

Dr. Helen Degeling

# The rise of critical minerals

... and what it means for you

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# What we'll cover....

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- Why are critical minerals so important, where are they located, and who's mining them?
- Surveying Australia's place in the global critical minerals market and what it means for Australian mining companies
- Forecasting the changing landscape in Australian mining as the critical minerals sector grows



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# The criticality of critical minerals

- A critical mineral or metal is one that is....
  1. essential for the functioning of our modern technologies, economies or national security and
  2. There is a risk that its supply chains could be disrupted.

*Australia's critical minerals list*

Be	Bi	Cr	Co	Ga
Ge	Graphite	He	Hf	HPA
In	Li	Mg	Mn	Nb
PGEs	REEs	Re	Sb	Sc
Si	Ta	Ti	V	W
		Zr		

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4

Jurisdiction	N. of critical minerals
Australia	26
US	33
EU	31 + Cu, Ni
Japan	31
China	24

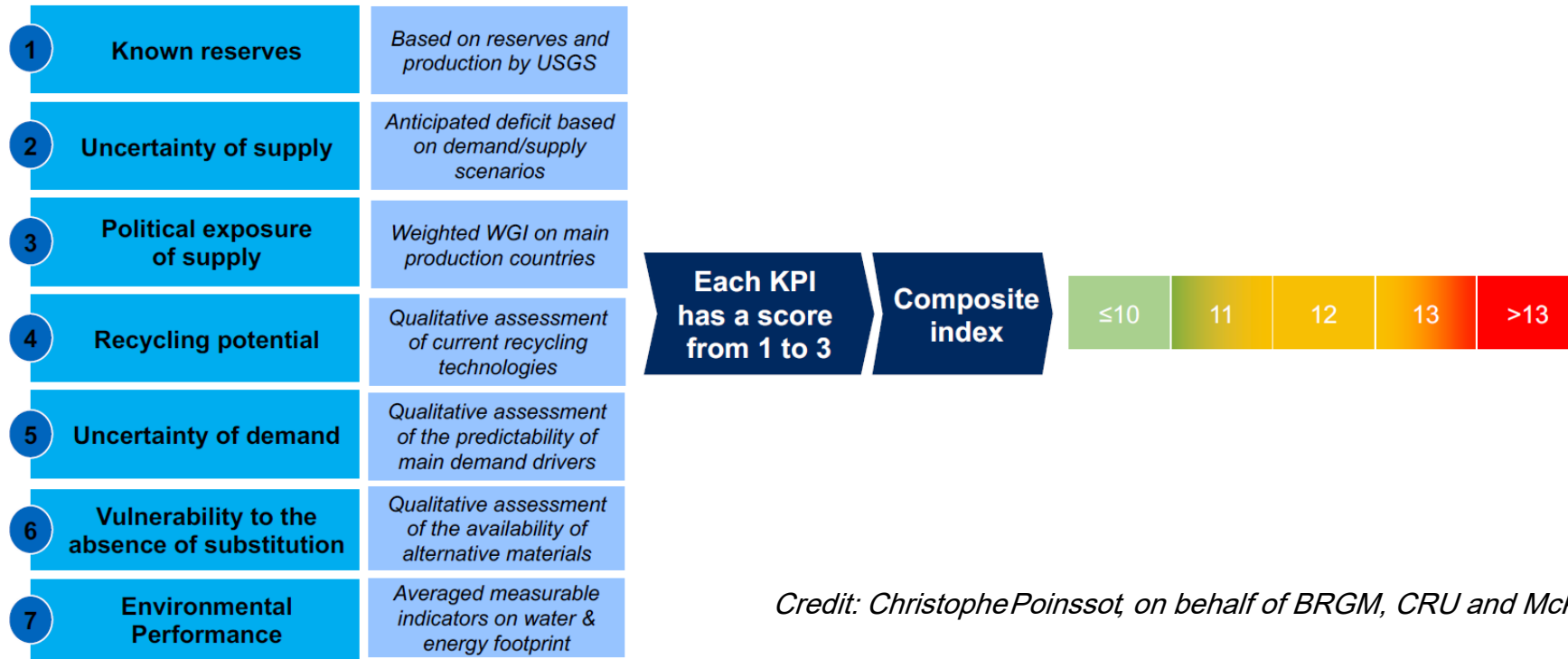


# The criticality of critical minerals

## WMF Criticality assessment methodology



- Methodology is based on 7 quantitative and qualitative KPIs, with Environmental Performance introduced in 2021
- The combination of them allows for a thorough understanding of key challenges facing value chains in the years ahead




Credit: Christophe Poinsoot, on behalf of BRGM, CRU and McKinsey




# What green energy technology is driving metal demand?

26 <b>Fe</b>	60 <b>Nd</b>	5 <b>B</b>	66 <b>Dy</b>	3 <b>Li</b>
28 <b>Ni</b>	12 <b>Mg</b>	27 <b>Co</b>	6 <b>C</b>	23 <b>V</b>
29 <b>Cu</b>	14 <b>Si</b>	42 <b>Mo</b>	30 <b>Zn</b>	13 <b>Al</b>




Windfarms

48 <b>Cd</b>	52 <b>Te</b>	42 <b>Mo</b>	4 <b>Be</b>	32 <b>Ge</b>
31 <b>Ga</b>	49 <b>In</b>	47 <b>Ag</b>	14 <b>Si</b>	5 <b>B</b>
15 <b>P</b>	13 <b>Al</b>	22 <b>Ti</b>	30 <b>Zn</b>	12 <b>Mg</b>
29 <b>Cu</b>				




Solar panels

30 <b>Zn</b>	25 <b>Mn</b>	19 <b>K</b>	47 <b>Ag</b>	3 <b>Li</b>
27 <b>Co</b>	6 <b>C</b>	28 <b>Ni</b>	82 <b>Pb</b>	23 <b>V</b>



