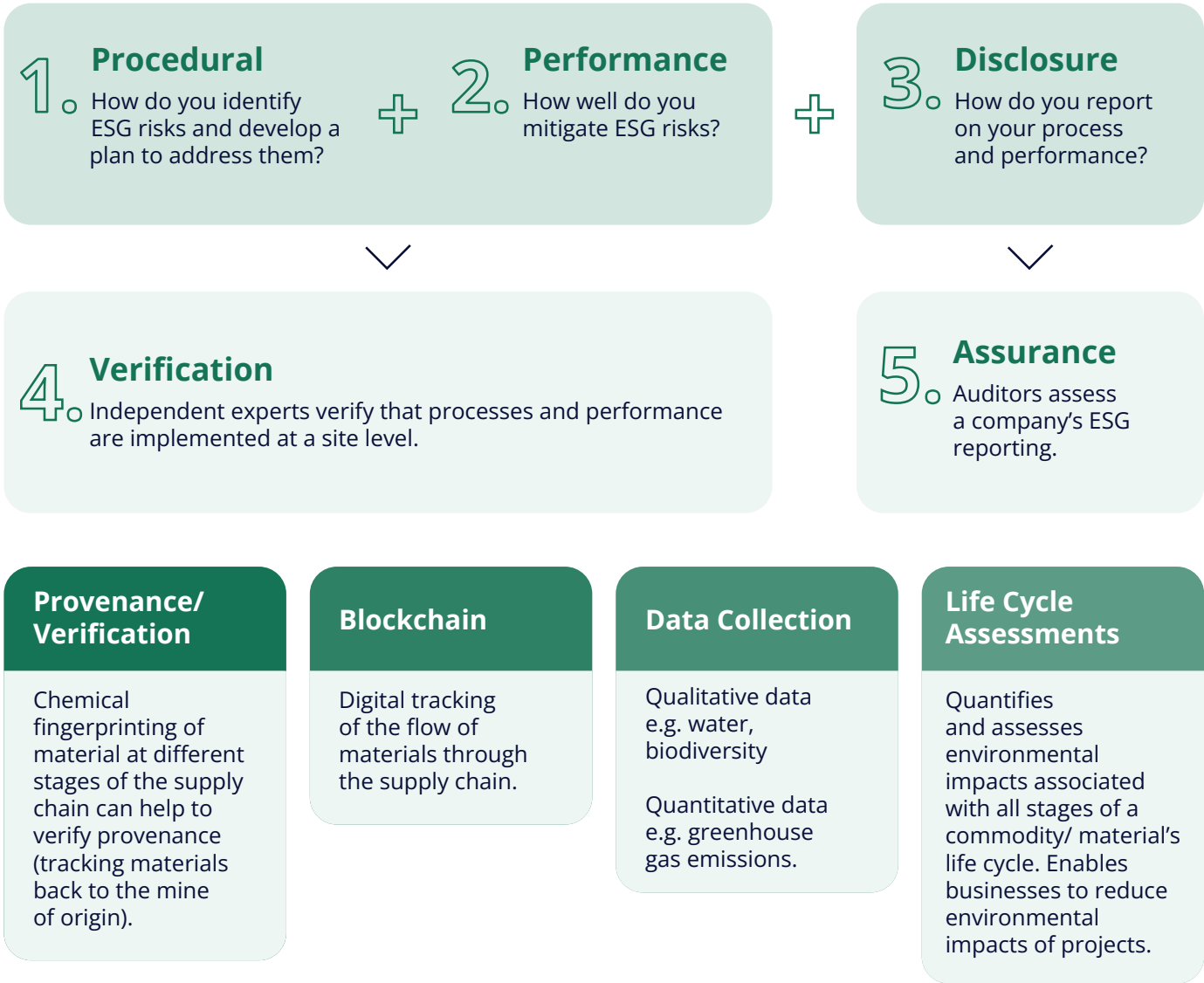


Figure 15 – ESG Standards can be categorised into their different functions.

The key to getting the most out of whatever is taken forward is the need to understand the expected ESG outcomes or deliverables, and whether the chosen standards cover these. It is important to understand all the standards

currently available, what they aim to deliver, their value, who is involved and what are the gaps or limitations. An ESG expert multi-stakeholder group can assist with this.

Issues-Based Standards

Issues-based standards help delve deep into details of complex issues-based topics, such as tailings, biodiversity, and water. Other, less complex issues could require less comprehensive reporting. Not everyone needs to spend the same amount of time addressing issues in the same amount of detail. Issues-based standards are helpful because from a regulatory and legal perspective, some standards are at such a high level that they are almost meaningless in influencing how a

mining company chooses to implement and report on them. Standards that recognise the importance of location and geographic context (environmental and socio-political) for ESG requirements are key, as priority issues differ depending on where you are in the world.

Governments need to ensure that any policy frameworks take into consideration environmental factors, such as biodiversity, land, and water contamination. These

should not be overshadowed by over-emphasis on carbon footprint reporting. Unequal bias towards carbon reduction can undermine ESG by motivating companies to pursue carbon offsetting technologies that could be detrimental to biodiversity. A wider picture needs to be considered. See Minviro's case study on lifecycle assessments on p.92.

Many companies are increasingly focusing on biodiversity in line with major standards. Horizonte Minerals' nickel project has undergone extensive Environmental and Social Impact Assessment (ESIAs) to ensure minimal impact on biodiversity. The project was re-designed to minimise biodiversity loss.

UK Legislation

It is important to consider whether existing UK legislation is good enough to meet ESG expectations, or whether industry standards need to fill the gaps. Regulatory changes around ESG compliance, governance or reporting will drive: the elements needed to comply, the industry to adopt these standards, and technology that can deliver the regulatory requirement outcomes. If the UK puts out legislation that affects supply chains, this has a global reach given the number of companies listed in or trading through London. UK legislation is automatically cross-jurisdictional. In Canada, the Canadian Government has been a champion of mining industry's Towards Sustainable Mining (TSM) initiative although there is no legal recognition of this standard.

The UK Government could take an 'ends-driven approach' – outlining 'this is what we expect the end result to be' and allow companies to decide how they reach the end goal. The UK Government successfully implemented the Modern Slavery Act 2015 by putting in place principles and allowing civil society and the private sector to step in and come up with strategies on how to follow through. The legislation requires companies (with sales over £36 million) to publish an annual statement to confirm the steps taken to ensure slavery and human trafficking are absent from their own business and supply chain but leaves it up to companies to decide how this is done. UK Government could consider taking a similar approach to ESG standards for critical mineral supply chains, by implementing an ESG Policy and/or Principles and providing the private sector and civil society with the end goal, while allowing organisations to determine how to reach the end goal themselves.

Verification and Assurance of ESG Standards

Stakeholders want to see that critical mineral supply chains are responsible and sustainable by being transparent, independently verified, easily comparable and trustworthy. There is ESG reporting by companies, but these are not necessarily data driven or verified. Independent monitoring and assurance of ESG standards should be strengthened. Implementation of ESG standards needs to be credibly verified and assured by independent third parties.

PROVENANCE AND TRACEABILITY

Many consumers, particularly the younger generation, wish to purchase products that are environmentally conscious and ethically sourced. Consumers must be considered, as ultimately, it is the demand created by them that enables the industry to exist. But most businesses do not have visibility into their supply chains from mine to product. Given the variety of critical minerals that go into end products, it is difficult to trace the entire supply chain. The Fairphone company has had some success in reporting on the ESG aspects of its supply chain. However, it has not captured the market yet as popular brands continue to dominate. ESG rankings have recently been called into question by Elon Musk over Tesla being de-listed from S&P 500, with some alluding to ESG as, "glorified corporate virtue signalling." In the mining industry, lack of adherence to industry best-practice ESG standards can have catastrophic results including vast environmental degradation and loss of life. Hence, ESG standards in the mining industry must not lose meaning.

ISSUES-BASED EXAMPLE

The Global Industry Standard on Tailings Management applies to investors in operators all over the world, in different regulatory contexts and with different ESG expectations (e.g. some adhere to regional best practice, others are members of ICMM). They would like minimum standards to be met comprehensively, and to be applicable to all mining companies (including smaller ones), to avoid disasters such as Brumadhino in Brazil and the Juukan Gorge aboriginal caves destruction in Australia.

The critical mineral supply chain has been under pressure to become more transparent from OEMs, consumers, and investors. With transparency comes knowledge of material concentration risks around supply that could test the resilience of these supply chains. Moving or building a supply chain that is more transparent and resilient is not a simple exercise.

Major companies are being asked to explain what their entire supply chain is doing. Small and medium enterprises supplying companies such as Rolls Royce will have to complete a due diligence component as part of Rolls Royce's supplier procurement process. This means suppliers will need to fill out multiple different forms on ESG for each OEM. Simplifying what is required would be helpful for small/ medium companies. Some automotive companies will train their small/ medium suppliers on how to fill out the forms.

The ability to verify the origin of input materials independently and scientifically is a critical part of supporting key ESG claims and compliance and must be done independently. This helps to mitigate the risk of 'greenwashing' and understand the chain of custody in opaque supply chains.

CIRCULOR

Circulor allows businesses to track the physical flow of critical materials from extraction to final production and recycling, as well as associated ESG characteristics and embedded carbon across Scope 1, 2, and 3 emissions. Businesses can then make decisions to improve responsible and ethical sourcing and sustainable production across their supply chains. See case study on p. 77.

SOURCE CERTAIN

Source Certain has leading capabilities in the provenance, or origin, verification space which is facilitated by scientific methodologies that complement digital solutions. Source Certain scientific technology, TSW Trace® enables the verification of origin of input materials with specificity to mine of origin. Read case study on p.73.

Effective verification of provenance requires a database of key input materials, while this may be difficult to achieve globally, a domestic database would directly supplement the work of the Critical Minerals Intelligence Centre and help to monitor any claims of origin. Government collaboration with individual producers and existing provenance companies would help to alleviate the financial burden of commencing provenance programs.

The implementation of a trusted supply chain brings multiple complementary solutions together to ensure various safeguards and checks are in place to verify and authenticate the supply and inputs right through the chain. Provenance and verification can help to restore the public's perception of mineral extraction and uphold industry best practice ESG standards.

Without proof of origin, transparency across supply chains and reliable verification of ESG claims, the mining industry is at risk of losing OEMs, policymakers and shareholders' trust. Despite a majority push for best industry ESG practice a handful of poorly governed and executed projects can undermine the whole of ESG.

LIFE CYCLE ASSESSMENTS

Life Cycle Assessment (LCA) is a methodology for quantifying the environmental impacts of products or processes. It takes into consideration all material and energy inputs (plus any direct emissions to the environment) which are needed to produce a given product output, whether this is a tonne of copper ore, a kilogram of nickel sulphate hexahydrate, or a kilowatt-hour of storage in a lithium-ion battery.

LCA can be used for two main purposes – (i) to predict environmental impacts and inform decision-making in the development or planning stage of a project, using engineering data (see Minviro Case Study p. 92) and (ii) to measure and track environmental impacts of operational production using real-time data. It is a powerful tool for capturing and quantifying variability across different commodities, and the huge range of host orebodies, liberation techniques, processing options and manufacturing flows of a single raw material product.

LCA goes beyond simple carbon accounting and quantifies impacts across a number of environmental impact categories (e.g. acidification potential, eutrophication potential, ecotoxicity, particulate emission potential, water scarcity impact) By using high-quality data already available for planning

mines, the amount of diesel, explosives and electricity used for a given product output can be translated into environmental impacts, so sustainable options can be prioritised alongside financial and technical optimisation.

The LCA methodology has ISO guidelines (ISO-14040, ISO-14044), as well as commodity and product-specific standards that ensure a globally aligned framework for the reporting of environmental impact results. LCA can also be synergised across commodities or material sectors, using Product Category Rules (PCR) , which are increasingly used by the raw materials industry, in part spurred by upcoming EU regulations on battery manufacturers to source sustainable supplies .

