


Minerals, Critical Materials, and the US Energy Transition

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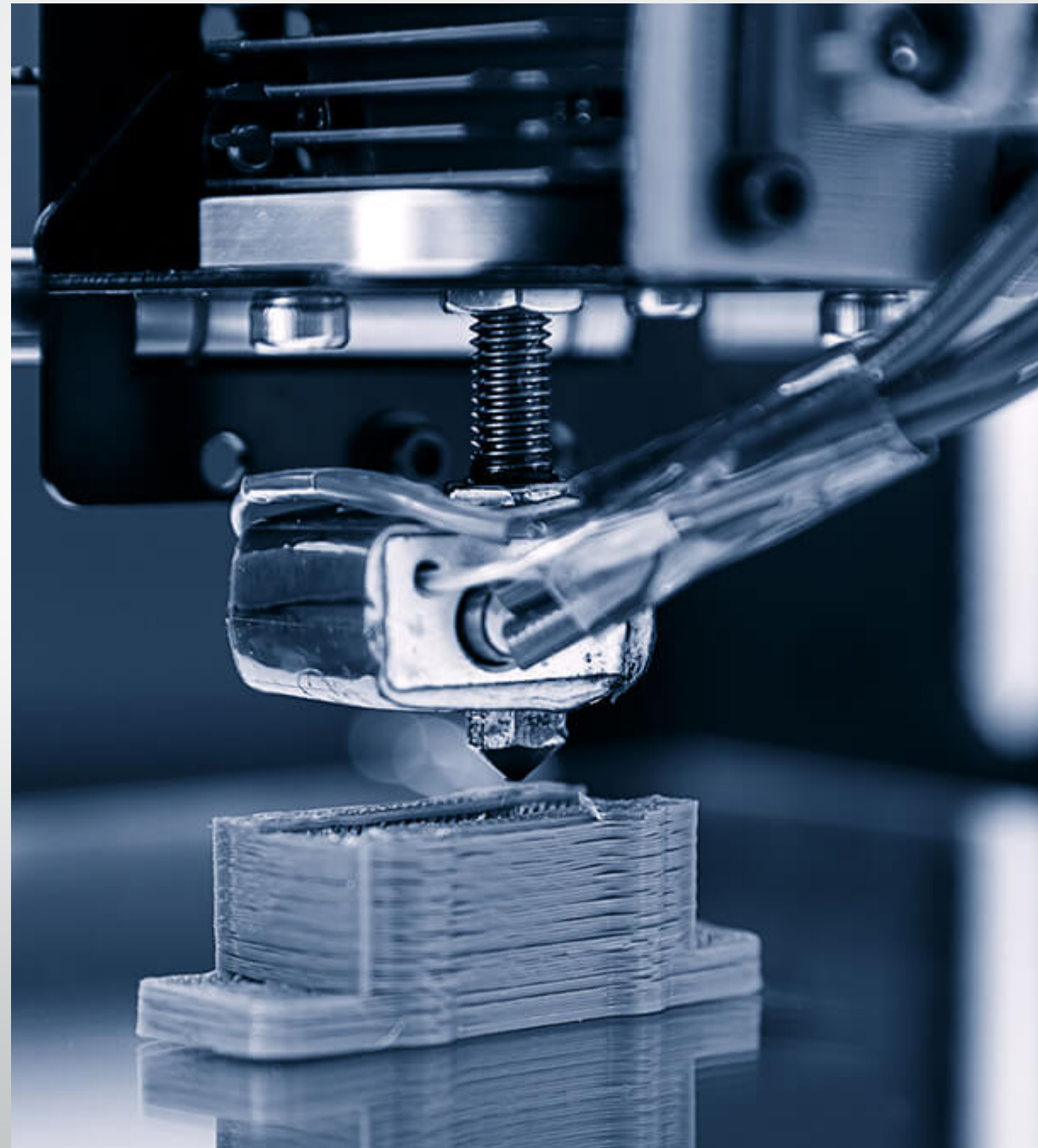


The Punchline

- What's critical depends on your perspective
- Every metal's story is different
- "Availability" is more than abundance

