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EXCHANGE RARE EARTH STRATEGIC METALS

Critical Minerals

The Core of the Modern Economy

The technological shift reshaping the global economy stands on a foundation hidden in plain sight: critical minerals buried in the Earth's crust. The rising adoption of disruptive technologies – AI data centers, renewable energy systems, electric vehicles (EVs), grid infrastructure, and defense tech – would be impossible without copper, lithium, rare earths, and other minerals that power the digital, electrified future.

Yet beneath this surge in technological innovation lies a brewing supply crisis driven by dwindling pipelines for new mines, lengthy development timelines, and highly concentrated supply chains. Forecasts show demand for these minerals rising sharply over the coming decades, widening the gap between supply and consumption.¹ Mitigating the emerging risks from potential supply shortfalls will require significant investment in mineral production, processing, and battery technologies.



Technologies at the Center of Electrification, Power, and AI Adoption Require a Variety of Minerals

EVs, renewable energy, energy storage, and data centers are forecast to significantly increase demand for critical minerals. For example, EVs require up to 6x more minerals than traditional internal combustion engine vehicles.¹



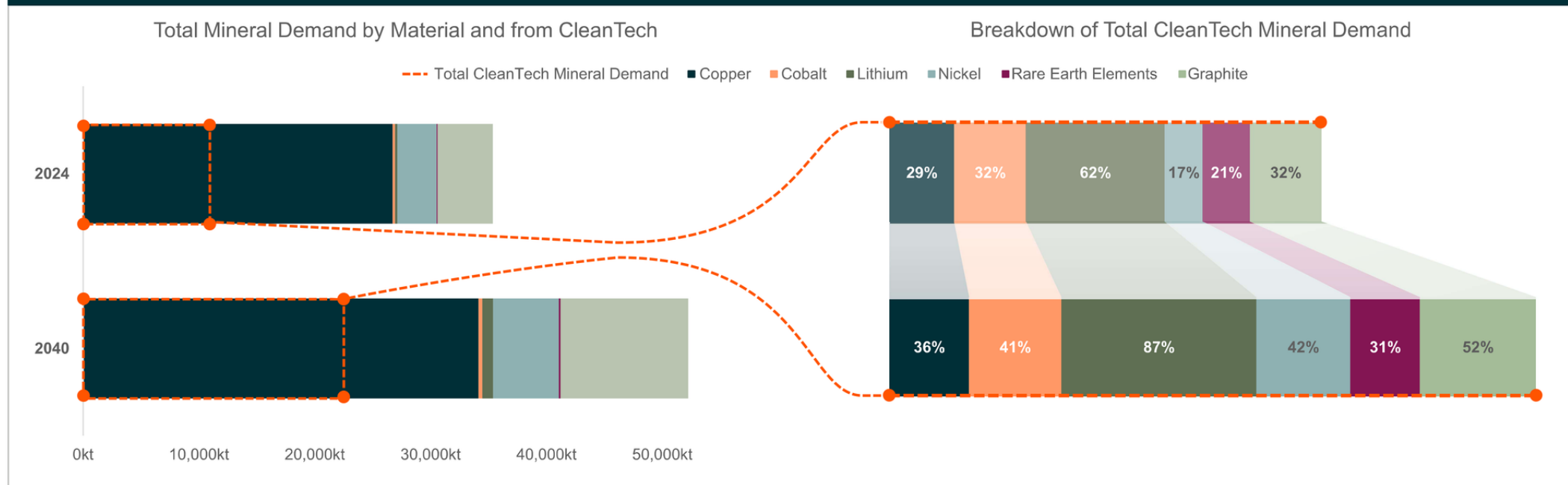
Note: REEs = Rare Earth Elements. PGMs = Platinum Group Metals.

Sources: Text: 1. IEA, May 2021; 2. Ibid.; 3. Ibid.; 4. Resources, Conservation and Recycling, Oct 2020; Chart: IEA, May 2021.

Energy Transition: A Global Structural Shift Increasing Demand for Critical Minerals

As mineral-intensive clean technologies such as EVs, renewables, and energy storage become more widely adopted, cleantech's share of total mineral demand is forecast to increase from 28% in 2024 to 41% in 2040.¹

Mineral Demand Is Forecast to Grow 1.5x from 2024 to 2040²



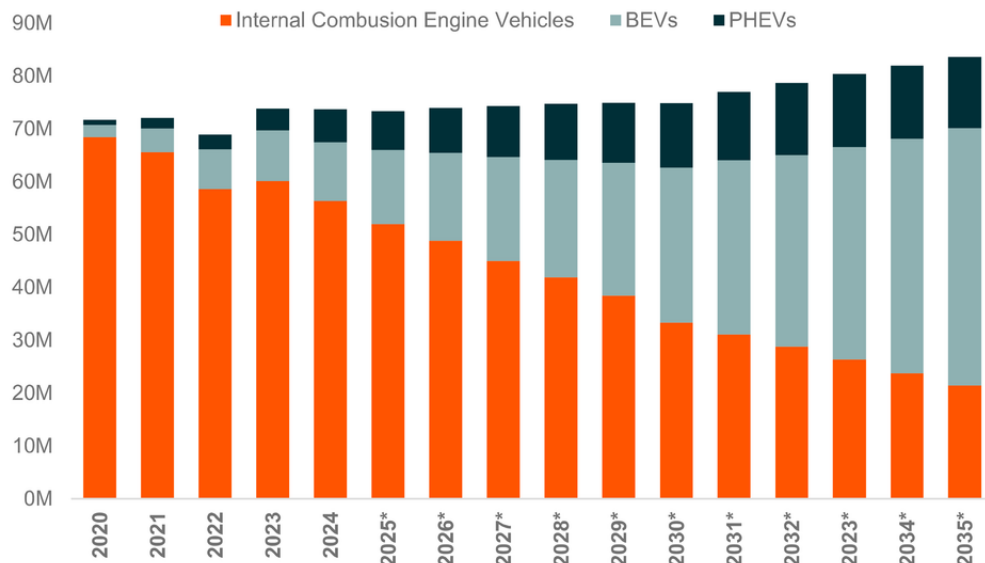
Sources: Text: 1. IEA, May 2025; 2. Ibid. Charts: IEA, May 2025.

