

A Just Cobalt Decarbonisation Pathway

EXECUTIVE SUMMARY

November 2024

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Cobalt is integral to modern life, powering everything from electric vehicle and handheld device batteries to specialized alloys and industrial catalysts. As the world advances toward a low-carbon future, cobalt demand is projected to double by 2050. This rise is expected to lead to increased emissions associated with more cobalt extraction and refining, as well as increased risk of other environmental and social impacts.

Although cobalt can support technologies that abate 3.6GT of CO₂e per annum, if the cobalt industry does not take action to decarbonise, it has the potential to emit up to 7.6MT of CO₂e per annum by 2050. Therefore, despite cobalt's essential role in the global transition to net zero, the cobalt industry has a crucial role to play through the decarbonisation of its operations and supply chains.

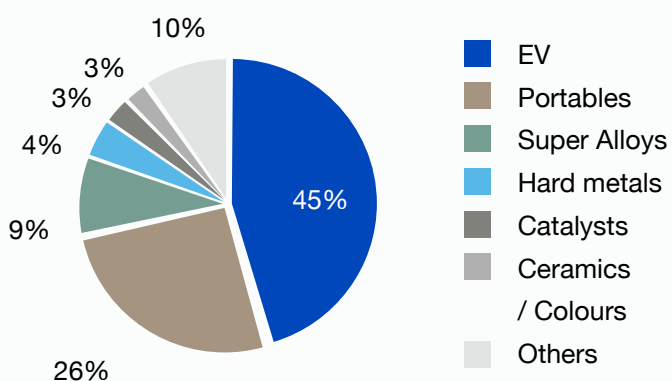
Since 2019, growth in the demand for cobalt of 10% per annum has led to a 58% increase in the industry's carbon footprint, most of which is Scope 3 emissions. Increased demand in batteries accounts for almost 75% of total cobalt demand in 2023, 45% of which came from electric vehicle (EV) batteries (Figure 1).

A Just Cobalt Decarbonisation Pathway builds on Cobalt Institute's Life-Cycle Assessment Report (2022), which generated industry-average datasets on the global warming potential of 1kg of different forms of cobalt.

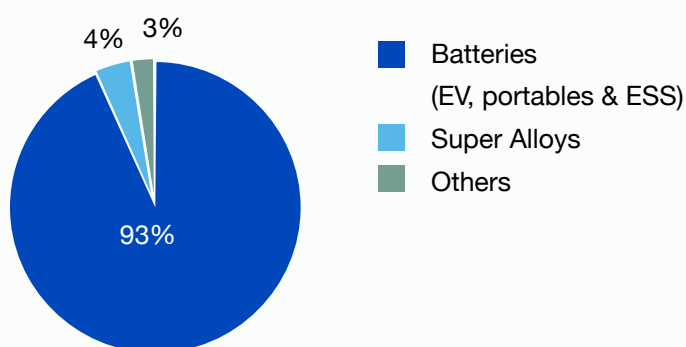
Taken together, the two reports offer companies in the cobalt supply chain a framework around which to create their decarbonisation plans and lower their carbon footprint.