A PCR framework provides specific guidelines as to how all aspects of impact quantification should be conducted, and material producers or product manufacturers can verify their environmental credentials with an Environmental Product Declaration (EPD) from this system. This ensures the validity of all LCA results in an international setting.

LCA can identify hotspots of environmental impact, balance these impacts (e.g. biodiversity, water, scarcity, carbon emissions), suggest alternatives to reduce the impact and ensure the world's move towards renewable technologies and greater mineral extraction does not couple material criticality with further environmental risk.

INNOVATION

There are many innovative technologies such as provenance verification, life cycle assessments, and blockchain that are paving the way for provenance, data, and traceability in supply chains. Space technologies and satellites have been used for tailings monitoring and independent verification of ESG. The technologies exist, but, with a few exceptions, are not widely used for independent verification given high costs. Government support to increase adoption could help.

Innovation in ESG is key, and government research and innovation funding should be targeted at critical minerals companies, to work with universities and graduates. The UK's Centre for Process Innovation (CPI) works with industry and universities to commercialise the technology. This drives innovation and attracts people to the UK. The UK should create more innovation funds and programmes specialising in critical minerals and commercialising innovations for ESG. These funds can also be used to support technology companies with the innovations that help operators to improve ESG performance.

MINVIRO

Minviro is a lifecycle assessment (LCA) consultancy and technology company that uses a robust, globally recognised quantitative methodology for environmental impact modelling within the raw material sector. LCA allows businesses to quantify the impacts (across a wide range of categories including and beyond CO2 impact) associated with their raw material product or process. Minviro uses first-hand, commodity-specific expertise to provide tailored sustainable solutions to producers and downstream OEMs manufacturing decarbonisation technology across the world. See case study on p.92.

Satellite-mounted sensors are increasingly used to provide independent verification and monitoring of ESG. This includes changes in biodiversity and vegetation, social activity including changes in urbanisation and artisanal mining, flooding events, changes in surface topography and absolute measurement of emissions in and around a mine site.

With over 200 satellites due to be launched in 2023, four of which are designed specifically to measure emissions, the reliability and resolution of satellite-derived datasets will continue to improve and become an increasingly vital source of assurance for investors, regulators, operators, insurers, customers and civil society. See case study on p. 86.

Auditing the Auditors

Some ESG standards require training for individuals to become 'certified verifiers.' However, in most cases, there is no standard or criteria which demonstrate that an individual is sufficiently experienced, knowledgeable, or qualified to understand the complexities of ESG in mineral extraction and/or processing to provide independent verification and assurance. This is problematic, as any individual or company could verify and assure ESG compliance of standards without needing to demonstrate they have the required experience.

The UK Government should work with ESG stakeholders through the ESG expert multi-stakeholder forum to determine the considerations around minimum standards required for assurers and verifiers where the existing standards do not specify this. The process of accreditation can be undertaken by a Government Standards agency – UKAS, the national accreditation body.

ESG DATA

Different datasets are required for assessing process, performance, and material risks for ESG. Data is important to supply proof of what is happening on the ground. However, it is important to prioritise necessary data, and avoid adding unnecessary data demands on operators. As with the multitude of ESG standards, consolidation of data demands would be beneficial. The Global Reporting Initiative (GRI) has been noted as a helpful foundation as it also covers many other data expectations. Greater guidance is required around what kind of data is needed, the quality of data, its availability and use.

One size does not fit all, and there are multiple considerations such as project size, role in the supply chain, location, commodity, and process, all of which affect the ESG issues that are of most relevance to the project. Data must be considered and interpreted in the right context.

COMPARISON OF PROJECTS

Project comparison is difficult based on data alone due to the multitude of variables. No two mine sites are the same. Benchmarking sustainability reports can be challenging, as many companies use different data metrics and it is hard to compare them.

With aspects of ESG, such as water, social engagement, biodiversity, context is everything

and projects cannot be easily compared based on quantitative data on these topics. A company collecting data on water consumption could compare its internal progress yearly, but could not compare its performance with another company, given the importance of context in how water usage impacts the surrounding environment.

For example, quantitative data on water usage will have completely different meanings if a project is in a desert or a tropical rainforest, and effective comparisons could not be drawn. The quantity of water used in a mineral extraction site will also depend on the processing requirements, which can often be the most water-intensive aspect of a mine and/or processing plant. In these circumstances, qualitative data is more useful, as project-specific questions can be asked to assess the outcomes, rather than the outputs.

International best-standard Environmental and Social Impact Assessment (ESIA) (and host country legislation and requirements) should be addressing these questions. Impacts on surrounding environments should be in every project's ESIA and part of ESG due diligence from potential investors. Data for specific issues such as water, social engagement, and biodiversity is useful for comparing a company's progress over time, as the data can be used to measure how a company's ESG performance for these criteria has been improving.

On the other hand, greenhouse gas emissions data is easy to compare. There is a protocol for calculating Scope 1, 2, and 3 emissions and these can be assured against an ISO standard. Measuring and comparing greenhouse gas emissions is straightforward, as there is a protocol for calculating these and the quantitative results can be compared across projects.

The UK Government should be cognisant of the costs and time needed for reporting, and that those smaller companies will have fewer resources (in-house or external consultants) to meet expectations of Scope 3 disclosures than larger companies. UK Government can support small and medium enterprises to ensure that they are not disadvantaged compared to their larger competitors.

To calculate scope 3 emissions, companies need proxy data and data to be able to map out where their scope 3 emissions are in the supply chain. In the future, companies might start requiring their suppliers and purchasers to declare information about their carbon footprints. Consolidating expected requirements is helpful for small

companies with limited time and resources. Government can help to ensure that smaller companies are not disadvantaged by their limited resources and that there is a level playing field between smaller and larger companies on disclosures.

It is important to recognise the difference between consolidated scores and consolidated standards. Consolidated scores within a standard may not cover certain issues. For example, a company could receive an IRMA rating of 75, but IRMA's certification scores do not cover wider climate change risks and opportunities in as much detail as, for example, TCFD. Standards that can tease

apart the individual issues will be a core part of the equation moving forwards.

A lack of standardised data and clear and quantifiable ESG goals (including scope 3 and recycling rates) is creating gaps. UK Government can work with allies in the EU, US, Canada, and Australia to align on global standardisation on data collection and requirements.



Source: Source Certain

Recommendations - ESG Standards

The CMA recommends that the UK Government:



1. **Does not create any new ESG standards.**



2. **Aligns with international partners (e.g. Australia, Canada, EU, USA), on ESG standards for critical minerals, for maximum impact and to avoid duplication (See appendix).**



3. **Establishes an ESG expert multi-stakeholder forum for critical mineral supply chains. (See appendix). This group would:**

Create a collaborative space to develop a roadmap and investigate questions raised in this discussion.

Help the UK Government to understand the complex landscape of ESG in depth, its stakeholders and its approaches.



4. **Establishes an Innovation Fund for ESG process improvements in critical mineral supply chain projects.**



5. **Develops a process of auditing and regulating the organisations and individuals that 'independently verify' ESG compliance. This could be developed by the ESG Expert Multi-stakeholder Forum and implemented by a government standards agency – UKAS, the national accreditation body.**

4. Creating an Enabling Domestic Environment

The UK does not yet have an established critical minerals mining industry. With greater support from the UK Government, existing UK projects could be significantly accelerated. The UK Government can develop an enabling environment to attract private investment into responsible critical minerals extraction and processing and ensure that its projects adhere to industry best practice ESG standards.

There is potential to explore for more critical minerals in the UK. However, many potential exploration companies and investors are disincentivised by a lack of a modern, central database that should be provided by the British Geological Survey. Some geological surveys carry out modern regional geochemical and geophysical surveys and publish easily accessible data sets and research papers to attract investment into their respective countries. The Geological Survey of Finland and the Geological Survey Ireland are great examples of adding value to their nations by actively engaging with exploration companies. Many developing nations such as Malawi and Mozambique also offer support during early exploration via access to data.

Responsible domestic production is essential for guaranteeing some security of supply. By accelerating domestic production of key commodities such as lithium, and processing feedstock in the UK (if a midstream was created), the UK could provide supply to its planned gigafactories such as Britishvolt. Shortening the supply chain for commodities such as lithium, tin, tungsten, or copper would reduce the carbon footprints of those supply chains by reducing global transportation emissions.

Given the significance of the UK's chemicals industry, there is a huge potential to expand the UK's processing and refining capacity. There are several UK-registered companies with advanced overseas projects looking to sell their feedstock to an alternative market which does not yet exist. By significantly expanding its critical minerals processing and refining industry, the UK will regain some control of supply. Localisation of those supply chains will make the UK more attractive to original equipment manufacturers who are frequently choosing other European nations. Germany and Poland are particularly viewed favourably due to governmental support for manufacturing, streamlined planning and permitting processes, subsidised land costs, and competitive energy prices.

The UK Office of National Statistics estimated the Full-Time Equivalent employment multiplier effect for mining of metal ores in the UK to be x9.85. For every one job created on a mine site, another nine could be created in the surrounding economy. A new mine creates job opportunities, many of which are highly skilled, STEM roles for areas which the Government has committed to levelling up, such as the South West, and typically also increases revenue streams for local authorities when the mine is in operation. Indirect benefits also come from the procurement of local goods and services, in addition to the benefits of higher disposable incomes in areas which become more prosperous through the establishment of well-paid jobs.

As the shift to a lower-carbon economy continues, the UK is seeking to secure its supply of critical minerals within its borders or with countries with which it has an established positive trading relationship. Beyond the obvious security of supply for these vital raw materials, there are many other benefits.

Mines have a far-reaching supply chain, going far beyond heavy equipment. A modern mine needs everything from laboratory reagents to environmental and engineering consulting, accounting, legal and HR services, IT equipment, cleaning services and uniforms. Since the UK has high regulatory standards, UK-based mines can source much of their supplies and expertise locally. They can seek out suppliers with superior standards and work to raise the capabilities of supplier companies, many of

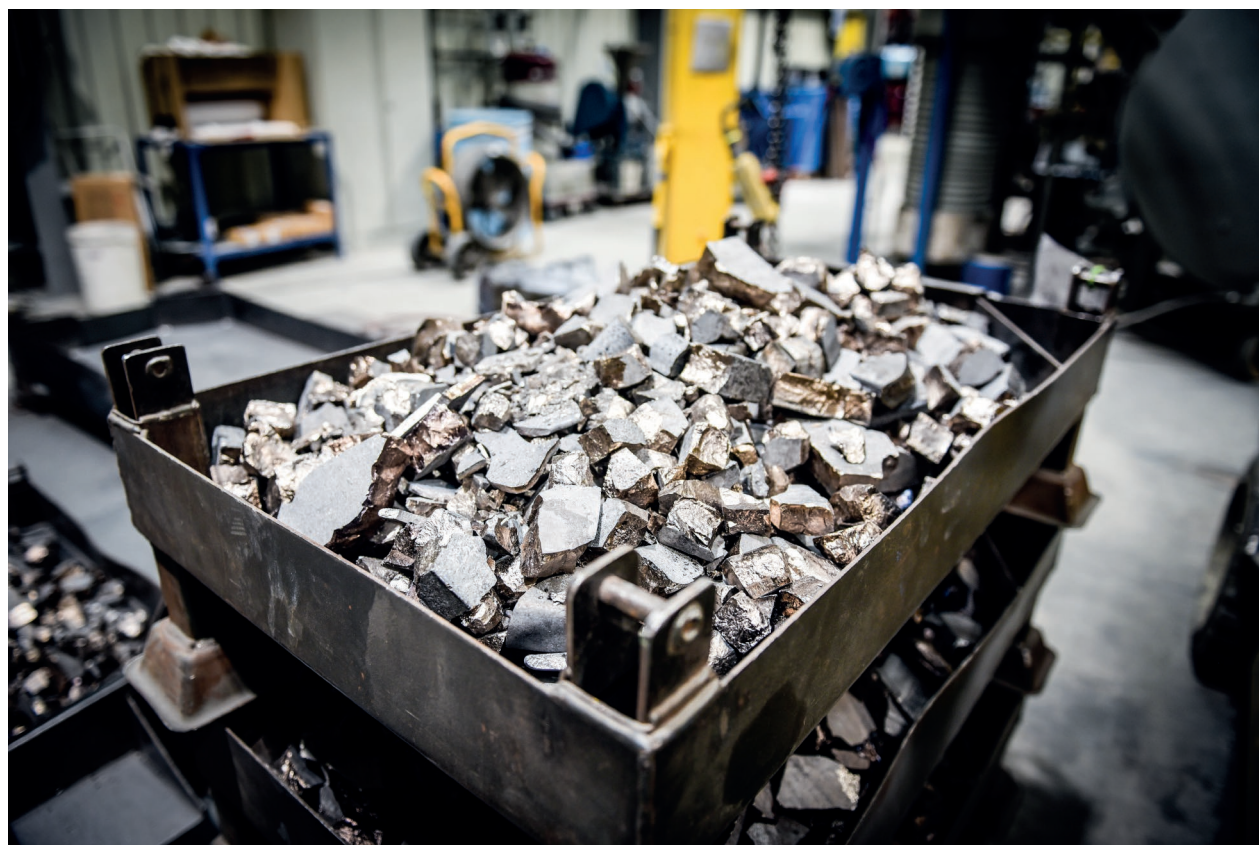
Dalradian is an extractive company adding value to the local economy. Dalradian's £750 million supply network will be within Northern Ireland, making it one of the biggest private sector investments of this generation. During the 20+ years of mine operation, 1,000 jobs will be created and 75% of spending is expected to be in NI. See case study on p. 82.