Batteries

26 <b>Fe</b>	25 <b>Mn</b>	23 <b>V</b>	42 <b>Mo</b>	13 <b>Al</b>
12 <b>Mg</b>	58 <b>Ce</b>	66 <b>Dy</b>	60 <b>Nd</b>	3 <b>Li</b>
27 <b>Co</b>	28 <b>Ni</b>	6 <b>C</b>	29 <b>Cu</b>	

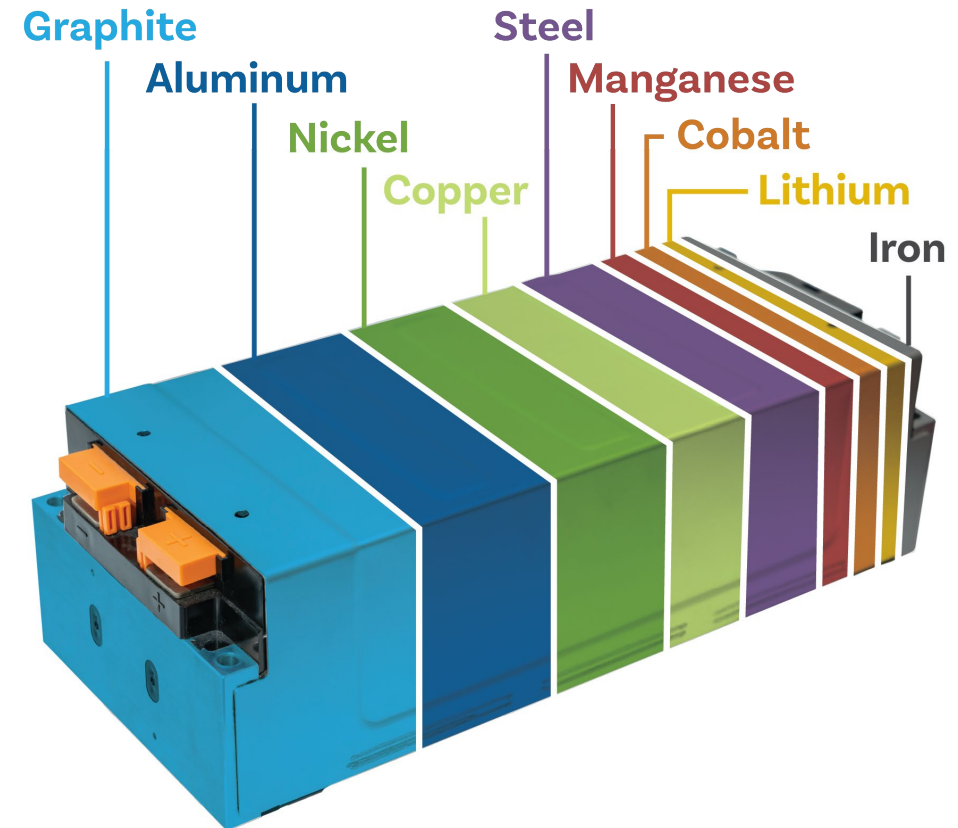


Electric vehicles



# What metals are in a typical EV battery?

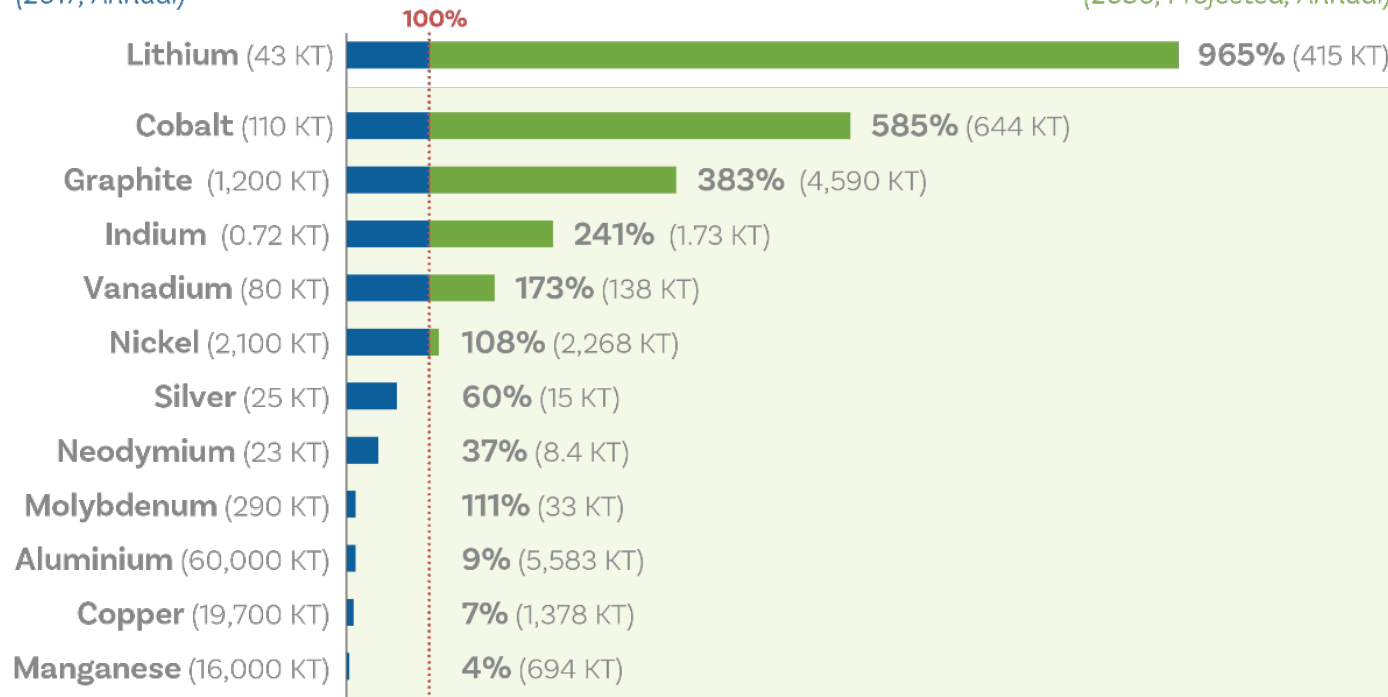
Mineral	Cell Part	Amount Contained in the Avg. 2020 Battery (kg)	% of Total
Nickel	Cathode	29kg	16%
Manganese	Cathode	10kg	5%
Cobalt	Cathode	8kg	4%
Lithium	Cathode	6kg	3%
Iron	Cathode	5kg	3%
Graphite	Anode	52kg	28.0%
Aluminum	Cathode, Casing, Current collectors	35kg	19%
Steel	Casing	20kg	11%
<b>Total</b>		<b>185kg</b>	<b>100%</b>