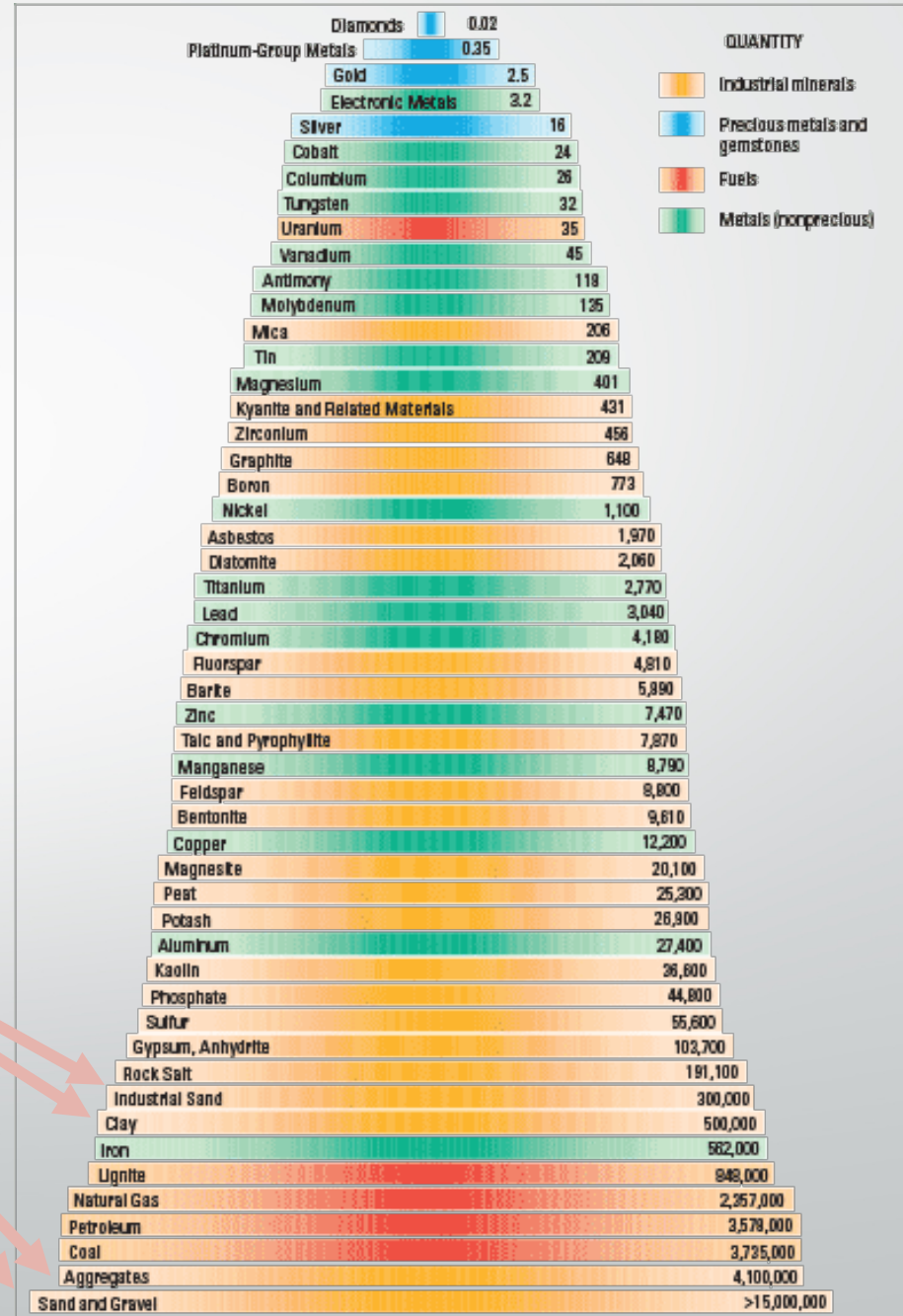
What is “critical”?

- When we hear “critical,” we think important
- Personal:
 - Hours: cell phone, TV
 - QOL: Transportation
 - Needs: food, water, shelter, medicine
- Business:
 - How would not having X affect my bottom line
- Economy:
 - Macro. Jobs, GDP



What minerals do we use?

- Top non-fuel minerals (by volume)
 - Dirt (sand/gravel) & rocks





Criticality *NOT JUST* Importance

- Mineral criticality is:
- How *important* is the mineral
- How *hard* is it to *get*