which will be in the local area. Owing to the technologically advanced nature of modern mining, mine development and operations will also help increase STEM and other skills in the region.

Exploration, Development & Processing

The UK boasts several critical minerals projects at various stages. There are five key exploration hotspots: the South West of England; North East of England; Wales; Scotland; and, Northern Ireland. Given adequate support, the UK has the potential to produce copper, lithium, nickel, platinum group elements, tin, tungsten.

However, the prospectivity of the UK has not been mapped. This task typically befalls a nation's geological survey. The BGS, underfunded and lacking resources to support metals and mineral extraction, has not consolidated historical data or created the modern datasets necessary to gain a better understanding of the UK's prospectivity.



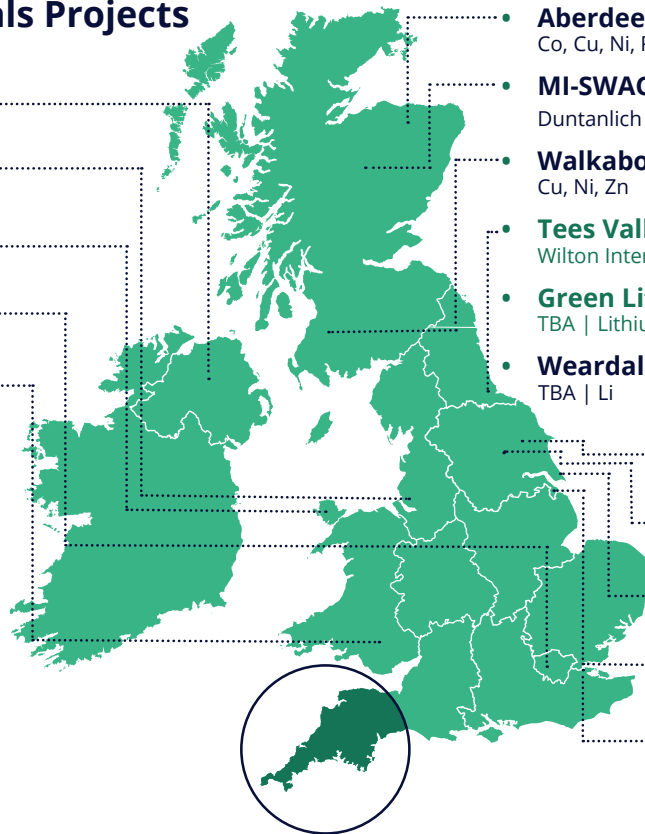
Source: Less Common Metals

UK's Critical Minerals Projects

- **Dalradian**
Curraghinalt | Cu
- **Less Common Metals**
Ellesmere Port | REEs
- **Anglesey Mining**
Parys Mountain | Cu, Zn
- **Vale**
Acton | PGMs
- **Vale**
Clydach | Ni

Green = exploration and mining projects

Blue = midstream and downstream processing projects



- **Aberdeen Minerals**
Co, Cu, Ni, PGMs
- **MI-SWACO**
Duntanlich | Barite
- **Walkabout Resources**
Cu, Ni, Zn
- **Tees Valley Lithium**
Wilton International | LiOH
- **Green Lithium**
TBA | Lithium hydroxide
- **Weardale Lithium**
TBA | Li
- **Peak Resources**
Tees Valley | REEs
- **ICL Boulby**
Boulby Mine | Polyhalite
- **Anglo American**
Woodsmith | Polyhalite
- **Pensana**
Saltend | REEs
- **Phillips 66**
Humber | Battery Coke



Redmoor project, Cornwall.
Tungsten, tin, copper.
One of the **largest undeveloped deposits** of its type in the world.

Employment Impact: ^{*}
- 200 Direct Jobs
Time to opening:
5 years
3 years Without govt. support



Trelavour & South Downs lithium in geothermal waters and in hard rock, Cornwall.

Innovative company exploring for lithium to play a significant role in UK-sourced **battery metals**.

Employment Impact:
- 100 Jobs



Time to operation:

5 years
3 years Without govt. support



South Crofty mine, Cornwall. High-grade tin and copper mine with long history of production.

Potential for rapid reopening. Recent copper and tin discoveries on additional mineral rights areas.

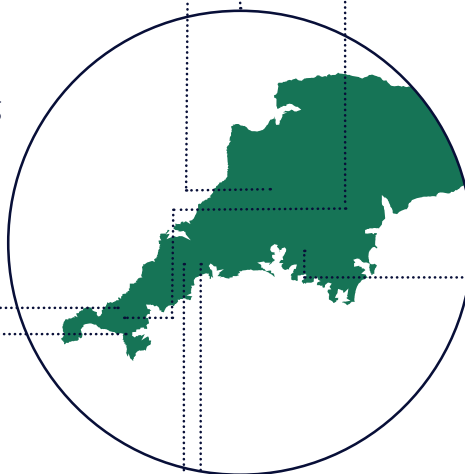


Great Wheal Vor Project, Cornwall. High grade tin; richest tin mine in world in 1800s.

Employment Impact:
- 200 Direct Jobs



Copper and tin exploration in Cornwall and Devon.



The Hemerdon mine is one of the largest tungsten deposits globally.

Employment Impact:
- 200 Direct Jobs



Hard-rock lithium exploration. Has identified lithium near St Austell, Cornwall.

Figure 16 – The UK has many opportunities for critical minerals extraction and processing domestically

Attracting Investment for UK Projects

If the UK wants to attract private investment for critical mineral extraction, processing, and recycling projects, it needs to demonstrate that it is open for business and that it has an internationally competitive operating environment. This can be done by the government providing an enabling environment and a smooth, predictable, supported process that offers certainty to investors and minimises investment risks related to government processes and policy. The 2021 Net Zero Strategy stated: 'The government is committed to working with industry and with international partners to safeguard these supply chains and our future economic resilience,' and committed to 'establishing an enabling environment for growing the sector in the UK.'

Policymakers, investors, and civil society must understand that certain fossil-derived products such as battery coke (used in electric vehicle batteries) are essential for green technologies until alternatives are economically feasible. Phillips 66 Limited is implementing ESG across its operations to help decarbonise the UK's transport sector. The UK Government should actively engage with the wider industry to enable a just transition, without simply avoiding fossil fuels based on public sentiment, and lack of foresight.

The Phillips 66 Limited Humber Refinery is already working to reduce emissions from its processes, with projects such as Gigastack and Humber Zero. The former aims to use renewable hydrogen to replace refinery fuel gas, while the latter looks to capture carbon directly from fluid catalytic cracker (FCC) stacks. Both would have a material impact on reducing CO2 emissions from the manufacturing process. See case study on p. 75.

UPSTREAM PLANNING AND PERMITTING

The UK's current planning and permitting system for critical mineral extraction, processing and surrounding industries need attention and improvement if the UK Government wishes to meet its Energy Security, and Environment and Climate Objectives.

Planning and permitting in the UK are important to ensure that mines are developed and operated responsibly. If the planning and permitting processes are delayed and/or protracted, as they have been for notable recent mineral developments in the UK, the development of critical minerals projects are likely to lose their competitive edge in terms of contributing to the UK's critical mineral supply chains in the coming years.

When regulatory authorities and other responsible bodies, such as the planning and environmental authorities (e.g. England Environment Agency, Scottish Environmental Protection Agency, Natural Resources Wales, Northern Ireland Environmental Agency), are assessing a project for planning or permitting decision-making, they are at the same time assessing a project for its ESG credentials. Decision makers must be adequately knowledgeable about all facets of a mining project to ensure that projects with positive ESG credentials are not unreasonably dismissed.

If we want to develop critical mineral extraction in the UK, the planning and permitting system needs to be supported to deliver timely and appropriate responses to applications for mining projects. It can take 10-15 years for an exploration project to become a producing mine due to the complexity of the process, including planning and permitting.

Prolonged and inefficient planning and permitting processes present big risks for both developers and investors. Many jurisdictions overseas have mining authorities that help to support companies and stakeholders through these processes and facilitate inter-agency alignment. Better resourced and more efficient planning and permitting processes for mineral extraction could facilitate the growth of the critical minerals extraction industry in the UK.

The UK, Scotland, Wales, and Northern Ireland should review their planning and permitting systems

for critical mineral extraction, processing, and surrounding industries, to ensure that:

- UK, Scotland, Wales, and Northern Ireland planning and permitting are aligned to international best practice ESG standards.
- Planning and permitting organisations are sufficiently resourced with decision-makers having expert knowledge (or access to experts) in mineral extraction and processing complexities and ESG.
- The UK develops internationally competitive domestic critical minerals which transparently embed international best practice on ESG.
- Critical minerals are deemed of national importance and planning and permitting timescales to reflect the urgency of the nation's need for security of supply, avoiding unnecessary delays.
- Roles and responsibilities across different decision-making bodies are clarified and clear to operators.
- Operators are well supported throughout the planning and permitting process in navigating multiple government agencies.
- Investors have confidence in a company's ability to operate to planned timescales in a predictable and stable environment, with planning and permitting processes providing minimal risk to their investment.

MIDSTREAM PLANNING AND PERMITTING ISSUES

Issues that have been raised for planning and permitting in the midstream sector are:

- Lack of understanding in the Environment Agency over certain “new” chemicals and materials including lack of experience with green energy materials.
- Lack of investment in government departments leads to staff shortages and long delays in getting information and feedback.
- Lack of government directives driving investment and growth in critical minerals, specifically related to streamlining the planning process.

There are also lengthy periods for the determination of environmental permits, in one instance an organisation had to wait almost a year for their permit. This could be related to a lack of resources at the Environment Agency (EA), but the EA officer assigned also did not understand the nature of the company's midstream process. At the same time,

the company was not well informed by the EA about the level and nature of the information they needed to provide.

The expectation that companies can hire specialist consultants to support these applications creates an unfair advantage for larger companies with more resources, as opposed to smaller companies who must navigate the process themselves. Smaller companies would benefit from greater support and advice, particularly technical support, on how to effectively and efficiently submit their permit variations when needed. There is scope for prioritisation in the EA's approval process to be better informed by the priorities of the central government, such as the importance of critical minerals and the urgency of, for example, developing an integrated rare earth supply chain within Europe.