Energy Transition: EVs Could Outsell Traditional Passenger Vehicles by the Early 2030s¹

Accommodative government policies in major auto markets such as China and the EU, as well as the rollout of more affordable EV models, are increasing buy-in from consumers across the globe.

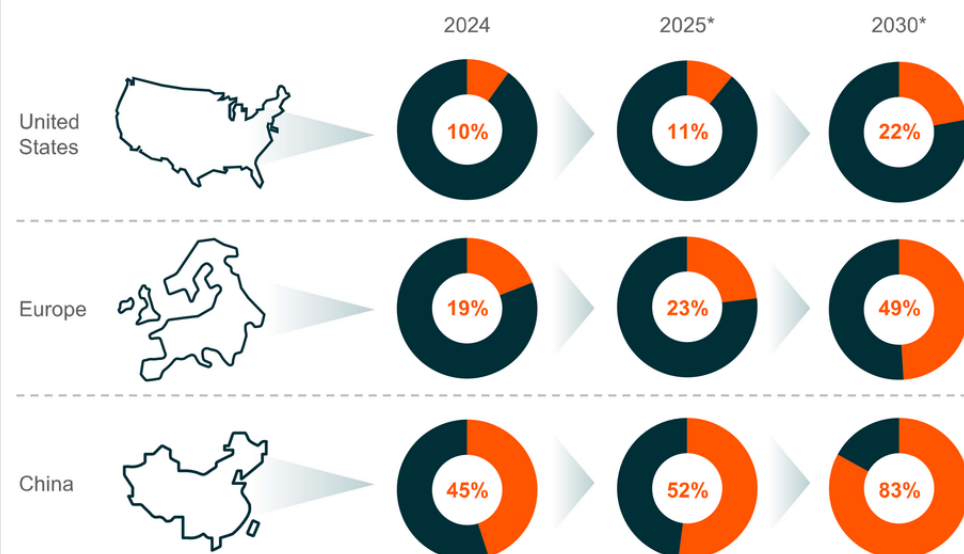
Global EV Market Share Could Reach 55% by 2035²

Global Vehicle Sales by Technology Within the Passenger Vehicle Segment



EV Share Projected to Rise Rapidly in Major Auto Markets³

EV Market Penetration Rates by Region



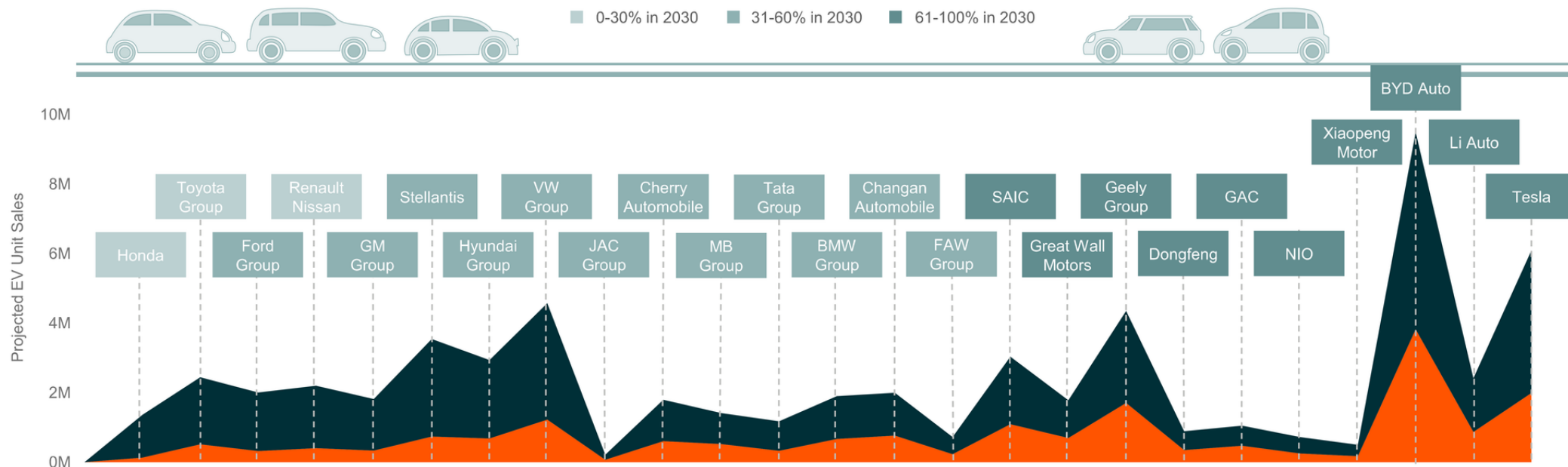
*Forecast; Note: BEV = Battery Electric Vehicle, PHEV = Plug-In Hybrid Vehicle

Sources: Text: 1. Rho Motion, Jul 2025; 2. Ibid; 3. Ibid; Charts: Rho Motion, Jul 2025.