Criticality *NOT JUST* Importance

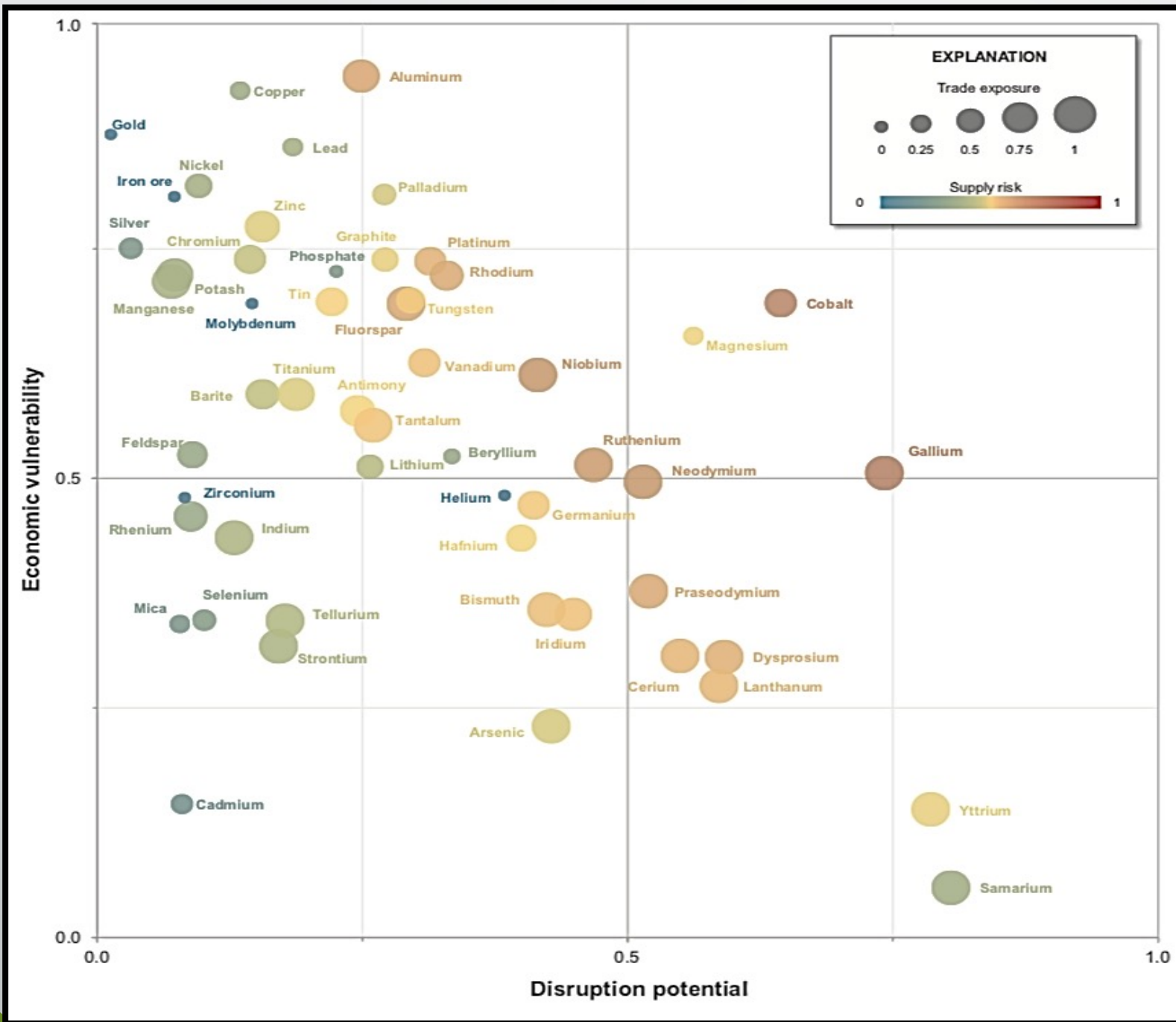
- Mineral criticality is:
- How *important* is the mineral
 - How upset would we be if we couldn't get it
 - What do we get out of the mineral X
 - Could we find an alternative?
- How *hard* is it to *get*

