

Criticality Assessment of Electrolyzer Materials: Supply Chain Sustainability and Vulnerabilities



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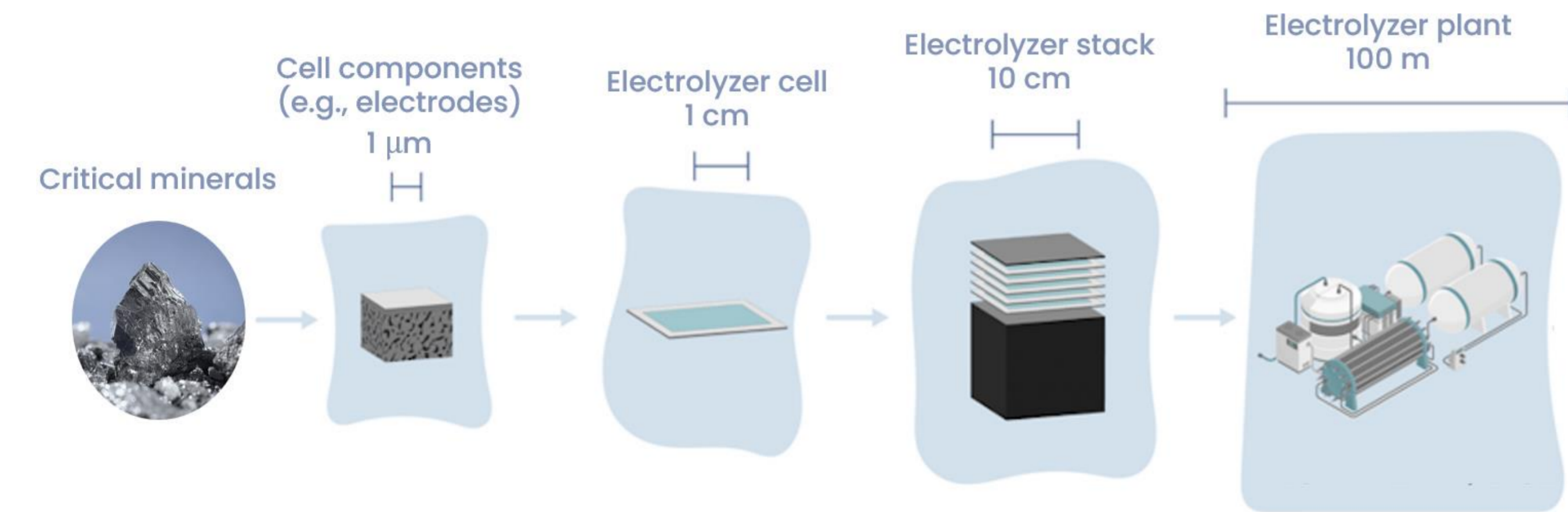
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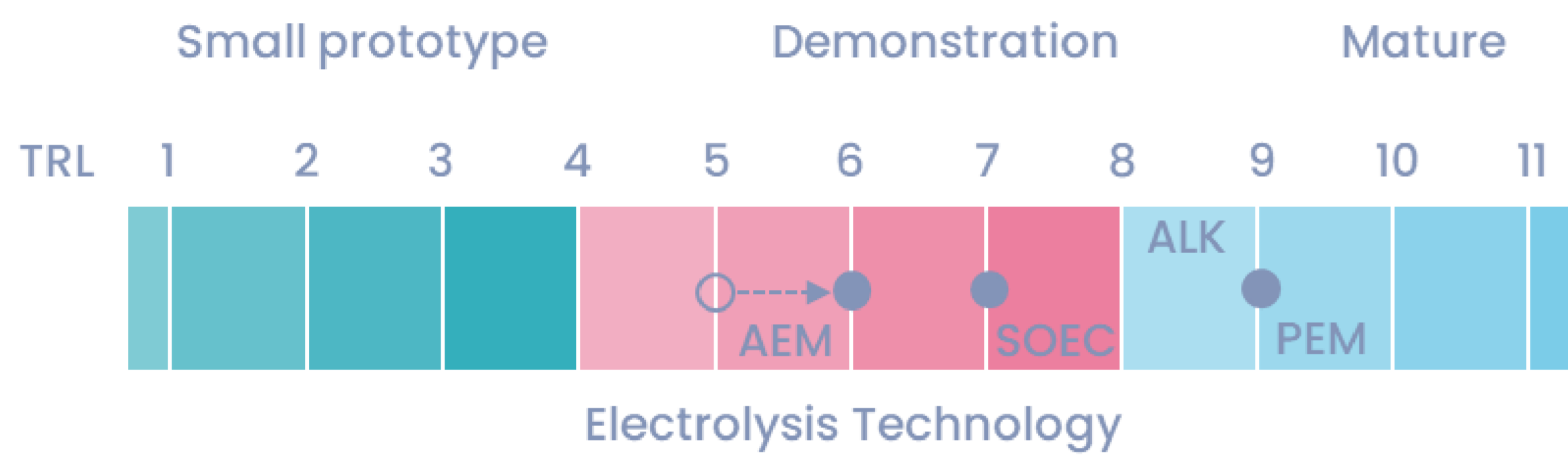
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Overview

