Copper: The core of the green revolution

Introduction

At least as far back as the early 2000s the pundits in and around the mining industry have been talking about a copper demand explosion, as the emerging middle class in Asia and the global South were predicted to adopt more intensive electricity and electronics at an unprecedented scale. Efficiency in the use of copper, through miniaturisation of electronics and the move from wired to wireless telephony and data transmission, forestalled the expected demand somewhat, despite the rapid urbanisation of China. However, 20 years later a transformational shift in global copper demand looks to be on our doorstep.

In 2023, copper supply is already tight. At the start of this year there were only three days of available copper inventory and production guidance for 2023 has already reduced expected 2023 output by as much as 700,000 tonnes[1]. As the physical impacts of climate change start to bite, ironically (or perhaps "copperically") weather is increasingly a factor, restricting supply in the short run and potentially signalling a new supply-side normal.

Consumption of copper to double

The increased copper intensity of renewables is only part of the equation. The speed at which the transition needs to happen, to meet 2030 and 2050 commitments around replacement of coal and gas generation capacity and the phasing out of oil for automobiles, means many analysts are predicting the consumption of copper to almost double to around 50 million tonnes per annum by 2035[2].

Supply side challenges

Unfortunately, copper supply isn't keeping up. Copper production from existing mining operations is expected to decline over the remainder of the decade; without replacement projects, the total supply of copper is expected to drop from current levels to around 19.6Mtpa by 2030 from existing operations and those under construction[3].

Despite the US Geological survey estimating that there are around 3.5 billion tonnes of discoverable copper out there[4], of the 228 deposits discovered between 1990 and 2021, only one was discovered between 2018 and 2021[5].

Environmental and other sustainability standards are, rightfully, increasing the complexity of obtaining approvals for new mining operations. If all things go smoothly, history shows it takes an average of seven to ten years to bring new operations on-line.

[1] https://www.youtube.com/watch?v=Z46b9wZoOS0
[2] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/071422-world-copper-deficit-could-hit-record-demand-seen-doubling-by-2035-s-p-global
[3] https://www.iea.org/events/the-role-of-critical-minerals-in-clean-energy-transitions-world-energy-outlook-special-report
[4] https://www.usgs.gov/news/national-news-release/global-undiscovered-copper-resources-estimated-35-billion-metric-tons.
[5] https://www.spglobal.com/marketintelligence/en/news-insights/research/copper-discoveries-declining-trend-continues.

Transformation in supply critical

For the energy transition to be successful, the world needs new reliable, sustainable sources of copper. Without a transformation in the supply, the increased demand for copper will drive prices to unsustainable levels, making energy transition infrastructure projects more expensive to execute, causing delays in construction as well as the supply of critical items such as turbines, panels, and storage capacity.

Against this backdrop, diversified global miners such as BHP have already signalled their intention, seeking to acquire the likes of Oz Minerals to access low-cost, long-life operations in low-risk jurisdictions[6].

Strong demand

With the supply side of the equation so tight, any incremental demand will have a substantial impact. Copper has long been one of the key metals of industrialisation, with white goods, electrical wiring and electronics all being copper intensive. With the world lifting people out of poverty at record pace, we are continuing to see rapid urbanisation in Asia and the developing world. This means traditional copper baseline copper demand is historically strong, with prices above US$4/lb for much of 2021 — despite the impact of the pandemic — and returning to hover around US$4/lb since January 2023[7].

What is new is the substantial incremental demand implied by carbon transition forecasts. The transition to renewable energy sources is critical to mitigating climate change and achieving a sustainable future. This shift requires an increased demand for minerals and metals that unlocks our ability to use renewable energy technologies in place of traditional fossil fuel-based energy sources; prime among these is copper. It looks like the world may have a massive copper deficit, just when we need it the most.

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New sources of demand

In 2022, around 80 million new motor vehicles were produced globally (down from around 89 million in 2019)[8]. To meet the Paris Agreement Net Zero pathway, limiting warming to 1.5 degrees, it is estimated that:

- By 2025, more than 35% of new vehicle sales need to be EVs
- By 2035, around 70% of new car sales need to be EVs[9]

Estimates put EV sales in 2022 at around 10.5 million globally, up from just 2 million in 2018; this accounts for around 13% of total new vehicle sales. EVs in this context include both plug-in hybrid (PHEV) and battery electric vehicles (BEV) with 73% being BEV[10, 11].

Both PHEVs and BEVs require significant amounts of copper; the copper requirement for an electric vehicle is between two and a half to four times the requirement for a traditional internal combustion engine. Wood Mackenzie have estimated that copper demand in the EV segment will increase to almost 10Mtpa by 2040, if the Paris agreement is achieved[12] — that's almost half the total volume of copper produced by all mines in 2022.