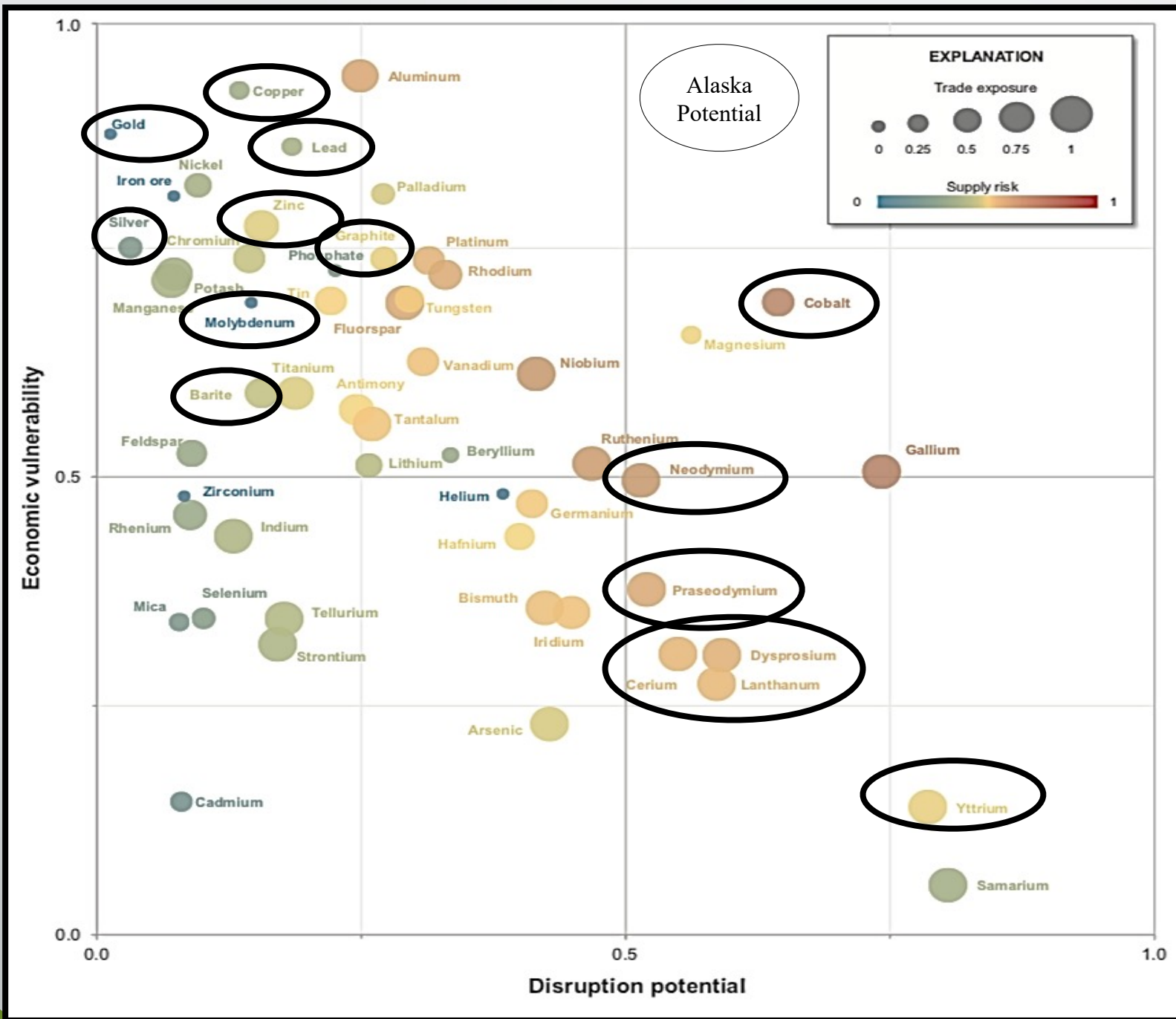
Criticality *NOT JUST* Importance

- Mineral criticality is:
- How *important* is the mineral
- How *hard* is it to *get*
 - Where does the mineral come from?