EVs in Focus: Automakers Remain on Track to Increase EV Sales Despite Recent Policy Headwinds

Shifting policies and new tariffs in the United States and Europe have made automakers rethink their electrification strategies.¹ That said, even laggards such as Toyota and Ford could surpass one million EV sales annually by 2030.²

Forecasted EV Share of Total Sales & EV Units Sold

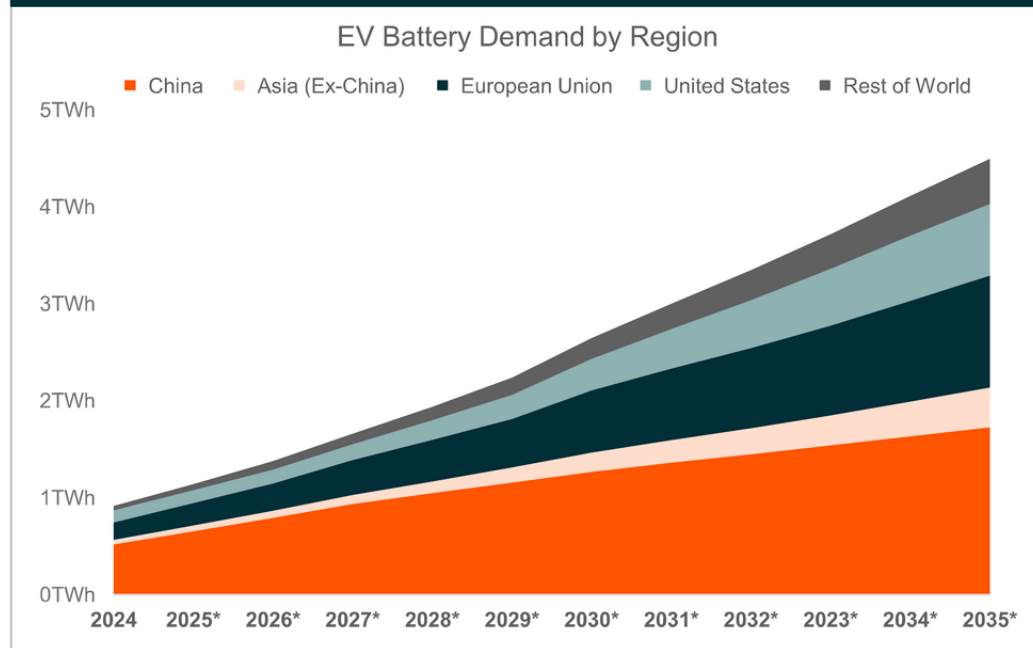


Sources: Text: 1. Area Development Magazine, Q3 2025; 2. Rho Motion, Jul 2025; Chart: Rho Motion, Jul 2025, Rho Motion, Oct 2024.

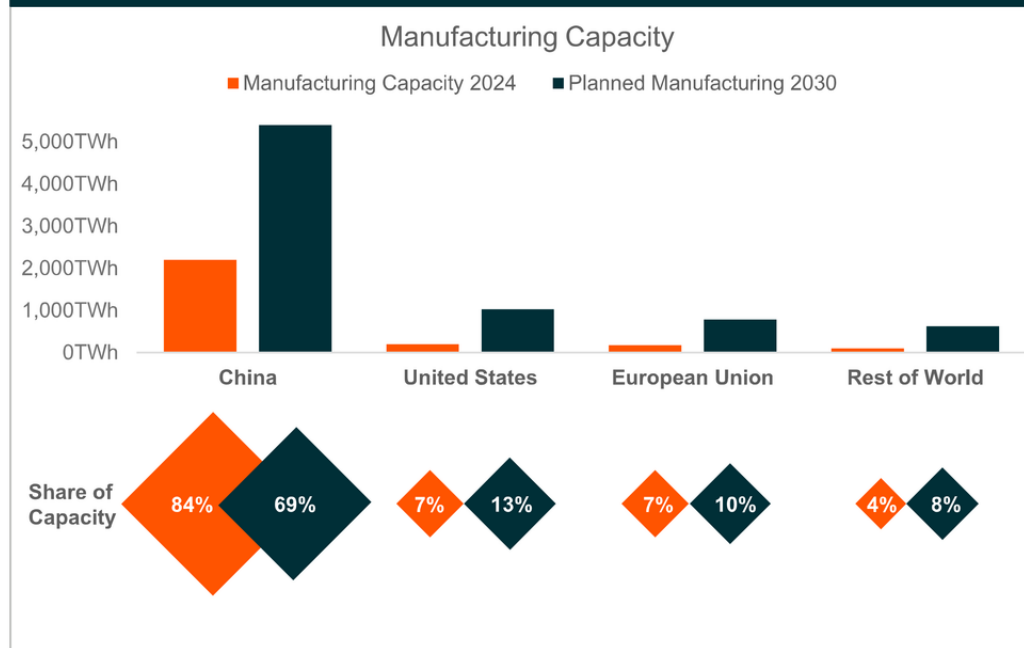
EVs in Focus: Battery Demand Grows as the Global Auto Market Becomes Increasingly Electrified

China is expected to remain the leader of both EV battery demand and production capacity.^{1,2} However, manufacturers are expanding in North America and Europe to meet growing demand and bolster domestic supply chains.

