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Understanding and responding to the human cost of the green energy transition

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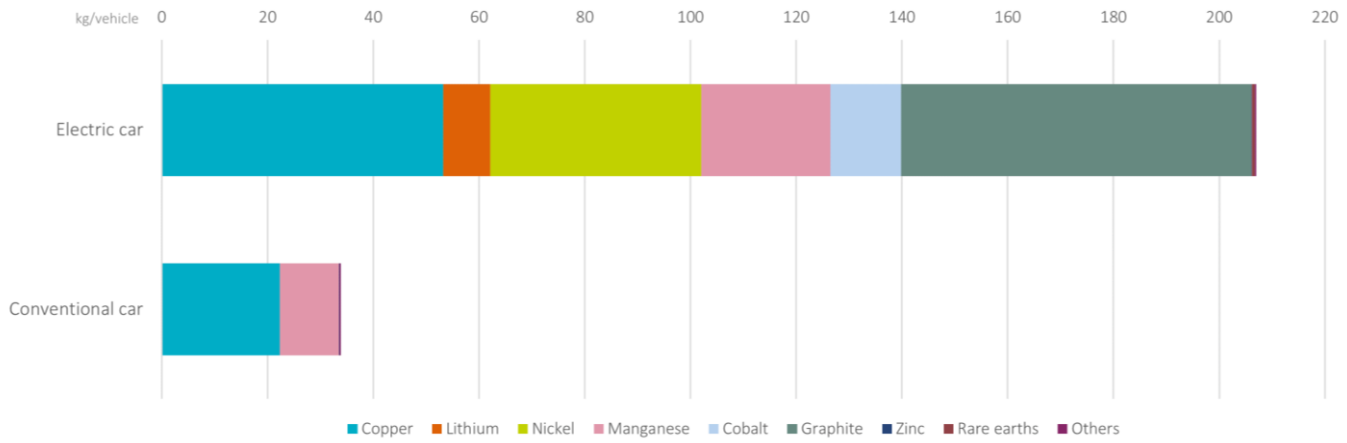
Key points

- The transition to a low-carbon world has become a political and public priority, putting pressure on all economic players to turn greener and requiring the massive expansion of renewable energy
- The necessary development of solar panels and wind turbines as well as the lithium-ion batteries used in electric vehicles and consumer electronics, relies on so-called 'critical' minerals such as copper, lithium, nickel, and cobalt
- With demand accelerating, the intensified mining of these minerals is set to exacerbate environmental and social concerns, in a sector historically plagued by accusations of abusive or unsustainable practises
- This paper highlights how transition minerals differ from fossil fuels, and explores the collateral effects on workers, communities and the environment, issues that will need to be addressed by responsible investors concerned that efforts to support the transition do not create new harms
- This paper looks closely at child labour in cobalt extraction to highlight how reputational and regulatory risks can be dispersed, undetected, across the many sectors relying on rechargeable batteries
- We believe responsible investors can help collaborative efforts to drive more sustainable practices and sourcing policies, both in the extractives industry and along the supply chain

As the world moves towards a low-carbon economy it will require a massive increase in the production of so-called transition minerals. These lie at the heart of an expected surge in demand for clean energy technologies. Electricity networks use a large amount of copper and aluminium, while lithium, nickel, cobalt and manganese are crucial to battery performance, longevity and energy density. In the same vein, rare earth elements are essential for permanent magnets that are key components of wind turbines and electric vehicles (EV).

Simply put, an energy system powered by clean energy is much more minerals-intensive than one fuelled by traditional hydrocarbon resources.[1] The following graphic clearly illustrates this point: a typical electric car requires six times the mineral inputs of a conventional car. For the same power generation capacity, an onshore wind plant, meanwhile, requires nine times more mineral resources than a gas-fired plant.[2]

Minerals used in electric cars compared to conventional cars



Source: International Energy Agency, May 2021

As is the case for carbon dioxide (CO_2) emissions reduction requirements, the expected demand figures for transition minerals are highly sensitive to the assumptions made. Under the International Energy Agency's (IEA) scenario based on the current stated policy positions of world governments (known as the Approved Pledges scenario), demand for critical minerals for clean energy technologies would be 2.5-times higher by 2030 than in 2020 – and four times higher by 2050.[3]

In the IEA's Net Zero Emissions scenario (NZE), an even faster deployment of clean energy technologies implies four-times higher demand for critical minerals in 2030 than in 2020 with a much less pronounced increase to 2050.[4] Those demand trajectories themselves are of course subject to large technology and policy uncertainty, but they nonetheless highlight the extent of the pressure on these resources.