As Power-to-X technologies drive the shift toward a sustainable economy, electrolyzer manufacturers face significant material challenges to keep pace with growing demand.

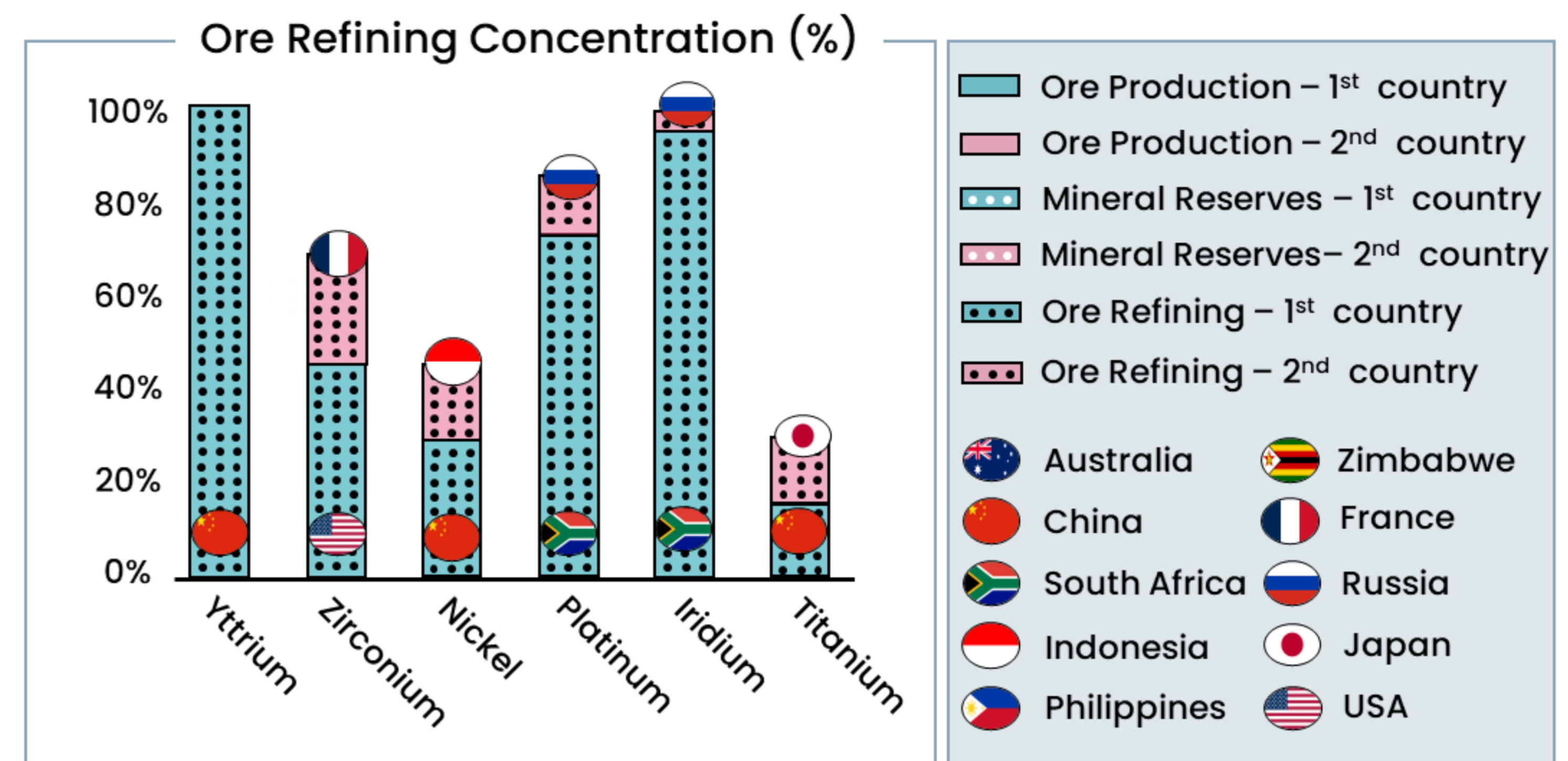
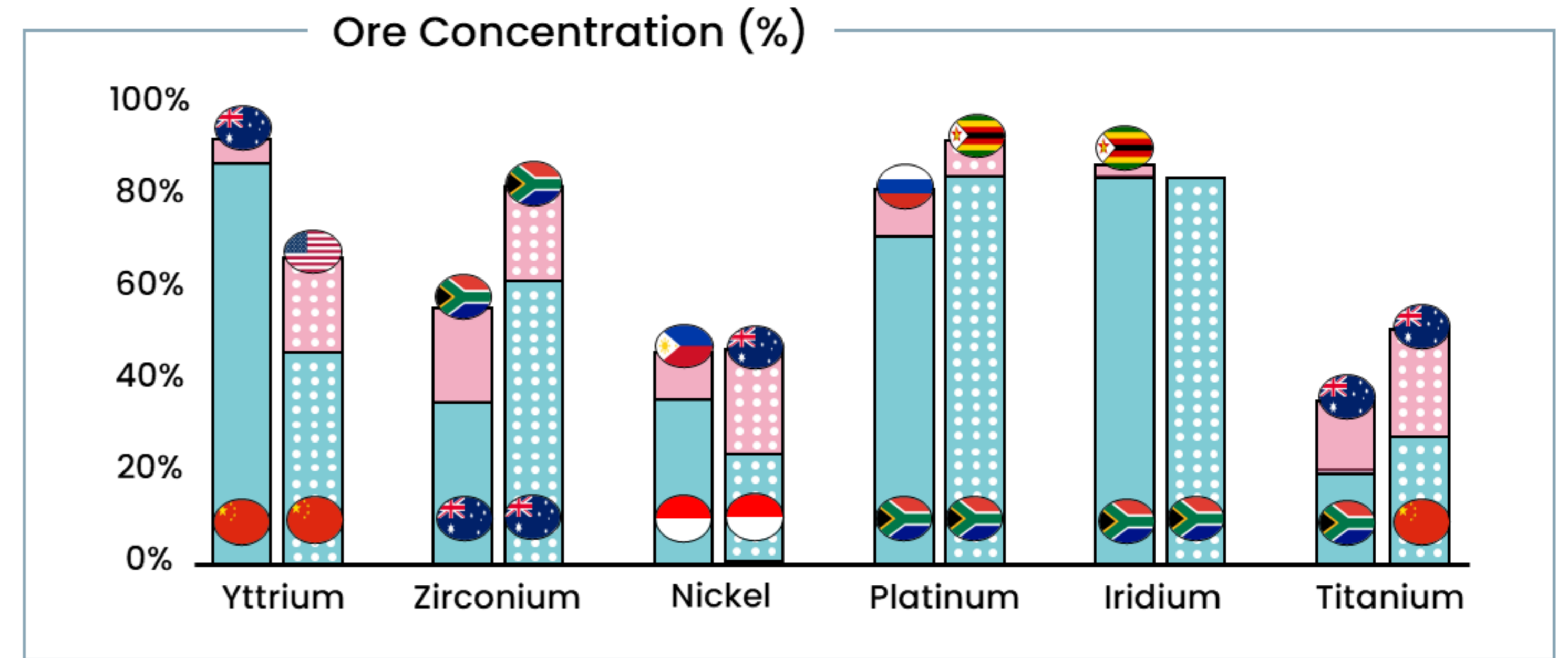


The power-to-hydrogen sector, in particular, is expected to experience a sharp rise in electrolyzer demand, with projections of up to 1350 GW of installed capacity needed by 2050, compared to the current capacity of just ~18 GW. Given the reliance on key materials critical to the clean energy transition, manufacturers and governments must adapt their supply strategies to navigate a highly constrained global market and ensure continued business growth.

