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U.S.-China Competition and the Minerals for Green Technologies

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The Role of Critical Minerals for Clean Energy Technologies

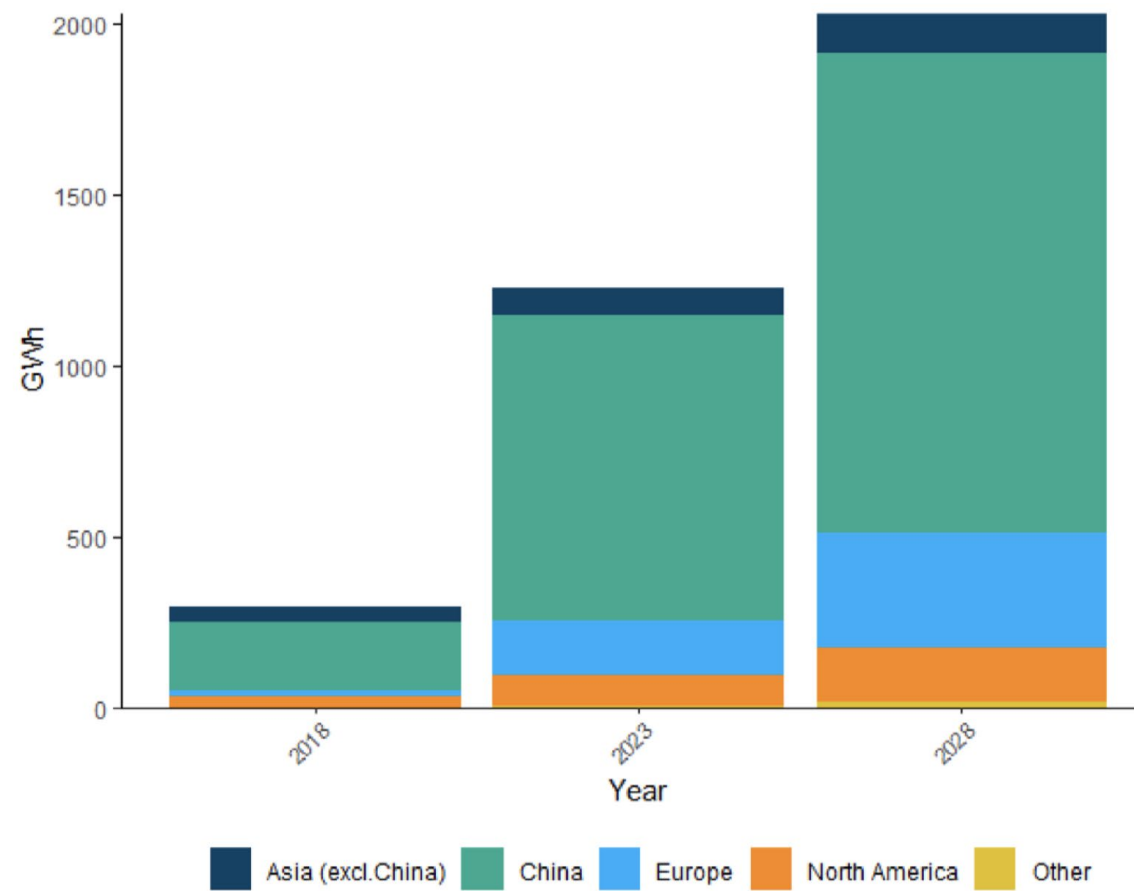
Critical Minerals for Clean Energy

Wind power: aluminum, copper, molybdenum, rare earth elements, zinc, etc...

Solar PV cells: aluminum, copper, lead, silicon, silver, tin, lead, etc.

Lithium-ion batteries: cobalt, lithium, manganese, nickel, etc...