Battery Demand Is Projected to Grow ~4x from 2025-2035³



United States Could Account for 13% of Production by 2030⁴



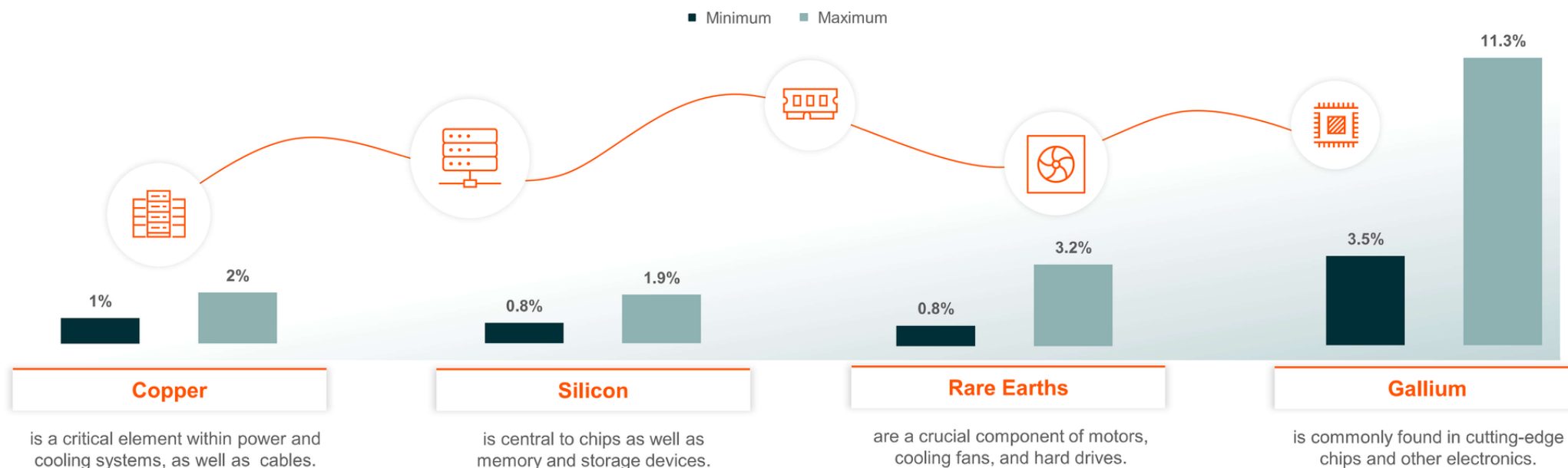
*Forecast

Sources: Text: 1. IEA, May 2025; 2. Rho Motion, Jul 2025; 3. Ibid; 4. IEA, May 2025; Charts: LHS: Rho Motion, Jul 2025; RHS: IEA, May 2025.

AI in Focus: Data Center Boom Gaining Prominence as a Demand Source for Critical Minerals

AI data center growth may boost demand for critical minerals such as copper, rare earths, lithium, and silicon. These are essential for power systems, cooling networks, high-speed chips, and renewable energy integration.

Data Center Industry's Minimum and Maximum Share of Total Demand



Sources: Charts: IEA, Apr 2025.

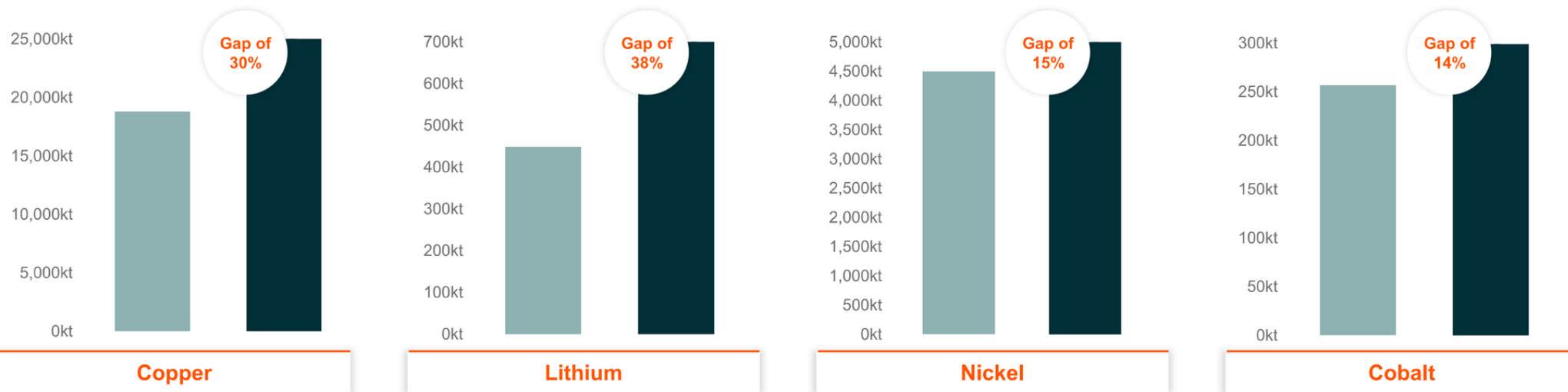
Critical Mineral Supplies May Fall Short as Electrification and AI Adoption Accelerate

Shrinking development pipelines for new mines, lengthy project timelines, and highly concentrated supply chains are among the factors creating long-term supply risks for critical minerals.