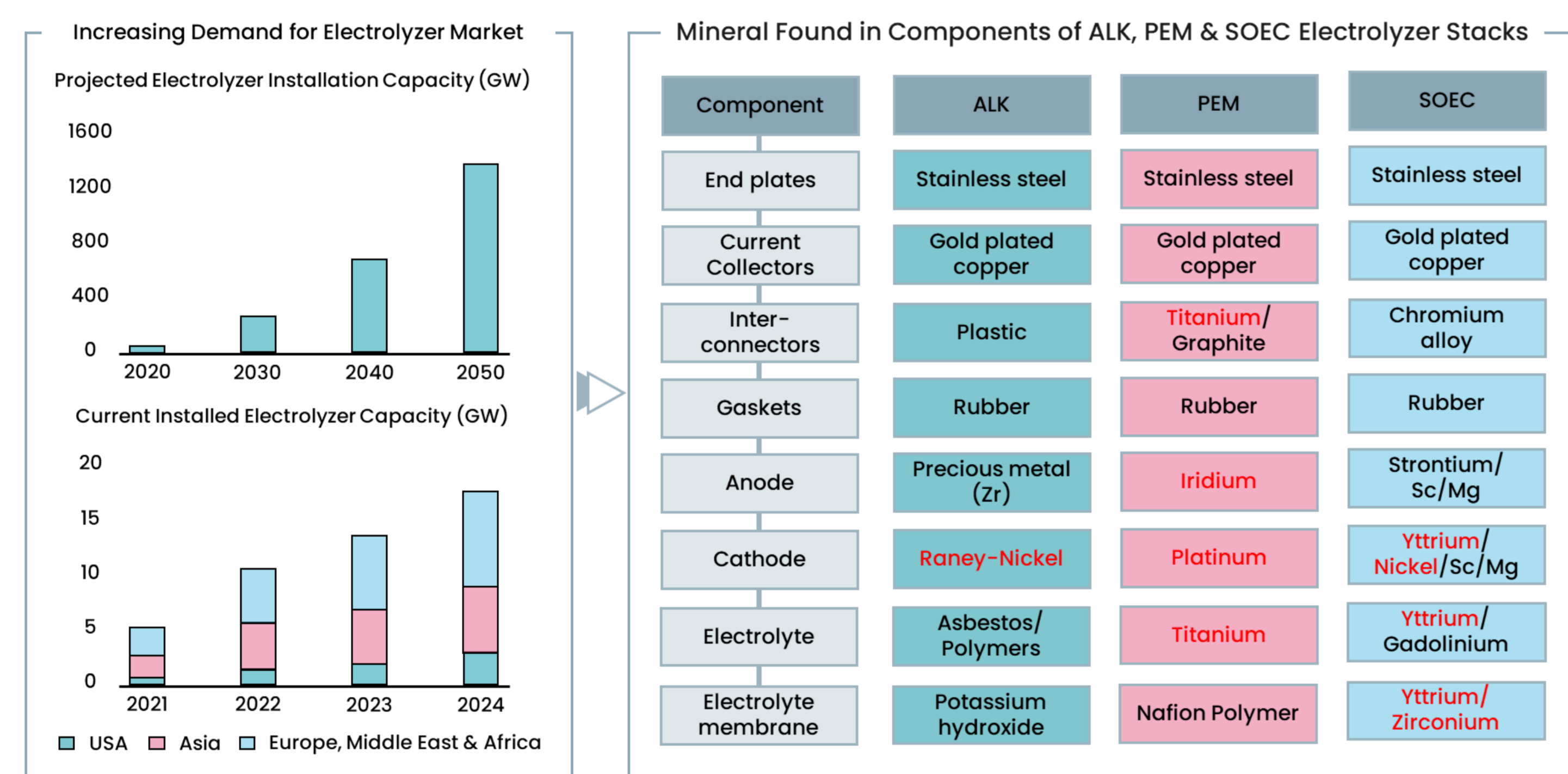


ALK - Alkaline
SOEC - Solid Oxide Electrolyzer Cell
PEM - Proton Exchange Membrane
AEM - Anion Exchange Membrane