# Growing demand

Current **Production**  
(2017, Annual)

**2050 Demand** in supplying each energy technology  
(2050, Projected, Annual)

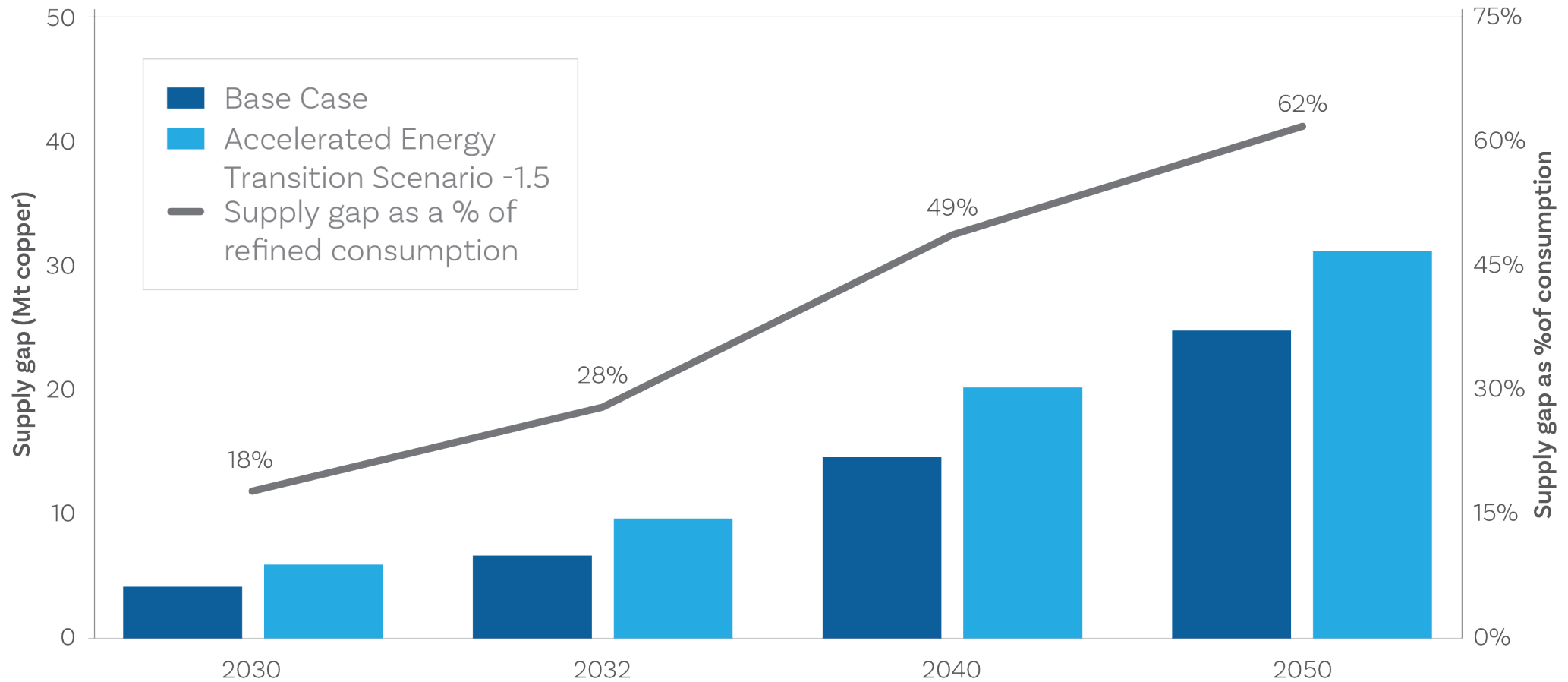


- Demand driven by energy technology
- Similar demands driven by electric car manufacturing, other technologies (phones, magnets, etc)