Figure 1: share of 2023 demand and growth by cobalt product

Share of 2023 demand



Share of 2023 demand growth



Data: Benchmark Mineral Intelligence – Cobalt Forecast

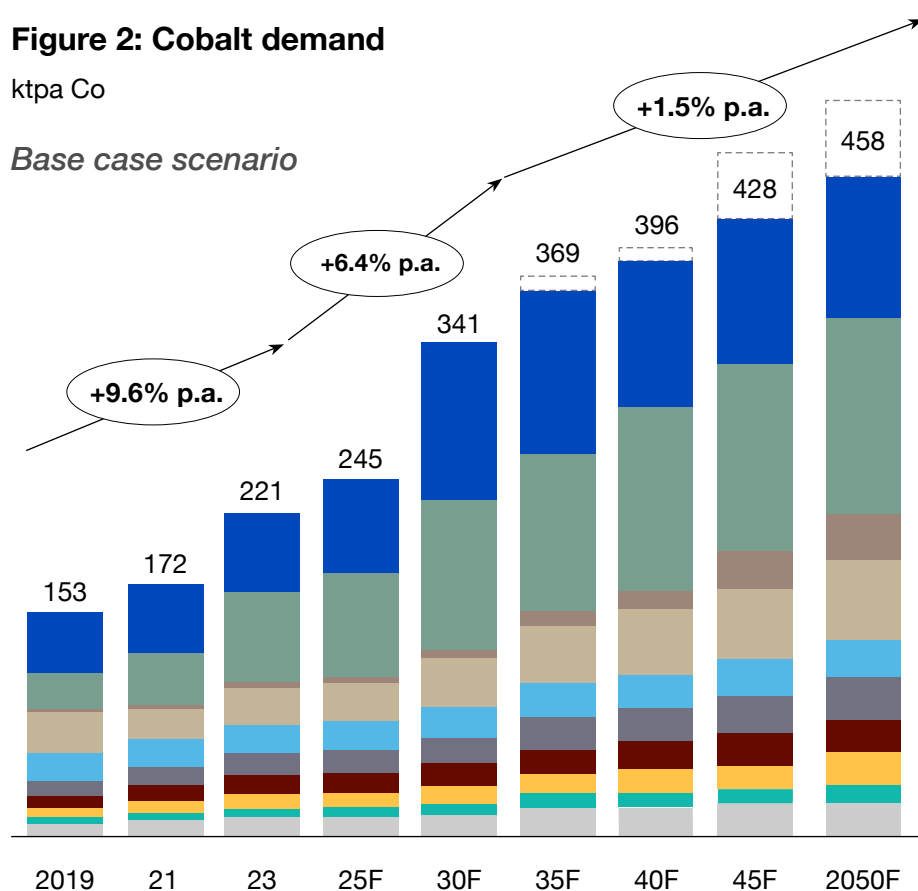
Cobalt supply chain

The growth in cobalt demand is expected to continue, with demand more than doubling between 2023 and 2050. The main driver of this will continue to be electric vehicles, the market for which is expected to grow by c.170%. Other uses for cobalt, including superalloys, consumer electronics, and other traditional uses such as agriculture and dyes will also see an increase in demand (Figure 2).

Figure 2: Cobalt demand

ktpa Co

Base case scenario



□ High case scenario²

Battery demand: ■ Appliances ■ Transportation
 ■ Energy ■ HPA¹ ■ Tool materials ■ Catalysts ■ Magnets
 ■ Pigments ■ Soaps/dryers ■ Other

¹ High Performance Alloys

² Growth of 2.1% p.a. between 2030-50, 515kt of cobalt demand by 2050

Note: The adoption of cobalt products could be unequal across regions, and affordability of cobalt products, such as electric vehicles, may have implications on vulnerable consumers. See 4. Just Transition for more information

Source: Battery Insights, MineSpans

Currently, 76% of the world's supply of cobalt comes from the Democratic Republic of the Congo (the DRC), with 78% of refining taking place in China. The dominance of both countries is expected to continue over the coming decades.

Although additional mining projects will be needed to bridge the supply gap, by 2050, recycled cobalt will constitute around 40% of all supply as more batteries reach end-of-life.

Decarbonising cobalt

In terms of future emissions, this report envisages that 30% of emissions can be successfully abated by 2030, 47% by 2040, and 80% by 2050. Such abatement would be achieved through the increased use of renewable energy,

biofuels, and carbon capture, as well as further electrification of mobile equipment, the decarbonisation of heating processes, and more sustainable logistics and procurement (Figure 3).