Supply Risks – Reserves, Extraction and Processing



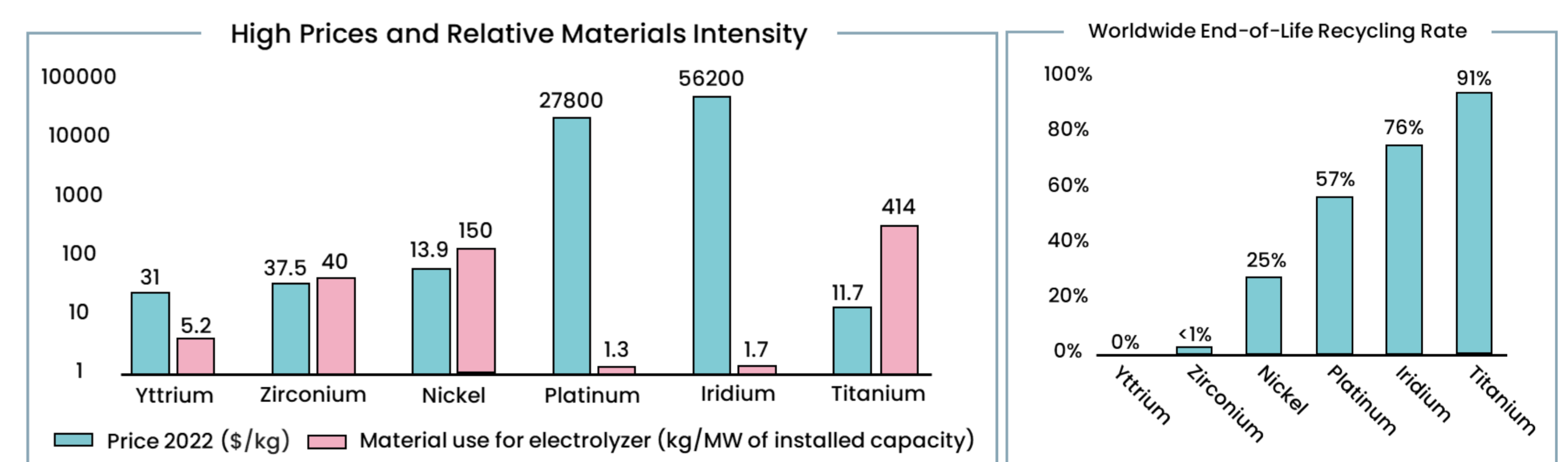
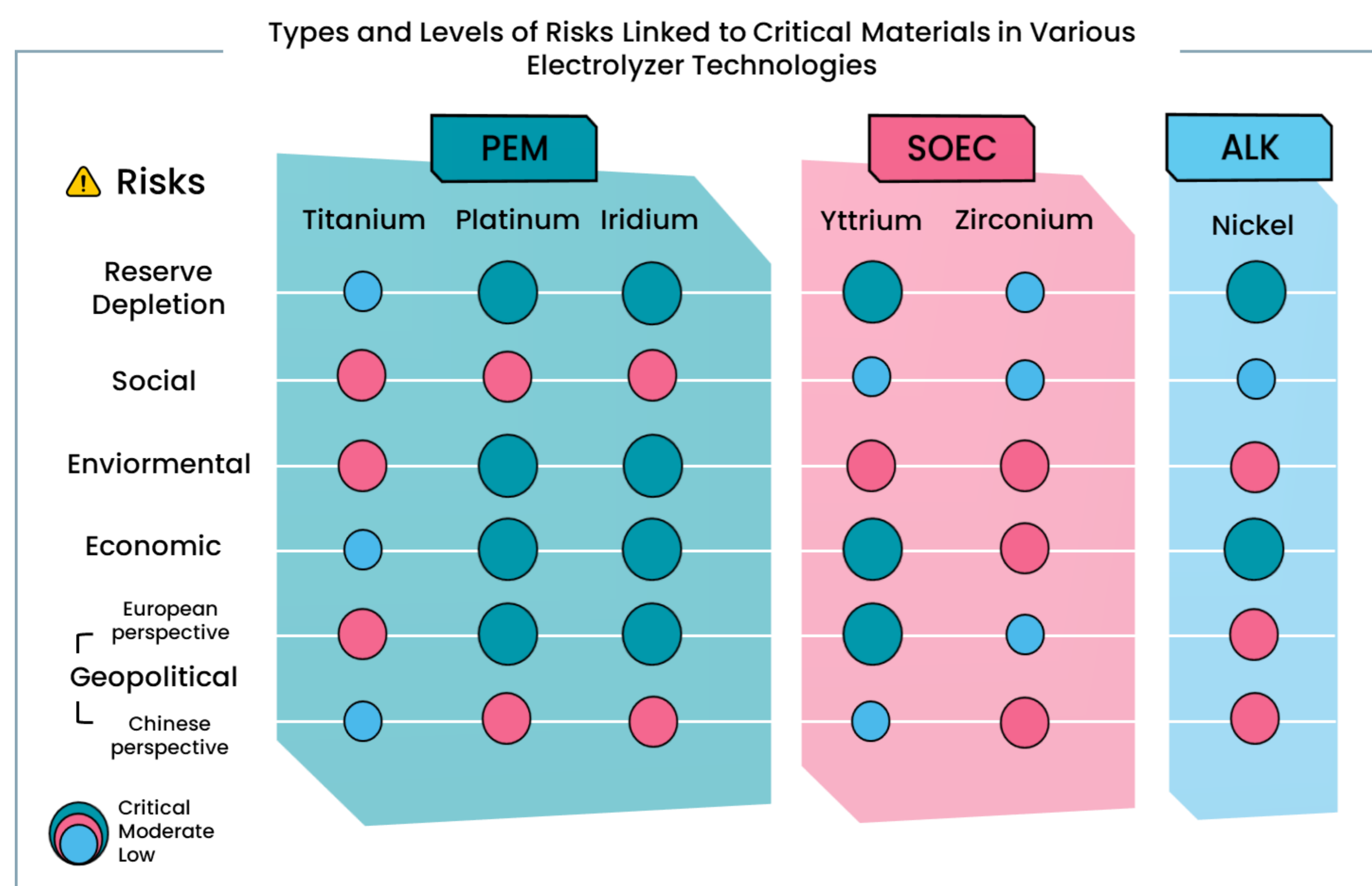
Electrolyzers Have Several Mineral Requirements



