



Energy Technology Perspectives 2023

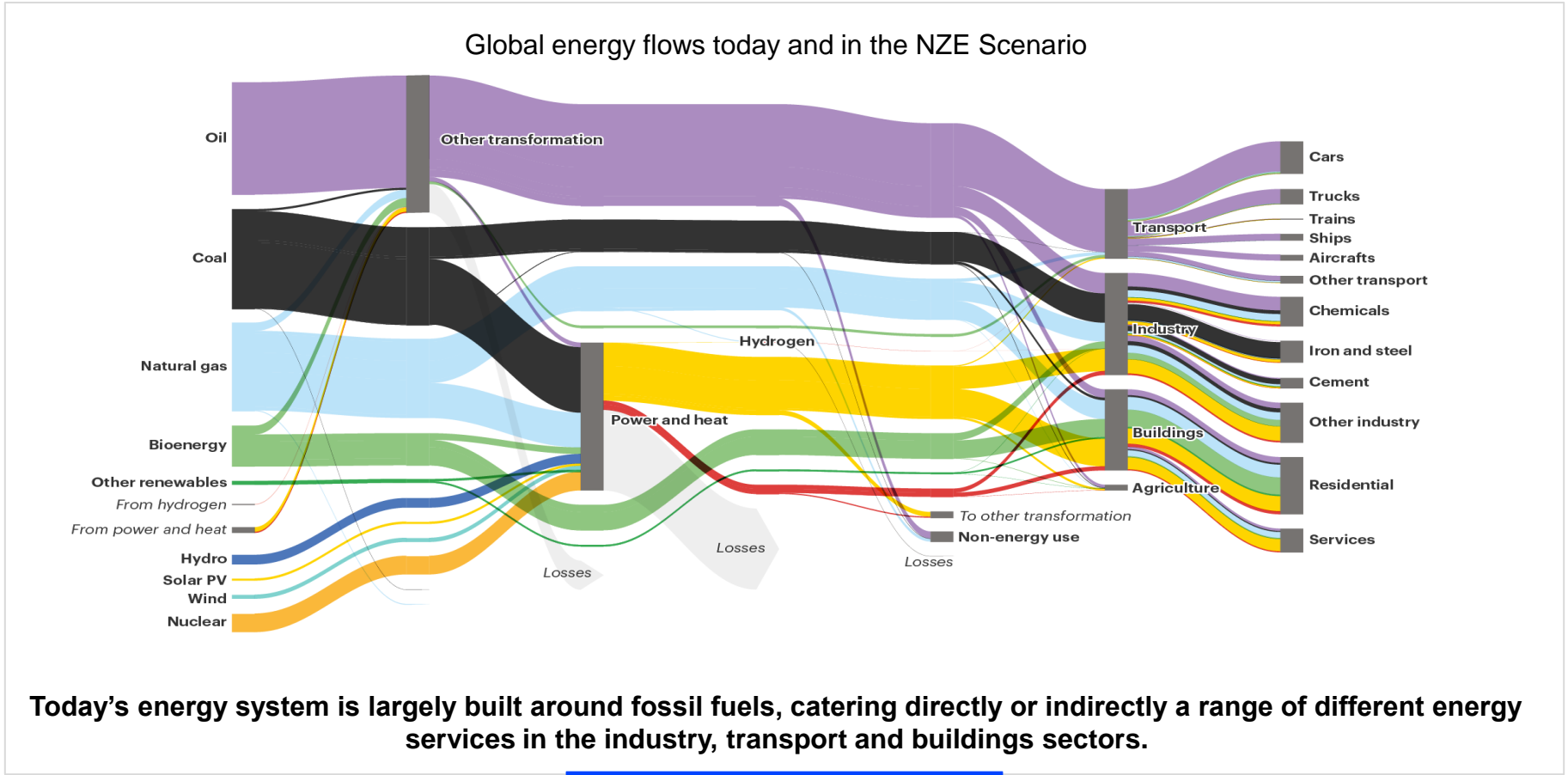
Risks and opportunities for clean energy supply chains