 - A single, volatile/risky supply chain
 - What do the economics of production look like?

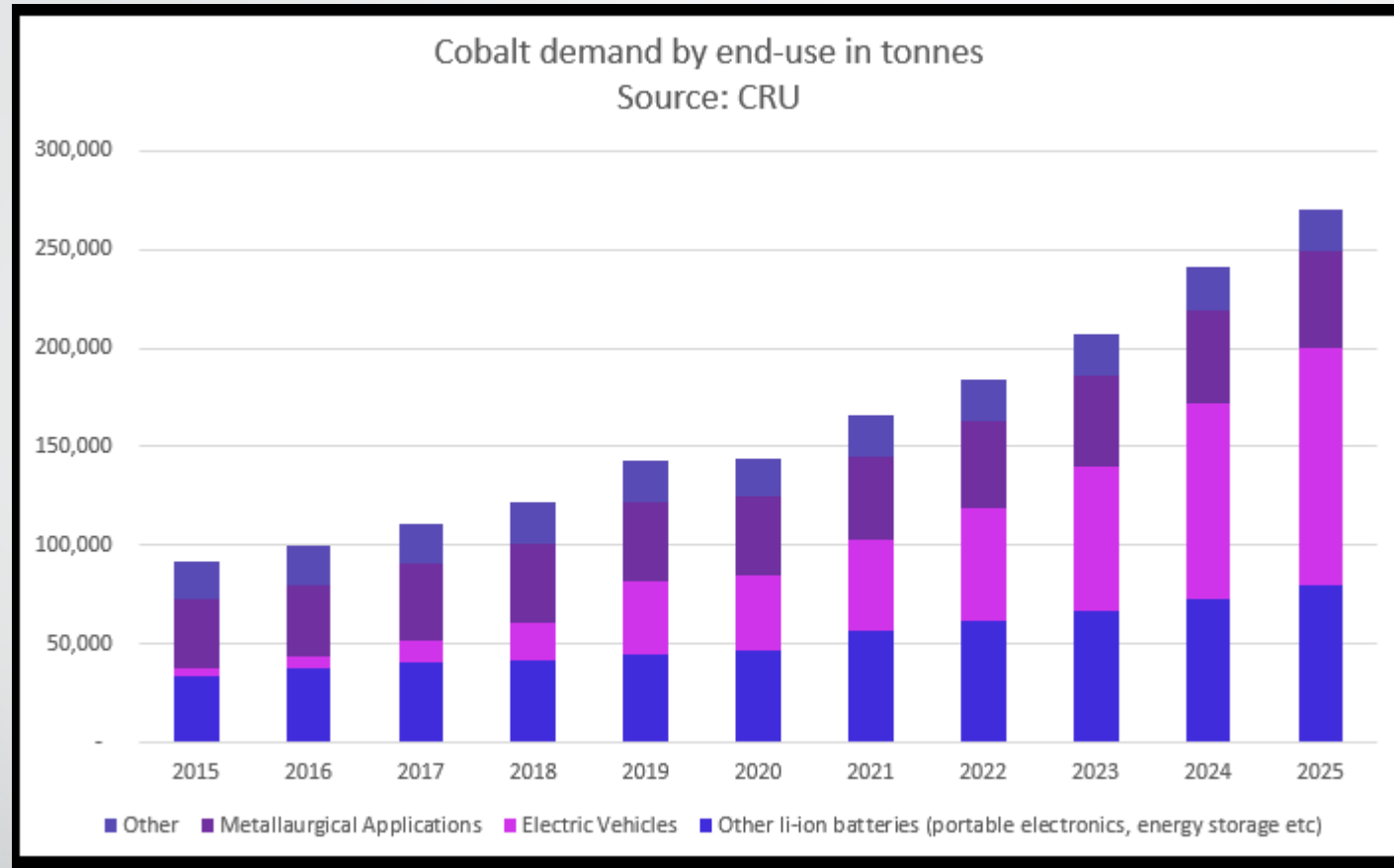
What's critical depends on your perspective