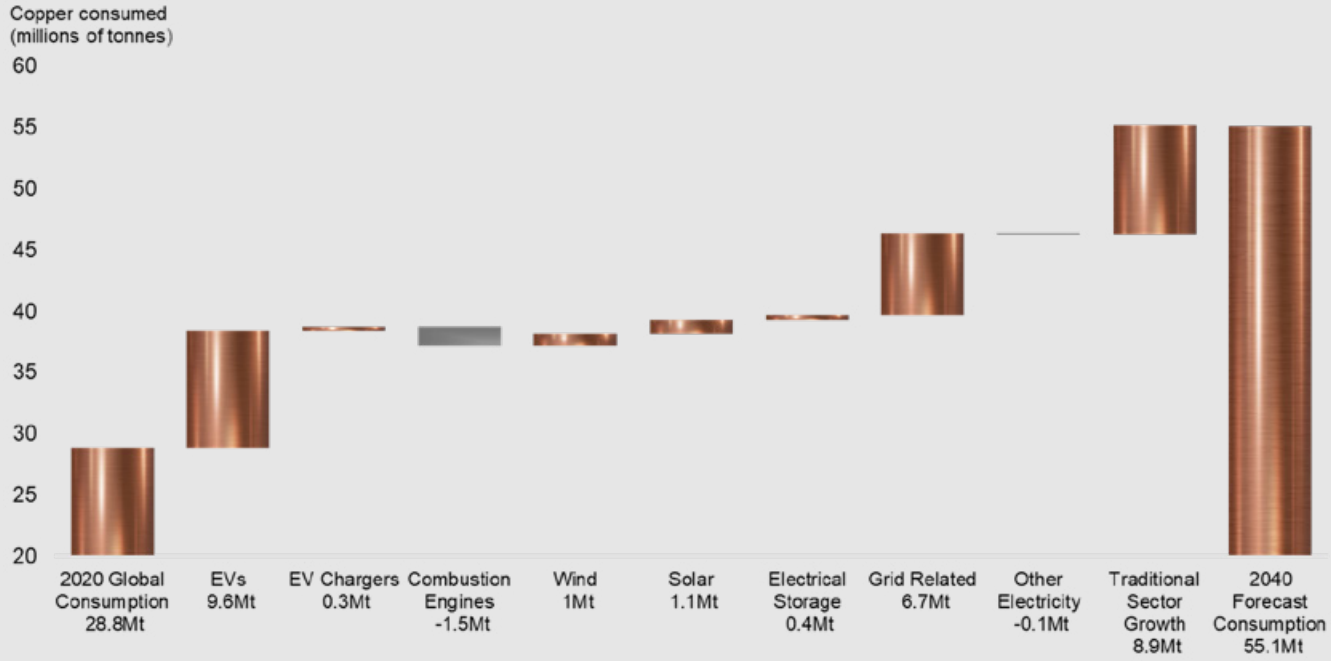
Electricity generation and distribution is already the largest consumer of copper, accounting for around 45% of annual copper use[13]. Renewable generation is more copper intensive than traditional methods, with an increased intensity of copper per megawatt.

A single 3-megawatt wind turbine can contain up to 4.25 tonnes of copper, while a typical solar panel requires around 3-4 kg of copper making copper intensity around 5 tonnes per MW of installed capacity[14]. Offshore turbines can be more copper intensive due to the additional cabling.

Renewable generation also has the issue of intermittency. This is a problem with a simple solution — install additional capacity and store the excess for use later. Both the additional capacity requirement in terms of generative capacity and storage are similarly copper intensive, so there is definitely a copper hue around the green energy future.

[6] https://www.forbes.com/sites/jonathanburgos/2022/12/22/bhp-offers-to-buy-oz-minerals-for-65-billion-as-mining-giant-seeks-to-boost-clean-energy-assets/
[7] https://tradingeconomics.com/commodity/copper
[8] https://www.just-auto.com/news/global-light-vehicle-output-depressed-but-forecast-to-grow-in-2022/
[9] https://www.woodmac.com/horizons/red-metal-green-demand-coppers-critical-role-in-achieving-net-zero/.
[10] https://www.ev-volumes.com/
[11] https://www.bloomberg.com/news/articles/2023-01-12/electric-vehicles-look-poised-for-slower-sales-growth-this-year?leadSource=uverify%20wall.
[12] https://www.woodmac.com/horizons/red-metal-green-demand-coppers-critical-role-in-achieving-net-zero/.
[13] https://www.visualcapitalist.com/copper-driving-green-energy-revolution/
[14] https://www.copper.org/environment/sustainable-energy/renewables/#:~:text=A%20three%2Dmegawatt%20wind%20turbine,farms%20use%20approximately%207%2C766%20lbs

Figure 3: **EY survey of institutional investors' approach to evaluating non-financial disclosure**



Note: Traditional sector growth refers to base case demand including construction, appliances etc

Source: Wood Mackenzie AET-1.5 Scenario (https://www.woodmac.com/horizons/red-metal-green-demand-coppers-critical-role-in-achieving-net-zero/)

Responsible mining

Given the backdrop of the climate crisis, there can be no question that additional mining of copper and other critical minerals is necessary. And clearly, this mining must be conducted in a responsible and sustainable manner, bearing in mind social and environmental considerations. Done poorly, the extraction of copper can have significant environmental impacts on communities and the environment through soil and water contamination, deforestation, and habitat destruction.

Given the expected decline in output from existing operations and the increased demand for the metal globally, copper mining needs to be seen by the public and the finance industry as an essential part of the solution to the climate crisis.

Some estimates to meet this demand forecast a new mine the size of Escondida in Chile needs to be brought online each year up to 2031[15]. There probably aren't eight more Escondida-sized projects in the pipeline, so many smaller operations will be required.

Whatever the makeup of the mining operations, there is a strong likelihood that copper will be sourced from jurisdictions with more political and investment risk.

Conclusion: the role of the risk manager will be key

What is critical to a low carbon future is that projects have support from the finance and insurance sectors today, to ensure the world can meet the energy needs of tomorrow.

The role of risk managers, brokers and insurers is to work together to improve the resilience of operations and new copper projects. Risk engineering, risk retention and risk transfer are all critical elements for ensuring the sustainability of the copper industry, especially as it forges into new jurisdictions, builds new projects and looks to improve the resilience and ESG performance of copper mining operations.

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[15] https://www.mining.com/miners-need-to-invest-over-100bn-to-meet-copper-demand/.