Demand trends are mineral-specific. In the IEA's NZE scenario, lithium sees the fastest rise among the key minerals, with demand surging by 26-times between 2020 and 2050 while demand for cobalt (six-times), nickel (12-times) and graphite (nine-times) also rises rapidly.[5] Those different demand patterns are important to keep in mind, as they have the potential to exacerbate pre-existing issues at stake.

For investors, this has clear and immediate implications, as we cannot escape the real-world impacts of the minerals in question or the possibility that, in the pursuit of an energy transition, we might replace one harm with another. Our efforts must be anchored in a profound understanding of how we can build a new sustainable economy while addressing the social and environmental risks in play.

Mining's inescapable harms

The environmental impact of minerals and metals extraction is unavoidable and demands attention at all stages of the mining cycle, from exploration to operations, where the impact is greater, to the refining phase where the varied processes used make the task particularly challenging. The purpose here is not to focus on the ecotoxicity of the different minerals but to highlight the major environmental issues facing mining activities. These are commonly viewed as:[6]

- Management of water consumption, especially in regions of water scarcity
- Acid mine drainage from tailing/process waste that can leak and cause groundwater contamination – even more important as leakage can continue long after the mine has closed
- Minimisation and management of waste
- Management of air emissions (sulphur dioxide, greenhouse gases, dusts and particulates)

Environmental and health issues are of course closely interconnected, making local regulation and local operational practices key considerations for responsible investors, in much the same way that they need to closely monitor methane emissions from on-the-ground operations in the oil and gas industry.

Waste management offers a useful illustration of the potentially dramatic effects on people and companies. The 2015 Samarco tailings dam collapse in Brazil, involving Australian group BHP and Brazil's Vale, killed 19 people, destroyed a nearby village and flooded the Dolce River with 60 million cubic meters of toxic sludge, depriving the local

population of food and fishing revenues for years.[7] Both companies are still being pursued for compensation that could reach tens of billions of dollars.

The structural importance of proper waste management should not be underestimated. Modern waste disposal design (including thick bottom liners and leachate collection systems) can help minimise the toxicity of mining operations for the environment, both soils and water.[8]

Social factors are particularly topical when reviewing mining activities. There are considerations around working conditions, health and safety and pay levels on one hand – and then there are separate challenges in terms of how local communities are treated. That may include issues around the use of land – including consent, compensation, resettlement and reduced access to food and water – as well the possibility of benefit sharing.

Increasing minerals extraction is likely to intensify those risks, in our view, and the vulnerability of indigenous people in particular. It is also likely to exacerbate poverty, social exclusion, modern slavery or child labour in poorer areas without effective regulation, governance or institutional frameworks.[9] This is particularly topical for cobalt, a case we discuss below.

A sector plagued by a history of abusive practices

The challenges above require both closer scrutiny of extractive companies and coordinated action to foster more sustainable practices. Independent non-governmental organisation (NGO) the Business & Human Rights Resource Centre has evidenced the concerning history of the extractive sector via its Transition Minerals Tracker,[10] monitoring the practices of 93 companies producing six minerals vital to the transition (cobalt, copper, lithium, manganese, nickel, and zinc).

In its 2022 update the NGO found a total of 510 allegations of human rights abuses between 2010 to 2022. It also found evidence of hazardous working conditions, water pollution and water access issues as well as significant impacts for indigenous peoples. It is noteworthy that more than a quarter of the allegations relate to attacks against people who are actively seeking to defend human rights.[11]

Investors do have a role to play in improving this picture, but clearly we should not underestimate the role and responsibilities of states to implement environmental and human rights-based natural resources laws, nor should we ignore the impact of poverty and corruption, or how armed groups in some regions of the world often underpin those abuses.