Within 10 Years, Minerals Critical to Power Infrastructure and Battery Technologies Could Face Double-Digit Shortfalls¹

2035: Expected Mine Supply from Existing and Announced Projects & Primary Supply Requirements, by Material

Expected Supply Primary Supply Requirements

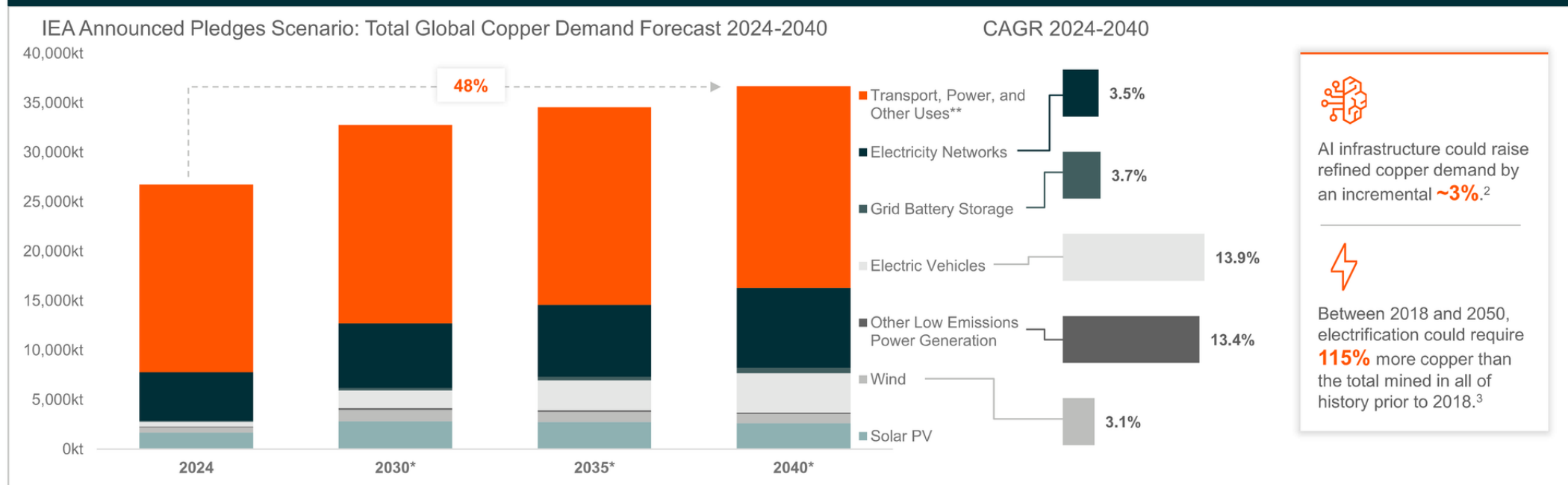


Sources: Text: IEA, May 2025; Charts: IEA, May 2025.

Copper: Integral to the Data Center, Power, and Grid Infrastructure Buildout

Indexed to 2021, global copper consumption is expected to grow nearly 70% by 2050, driven by electrification and power infrastructure demand growth.¹

Electric Vehicles and Power Generation Solutions See the Fastest Pace of Copper Demand Growth



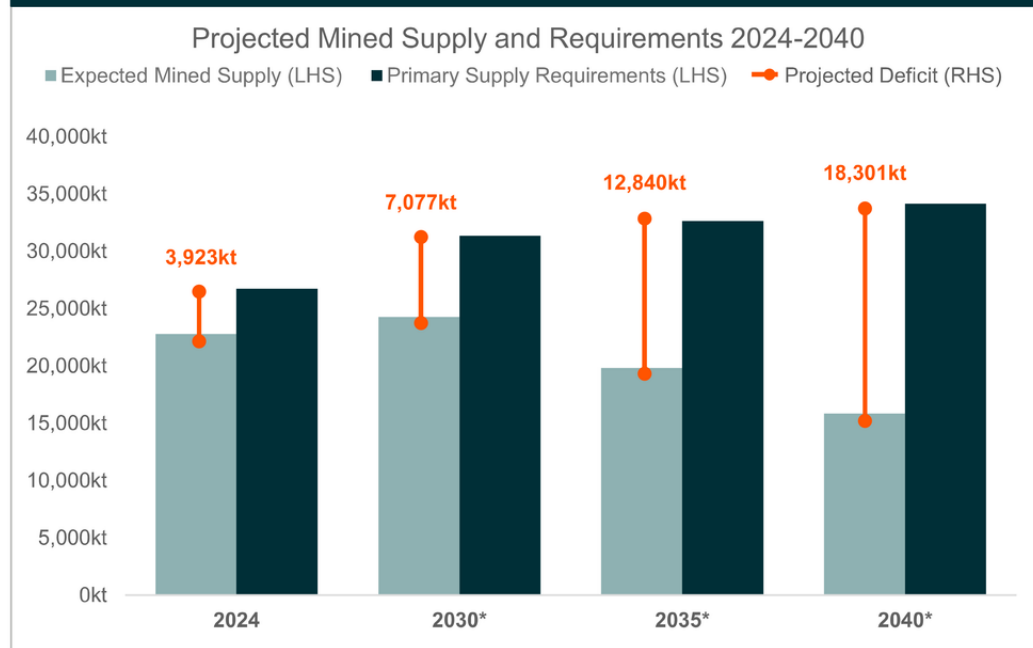
*Forecast; **Other Uses: Includes projections for other applications, including transport and power generation outside of the clean energy scope.