- Place – what's hard to get in Norway might be easy to get in China
- Industry – jewelers care about gold, auto cares about lead
- Time – what's critical today may not be tomorrow



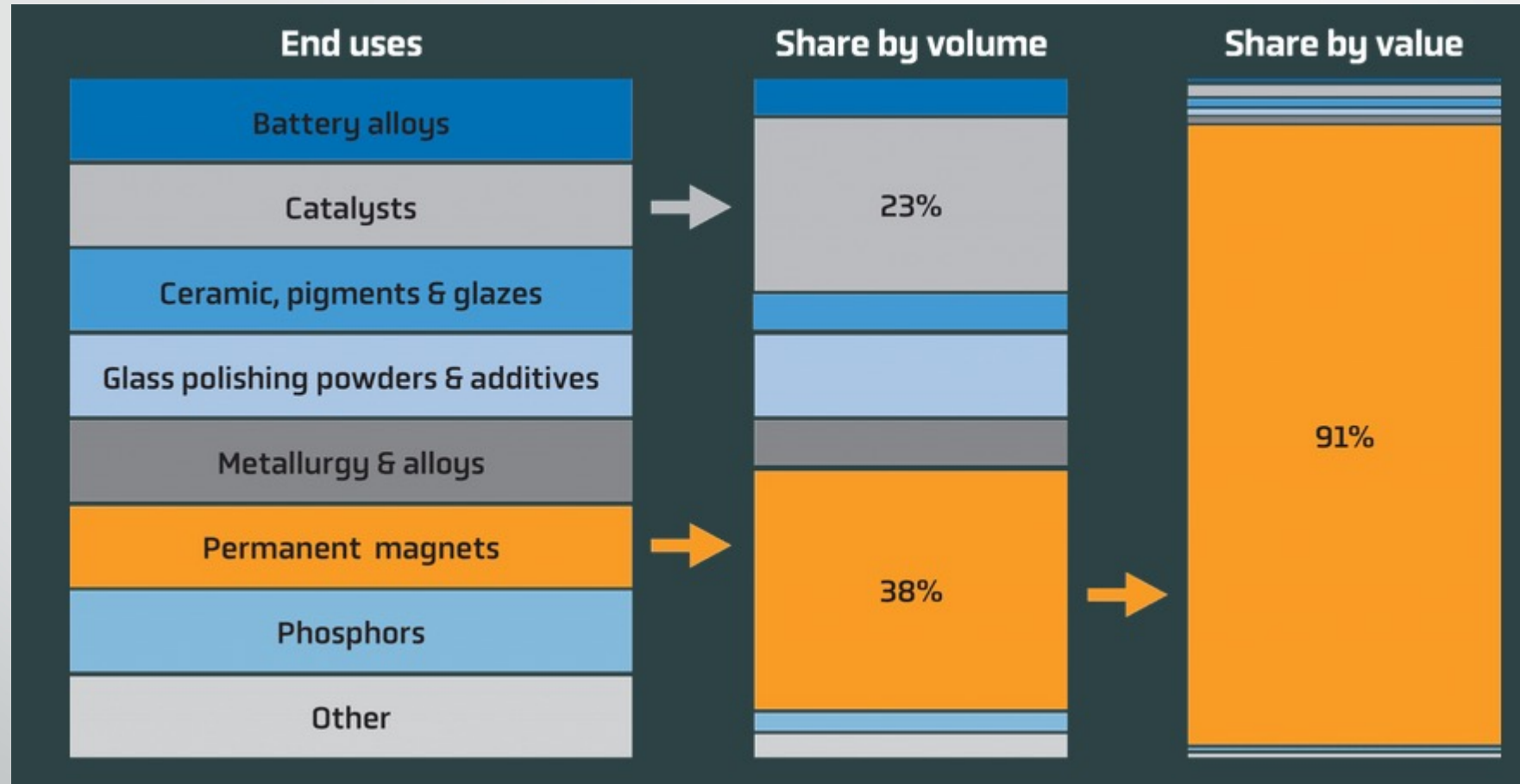


Cobalt

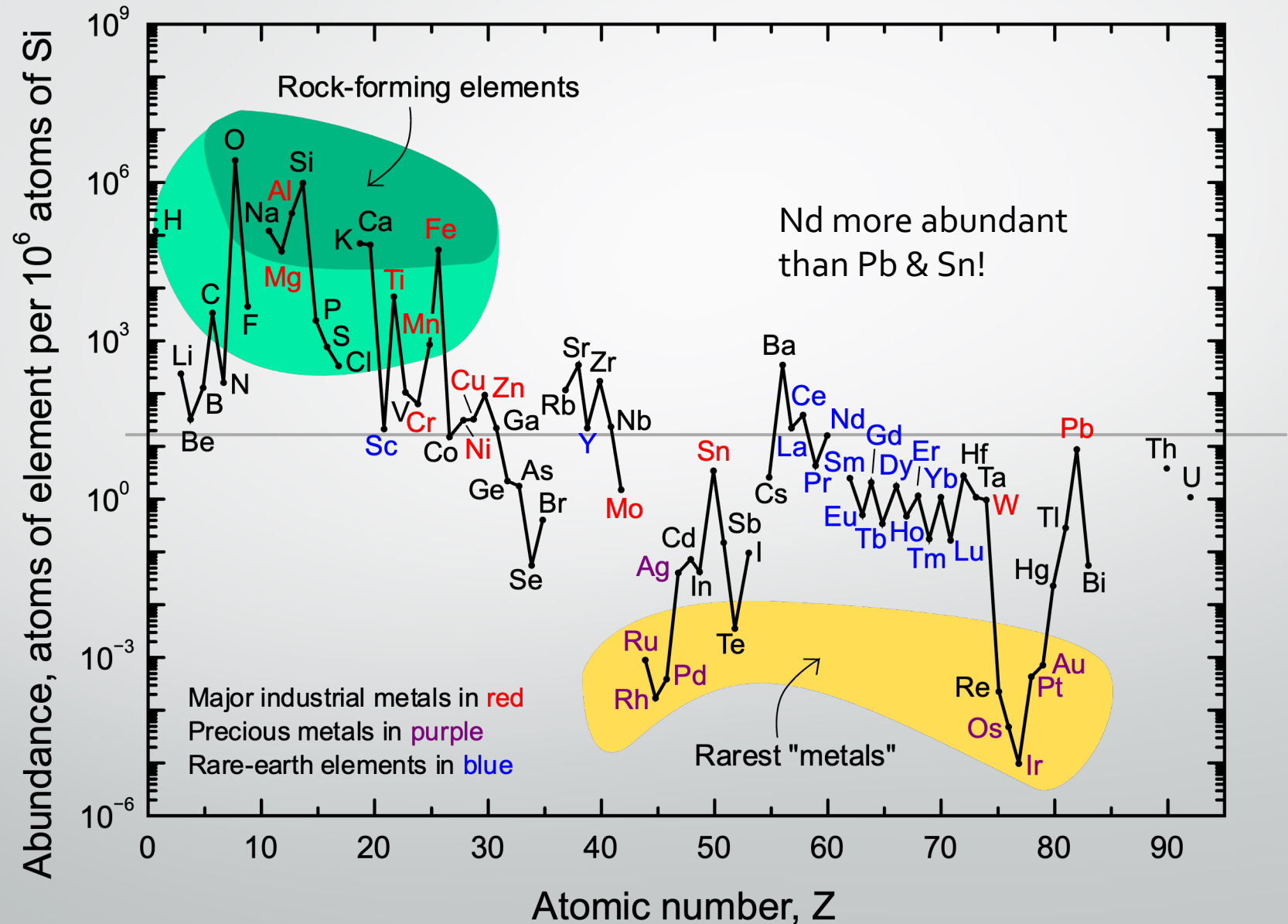


- 70% of World Production DRC (Kinshasa)
- Alaska id'd Co resources in Ambler's Bornite