Presentation to SMA Annual General Meeting

02 March 2023

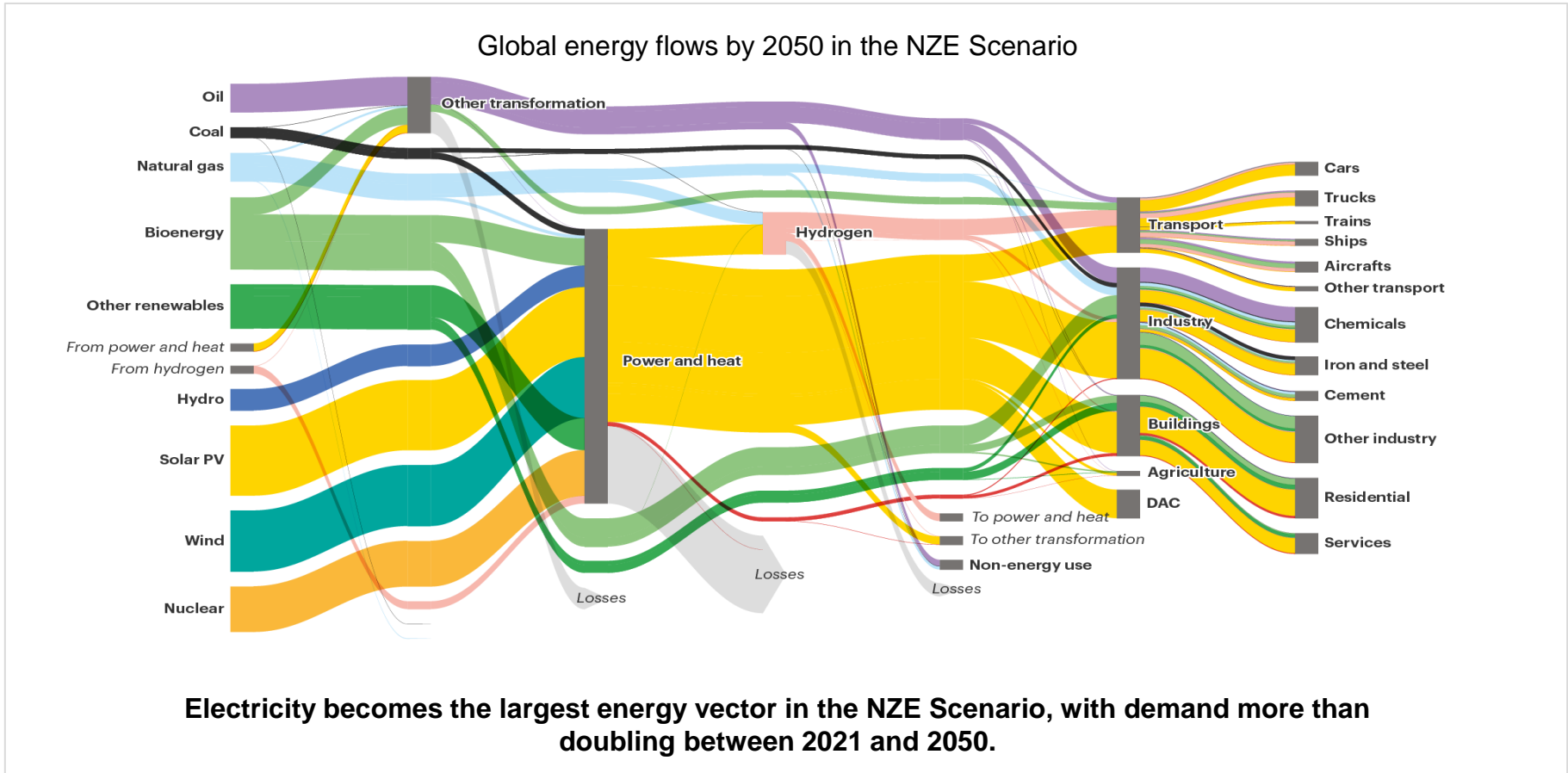
Alexandre Gouy

A new energy system means a new energy supply chain

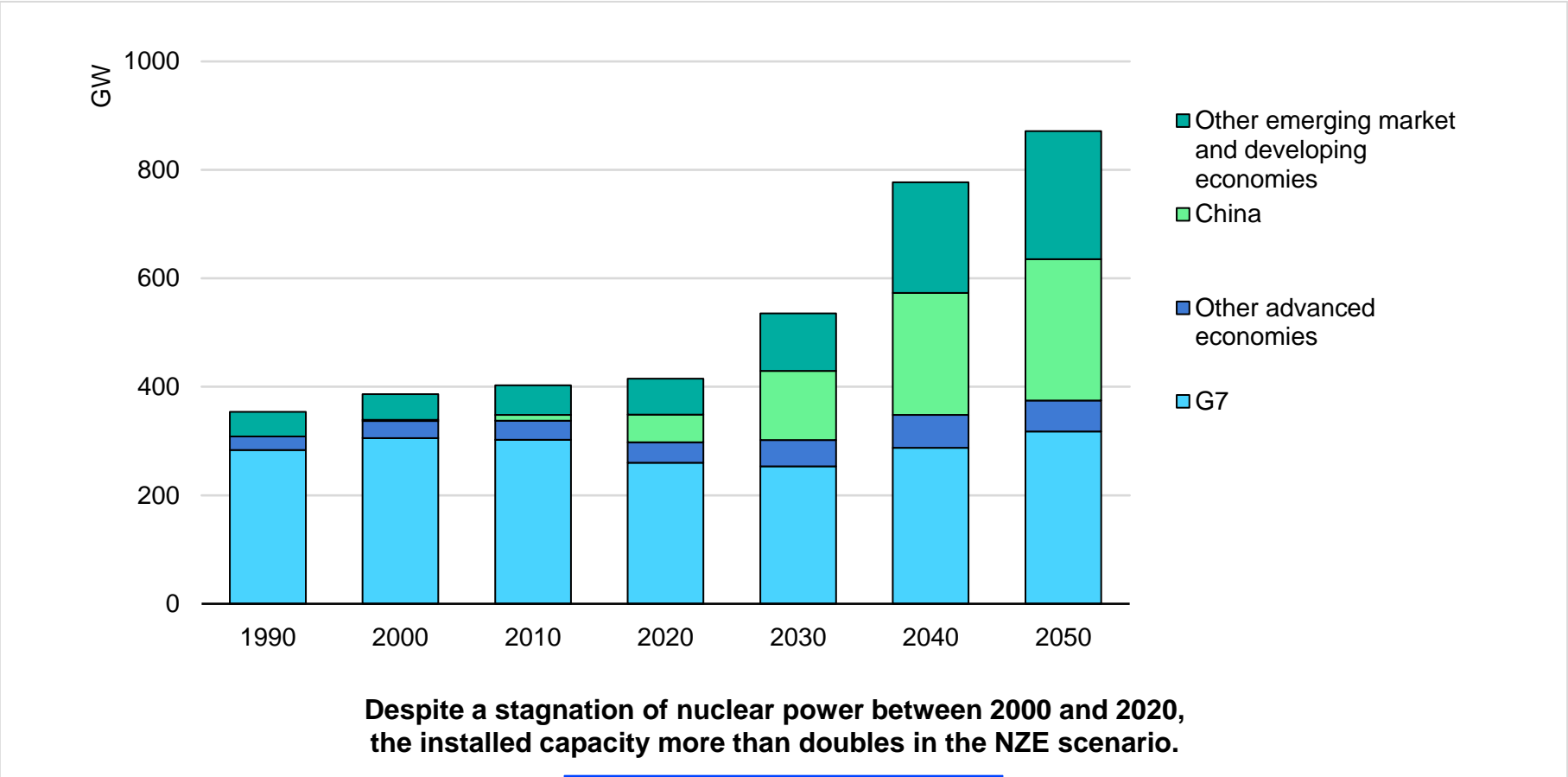


Today's energy system is largely built around fossil fuels, catering directly or indirectly a range of different energy services in the industry, transport and buildings sectors.