Economic Vulnerabilities – Prices, Trends and Demand

	Future demand intensity of the materials (~2035)	Supply-side scarcity	Average price volatility (in last decade)
Zirconium	Stable ceramic market - Low	Important reserves and substitutes available - Low	~40% - High
Titanium	Electronic, desalination plants and prosthetic technologies - Low	Important reserves and substitutes available - Medium	~11% - Low
Nickel	Massive increase in Lithium-ion batteries' demand - Extremely high	Important reserves and substitutes available - High	~26% - Medium
Yttrium	O ₂ sensors in autonomous cars - Medium	Concentrated and low reserves in unstable countries - Extremely high	~73% - Extremely high
Platinum	Fuel cells markets to skyrocket - High	Already low reserves balance and hard to extract - Extremely high	~25% - Medium
Iridium	Huge increase in demand for digital screens - High	Byproduct of platinum mining - Extremely high	~74% - Extremely high

Criticality Assessment – Material and Technology



Conclusion and Outlook

- **Material substitution and reduction:** Reducing material intensity and encouraging substitution can alleviate supply strains and lower costs.
- **Recycling:** Recycling helps ease pressure on primary supply sources, with governments promoting higher recycling rates to reduce import reliance.
- **Knowledge development:** Enhanced business intelligence in raw material supply chains is crucial for economic resilience and informed decision-making.
- **Diplomatic strategies:** Countries must explore new partnerships and strengthen existing relationships to secure and diversify future material supplies.

References

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