Rare Earth Elements



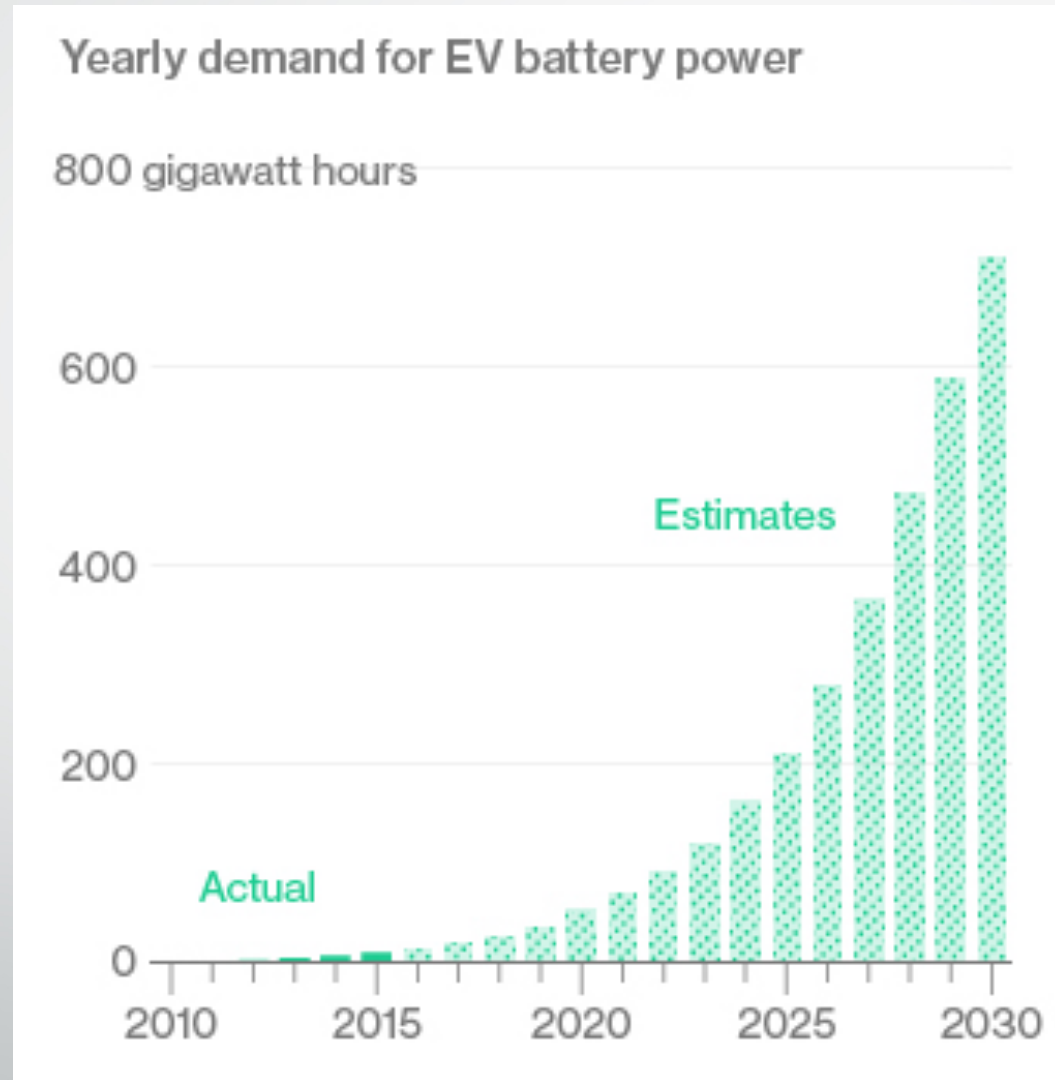
Rare Earth Elements – Not (that) Rare!