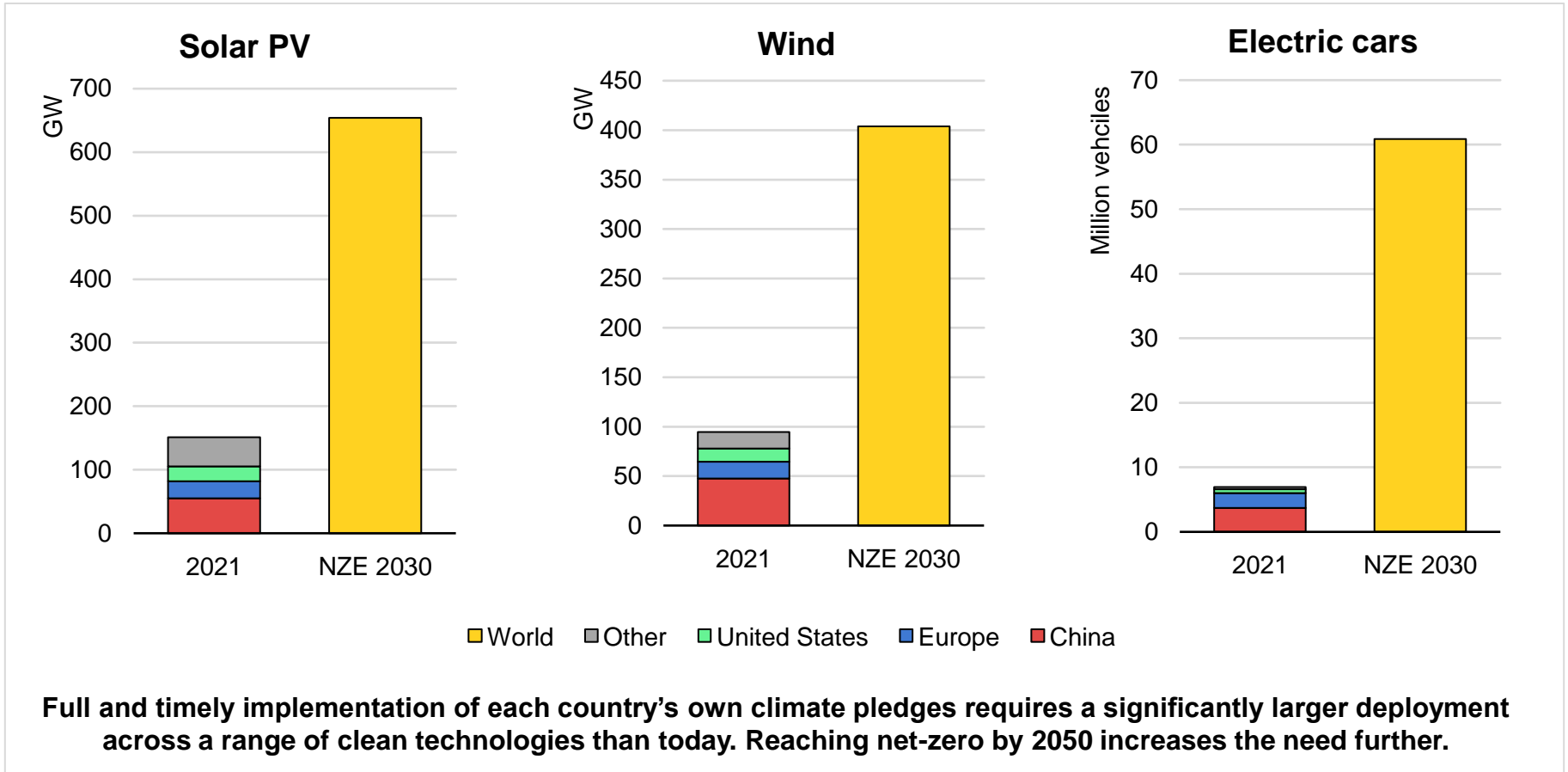
A new energy system means a new energy supply chain