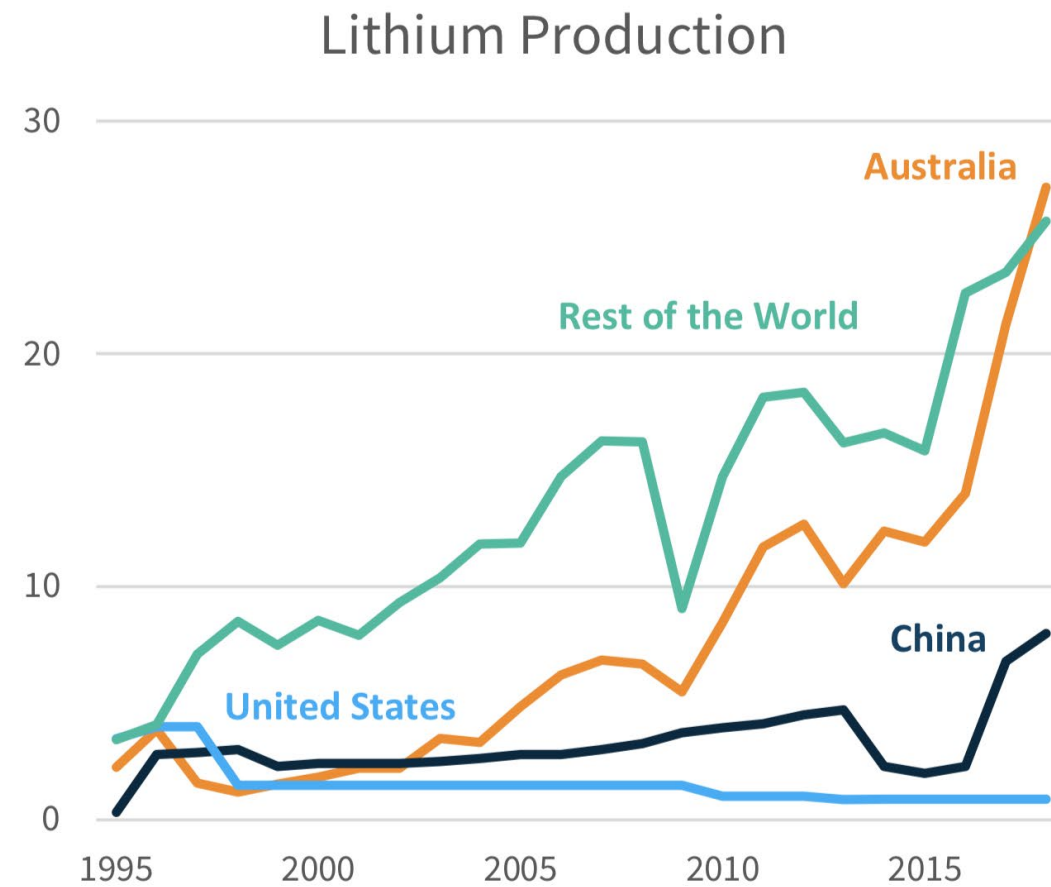
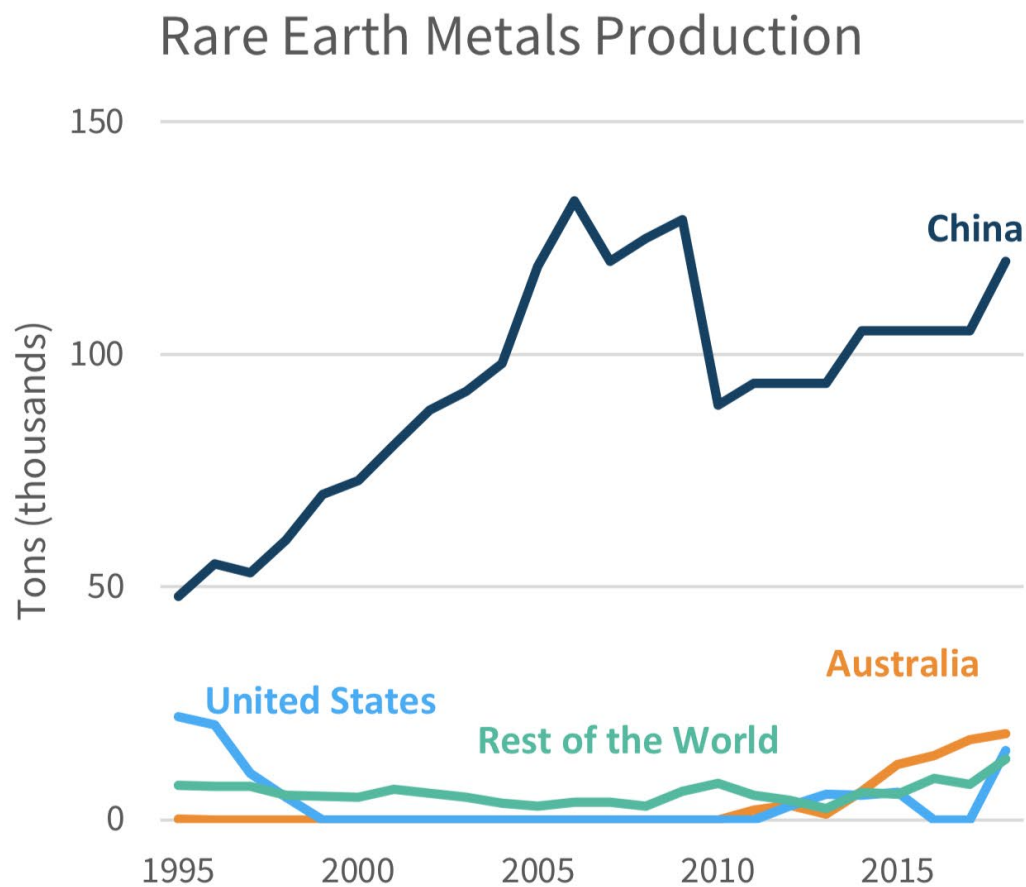
Lithium-ion battery production capacity



Source: Benchmark Mineral Intelligence, *Lithium Ion Battery Megafactory Assessment* (August 2019), <https://www.benchmarkminerals.com/megafactories/>.

The U.S. is Significantly Import Dependent for Clean Energy Component Minerals

Critical Minerals Global Production Levels



Source: BP, *BP Statistical Review of World Energy, 2019* (London: 2019), <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf>.

China Has Long Taken a Strategic Approach to the CM Industry

Key Takeaways

- Resource endowment (e.g., Baotou in the north, and Gannan-Yuebei in the south).
- Strategic focus has shifted from primarily expanding industry production, towards creating higher value.
- Policy support includes:
 - 7th Five-Year Plan (1986-1990) for Rare Earth Industry
 - *Made in China 2025* >> “new materials” industry (e.g., permanent magnets)
- Financial and regulatory support
- **Where China is limited in upstream resources, the country invests abroad.**
- **Chinese dominance of the critical minerals supply chain lies in the midstream/processing.**

Critical Minerals Global Production (2017)