Alignment with International ESG Standards

The Natural History Museum estimates that the UK only has 53% of its biodiversity intact, putting it in the bottom 10% of the world's countries for biodiversity intactness. With UK planning and permitting processes being applied to new mines for critical minerals, some of which may be in former mining areas, there are opportunities for these sites to be restored in a manner which increases ecological value in line with the biodiversity gain condition of planning permission in England as outlined in the Environment Act 2021.

In countries with well-developed mining industry, approval of mining projects is based on modern minerals legislation that provides for sustainable mining and complementary environmental permitting legislation. In the UK, the dominant legislation for approval of mining projects is

planning legislation, which does not recognise the unique features of metal mining projects, particularly in respect of how they are planned and financed. Environmental permitting is complementary to planning approvals and covers emissions, water use and discharges, extractive waste management, waste management, and the protection of biodiversity and cultural heritage. The permitting legislation is heavily influenced by EU legislation, having been transposed from EU Directives.

While the UK's rule of law is internationally renowned, its legislation around minerals extraction is outdated. One legislative update which would be helpful is for mining to have its category in the Environmental Permitting (England and Wales) Regulations 2016. And the Pollution,

Prevention, Control Regulations in Scotland, and Northern Ireland.

Mine closure plans require further consideration. Extraction companies should have appropriate plans and sufficient funds in place for closure and remediation from the start. Local authorities should not financially burden exploration companies from the outset. This hinders exploration and delays the financial benefits of mining to local communities. Closure plans are key to avoiding creating legacy issues for future generations, where contamination creates an environmental and public health risk. Remediation costs for historic mines have fallen on the government.

Many historic mines have not been remediated and continue to pollute the local environment. Modern mines should be designed with the end purpose in mind. This will lower the costs of site re-purposing and help to garner local support if the site will benefit the local community once extraction ceases.

The UK Government should commission a review of international best practice in funding mine closure, including early and unplanned closure, and develop national guidance on this. This might consider staged payment of closure cost bonds, or an insurance-backed equivalent, linked to magnitude and timing of project impacts; for example, expanding in line with the liabilities over the life of a project once construction starts, perhaps linked per tonne of production.

UK's historic mines and surrounding areas offer exciting geological opportunities for primary and secondary extraction.

This paper proposes that what needs to take place is a national expectation, and national support to ensure that decision-makers around planning and permitting have the knowledge and experience required around minerals extraction, processing and ESG (or that they are supported by experts) and that they are assessing a project based on international, industry-specific ESG standards relevant to a companies' stage of development, e.g. Global Industry Standard on Tailings Management, Towards Sustainable Mining, ICMM, IRMA. Decision-makers in Northern Ireland have applied Canadian ESG standards to projects in addition to UK legislation, to adhere to international best practice.

Decision-making on planning and permitting is devolved to the local level. However, many local authorities generally do not have:

- 1. The in-depth understanding of mining and associated technical issues needed to assess projects.**
- 2. A 'mining-focused mindset when it comes to evaluating projects (e.g. assessing a mining project through the same lens as an infrastructure project).**
- 3. An understanding of the mining sector, transnational processes and stakeholders that influence mining projects (e.g. investors, financial institutions, global standards, downstream manufacturers).**
- 4. Knowledge of the key ESG risks in mining, e.g. water impacts, and closure plans, which can be managed in the mine design or in the context of international responsible mining standards.**
- 5. Sufficient resources and capacity.**

From a Local Planning Authority perspective, there are several areas which, if addressed, could help support operators with the planning and permitting process. These are:

1. MINERALS SAFEGUARDING AREAS

- a. In order the value of a geologically prospective site to be considered as part of an LPA's decision making in an application for a site to be developed for non-mineral use (e.g. housing, infrastructure, world heritage site status), LPAs need data on where potential critical minerals/ minerals are located. With geological data, this can be used as evidence to counter competing demands. The BGS could reallocate its resources towards geological mapping in areas of high geological prospectivity, or Government could allocate funding towards geological surveys through the BGS or UKRI grants. This would not only encourage greater private investment and companies into the UK, it would also help LPAs to update their Minerals Safeguarding Development Plan documents (Cornwall Council has proactively published their Minerals Safeguarding Development Plan in 2018, but this is based on old mine shaft access due to the availability of other data at the time of its preparation . Further geological surveys would help in future updates of the plans)
- b. Mineral site allocations or preferred sites in an adopted Local/Minerals Plan provide more certainty that permission would be forthcoming but are more onerous to adopt (the LPA has to carry out far more detailed assessments etc.)

2. THREATS OF JUDICIAL REVIEW

- a. If people are opposed to a development, there is a tendency to attempt to find fault in the process through a judicial review. There can be several windows which can be points of legal challenge. With the threat of judicial review, LPAs can end up being overly cautious, for example changes to an aspect of a mine's proposal may result in the LPA re-consulting to ensure a transparent process but this would have obvious consequences in terms of delays. In mining things change, and there needs to be flexibility in allowing changes in a complex operation. Ensuring LPAs have resources for a legal advisor is key.

3. TWIN TRACK PLANNING AND PERMITTING

- a. Given certain overlaps in planning and permitting expectations, running planning and permitting in tandem, as a twin track, would be helpful. Good practice is for the LPA and Environment Agency (England) or SEPA/ NRW/ NIEA (Devolved administrations) to identify areas of overlap in reporting and to request the information at the same time from the operator.

4. PUBLIC PERCEPTION OF MINING

- a. Early operator engagement with local community and LPAs/key stakeholders in the planning and permitting process is key. It is very time consuming for LPAs to have to go through large quantities of submissions of objectors and identify issues raised. Local community support for a project through continued operator engagement could reduce the number of submissions, and is integral to the 'Social' element of ESG.

National governments should work together to write a paper demonstrating how UK critical minerals extraction and processing display best-in-class ESG, and use this paper to attract inward investment from overseas.

By ensuring planning and permitting decision-makers have sufficient knowledge and expertise (or access to an expert), adding mining to the legislation - Environmental Permitting (England and Wales) Regulations 2016, and having a national expectation that planning and permitting are aligned to international ESG standards, the UK, Scotland, Wales, Northern Ireland will be able to demonstrably promote their domestic projects internationally as best in class ESG operations.

Recommendations-An Enabling Domestic Environment

The CMA recommends that the UK Government:



1. UK Government to provide a Statement of Commitment recognising the importance of domestic Critical Minerals.

To speed up the planning and permitting process and to meet the increased demand expected for critical minerals, our recommendation is to support and facilitate planning and permitting for Critical Minerals as commodities deemed of national importance for the UK's strategic ambitions. There would need to be a clear process/policy defined for this. It will be important to define which critical minerals are of national importance. A Critical Minerals List commissioned by UK Government BEIS, once published in 2022, will be a start. The National Planning Policy Framework refers to aggregates but not critical minerals and metals, this should be updated. There is also currently no National Policy Statement for Critical Minerals.

The National Planning Policy Framework defines minerals resources of local and national importance as:

"Minerals which are necessary to meet society's needs, including aggregates, brickclay (especially Etruria Marl and fireclay), silica sand (including high grade silica sands), coal derived fly ash in single use deposits, cement raw materials, gypsum, salt, fluorspar, shallow and deep-mined coal, oil and gas (including conventional and unconventional hydrocarbons), tungsten, kaolin, ball clay, potash, polyhalite and local minerals of importance to heritage assets and local distinctiveness."

Government BEIS, once published in 2022, will be a start. The National Planning Policy Framework refers to aggregates but not critical minerals and metals, this should be updated. There is also currently no National Policy Statement for Critical Minerals.



2. Critical Minerals to be deemed of National Importance

- a. National Planning Policy Framework and Planning Practice Guidance to include critical minerals as 'mineral resources of local and national importance.'
- b. Giving timely consideration to planning and permitting applications for critical minerals as commodities deemed of national importance for the UK's strategic ambitions.

"A material consideration is a matter that should be taken into account in deciding a planning application or on an appeal against a planning decision."

Critical mineral extraction project planning and permitting applications are in the same category as any other applicable planning application.

Given the central pillar of critical minerals in the government's Net Zero Strategy, their planning applications should be given significant attention by local authority decisionmakers, but there is currently no incentive for these complex applications to be given timely consideration in the system. Applications should continue to be rigorously assessed with high standards applied, but applications could be encouraged to move through the planning/ permitting process in a timelier manner.

- iii. Define what material considerations are to planning permission and permits. It would be helpful for government and stakeholders to define and agree on what is and isn't 'material' to an application. For example, there have been several applications for projects, which have been in dispute over the environmental impact of the end product rather than the project itself.



3. Creation of a coordinating body / mining agency / national government coordinator(s) / minerals expert(s) who act as POCs for mining companies to navigate different agencies (e.g. local planning authorities, Environment Agency (EA)).

In many countries, mining agencies and geological surveys promote their mineral extractive prospects to attract international investment and diversify their economy. The UK does not do this. A written statement or an open event where a minister offers a statement of commitment and explains how the UK's critical mineral sector will be supported would be welcome. Without UK Government support, companies will choose to invest in other countries with significant loan facilities, and supportive mining agencies, because of the risk of investing in a project with unreasonably long planning/permitting processes, and where decisions can be revoked for political reasons, is too high.



5. For mining to have its category in the Environmental Permitting (England and Wales) Regulations 2016. And the Pollution, Prevention, Control Regulations in Scotland, and Northern Ireland.



4. Practical Support & Resources to Local Planning Authorities and decision-makers to increase capacity and expertise in decisionmakers

- a. Create a planning policy framework and short written guidance to help officers to undertake decision-making in critical minerals planning and clarify roles and responsibilities across decision-makers. This written guidance should also include a best practice template for operators to support them through the process
- b. Supporting LPAs with expert knowledge of mineral extraction, processing, ESG standards
- c. Clarify roles & responsibilities of existing decision-makers for operators and the National Government to understand where various agencies come in through the process, and who is accountable for the process/ making the decisions



6. Review UK Mine Closure expectations and align these with international best practice internationally

Conclusion

Significant forward planning by Governments is urgently required to prepare for increasing demand for responsible critical minerals to meet Government ambitions for Net Zero.

Actions, not words, are needed to develop the UK's potential as a world class champion of ESG compliant critical minerals. Government can break down the barriers outlined around access to capital, ESG standard alignment and verification, a talent pipeline, and a domestic enabling environment. Government championing the importance of critical minerals for Net Zero and the Green Economy, would lead to greater widespread awareness of the materials needed to fight climate change.

The CMA looks forward to government strategy taking on board these policy recommendations and breaking down barriers for responsible sourcing of critical minerals.



Figure 17: Breaking down barriers for responsible sourcing of critical minerals. Exploration for critical minerals in South West England uses hay bales for both noise attenuation and to reduce visual impacts of drilling, in sensitive areas. Hay bales are not always required, each drill site needs to be assessed following noise surveys and site inspections, as well as discussions with the community. Source: Cornwall Resources Ltd

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Appendix A - Case Studies

Less Common Metals – Community Engagement

Less Common Metals (LCM) has carried out several community engagement projects and views them as crucial to reconnect the next generation with raw materials present in their daily lives. LCM is building key community relationships through local community groups, science museums, education, and local representatives.

The public needs the opportunity to interact with the mining and metals industry to learn about the role of metals and materials in green and future technologies. Education of local communities helps to inspire young people to understand the necessity of metal and mineral processing and see the value in LCM's work.

LCM has been working with a Belgian Company, Prospex Institute, to promote the SecREEs project (Secure European Critical Rare Earth Elements) which is funded by Horizon 2020. During the lifetime of this project, LCM has engaged 200 local citizens from the age of nine years old up to 70 years old.

Other outreach activities include:

UNIVERSITY ENGAGEMENT

LCM delivered a seminar talk at the University of Chester about critical minerals and hosted a tour of the premises for course leaders.