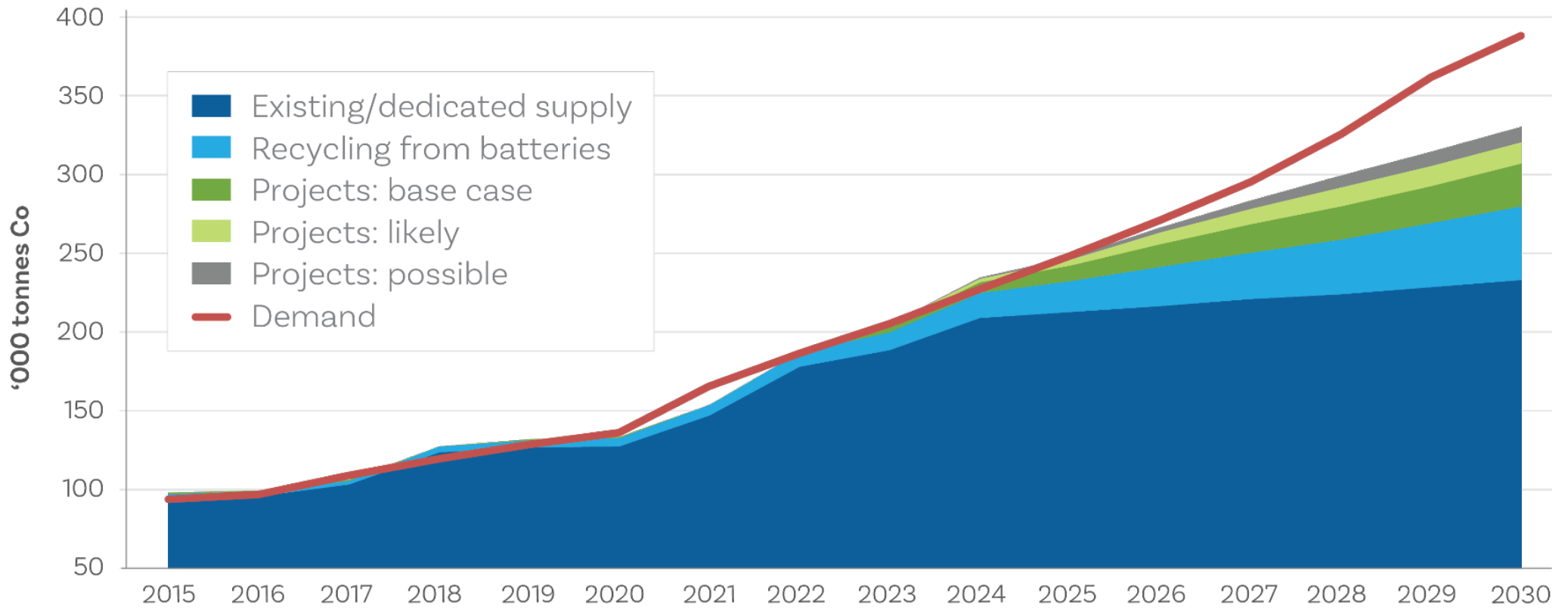


# Cu Future Supply vs Demand

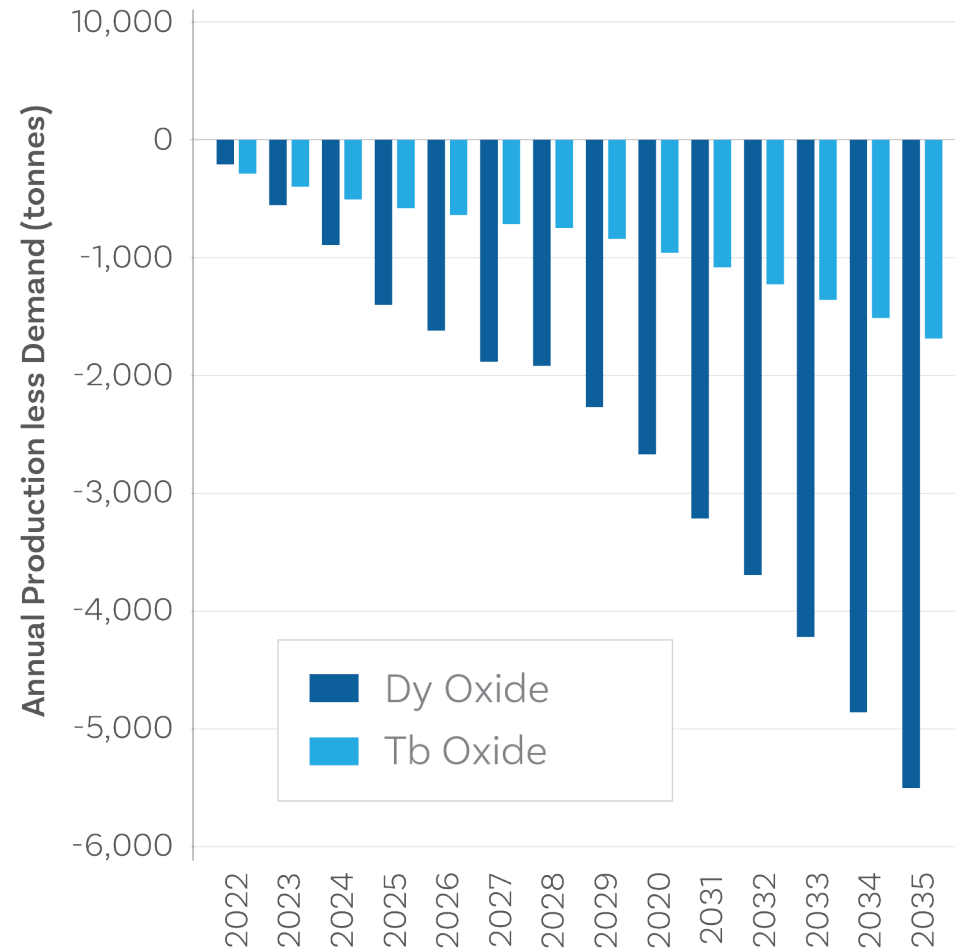
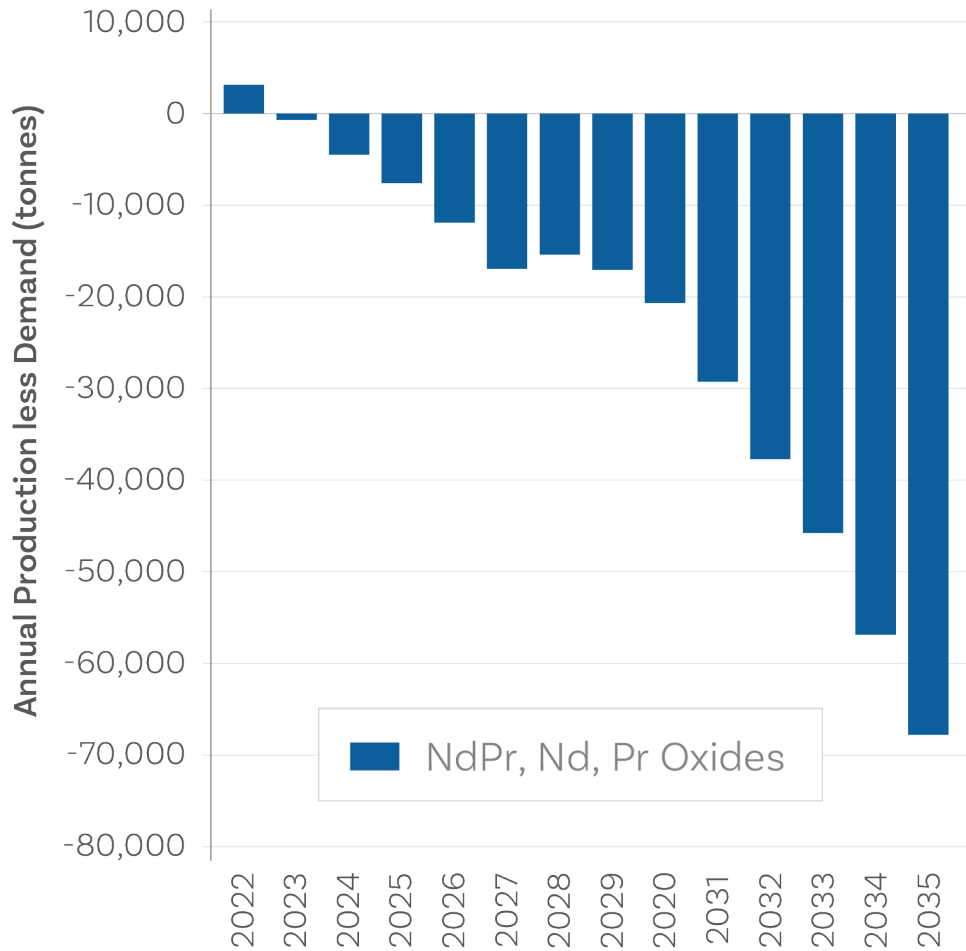