Sources: Text: 1. BHP, Sep 2024; 2. Bloomberg Intelligence, Jun 2024; 3. IEF, May 2024; Chart: IEA, May 2025.

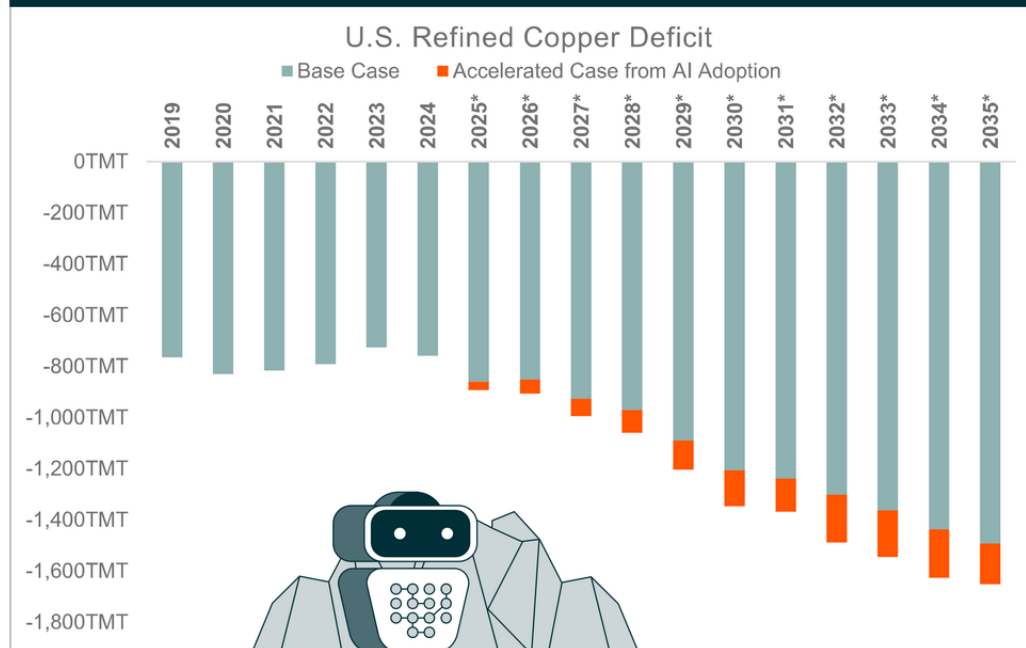
Copper: Deficits for Mined and Refined Supply May Be Exacerbated by Ramp-Up in Demand

Although greenfield copper mining projects are starting to pick up, long lead times on new mines, declining ore grades, and project delays may increase prices. The United States faces a capacity crunch for copper smelting and refining too.

Mined Production Deficits Expected to Widen into 2040



AI Expansions Projected to Exacerbate Existing Deficits



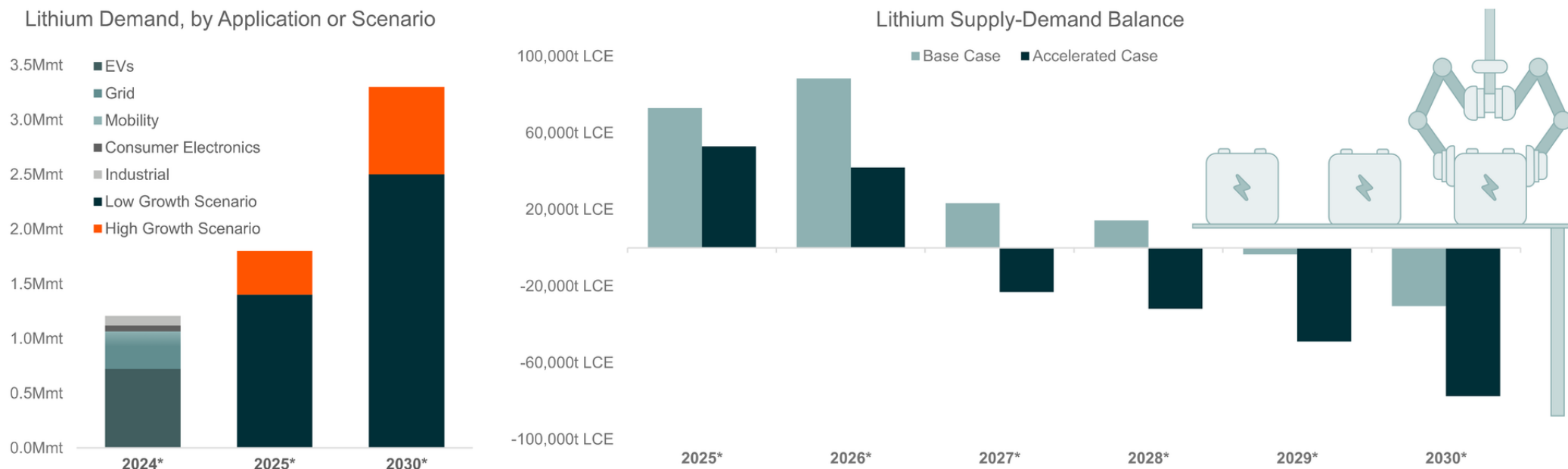
*Forecast; Note: TMT = Thousand Metric Tons

Sources: Charts: LHS: IEA, May 2025; RHS: Bloomberg Intelligence, Jun 2024.

Lithium: Looming Supply Shortages Could Result in a Lithium Price Recovery

Leading lithium producers have scaled back expansion in the past two years. Given lithium supply is relatively inelastic, even slight shifts in supply or demand could lead to a deficit and boost lithium prices.