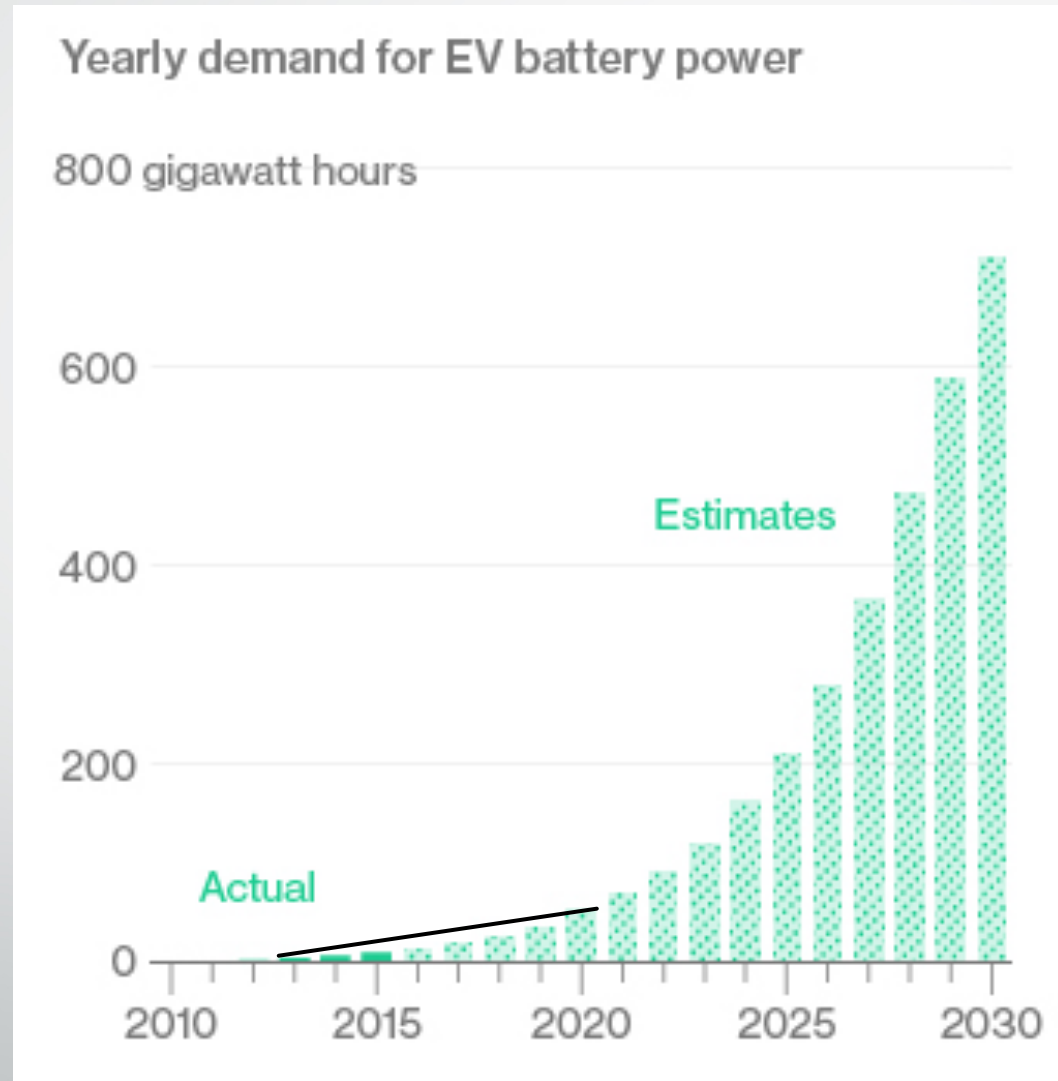
Graphite

- Used as an anode material for electrodes for NMH and Li-ion batteries
- Nissan Leaf uses 40kg
- Synthetic graphite a by-product of petro refining, natural graphite mined
- AK: Graphite Creek/Graphite One Project

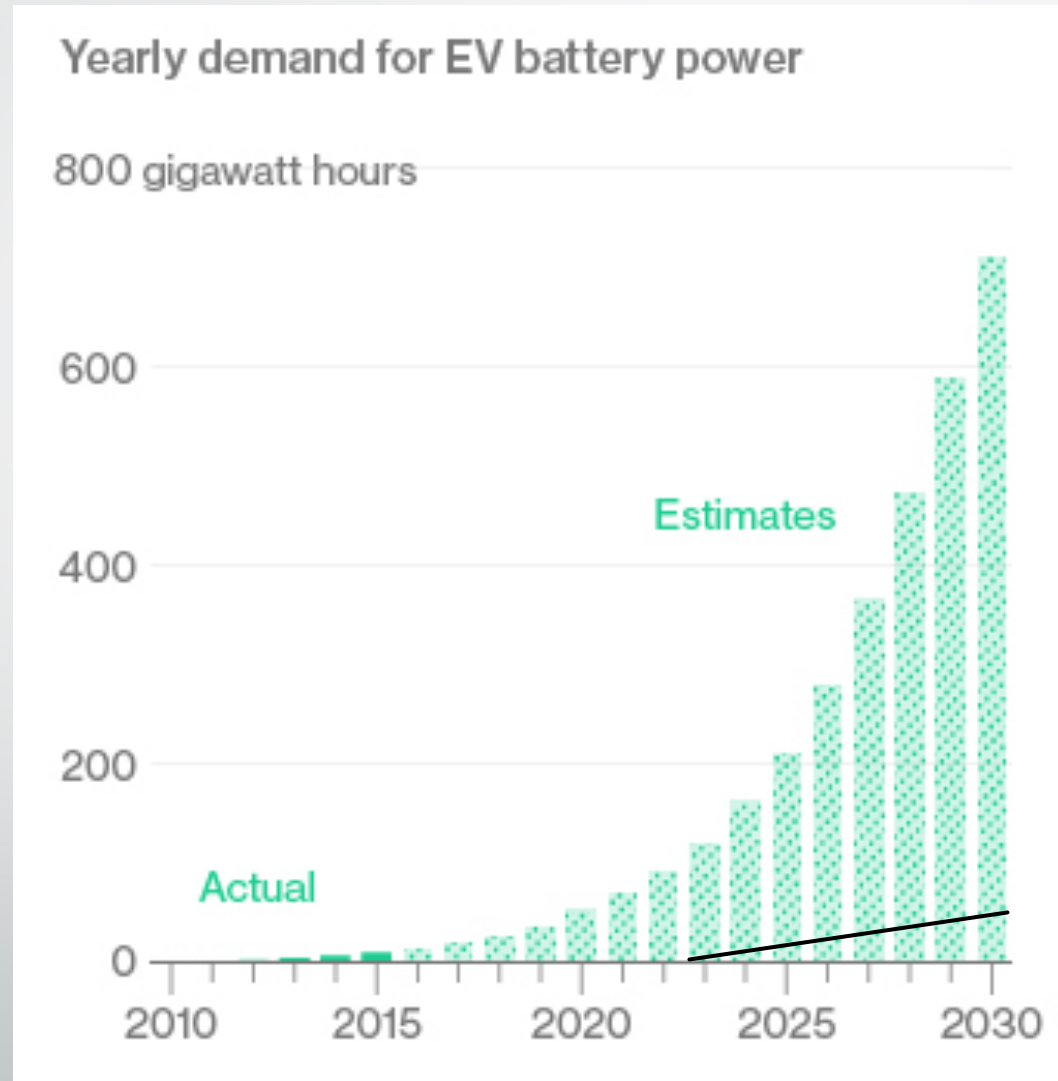
What about recycling – Co Exp.



Average car life: 12yrs



Average car life: 12yrs





Mineral Availability

- Geologic
- Technical
- Economic
- Social



Thank you!

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