# Cobalt future of supply and demand

Another ~50ktpa is required by 2025, reaching another ~150ktpa by 2030

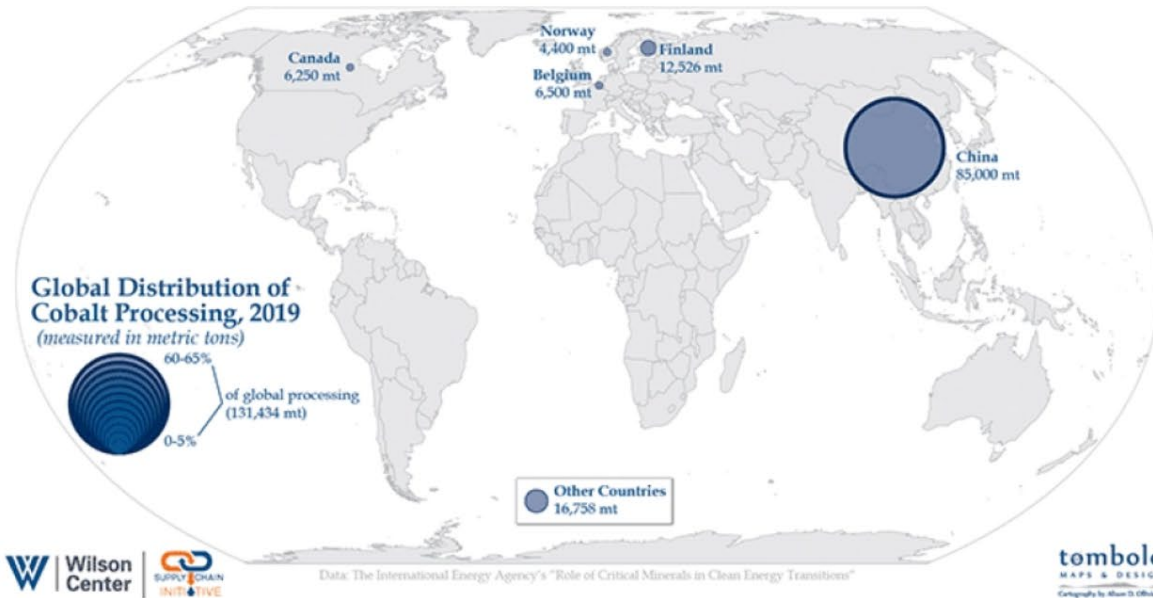


# REE Future Supply vs Demand

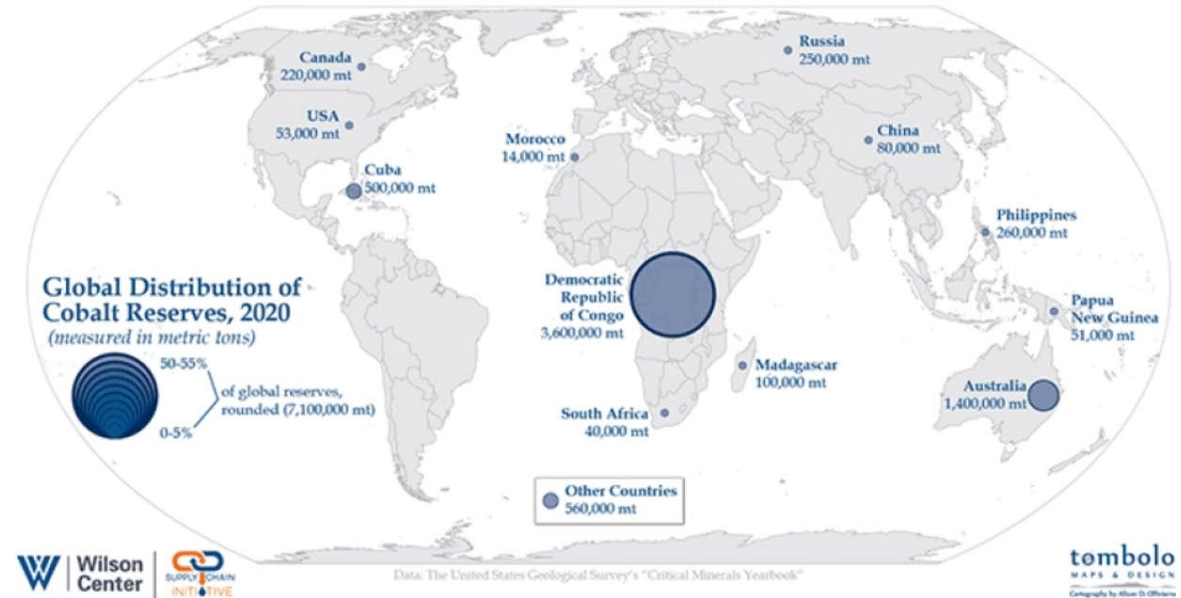


# Where in the world...

## Cobalt Processing

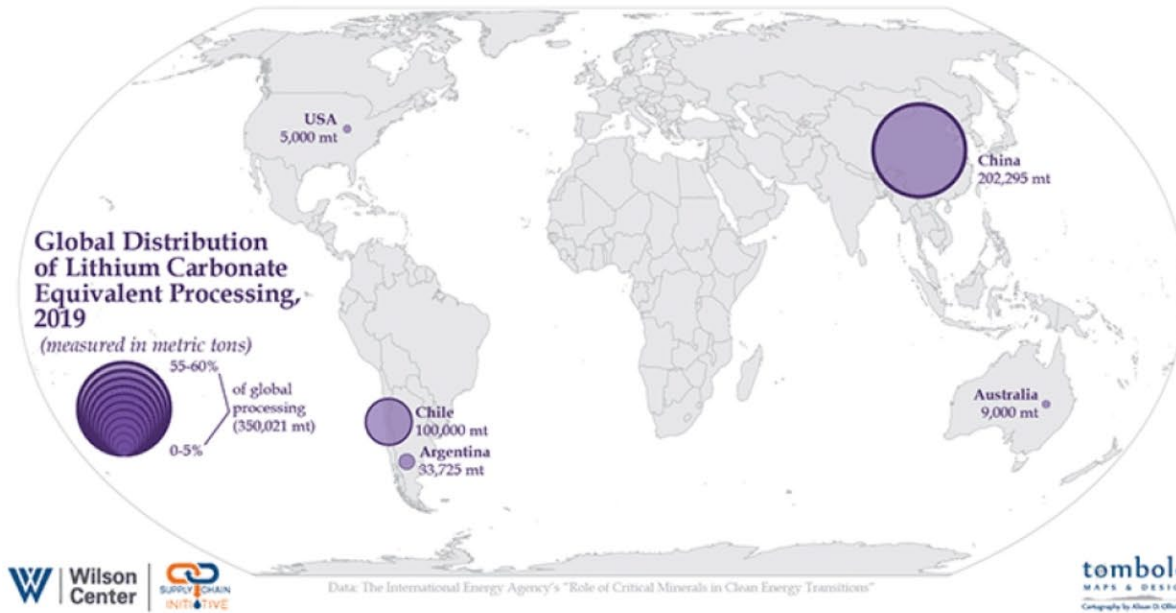


## Cobalt Reserves

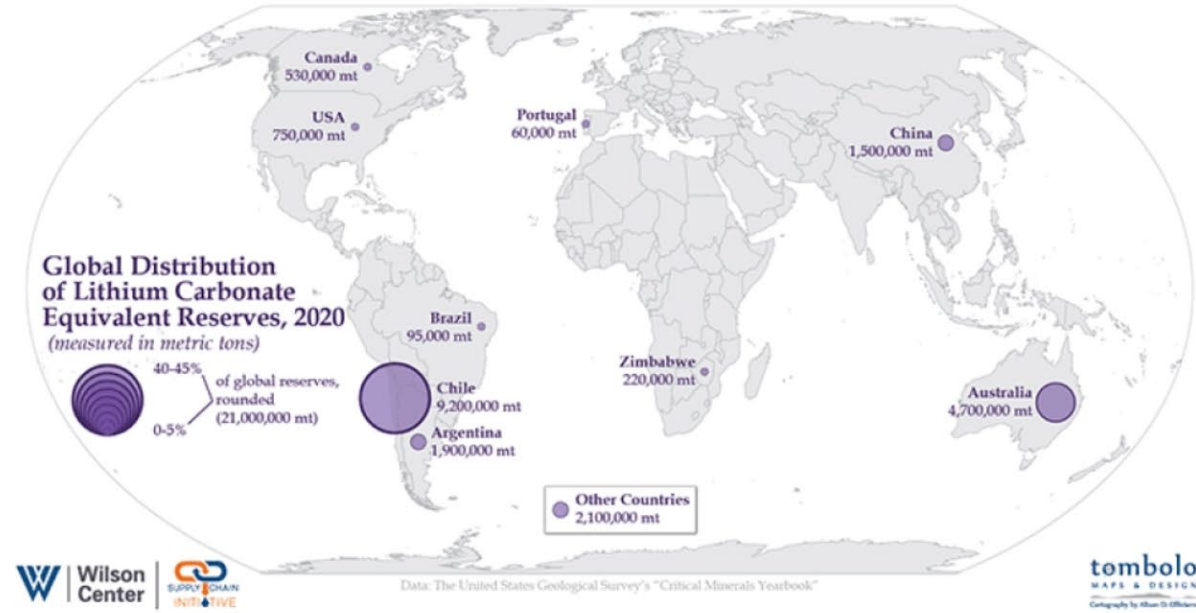


# Where in the world...

## Lithium Processing



## Lithium Reserves



# Where in the world...

## Nickel Refining

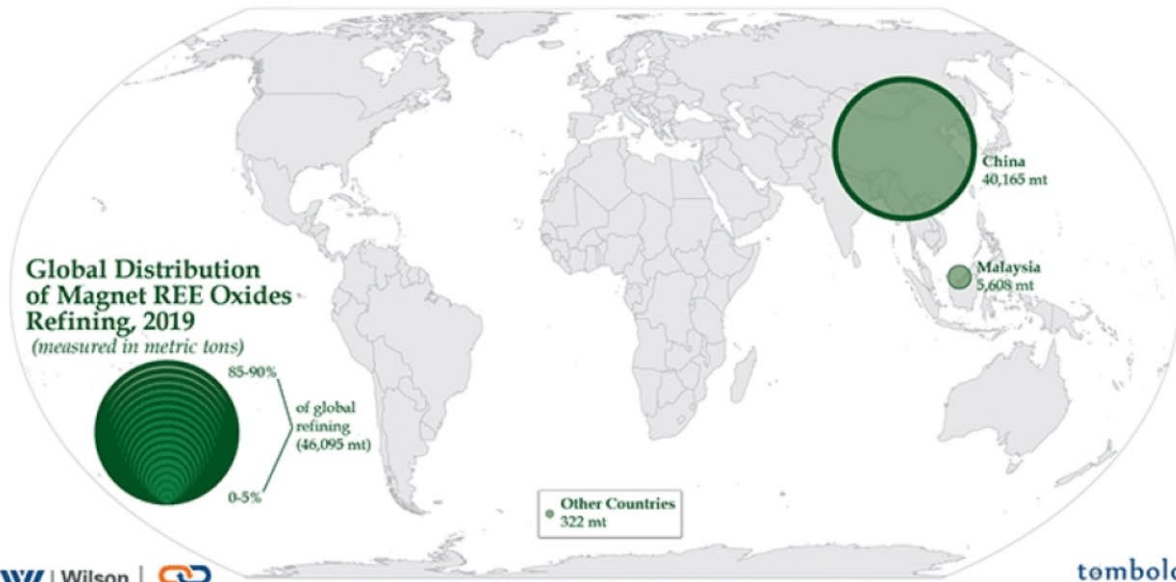