Lithium Demand Could Once Again Surpass Supply as Demand Increases for EVs and Battery Energy Storage Systems¹



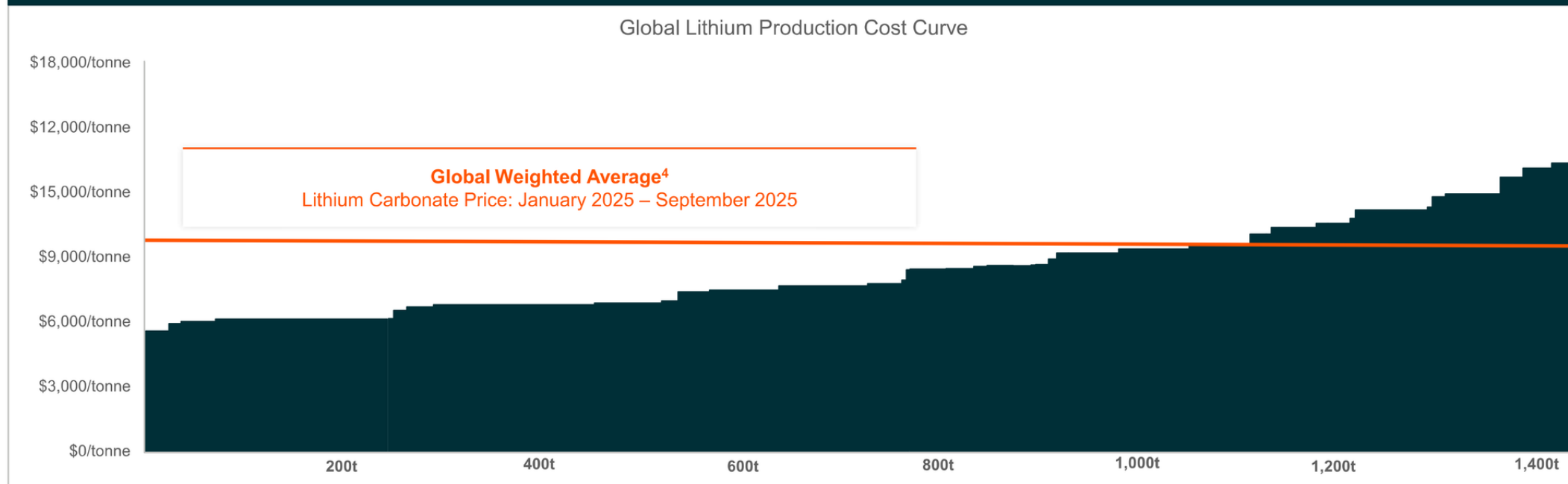
*Forecast; Note: EVs = Electric light-duty passenger vehicles; Mobility = Other electrified transport, such as long-haul trucks and aircraft.; t LCE = Tonnes of Lithium Carbonate Equivalent.

Sources: Text: 1. Benchmark Mineral Intelligence, Aug 2025; Charts: LHS: Albemarle, Jul 2025; RHS: Benchmark Mineral Intelligence, Aug 2025.

Lithium: Operations Remain Profitable at Current Levels for Many Producers

The lithium price environment remains well below the peak of late 2022, when prices reached nearly \$80,000 per tonne.¹ However, ~60% of lithium projects have a breakeven under the recent average selling price of \$9,000/tonne.²

Prices Could Rise from Mine Closures and Permitting Changes in China, Benefitting Miners Along the Upper Cost Curve³



Sources: Text: 1. Benchmark Mineral Intelligence, n.d., accessed September 15, 2025; 2. Ibid; 3. Benchmark Mineral Intelligence, Aug 2025; 4. Benchmark Mineral Intelligence, n.d., accessed October 1, 2025; Chart: Lithium Americas, Sep 2025.

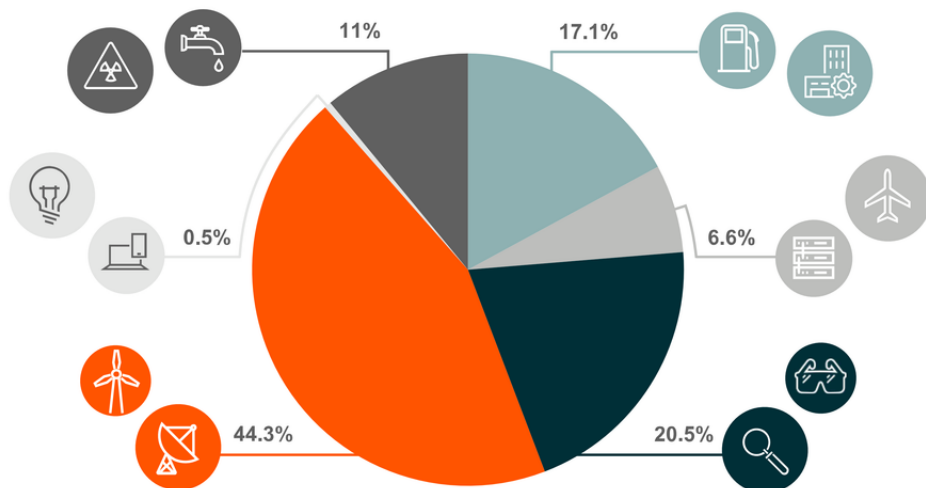
Rare Earths: Critical to a Wide Range of Technologies and End Uses