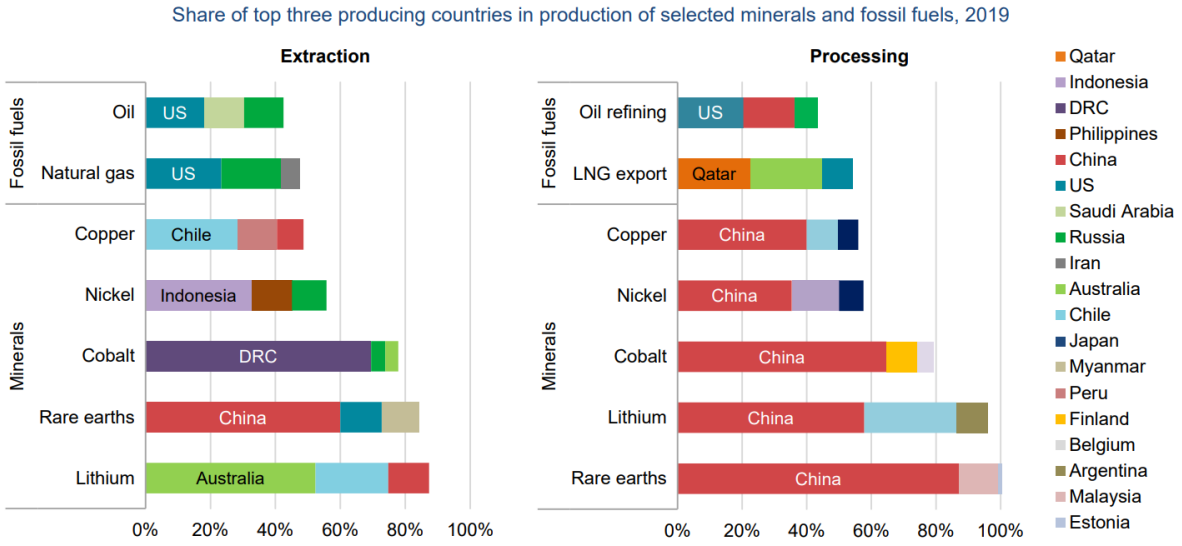
The banning in Chile of tailings dams built using the upstream method after the 1965 El Cobre mine catastrophe illustrates the role and importance of proper regulation. This reality is echoed by the work currently carried out by the United Nations, that will present a report to the UN General Assembly in October 2023 on the just transition and human rights in the extractive sector.[12] It will aim to provide practical guidance to states, businesses and key stakeholders.

The specific context of transition minerals

Transition minerals differ from fossil fuels in many ways, impacting not only the extractive companies but also key sectors in their supply chain.

- **Concentration:** The production of many energy transition minerals is far more concentrated than that of oil or natural gas, as highlighted in the graphic below. In the case of lithium, cobalt or some rare minerals, three quarters of global output is in the hands of the top three producers.[13] This is even more pronounced for processing operations, where China has a strong presence across the board (a 50%-70% share of refining for lithium and cobalt, and nearly 90% for rare earths elements)
- **Declining resources quality:** The IEA has raised concerns around ore quality continuing to fall across a range of commodities and cites the fact that average copper ore grades in Chile have declined by 30% over the past 15 years. Extracting metals from lower grade ore requires more energy and generates higher waste volume, increasing environmental risks alongside worsening working conditions for workers
- **High exposure to water stress:** Some 50% of lithium or copper production, for instance, is concentrated in regions with high water stress levels[14]

IEA assessment of production concentration



Source: The Role of Critical Minerals in Clean Energy Transitions, IEA, May 2021. Notes: LNG = liquefied natural gas. The values for copper processing are for refining operations.

Those topics need to be integrated and tackled. However, transition minerals also differ from fossil fuels in that they may include non-negligible positive aspects, as, unlike fossil fuels, they have the potential to be recovered and recycled. The short-term implications of this are uncertain – recycling practices for transition minerals are not yet well established. But what is not in doubt is that over time this characteristic can contribute to a more sustainable use of resources, possibly opening up new economic opportunities in the field of waste recovery and recycling over the medium term.

Approaching a situation of closed mineral loops, beyond being technically difficult due to recycling-related losses, would also require demand to level off, which will take more time in developing economies. Meanwhile, reducing material intensity and encouraging mineral substitution via technology innovation will further contribute to reduce extraction strain, thereby alleviating collateral environmental and social damage.