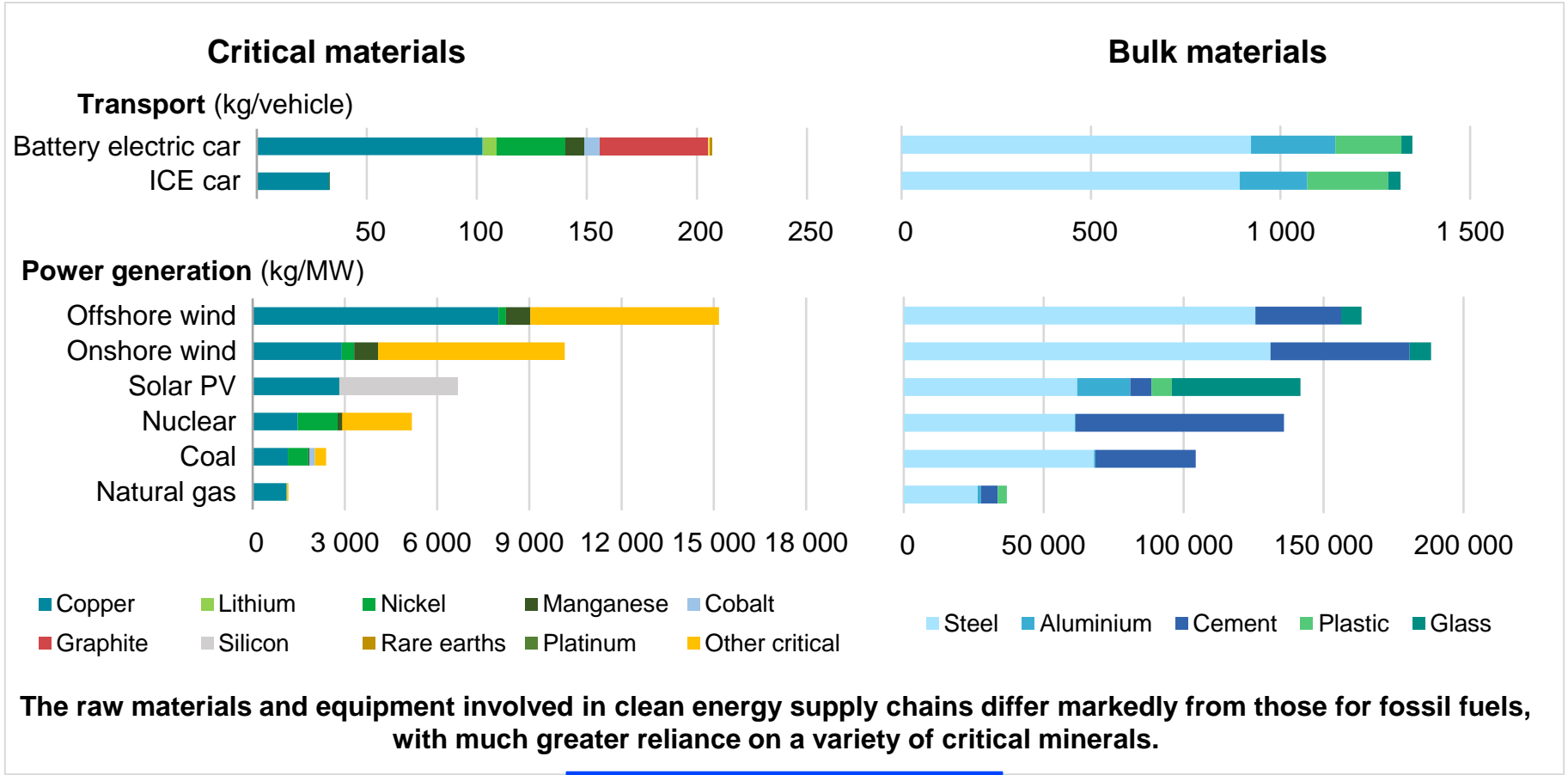
Demand for nuclear power is increasing



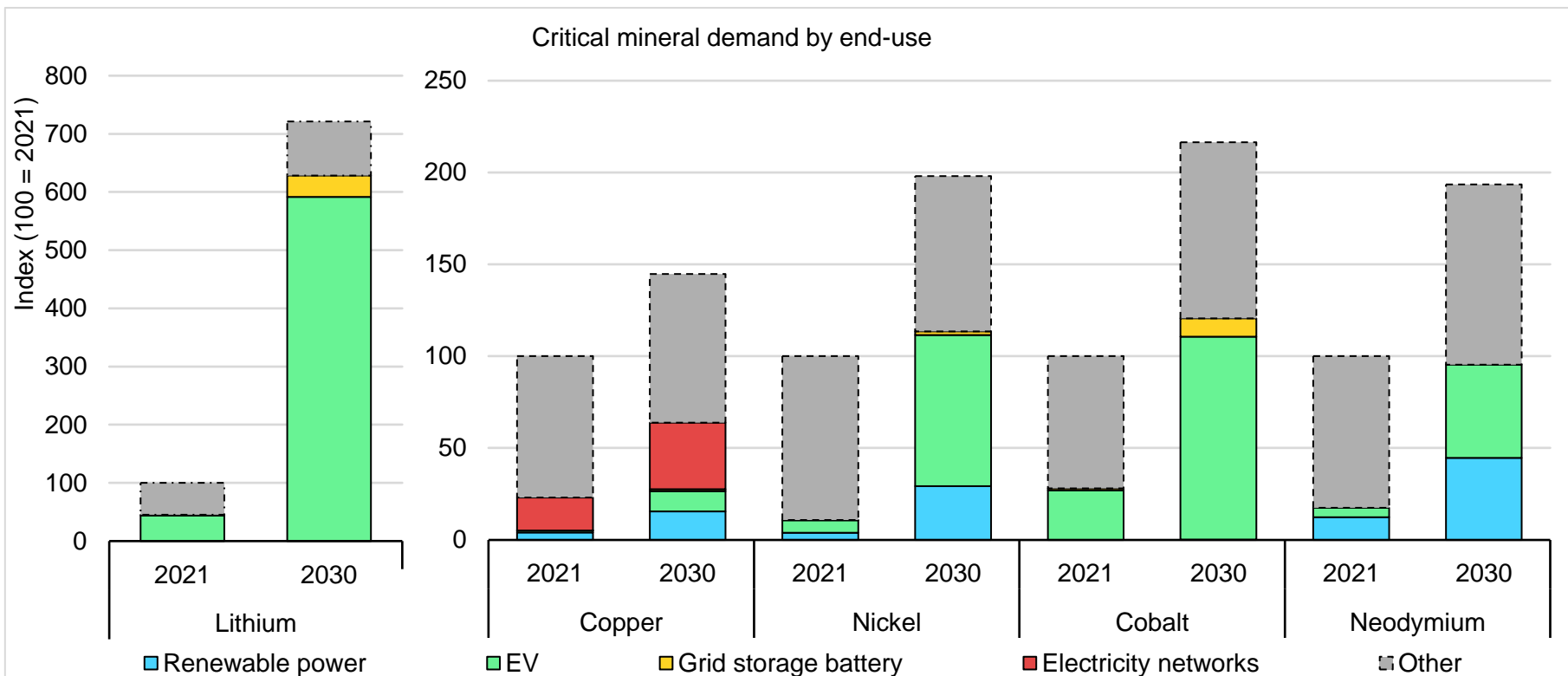
A major scale up of clean energy technologies is needed...



... And those technologies require different materials

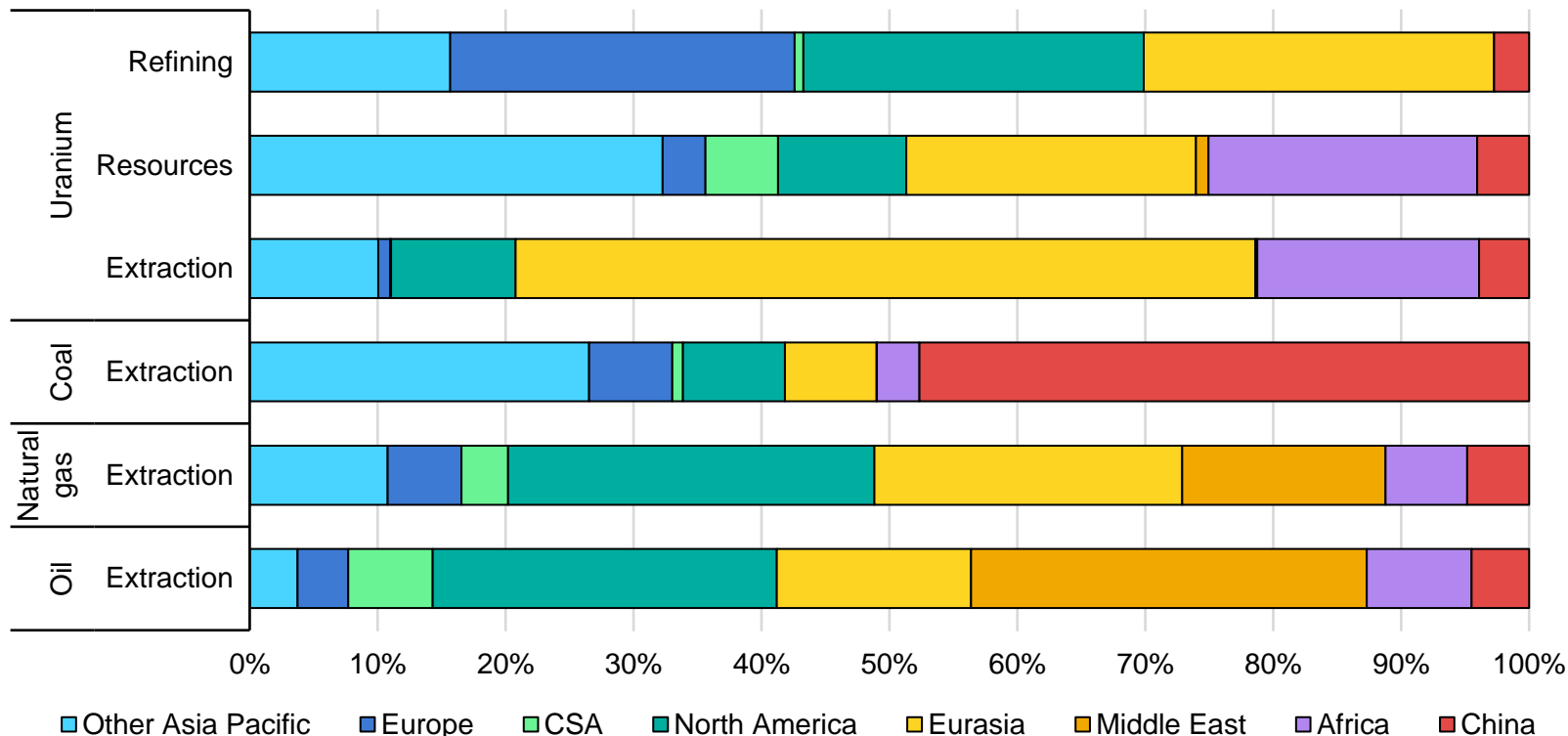


What drives critical mineral demand?