Figure 3: Cobalt industry CO₂ abatement potential

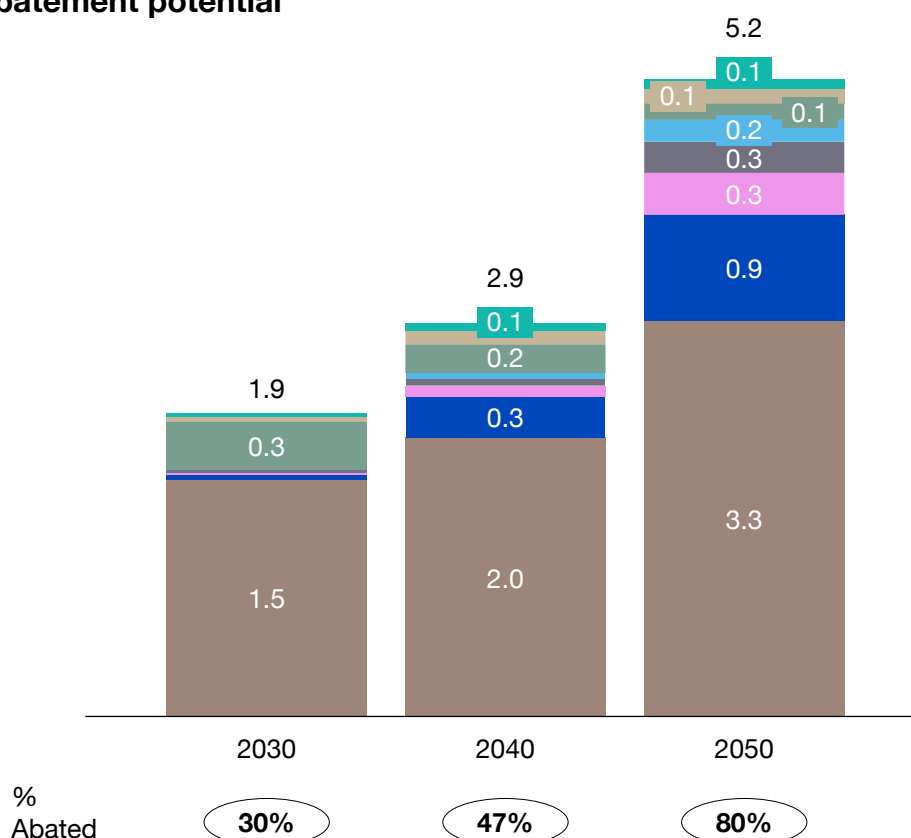
Million tonnes CO₂e

Base case scenario

- Efficiency improvement
- Alternative fuels
- Renewable electricity
- Mining equipment electrification
- Carbon capture
- Limestone replacement¹
- Heat decarbonisation
- Scope 3²

¹ Replace by low carbon lime

² Replacement of standard NaOH, HCl, Lime, MgO and NH₄HCO₃ by chemicals produced with low-carbon electricity, low-carbon heat and carbon capture



Note: Implementation of abatement actions may have environmental and human rights risks associated with them. See 4. Just Transition for more information