The subject of mineral resources depletion is a significant threat for resource-based economies in the developing world. Right now, there is no consensus or recognised methodology to assess the issue as it depends on key variables. These include the conversion rates at which deposits can be recovered from established sources, the potential for as-yet-undiscovered deposits and society's ability to respond to price rises by substituting metals over the long term – which in turn would depend on environmental regulation and social demands.

How investors can prioritise areas of focus

Scrutiny of target companies

Environmental and social impacts are often interconnected, which makes identifying the most impactful practices crucial. We think the above-mentioned Transition Minerals Tracker is a good starting point for the selection of companies to target.

Scrutiny of the mineral mix

As seen above, all minerals are not created equal with regards to demand trends or impacts. They must be reviewed in the context of the location for both production and refining, as each stage of the process brings different types of risks, both in nature and severity.

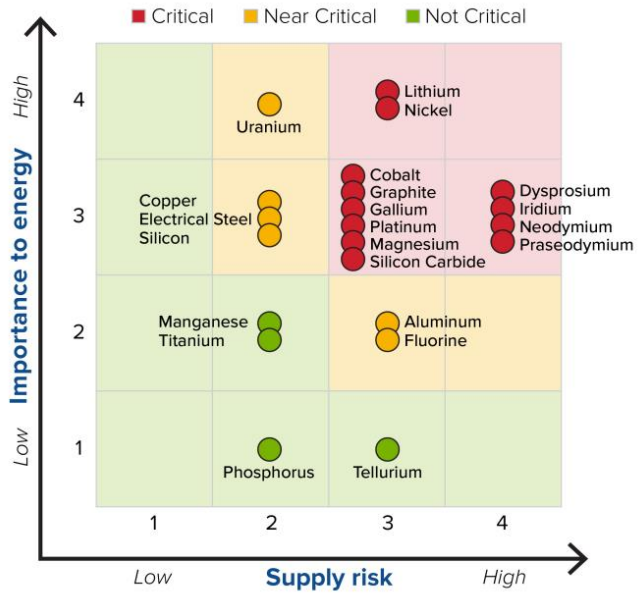
For instance, copper is mainly produced in Chile or Peru and the associated risks are largely transversal social ones. These include safety, working conditions, living wages and local communities' rights, all of which combine to define a company's 'social licence to operate' (SLO) – the idea that firms must meet a certain standard of behaviour and fairness to gain the consent of all stakeholders. By contrast, a topic such as child labour will be less prominent in these geographies.

As widely acknowledged, child labour is mainly associated with cobalt production. A US government assessment of critical minerals released this year assigned its lowest, or 'most critical', rating for cobalt in terms of 'Political, Regulatory and Social' factors, which incorporates child labour or forced labour alongside occupational health and safety. Cobalt stands out as the only critical mineral out of the 22 studied to gain the lowest score in this category, and it applied over both a short-term and medium-term horizon.[15]

Focus on the most critical minerals

Western companies are already subject to mineral supply difficulties driven by geographic concentration and low substitutability, but bottlenecks associated with the COVID-19 pandemic, geopolitical events and US-China trade tensions have exacerbated their vulnerabilities. This is most keenly felt in the most critical minerals for the transition economy where there is the greatest pressure on extraction and potentially less consideration of environmental and social criteria. Lithium, nickel, and cobalt are among the most critical as identified by the US government, and in that sense deserve more attention, in our view.[16]

US government assessment of medium-term criticality of minerals



Source: Critical Materials Assessment, US Department of Energy, May 2023

This idea of criticality is important from a forward-looking perspective as it has led western countries to work on re-localising minerals supply closer to home.[17] The US Inflation Reduction Act is a major step in that direction, incentivising domestic production and helping shore up relationships with US trade partners, while a plan for half a million charging stations for EVs as part of US infrastructure goals is expected to prompt an increase in domestic lithium mining projects.[18]

European countries are echoing the trend. There are notable lithium deposits in Serbia, Spain, Portugal and France and the European Union is seeking to develop the industry by funding research projects.[19] In France specifically, a 2018 study found potential for the country to become self-sufficient in lithium production,[20] although work is still needed to understand how extraction might work in each case. The hope is this trend in western markets could help ensure more rigorous standards, both environmental and social, and ultimately foster the development of more sustainable practices abroad.