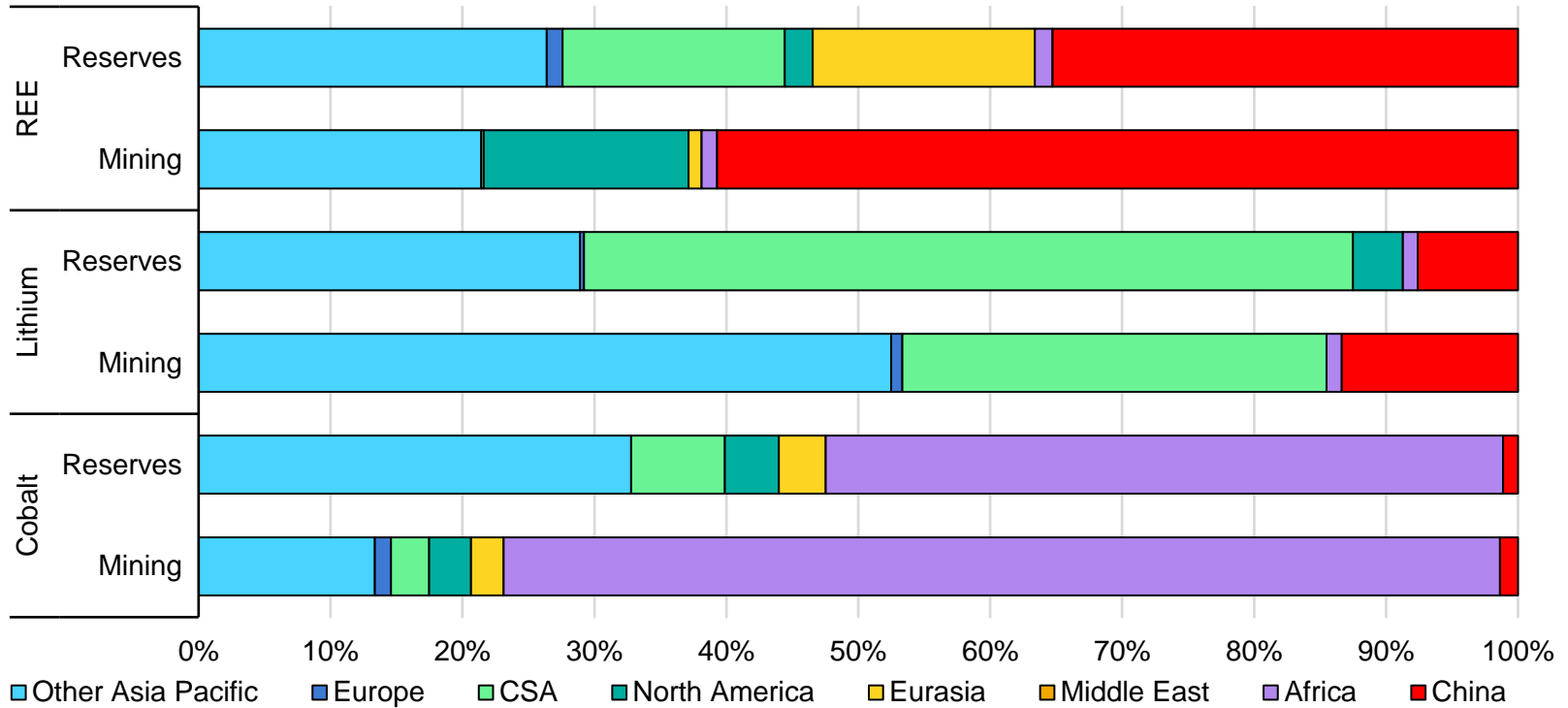
Demand for critical materials increases rapidly in the NZE Scenario, driven mainly by clean energy technologies and infrastructure, lithium having the fastest increase.

Conventional energy sources are decentralised...



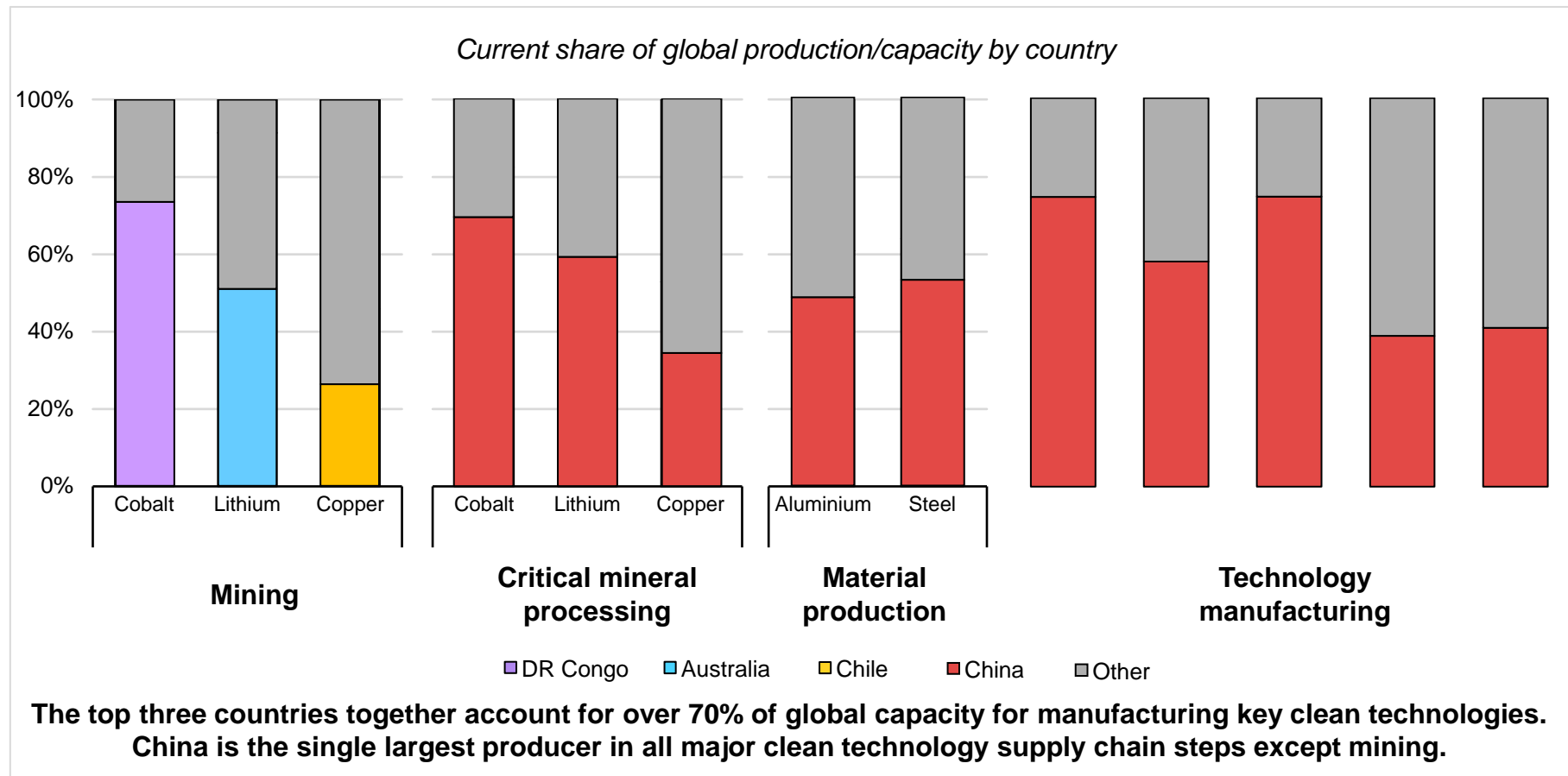
North America and the Middle East are the main sources of oil and gas while China and Kazakhstan are the main producers of coal and uranium respectively.