LCM intends to support Glyndwr University which is organising a STEM day for local Year 10 students from disadvantaged areas who and as a result are less likely to enter higher education. LCM will partake in this day in July 2022 and construct an engaging session about the rare earth industry to help inspire and motivate young people to continue their studies as there are ample career opportunities in the industry that can facilitate social mobility.

KNUTSFORD SCIENCE BAR

Seminar talk at Knutsford Science Bar about the importance of critical minerals. Predominantly, this attracted people over 50 years of age.

OUTREACH INTO SCHOOLS

LCM, Prospex Institute and Xplore! worked together to create and deliver workshops to Year 5 and 6 children at Childer Thornton, Whitby Health and Ysgol Rhos Helyg primary schools. By covering the six steps of the supply chain in a fun and interactive way LCM was able to teach children about mining, extraction, and separation, crushing, heating and moulding alloys, production of permanent magnets and, permanent magnets in EVs. These sessions were tailored to fit in with the National Curriculum by linking it to geography and chemistry. Mining and extraction, and material science are not part

of the curriculum despite their integral role in society.

ENGAGEMENT WITH LOCAL POLITICIANS

Site visits, local newspaper attention and helping Justin Madders MP for Ellesmere Port and, Chris Matherson, MP for Chester to understand the industry including challenges and opportunities.

YOUNG CHAMBER – WEST CHESHIRE AND NORTH WALES CHAMBER

LCM are part of the Young Chamber which is an arm of the West Cheshire and North Wales Chamber, created to benefit local schools and colleges. LCM's role within the Young Chamber is to facilitate young people with mock CVs, interview questions, and career talks and help bridge the gap while acting as a mentor.



Source Certain – Provenance Verification

Source Certain scientific technology, TSW Trace® enables the verification of the origin of input materials with specificity to the mine of origin. This can set the foundation for more trusted and resilient critical mineral supply chains by enhancing the integrity, transparency, trust and compliance behind origin-based claims (ESG) associated with critical minerals. TSW Trace® works alongside blockchain and certifications so clients can leverage the combined power of provenance science, certification, unique identification and information sharing to drive the highest standard of integrity within their supply chain.

Source Certain scientifically links the raw and processed materials carrying the ESG claims back to the mines and downstream processing facilities that deliver on those ESG claims. In doing so, it helps mitigate the risk of 'greenwashing', introduces transparency into the supply chain and allows a scientific and independent verification of product and origin claims carried within a digital or paper-based chain of custody or traceability systems.

TSW Trace was first applied to link stolen or smuggled gold back to its mine of origin and was often referred to as 'gold fingerprinting'. TSW Trace® was used to assess forensic evidence in criminal investigations globally including several high-profile cases.

This scientific technology analyses the relationship between a product and its

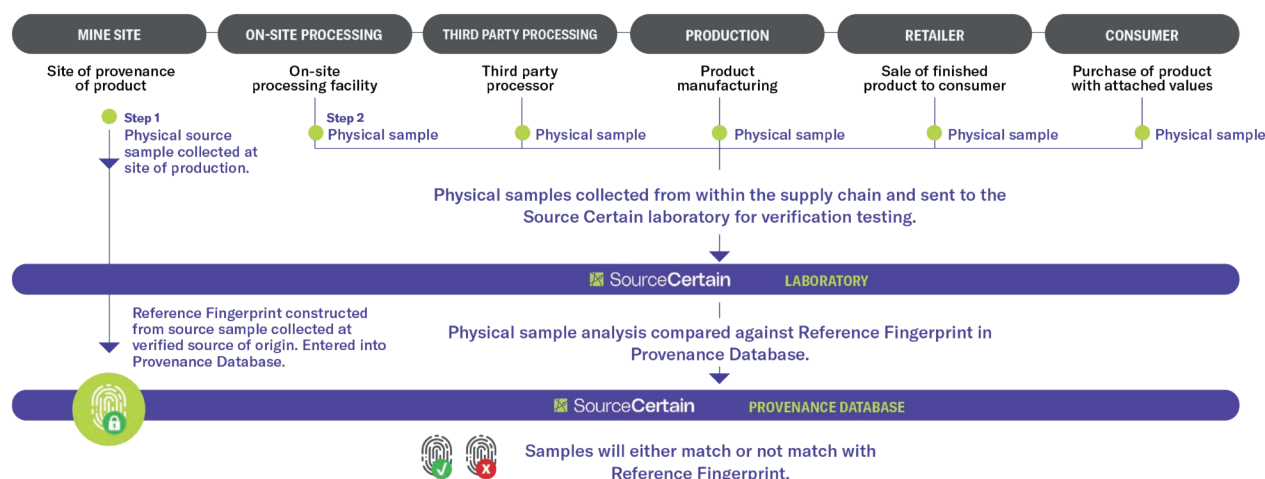
environment by analysing trace elements, isotopes, chemicals, and molecules that are naturally absorbed by the product from the environment. We use this information to create a unique reference chemical fingerprint for the product and its matching location of origin. This fingerprint allows us to verify a product back to a specific point of origin from any point in the supply chain.

A good practical example of this is the collaboration between Source Certain and Cornish Lithium. This project intends to address growing consumer interest in product provenance and ethical sourcing.

Source Certain plans to apply its scientific provenance verification technology TSW Trace® to establish a reference database of all Cornwall-sourced lithium. The samples in the database would then be cross-referenced against lithium in the battery supply chain to verify its UK origin.

Cornish Lithium and SCI are hopeful their work will form a foundation for developing a transparent and accountable lithium supply chain for batteries in the UK.

Source Certain's provenance technology will provide the level of precision to verify the origin of lithium mined by Cornish Lithium.



Phillips 66 Limited – Battery Coke

The Phillips 66 Limited Humber Refinery, situated near the mouth of the Humber River in North Lincolnshire, UK, is uniquely positioned as the only European producer of battery coke, a graphite precursor material used in battery anode production. Phillips 66 Limited is part of the larger Phillips 66 group that also produces battery coke in the US. As such, the company and its refinery stand to play a critical role in the development of the local battery supply chain and carbon emission reduction efforts as electric vehicle and stationary storage demand grows.



Phillips 66 produces battery coke at the Humber (UK) and Lake Charles (US) refineries through a process known as delayed coking.



This high-quality grade of coke undergoes further processing to make synthetic graphite.



The synthetic graphite is then used in the manufacturing of anodes, which are critical components of lithium-ion batteries.



These are the same high-performance batteries that power EVs, personal electronics, medical devices and grid storage.

Phillips 66 Limited exports most of its battery coke to synthetic graphite manufacturers in China. Given the UK and European governments' desire for greater domestic production, increased energy security and upcoming Rules of Origin legislation for manufacturing, the benefits of increasing the value chain in the region are being considered.

At the environmental level, there is the potential for reductions in transport CO₂ emissions in line with UK's and Europe's strong environmental standards. The Humber Refinery is already working to reduce emissions from its processes, with projects such as Gigastack and Humber Zero. The former aims to use renewable hydrogen to replace refinery fuel gas, while the latter looks to capture carbon directly from fluid catalytic cracker (FCC) stacks. Both would have a material impact on reducing CO₂ emissions from the manufacturing process.

The end-use product of battery coke, used within batteries in EVs, will support the reduction of CO₂ emissions within the transport sector, the largest emitting sector in the UK.

These and other initiatives stand not only to advance the decarbonisation of heavy industry but provide economic benefits to the local communities through the creation and maintenance of local jobs. On the social side, expanding the value chain in the UK and Europe will ensure safety and labour conditions for the workforce based on the values, processes, and regulations of the region.

Battery coke produced by the Phillips 66 Limited Humber Refinery is already contributing to the energy transition. By developing the battery value chain in the UK and Europe, the Humber Refinery can play a key role in advancing environmental, social and economic progress, as well as the security of energy as the local and regional battery economies, evolve.



Figure 13 – The UK has many opportunities for critical minerals extraction and processing domestically

Circular – Blockchain

Circular is a global technology business that enables customers to gain visibility into their supply chains, demonstrate responsible and ethical sourcing, and prove their ESG and GHG goals. Circular has extensive experience with EV battery materials, tracking lithium, copper, graphite, manganese, cobalt, mica, and nickel.

Circular technology allows businesses to track the physical flow of critical materials from extraction to final production and recycling, as well as associated ESG characteristics and embedded carbon across Scope 1, 2, and 3 emissions. Businesses can then make decisions to improve responsible and ethical sourcing and sustainable production across their supply chains.

As the world electrifies its energy and transport sectors, greater emphasis is placed on where and how critical materials are sourced. For the mining industry, underpinning ESG performance is crucial to differentiate and add value to the downstream. In March 2022, Circular partnered with Rock Tech Lithium to do just this.

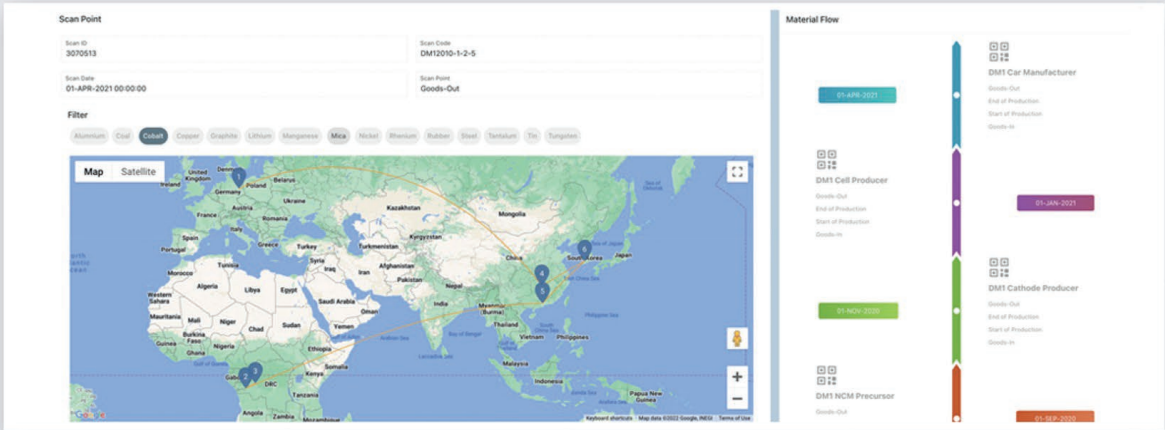
Rock Tech Lithium is a Canadian company extracting raw material for the lithium hydroxide from its mine in Ontario. Their planned battery-grade lithium refinery in Brandenburg, Germany will produce 24,000 metric tons of lithium per year – enough for the batteries of half a million EVs. Their goal is to produce lithium with the lowest possible environmental impact and to ensure that 50% of materials come from recycled batteries by 2030.

This partnership will give Rock Tech clear proof of origin of the lithium as well as embedded CO2 emissions and in the future, the recycling rates at the facility. To do this, Circular applies a combination of technologies, including blockchain, to create a digital twin of materials and track the physical flow from source through the manufacturing processes to provide an immutable record of provenance, activity, and compliance.