The subject of the social licence to operate and regulatory permissions, is worth noting here. Regulatory permissions might have the potential to delay projects and distort the level playing field across geographies. Once granted, they can also be impacted by an 'insufficient' SLO, as demonstrated in Serbia, where the country revoked permits for a lithium mine operated by Anglo-Australian group Rio Tinto in early 2022 following weeks of nationwide protests driven by environmental and health concerns.[21]

FOCUS: Cobalt and child labour

Cobalt is one of the minerals vital to the energy transition. It is a hard metal primarily derived as a by-product of mining nickel, silver, copper or iron, and used in lithium-ion batteries needed for electric cars and devices like laptops and smartphones.

Around two thirds of global production comes from the Democratic Republic of Congo (DRC), which is estimated to hold around half of global reserves. DRC's mine production of cobalt has more than doubled since 2010,[22] making the mining industry as a whole the most essential part of the DRC economy.

Although lucrative to the economy, a large part of production – between 15% and 30% – is still drawn from so-called artisanal and small-scale mining (ASM).[23] This implies people working with their hands as opposed to heavy equipment, using rudimentary tools, without any safety equipment and exposed to hazardous working conditions. ASM offers a lifeline for more than two million Congolese as it often constitutes the only viable livelihood for local communities and can generate up to five times the income of agricultural activities.[24] As such, ASM is a business reality in the cobalt supply chain.

However, ASM in DRC is plagued by child labour. Children as young as five or six carry out surface digging, older ones are tasked with rinsing and sieving while teenage boys are involved in tunnel digging. Overall it is estimated that more than 40,000 children work in cobalt in the DRC.[25] The sheer scale of the problem has forced the government to acknowledge it and adopt policies that theoretically forbid the use of children for dangerous work while promoting free primary school education. A lack of enforcement of labour laws, however, as well as the persistent threat of poverty, mean that children continue to mine cobalt in hazardous conditions.

Ripple effects in the supply chain

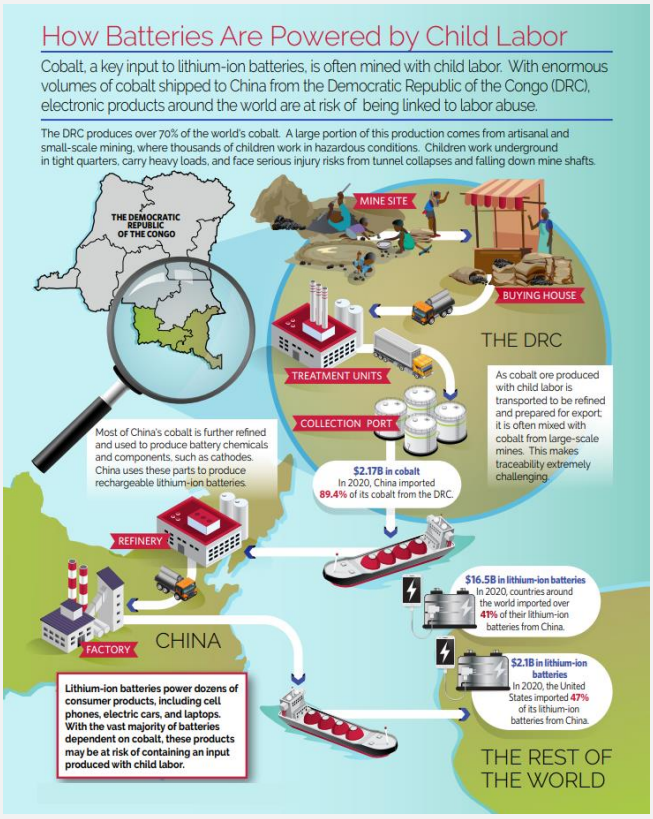
The implications for investors here are clear. Cobalt's criticality, combined with its links to child labour and a relative lack of due diligence have helped make it a target for NGOs such as Amnesty International.[26] Since 2017, accusations have targeted industrial giants from the auto or electronic sectors and the first legal challenge arose in 2019 after a US NGO – International Rights Advocates – launched a lawsuit against Apple, Tesla, Google, Microsoft and Dell.