## Nickel Reserves



# Where in the world...

## REE Refining

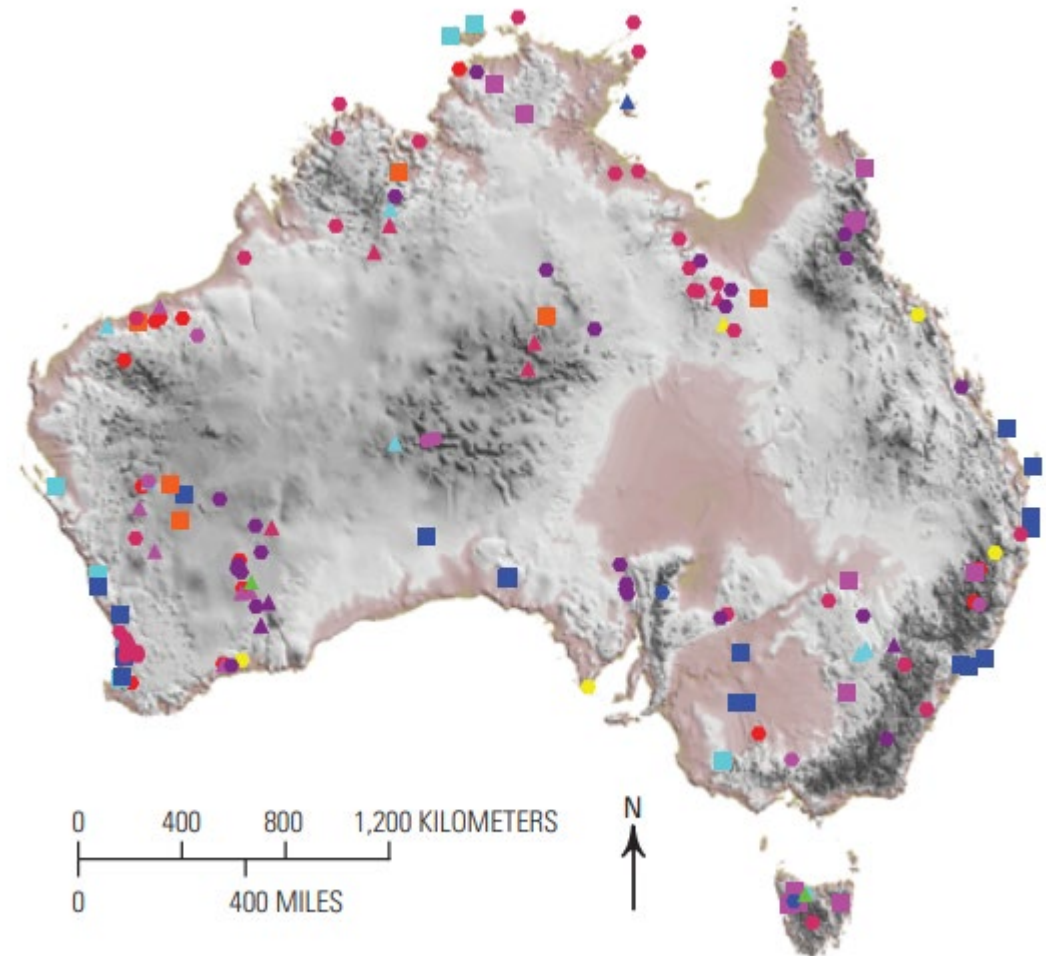


## REE Reserves



# Where does Australia fit?

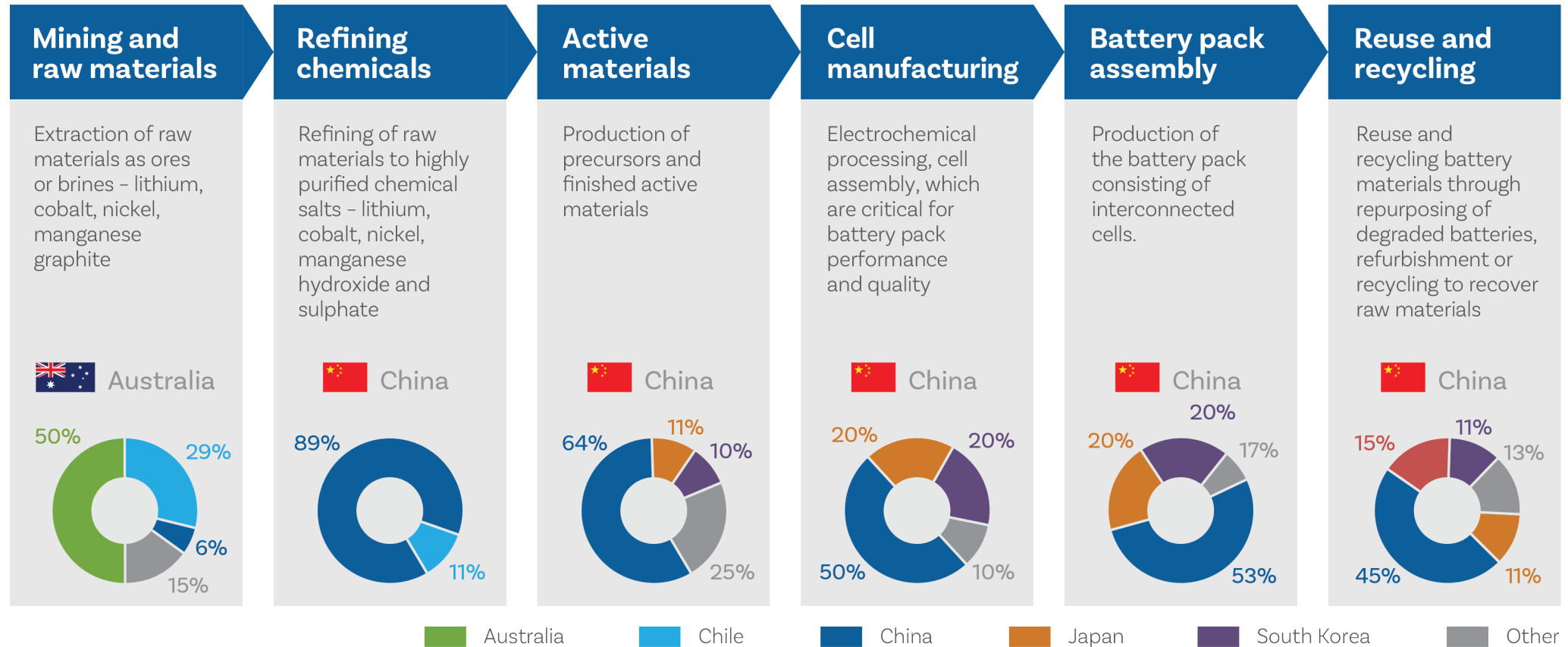
- Global top 3 resource inventory for:
  - Bauxite
  - Cobalt
  - Copper
  - Lithium
  - Manganese
  - Nickel
  - Tungsten
  - Vanadium
  - zinc





# The battery supply chain

Batteries are produced through a complex value chain, with Australia strong in mining and China dominant downstream