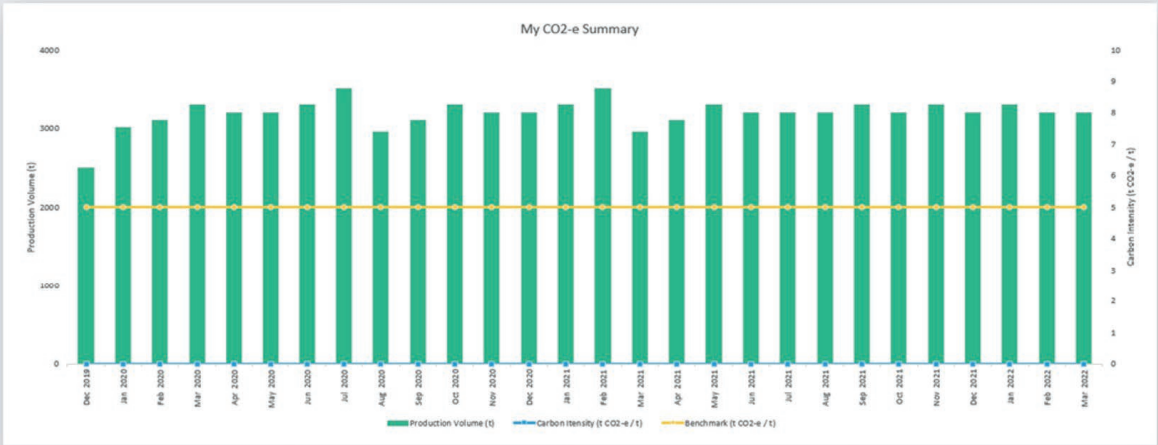
With the holistic documentation of its value chain, Rock Tech sees that it will create decisive added value for its customers, giving them proof of origin. Together with Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT, Rock Tech will create a material passport for its product.

“Unlike other traceability solutions, we track the actual material as it flows through the supply chain, not just the transactions between participants. This means we can track the material and emissions at each step, creating accurate and insightful information about the embedded CO2 so that our customers can better serve their customers,” Circular CEO and Founder Douglas Johnson-Poensgen explains.

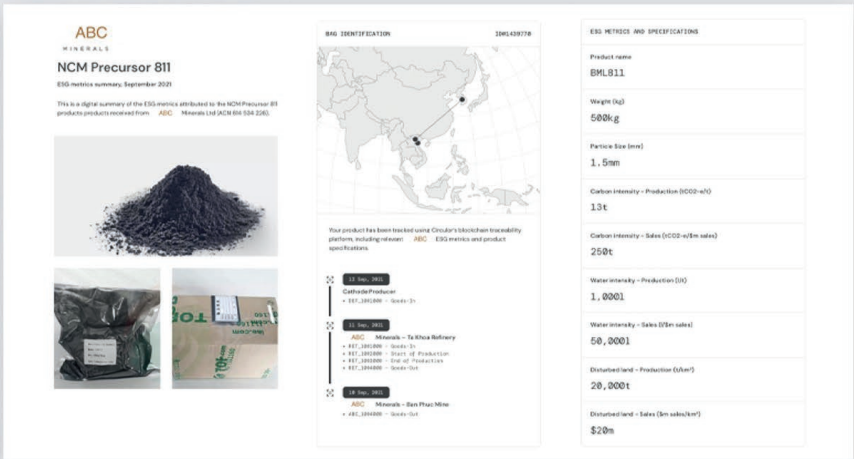
1. Material journey to customers



2. CO₂ intensity linked to the flow of materials



3. ESG token



Note:
All graphs /
images are
for illustrative
purposes using
test data.

Horizonte – Biodiversity

Horizonte Minerals is developing two, nickel projects in Pará State, Brazil. In May 2022 Horizonte commenced the construction of the Araguaia nickel project (ANP) which is in a transitional area between the Brazilian Amazon and Cerrado Biomes. The project area has historically been cleared for agriculture - cattle grazing or crops (pineapple and corn/maize) – and is now mainly characterised by modified habitat.

To quantify the potential of the project's impact on biodiversity, extensive baseline studies were conducted from 2013-2014 and expanded in the period 2017-2018. These studies and a Critical Habitat Assessment (CHA) conducted in 2018 and updated in 2021, have established a comprehensive understanding of the existing species richness and diversity of flora and fauna.

The studies identified that of the approximately 1,726 hectares of land expected to fall within the area of direct impact:

- some 71% were found to be modified habitat (primarily pasture and farm);
- 24% is natural habitat (discrete areas of metallophile savannah, open ombrophile forest and aquatic and hydromorphic habitats) and;
- 5% is critical habitat.



Project site in March 2022.



Native plant nursery in July 2022.

Horizonte has developed a Biodiversity Action Plan (BAP) that has as its core objective, a minimum of no net loss of biodiversity in natural habitat and the goal of net positive impact (NPI) or a net gain of critical habitat. The mitigation hierarchy of the BAP considers prevention (and avoidance), minimization and restoration before compensation:

PREVENTION/AVOIDANCE

- Horizonte has already redesigned part of the Araguaia south layout to reduce intervention in critical habitats and continues to explore options for further optimisation.
- Additional avoidance of impact on biodiversity and critical habitats is expected to be achieved by:
 - Design optimisation for the cooling water dam that is likely to result in a reduction in footprint;
 - Re-design of the water abstraction point proposed for the Arraias River, removing the originally proposed floating barge and pumping system, with a less invasive channel diversion from where water will be abstracted; and
 - Water pipeline design modification, so that the project water pipeline will be buried to reduce interference to animal movements that would result from an above-ground pipeline.

MINIMISATION

To minimise loss resulting from vegetation clearing, Horizonte has implemented a Germplasm Rescue Program (flora), where plant propagules including seeds, fruits, tubers and seedlings are collected, stored and later propagated for revegetation - conserving not only the species diversity but also the genetic diversity of these species.

RESTORATION

In addition to mine-site reclamation, Horizonte has committed to enhancing biodiversity through an array of actions including:

1. Protection of areas of critical habitat that are not currently within legal reserve areas;
2. Restoring riparian vegetation and habitat adjacent to springs and water courses impacted by agriculture, and protection of these areas through the establishment of buffers; and
3. Undertaking revegetation and reforestation of pasture and farm areas with native and endemic species;

These will have the outcome of creating wildlife corridors and improving buffer areas, reducing-edge effects and enhancing and/or re-establishing ecosystem services.

In support of these actions, the company established a nursery in 2017 and has been propagating native species for forest restoration. This nursery is now undergoing expansion, to enable an annual production of some 80,000 seedlings and is being complemented by the construction of a Biodiversity Conservation Centre that will be utilised for a variety of environmental education programming.

COMPENSATION

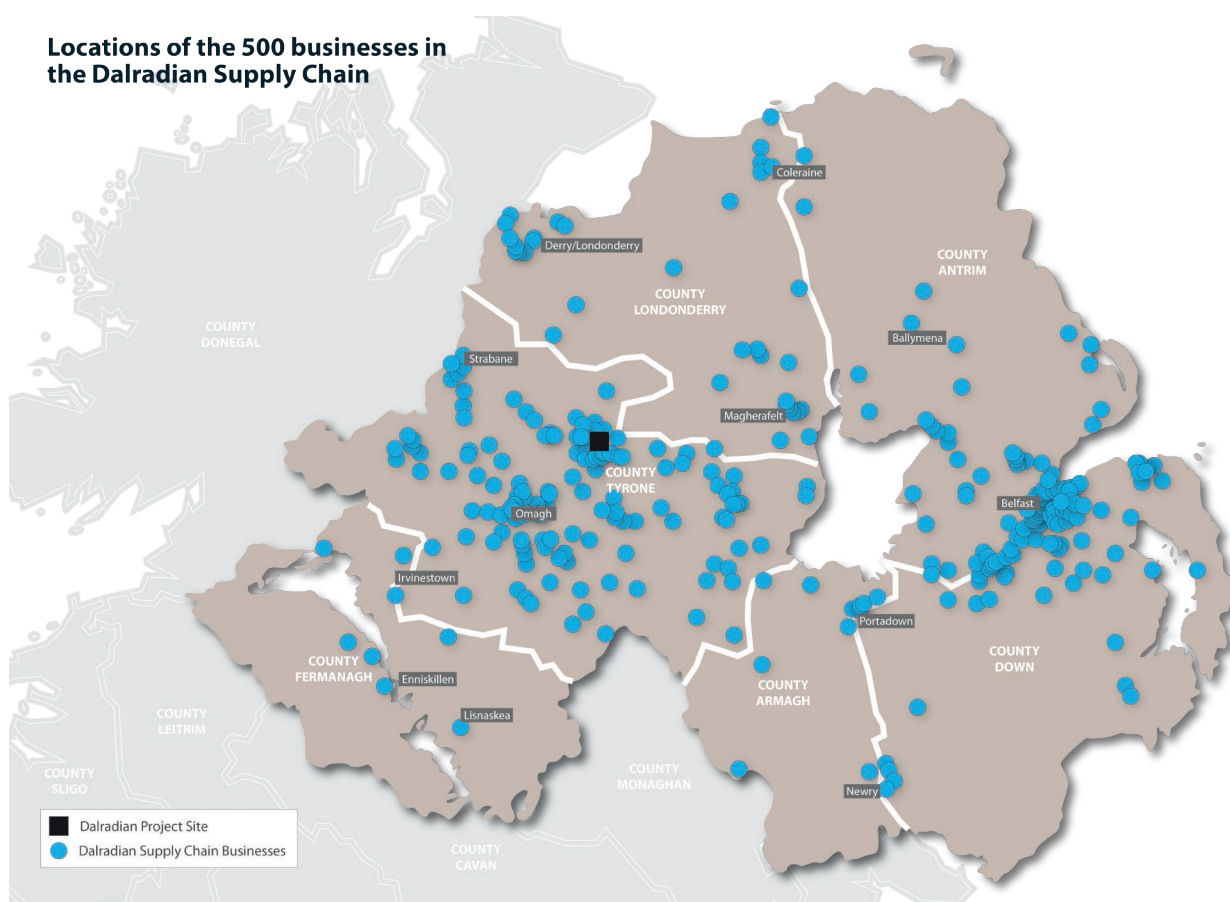
Horizonte has an Environmental Compensation Program agreed with the Environmental Compensation Chamber of Pará (CCA) which will see Horizonte invest an agreed amount of funds into one or more conservation units located within the State as directed by the CCA. This program achieves the International Finance Corporation PS 6 requirement for 'set-aside' compensation – that is, land of higher biodiversity or ecosystem services value is set aside and excluded from development for the implementation of conservation enhancement measures.

Dalradian – Indirect Benefits of Mining

Dalradian has been advancing its plans for a modern underground gold-silver-copper mine in Tyrone, Northern Ireland since late 2009. The project is currently in the final stages of planning, with the planning application having been referred to a public local inquiry. Dalradian has been supportive of this approach since the submission of the application in 2017 since it is aligned with an open and transparent public examination of the proposals.

The application builds on the work of the Bulk Sample Programme of 2014-2015. Dalradian has begun working with existing and potential suppliers to encourage higher ESG standards, particularly concerning carbon emissions, since Dalradian's planning application commits to operating one of Europe's first carbon-neutral (net zero) mines. Dalradian has partnered with NI Chambers of Commerce and other business groups at Meet the Buyer events to inform them of the opportunities the mine presents as well as their strong preference to work with suppliers that have a process and a plan to further develop

ESG within their businesses.



In the exploration phase of the project since 2009, Dalradian has already worked with more than 500 suppliers in Northern Ireland and invested over £130 million in advancing the project, including the Bulk Sample Programme.

£750 million of Dalradian's supply network will be within Northern Ireland, making it one of the biggest private sector investments in this generation. During the 20-plus years of the mine operation, 1,000 jobs will be created and 75% of spending is expected to be in NI. This presents an outstanding opportunity for UK businesses to grow and improve their environmental and social performance as they partner with a mine producing the raw materials necessary for modern life.

Dalradian is advancing its mining project against a unique backdrop – the West of Northern Ireland is already known for designing and manufacturing more than 40% of the world's mining and quarrying equipment. Dalradian believes its development of a technologically advanced underground mine can further enhance the region's expertise and skills in this area by developing an Engineering Centre of Excellence. To that end, the company has already met with many of the local equipment suppliers and facilitated site visits for local engineers, many of whom have never been underground before, even though they design and build equipment for underground use.

The NI industry is already active in this regard through MEGA (Manufacturing & Engineering Growth & Advancement) which brings together local government (Mid-Ulster District Council and Invest NI), industry (30 local companies active in manufacturing and engineering of mining and quarrying equipment) and higher education (South West College and other advanced education organizations) in a partnership to build awareness and/or recruit to engineering programmes and build local skills feeding into material handling sector.