That suit, on behalf of a dozen families of children injured or killed in artisanal cobalt mines in Congo, was dismissed by a US district court in November 2021,[27] but the reputational threat that it highlighted raised awareness across the cobalt supply chain – in short everything from EVs to smartphones to wind turbines and hearing aids, that use lithium-ion batteries.

This rising awareness has driven companies in sectors such as automotive or consumer electronics to join responsible sourcing initiatives or assurance schemes such as the Responsible Minerals Initiative (RMI), the Initiative for Responsible Mining Assurance, or the Fair Cobalt Alliance (FCA) in an effort to ensure responsible sourcing.

However, once cobalt reaches the refining stage, traceability becomes more complex. According to the US Department of Labor, Chinese firms own, operate or finance most of the DRC cobalt mines, and the country imports nearly 90% of its cobalt from the DRC.[28] In the process of refining prior to export, cobalt from multiple sources is mixed together and so cobalt produced with child labour becomes impossible to isolate, tainting nearly all the DRC's cobalt exports and its supply chain, as set out by the Department of Labor in the graphic below.

US view of cobalt child labour in the supply chain



Source: Exposing exploitation in global supply chains, US Department of Labor, retrieved June 2023. US ITC Dataweb and UN Comtrade. Trade data from 2020

Faced with persistent child-labour-related risks in DRC, some industrial companies have chosen to reduce their exposure to the country. This is the case for German carmaker BMW, which decided to source cobalt from Morocco or Australia for the fifth generation of its high-voltage batteries.[29] Meanwhile, Tesla announced that nearly half of the vehicles produced in

the first quarter of 2022 were equipped with cobalt-free lithium iron phosphate batteries. That is part of a programme of diversification to secure long-term capacity growth, but nonetheless illustrates the systematic reduction of any dependency on controversial minerals.[30]

A word on standards

As companies, and investors, navigate these issues, the proliferation of standards and initiatives can be confusing, creating risks of duplication and inconsistency. However, we think that their perspectives can be complementary. The RMI, for example, incorporates due diligence processes, a global risk map and certification through audits of specific mines, while the FCA aims to transform artisanal mining in DRC. It recognises that poverty is the root cause of child labour and works directly with ASM cobalt sites to reduce hazardous practices and encourage childhood education.

The FCA approach echoes a white paper from the Geneva Center for Business and Human Rights circulated at the 2020 World Economic Forum in Davos.[31] It concluded that seeking an end to artisanal mining would work against the goal of "making mining safe and fair" and that this would in fact be better achieved by helping companies work with authorities to formalise ASM. Worldwide, it is estimated that 70%-80% of artisanal and small-scale miners work in the informal sector – either illegally or in legal grey areas.[32]

The white paper builds on concrete pilot projects carried out by different players, including Huayou Cobalt, China's largest cobalt producer, and commodity trader Trafigura. The projects identify potential steps to make formalisation projects replicable and scalable in a way that improves safety and helps take children out of the mines and into schools, including measures that enable more women to join the mining workforce to replace lost household revenue.

Obligations to act

From storage solutions that address the intermittent nature of renewable power to electric vehicles and cell phones, rechargeable battery technology is at the heart of our shift to a low-carbon world. The collective pursuit of net zero is placing new and growing pressure on the natural resources that will enable this transition, bringing social and environmental impacts that companies and investors must learn to acknowledge, measure and manage.

Extractive companies are at the forefront of those challenges and are coming under regulatory, legal and public pressure to ensure the development of sustainable practices in the countries where they operate. In developing nations where artisanal mining is important but burdened by links to child labour, and where its production is an integrated part of the overall supply chain, companies should work on formalisation, alongside the different stakeholders involved. Formalisation pilot projects already exist, and in facing up to potential reputational and financial risks in play, we think investors should be encouraging companies to deploy the lessons learned and scale up where possible.

This obligation to take responsibility for sustainable sourcing should extend into extractive companies' supply chains. After years of benefitting from natural resources, they are now in a position where a long-term ambition of closing the minerals cycle can be actively targeted through waste minimisation and recycling. More broadly, this is the moment for companies to come to the table and strengthen coordination with policymakers, regulators, investors and communities to help us all make genuine progress, most notably in developing nations.

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