...But critical mineral mining is highly concentrated

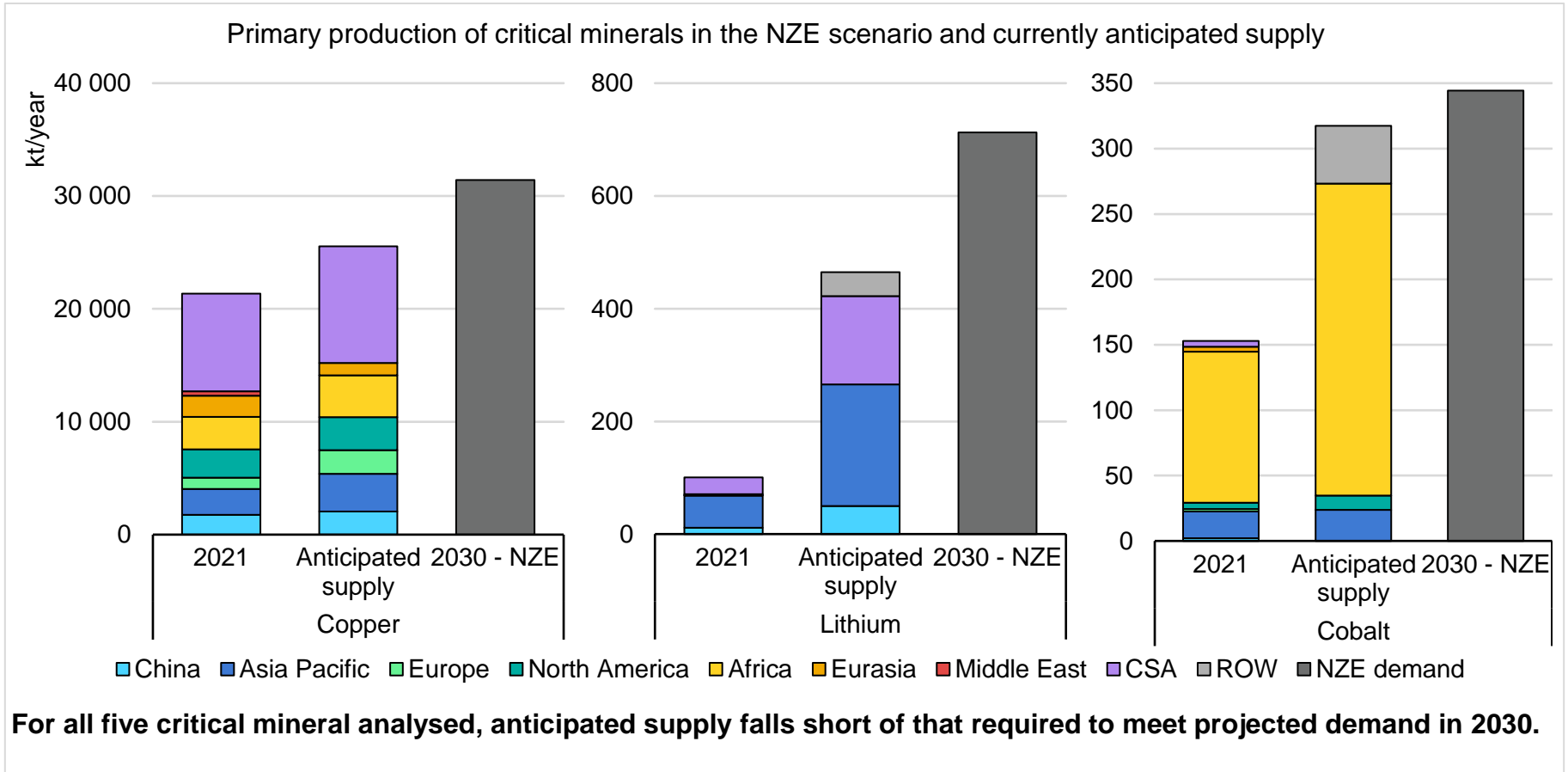


70% of cobalt comes from the DRC and 60% of rare earths come from China. Known reserves are less concentrated, giving opportunity to diversify production.