Dalradian is also aiming to create a centre of excellence for environmental protection. To date, the company has worked with the local community association on river and wetland enhancements as well as starting a nursery for native tree species. Dalradian has committed to a £15 million training program at the mine to maximise local employment during the two years of construction and first year of operations. The company has already supported 35 internships and 23 bursaries at a local college during the exploration phase of the project.

These are the seeds that have the potential to grow into a strong new industry for Northern Ireland and the UK, particularly given a nurturing environment of supportive government policies, legislation, and regulation.

Tungsten West – Challenges in Decarbonisation

Tungsten West plc is a junior mining company set up to restart tin and tungsten mining operations at Hemerdon Mine, Devon, England.

Due to higher power prices, Tungsten West is now exploring technical options to reduce the amount of energy consumed by the operation and to develop renewable energy technologies onsite. By far the most attractive of these options is to install wind turbines.

Tungsten West purchased the Hemerdon Mine site in November 2019 and commissioned a feasibility study for mine restart. The study was completed in March 2021. Following a public listing and capital raise, Tungsten West prepared to implement the feasibility study design.

Key inputs into the feasibility study design included project costs (CAPEX) and mining and processing costs (OPEX). As global economies recovered from the COVID-19 epidemic in 2021 the demand for energy (both kWh and diesel) led to a sharp increase in energy prices putting pressure on some of the CAPEX and OPEX assumptions within the feasibility study. The UK's energy supply is over reliant on gas, so when the gas price spiked so did energy prices. Long-term forecasts do not predict power prices normalising back to pre-2020 levels for several years.

In February 2022, Russia invaded Ukraine and in April 2022 the UK government removed the red diesel rebate from most sectors including mining. With Russia exposed to Western sanctions, energy costs increased further, and Tungsten West made the decision to pause the implementation of the feasibility study design until a lower CAPEX and OPEX solution could be developed at Hemerdon.

Tungsten West is looking to implement renewable energy on site in the form of onshore wind turbines. However, the long lead times in planning and, permitting for building offshore wind turbines, even on industrial brownfield sites, make the reality of developing renewable energy sources extremely difficult. This is counterintuitive, given the UK Government's Ten Point Plan for a Green Industrial Revolution and the Prime Minister's vision to transform the UK into 'the Saudi Arabia of wind.' The UK Government's strategies commit to being a world leader in transitioning to Net Zero, but the reality is, the systems in place are not yet accommodating to deliver this.

The National Planning Policy Framework for England and Wales states that any new wind turbine in England must be on a site designated for wind in a local plan and have met the planning concerns of the local community and therefore have its support. The Plymouth, West Devon and South Hams joint local plan (adopted in 2019) states wind turbines must be designated in a neighbourhood plan, developed by local parishioners. The process is expected to be long and drawn out and it will be challenging to get consensus support for wind turbines. A long, unwieldy, and unpredictable process makes attracting investment for such a renewable energy project difficult. Officers in the local council accept that the mineral operation could be supported by opportunities to develop renewable energy to support Net Zero goals, but the current national planning policy would restrict the opportunities in this location due to its advice on land based wind generation.

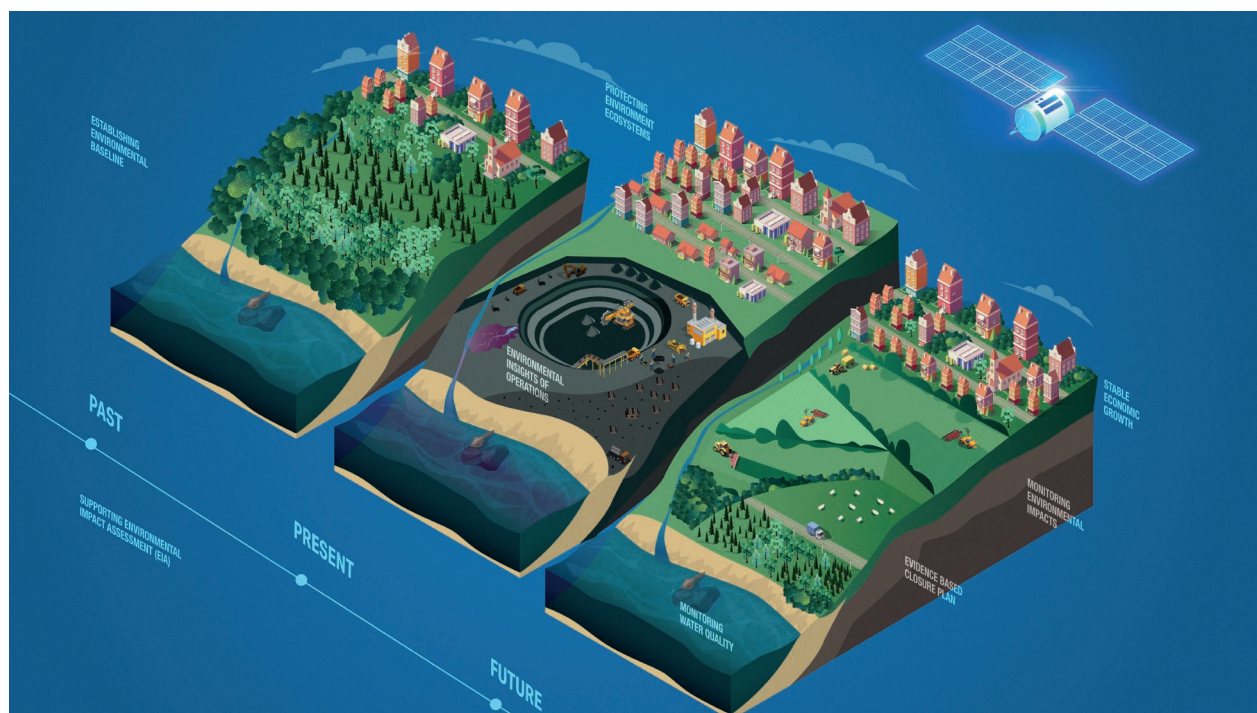
As a direct result of current national planning policy, a critical mineral designated site is unlikely to be able to develop a renewable energy solution in the timescales required. In the immediate future, Tungsten West will not be able to transition to wind energy despite the environmental and cost benefits this would bring but welcomes government support in the hopes that more straightforward processes will lead to greater proliferation of renewable energy.

Tungsten West is exploring other renewable opportunities for the site however none of the other options available to Tungsten West can provide the consistency of power required for the processing plant which operates 24/7.



Satellite Applications Catapult – ESG Investment

Satellite technology has an increasingly important role throughout the mining lifecycle and the Satellite Applications Catapult believes accelerated adoption is critical to support sustainability and delivery of the new Green Industrial Revolution.



Satellites are used in our daily lives, whether it be to observe the world and how it is changing, to communicating in the hardest to reach areas of the world or when we navigate to a new place.

The applications of satellite technology are diverse and can be applied across multiple sectors. For example, in environmental monitoring, these can include land cover analysis, detection of deforestation, vegetation analysis, understanding soils and geology, detecting pollution, water quality, atmospheric changes and many more.

In the UK, the Satellite Applications Catapult, under the Satellites for Batteries programme, has been leading work in the South West to investigate how satellite earth observation can use multiple proxies to identify critical minerals. The consortium brings together leading UK mining, geology, earth observation and machine learning organisations and is composed of Cornish Lithium, British Geological Survey, University of Exeter: Camborne school of mines, CGG, Terrabotics, Pixalytics, Decision Lab and Globaltrust. Building upon a successful discovery phase, the consortium is keen to identify funding to progress to an implementation phase and looks to consolidate work undertaken in Cornwall and expand to other relevant regions of the UK and examine export potential.

Internationally, the Catapult has partnered with the British Geological Survey to work on the Li-Bol initiative, which involved the development of a framework for earth observation and the modelling of Lithium Brine deposit formation. This work was focused on Bolivia's Salar de Uyuni, the world's largest salt flat. We explored how Lithium brine deposits form, where the water and solute come from, and how abstraction affects the mass balance inside the salar.

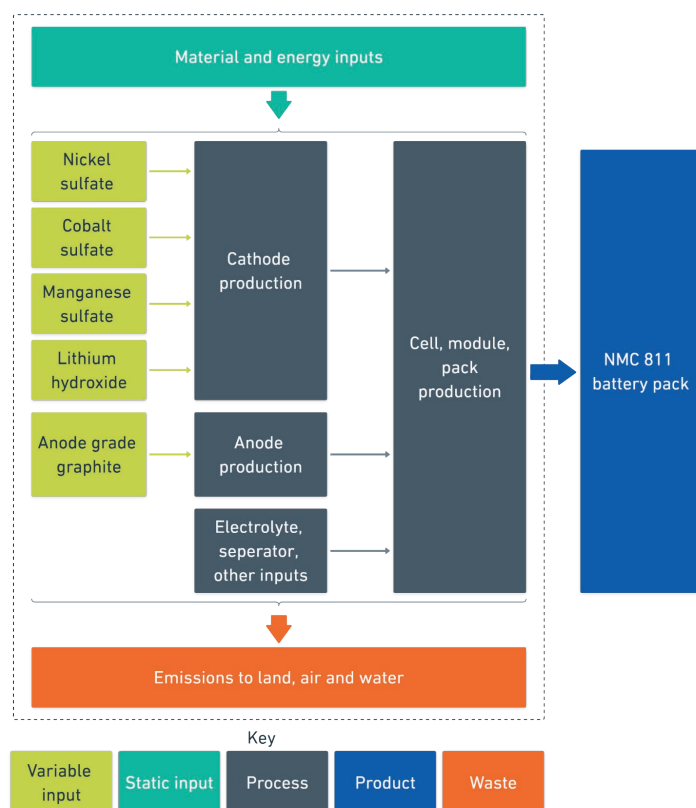
Globally, when considering the mining life cycle, a high profile and current issue, which has attracted significant attention and focus from organisations such as the Church of England pension's board, is tailings management. Tailings dams are embankment dams constructed to contain and store the tailings waste of mines. Their ongoing maintenance and monitoring is however crucial to protect surrounding communities from catastrophic failure or seepage. Monitoring these tailing dams can be problematic and challenging depending on location, resources or ability of operators to monitor these assets. Satellites have a role in the cost-effective monitoring of tailings dams to help us all understand the risk they pose. The potential consequences of tailings failure are high from a human, environmental and financial perspective, and there are further benefits of satellite technology where tailings storage facilities are in remote and hard to access locations. The intelligence that satellite technology provides can generate up to date, independent information on tailings storage facilities. When combined with

on the ground knowledge and geotechnical expertise of the tailings facility, this global reach allows increased monitoring capability and the ability to detect and intercept earlier anomalous movement.

In summary, there are opportunities right from the start of the mining lifecycle, for example looking at wide area exploration for battery metals and other critical minerals through to environmental and social baselining, future energy modelling such as renewables through to volumetric analysis, detection of illegal mining, right through to evidence based closure plans. The underlying technologies exist, it is now all about adoption.

Minviro - Life Cycle Assessments in the Battery Supply Chain

No other downstream technology demonstrates the need for LCA in the raw materials space as well as lithium-ion batteries. The demand for batteries, primarily used for electric vehicles, is set to increase global demand for lithium by 90% , and this is only one material component in a final battery cell. Nickel, cobalt, manganese, graphite, aluminium, and copper are all facing heightened criticality as the world races to establish widespread decarbonisation strategies while weaning off fossil fuels. It is of paramount importance to recognise the environmental risks associated with this surge in demand, and LCA is an ideal tool to help establish sustainable practices in the supply chain,



Minviro has completed numerous commercial battery LCAs, most recently for Tesla as part of their 2021 Impact Report and has produced a whitepaper highlighting the differences in environmental impacts by varying the choice of key raw materials . This battery LCA model was constructed for the production of an NMC-811 battery, using a consistent methodology, Most material and all energy inputs were kept the same throughout the LCA process.