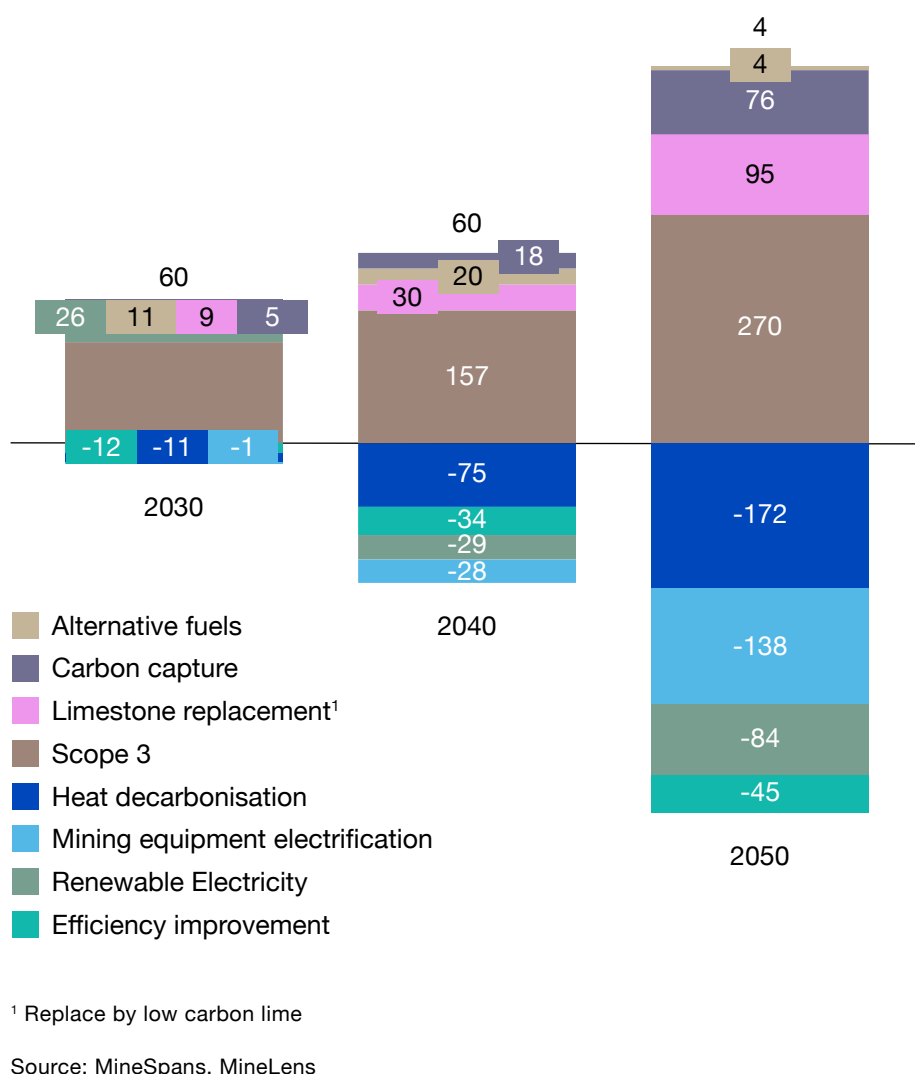
Source: MineSpans, MineLens

Framework conditions

This process will be neither immediate nor easy, and many actions, such as the decarbonisation of sulphuric acid – a byproduct of an oil and gas industry also looking to decarbonise – will prove a challenge.

Decarbonisation will also not come without cost – this report shows that the 80% abatement potential requires \$1.6 - \$2.1 billion in capital expenditure (CAPEX) for cobalt specific supply chains, with almost half of this investment required in China to decarbonise its refining. This upfront investment, however, will pay off as long-term cost savings and operational expenditure (OPEX) offsets are realised (Figure 4).

Figure 4: Allocated cobalt industry decarbonisation OPEX
USD/t Co eq.



This report also recognises that the challenges faced by certain jurisdictions important to the cobalt supply chain may differ. China and Indonesia both face the challenge of pivoting away from non-renewable sources of electricity, yet their country contexts are very different and will require different solutions. Nonetheless, both the DRC and Indonesia can facilitate decarbonisation through greater investment in clean, reliable energy and energy infrastructure.

Policy makers in the EU and other large economies have important roles to play in working with companies based within their jurisdictions to decarbonise. Steps to achieve this include the creation of fit-for-purpose regulatory frameworks that incentivise decarbonisation, support for innovation and a circular cobalt economy, and the moulding of an environment where financial instruments can be deployed to facilitate the just transition¹.

¹ Robins et al. [The just transition: transforming the financial system to deliver action](#) (2024)