Clean technology supply chain concentration risks extend beyond mining



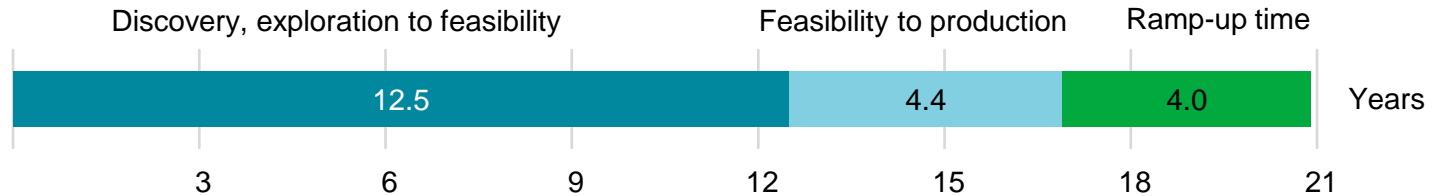
The anticipated mineral supply is not enough



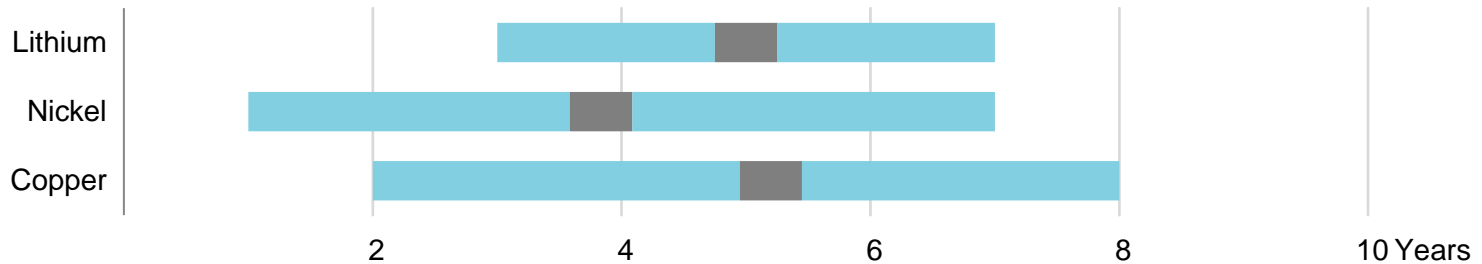
For all five critical mineral analysed, anticipated supply falls short of that required to meet projected demand in 2030.

Long lead times may imply a bottleneck

Global average for new mines, 2010-2019



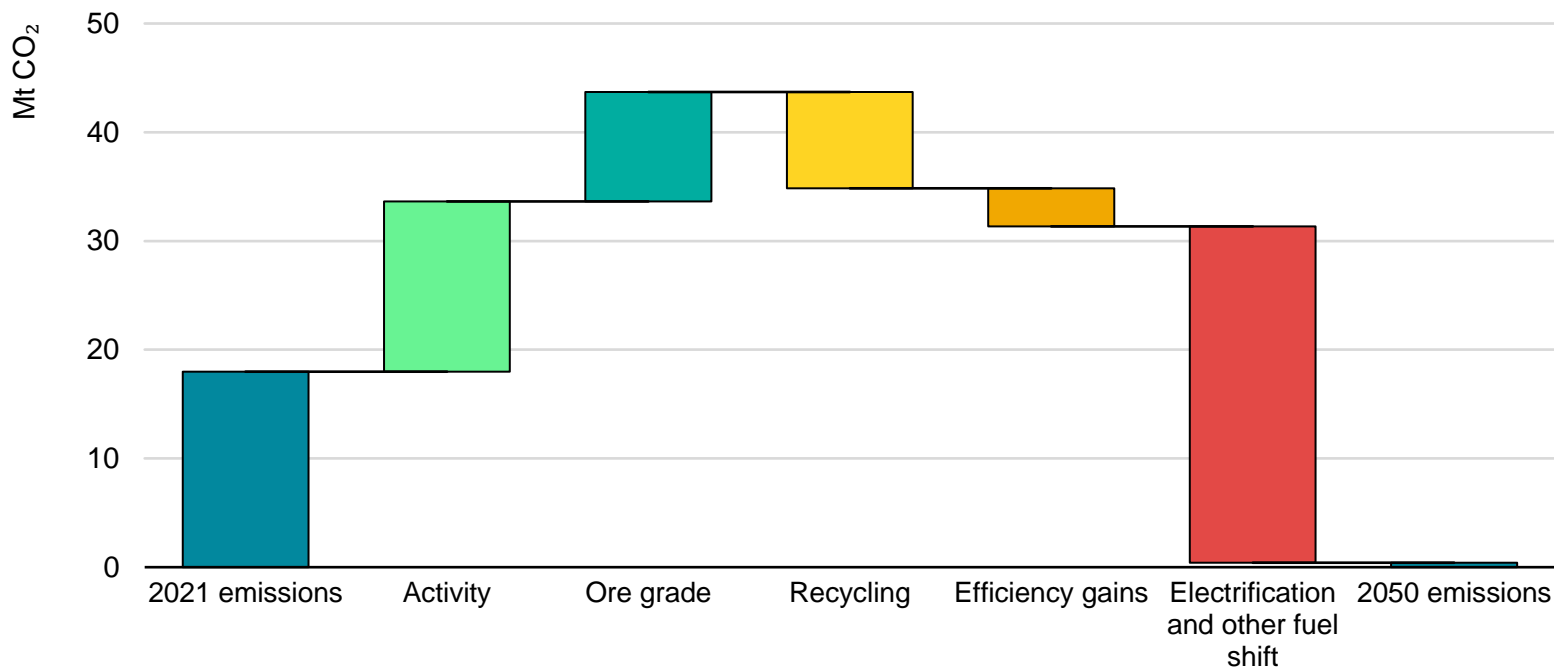
Average observed lead time for selected minerals (from feasibility to production)



Exploration takes the most time in bringing new mines into operation, while construction and ramping up production to full capacity typically take almost a decade.