Minviro used its LCA database of different primary production source regions/hosts, extraction methods and processing routes for lithium hydroxide, nickel sulfate, cobalt sulfate, manganese sulfate and graphite supply and showed different scenarios for how a company's choice in upstream supplier can affect the overall embodied climate change impact of manufacturing a battery.

Figure 18: System boundary for an LCA of an NMC-811 lithium-ion battery. Source: Minviro.

Climate Change Impact of NMC-811 Battery Pack

kg CO2 eq. per kWh

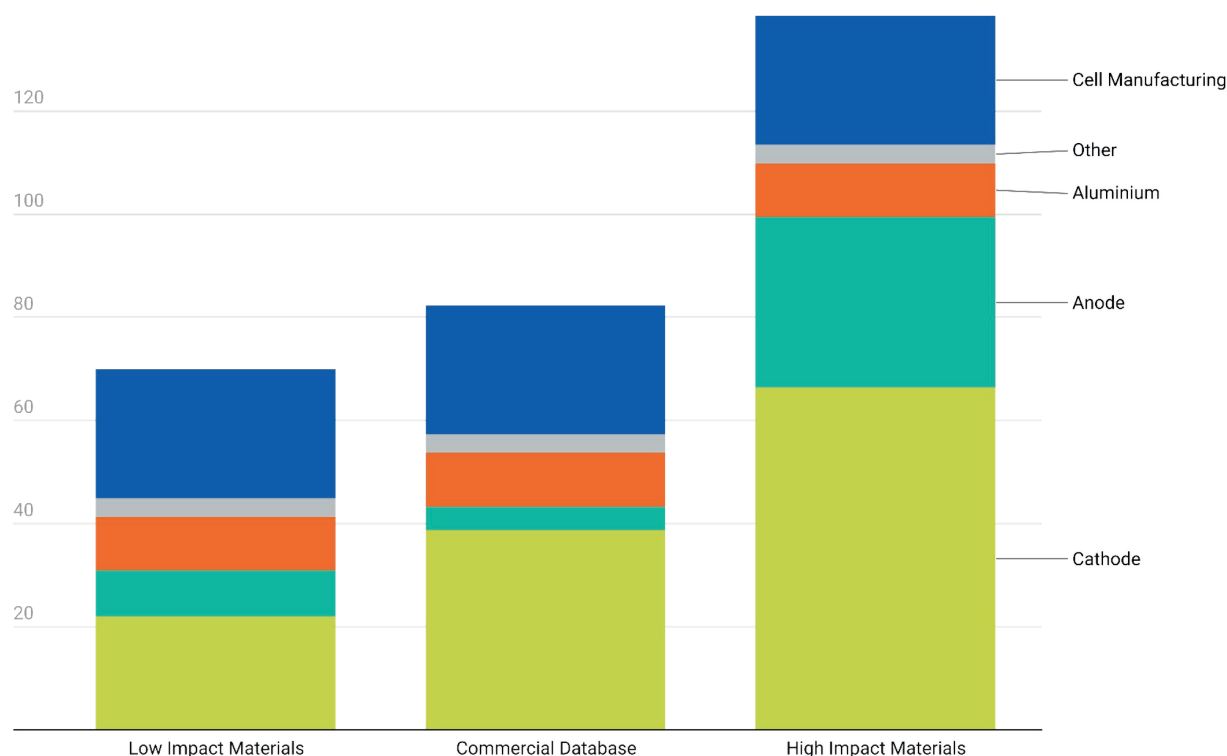


Figure 19

Figure 19 - Climate change impact variability of NMC-811 lithium-ion battery, depending on raw material supply chains. Source: Minviro. The model displayed the degree of variability in embodied climate change impact of manufacturing a battery based on these five inputs:

- Lithium chemical impacts vary depending on the extraction technology and if it is sourced from brine, spodumene or clays.
- Nickel, manganese and cobalt sulfate impacts are highly dependent on the ore type and subsequent chemical and energy requirements for liberating and processing the metals into their respective final products.
- Graphite impacts, whether synthetic or natural, vary primarily due to substantial energy requirements during the production of anode-quality material, and the type of electricity used throughout.

Impacts associated with electricity consumption during battery manufacturing are often tied to the source for a particular process in the chain (e.g. electrode manufacturing, battery assembly). Manufacturing using hydroelectricity can be orders of magnitude times less impactful per kilowatt hour within the climate change impact category compared to coal-generated electricity. Once environmental impact 'hotspots' have been recognised, companies can work to reduce them by switching raw material supplies, applying alternative energy approaches, or changing process flows.

Minviro works with companies to quantify their environmental impacts, and make tangible, achievable targets for reducing the environmental impacts of their critical materials supply chains.

Satarla – Guidance for mining companies – how to construct a typical TCFD

Satarla is a sustainability and risk management consultancy that works with all stakeholders within the mining industry. Satarla has contributed to the drafting of many standards including ISO and TCFD guidance documentation. Satarla focuses on the practical implementation of actions to result in true ESG performance.

TASKFORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURE (TCFD) – LEGAL REQUIREMENT IN THE UK

As of 2022, TCFD is a legal requirement for all UK-registered companies with over 500 employees and £500 million in turnover. TCFD relies on the collation of data drawn from assets fully owned by a company, together with subsidiaries and investments; it therefore impacts on a far larger group of organisations globally. While TCFD is not yet mandatory elsewhere in the world, versions of it are due to come into effect in Europe, the USA and Canada in the coming years, thereby increasing the focus on climate related datasets.

Figure 2

Core Elements of Recommended Climate-Related Financial Disclosures



Figure 20 - Core Elements of Recommended Climate-Related Financial Disclosures. Source: Task Force on Climate-related Financial Disclosures.

GUIDANCE FOR MINING COMPANIES – HOW TO CONSTRUCT A TYPICAL TCFD

TCFD is intentionally structured to integrate into the normal structure of an organisation. It can be designed and implemented rapidly with most of the effort going into delivering on the resulting Transition Plan. The Disclosure should include information on four pillars: Governance; Strategy; Risk Management; Metrics and Targets.

Governance – The accountability and oversight regarding climate change threats and opportunities (posed to and from the organisation) required at Board and Management levels.

Hints and tips for a mining company to deliver this:

- Clearly depict how and where the Board discuss and challenge climate change related risks (e.g. in the Risk and Audit Committee and/or ESG committee).
- Integrate climate action related targets into senior leader remuneration.
- Ensure the discussion is about broader ESG and not just about Climate Change (The Taskforce on Nature-related financial Disclosure (TNFD) is in draft and the EU and USA are set to launch ESG-

wide requirements in the next 24 months).

- Tell your stakeholders about what you are doing (via e.g. your annual report).

Strategy – Integrate actions to address climate change related opportunities and threats into the company strategy and action plans.

Hints and tips for a mining company to deliver this:

- Integrate climate related actions into Life of Mine, budget, and strategy setting processes.
- Stress test the short and long-term company strategy (including portfolio composition and post-closure plans and requirements) through a series of relevant climate-related scenarios that include both physical and non-physical (e.g. carbon pricing) related variables.

SCENARIO ANALYSIS

TCFD does not stipulate the methodology to be used for scenario analysis. A simple “what if” conversation may be held with a diverse group of leaders; or a more complicated quantitative analysis carried out. Most organisations use a range of approaches, to test the organisation to ensure it will be resilient to climate change threats and opportunities, should they occur.

The NGFS has provided organisations with a range of recognised global scenarios, all of which can be adapted for a mining organisation of any scale.

Typically mining organisations will commence with 3-5 distinct scenarios, designed to be specific to their own portfolio of assets.

Risk Management – Addressing uncertainties through simple integrated risk management, drawing together all forms of threat and opportunity from the long-term strategy of the company, to short term health and safety risks. The focus should be on networked action and impact.

Hints and tips for a mining company to deliver this:

- Take the opportunity to use TCFD to refresh the company's approach to integrated risk management, updating it to be in line with good practice (rather than traditional tick-boxing approach).
- View risks as a network rather than a taxonomy. One person's risk may be someone else's cause or consequence. This includes both physical and non-physical climate change potential threats and opportunities.
- Prioritise risks using impact vs action rather than impact vs likelihood. This focuses effort on those risks that require immediate action rather than on a debate regarding likelihood. (Note: likelihood can be used for those risks where it is relevant).
- Use risk management to prioritise actions for inclusion within the strategy.

Metrics and Targets – Practical, achievable targets that are in line with the ambitions of the business are key. These can be altered as the context of the world changes, however these must all result in Net Zero by 2050.

Hints and tips for a mining company to deliver this:

- Determine what data is already available and what is required to calculate Scope 1, 2 and 3 emissions. (Note: this data may be drawn from multiple departments including environment, procurement, budgeting, mine planning, community engagement, etc.).
- Determine Net Zero and other relevant targets for climate change (Note: this should include targets concerning e.g. water use; production stoppage due to, for example heat; obtaining of permits; community engagement).
- Design and budget for a Transition Plan that will enable the business to achieve Net Zero by the desired date. Alter the plan or target if funds are not available.
- Design and use an intuitive dashboard so that interested parties can monitor progress being made.

Appendix B

Definitions

Convergence/ Consolidation of Standards	Reducing the number of ESG standards by converging or consolidating similar ESG standards. <i>e.g. The International Sustainability Standards Board (ISSB) have communicated plans for building upon the SASB Standards and for embedding SASB's industry-based standards development approach into the ISSB's standards development process.</i>
Corporate Level Standards	ESG standards that are embedded in policies and procedures across the entire organisation
Corporate Governance	'Corporate governance is the system by which companies are directed and controlled. Boards of directors are responsible for the governance of their companies. The shareholders' role in governance is to appoint the directors and the auditors and to satisfy themselves that an appropriate governance structure is in place. Corporate governance is therefore about what the board of a company does and how it sets the values of the company, and it is to be distinguished from the day to day operational management of the company by full-time executives.' (ICAEW)
Equivalency	The ability for specific ESG Standards to be interchangeably used and widely recognised to meet required criteria.
ESG Disclosure	Reporting mechanisms for a company to share ESG-related information to stakeholders who require evidence of ESG considerations.
ESG Framework	Set of objectives/ principles that guide action at a government, stakeholder level on performance against the ESG aspects at a reasonably high level. Examples include SDGs, IRMA, and ICMM.
ESG Legislation	National, regional and international legislation that relates to ESG-specific issues e.g. UK Bribery Act 2010.
ESG Scores	Certain ESG Standards (e.g. IRMA) will give companies an 'ESG score' which incorporates how well a company has done on a numerical scale without outwardly detailing what the score comprises. Few stakeholders use high-level aggregated ESG scores for companies as a guide.
Greenwashing	'The process of conveying a false impression or providing misleading information about how a company's products are environmentally sound. Greenwashing is considered an unsubstantiated claim to deceive consumers into believing that a company's products are environmentally friendly' (Investopedia).
Independent verification and assurance/ audit	The ability of an impartial external stakeholder (e.g. consultant, government, NGO) to independently verify that reported ESG standards have been duly adhered to at a corporate or site level and to provide assurances that reported ESG standards have been properly implemented.

Issues Based Approach	A focus on the individual issues covered by ESG standards (e.g. water management, community relations, tailings management) to compare and contrast how companies perform on individual issues, regardless of what ESG Standards they use for reporting.
Site Level Standards	ESG standards that are only incorporated on individual mine sites
Minerals Resource Governance	'Policies and practices to mitigate adverse impacts and enhance positive economic, social and environmental outcomes of mineral exploitation, particularly in terms of realising the potential of mining as a catalyst for growth and development in mineral-rich developing countries' ⁵⁶

56. <https://www.resourcepanel.org/reports/mineral-resource-governance-21st-century>