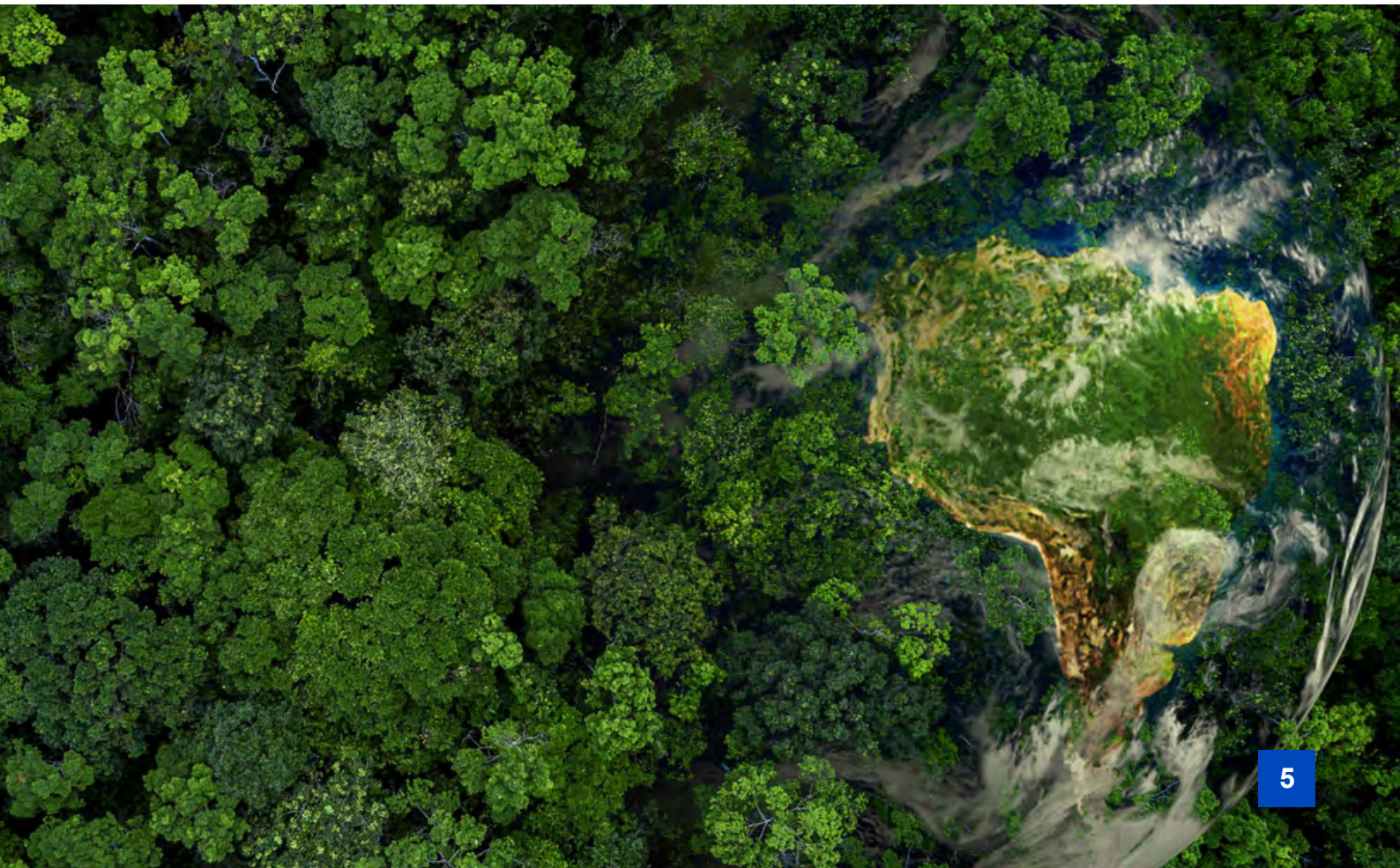
Just transition

A *Just Cobalt Decarbonisation Pathway* also recognises the importance for companies in the cobalt supply chain to apply a just transition lens to their process of decarbonisation. It explores the link between environmental and social impacts inherent in the ‘just transition’, an intersection enshrined in the Paris Agreement (2015) and one which has provided the framework for a variety of mandatory due diligence legislation, as well as initiatives such as the EU’s Just Transition Mechanism and the multinational Just Transition Energy Partnership (JETP).

The reality of decarbonisation is therefore that companies in the cobalt industry have to consider the environmental and social impacts of the abatement actions they pursue, and should extend their existing responsibility to respect

human rights, aligned with international authoritative frameworks, to assess the risks brought about by decarbonisation. This report provides an overview of actual and potential risks companies may face when pursuing decarbonisation, including impacts on workers and communities in both their own operations and in the supply chain.

The clock is ticking – many of the actions contained in this paper, and the projections on the potential to abate greenhouse gas emissions by 2030, require immediate action. Cobalt Institute looks forward to continuing to bring together stakeholders to propel the decarbonisation agenda, and encourage the cobalt industry to play its part over the coming decades.





Contact us if you have any questions

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