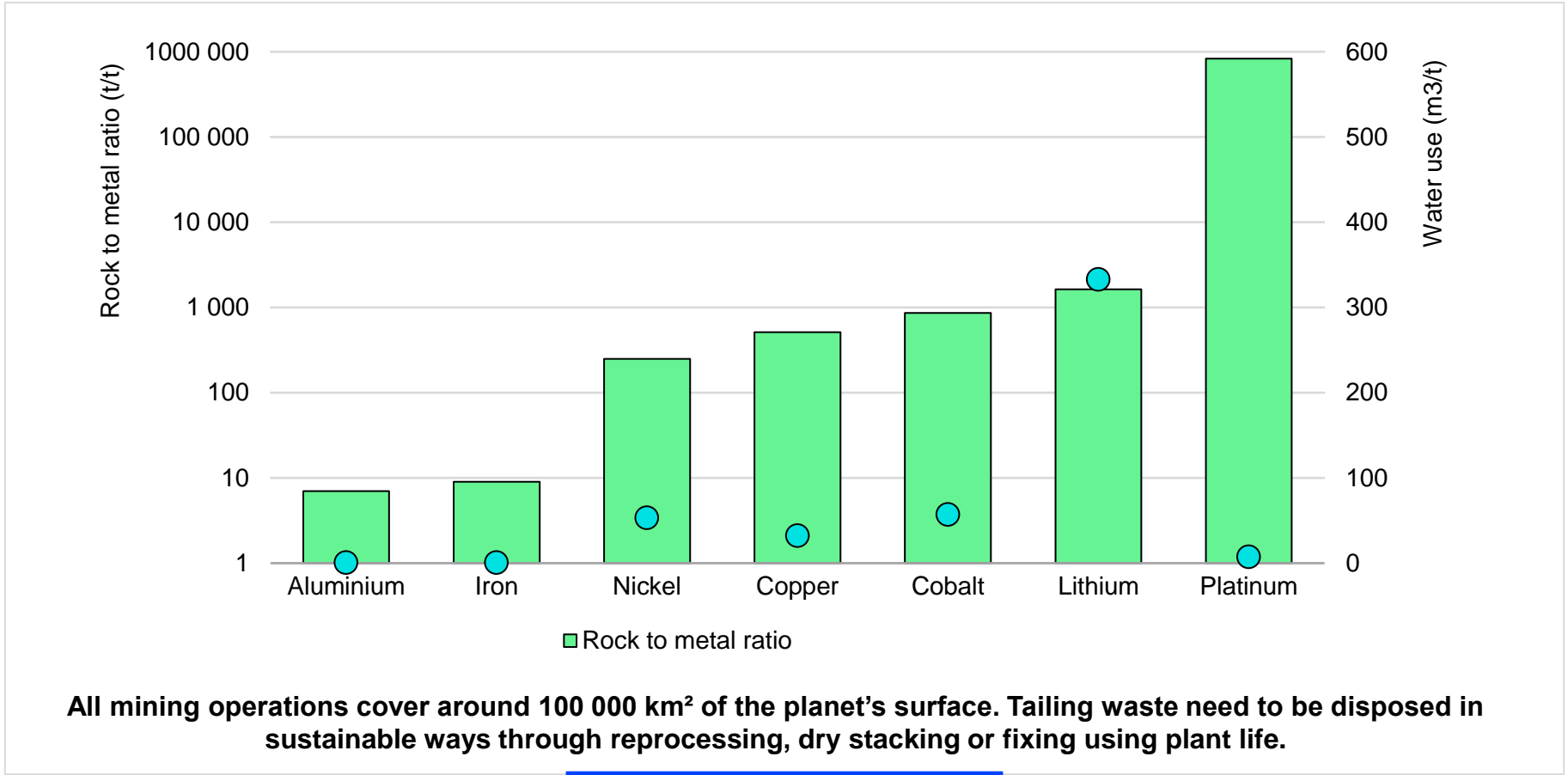
What about the climate impact of mining?

Decomposition of change in direct CO₂ emissions from mining of iron, bauxite, copper, cobalt, nickel and lithium.



Emissions from the mining sector represent less than 1% of current global energy sector emissions. Nonetheless, the increase in activity and decreasing ore grade could increase their weight. Recycling and electrification are key to limit the climate impact of this sector.

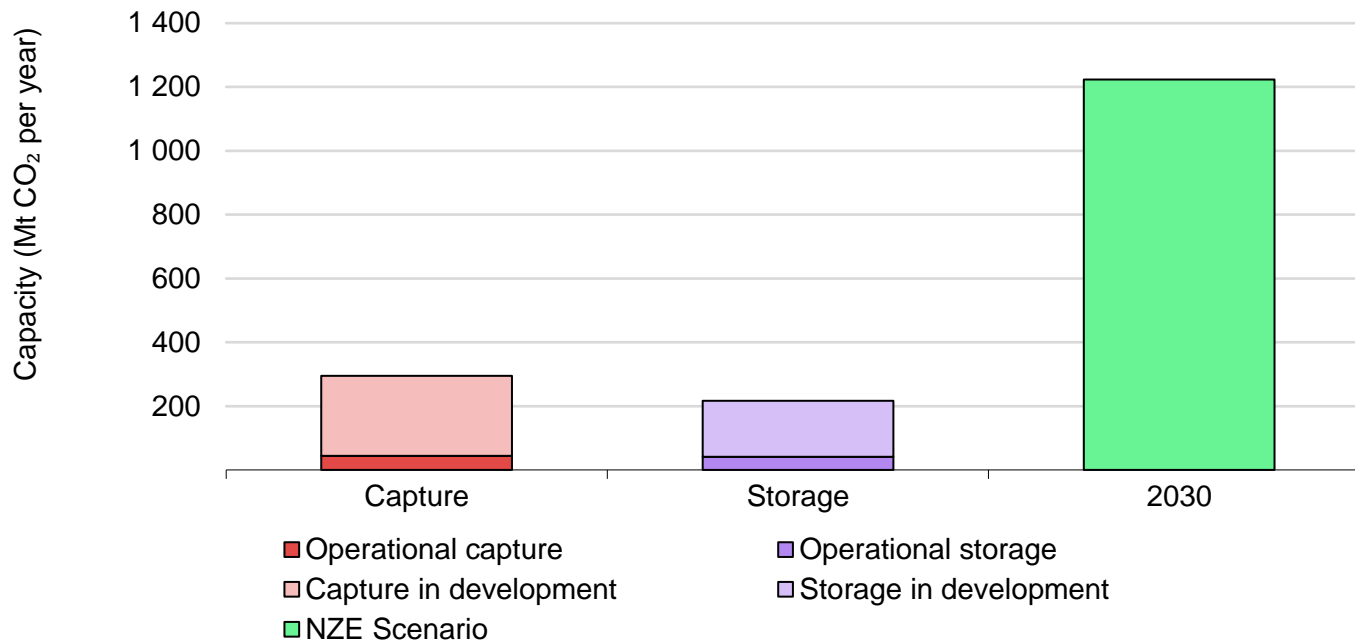
The impact of mining is not limited to CO₂



All mining operations cover around 100 000 km² of the planet's surface. Tailing waste need to be disposed in sustainable ways through reprocessing, dry stacking or fixing using plant life.

Carbon storage is another growing industry

Existing and planned CO₂ storage injection capacity compared with NZE scenario



Substantial capacity to inject CO₂ into geological formations is already in development, but there is a growing gap between capture and storage injection capacity.

- The energy world is in the early phase of a new industrial age – the age of clean energy technology manufacturing; reaping the benefits requires an **all-of-government approach**.
- High geographical and market concentrations threaten **supply security**; the policies to deal with such threats differ by supply chain, and must build on competitive advantages and strengths.
- Boosting **supply chain resilience** and **sustainability** is crucial; market disruptions and input price fluctuations can have profound cost implications.
- Participating in the emerging new energy economy requires **industrial strategies** that build on a **mapping of domestic opportunities** and **identify strategic partnerships**.
- **Time is of the essence** for clean energy technology supply chains; governments hold the key to accelerating deployment and tapping into economic opportunities.

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