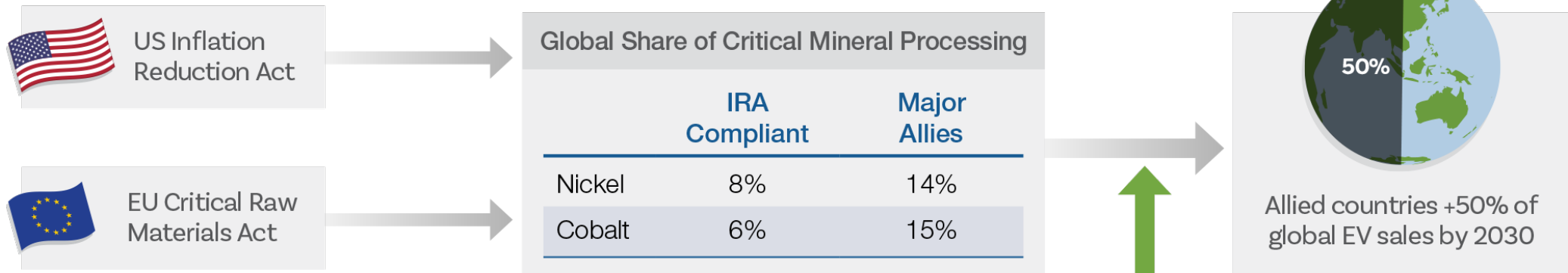


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Source: Benchmark Minerals, Cobalt Blue Holdings Limited



# Supply chain diversification



## OPPORTUNITIES



Australia is the only Allied country that produces all four cathode elements (lithium, nickel, cobalt & manganese)



Cobalt Blue to become one of the largest Allied suppliers of cobalt sulphate



# Our critical future

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- Advanced processing and manufacturing in Australia requires
  - Foresight (the long term view)
  - Collaboration (industry, govt, academia)
  - Investment (industry and govt)
- Future with investment in key sectors
  - Exploration and mining
  - Tailings re-processing
  - Processing
  - Manufacturing
  - Sustainability
- Future without govt/other investment
  - We are the world's quarry
  - Loss of investment, loss of knowledge, loss of rewards



# Cobalt Blue

[www.cobaltblueholdings.com](http://www.cobaltblueholdings.com)

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