Despite their name, rare earth elements (REEs) are a relatively abundant group of 17 metallic elements. REEs' fluorescent, conductive, and magnetic properties make them an essential component in over 200 products.¹

Defense Tech and Data Centers Rely on Rare Earth Magnets

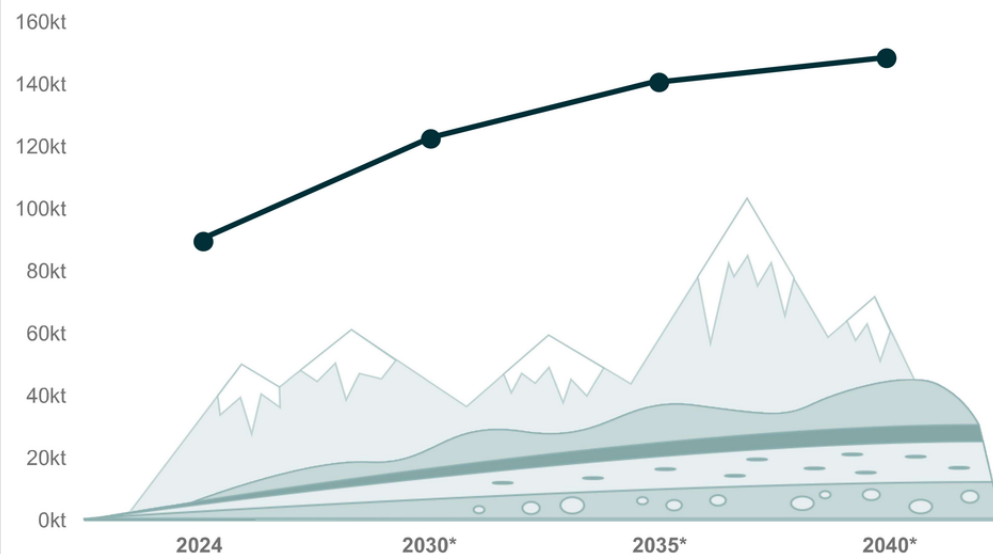
Rare Earths Element Demand by End Use, 2022

■ Catalyst ■ Metallurgy ■ Glass Polishing & Ceramics ■ Magnets ■ Phosphors ■ Other



REE Demand Could Grow 65% by 2040²

Global Rare Earth Element Demand



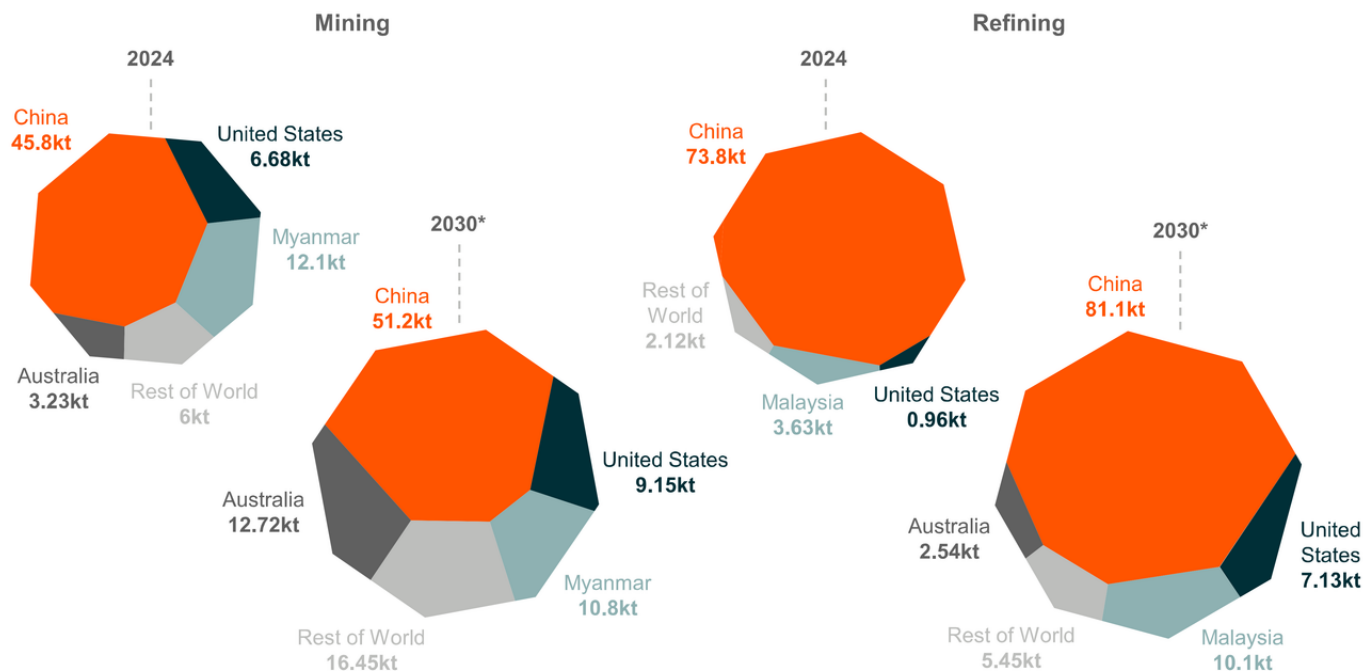
*Forecast

Sources: Text: 1. Eos, Oct 2024; 2. IEA, May 2025; Charts: LHS: Government of Canada, Dec 2024; RHS: IEA, May 2025.

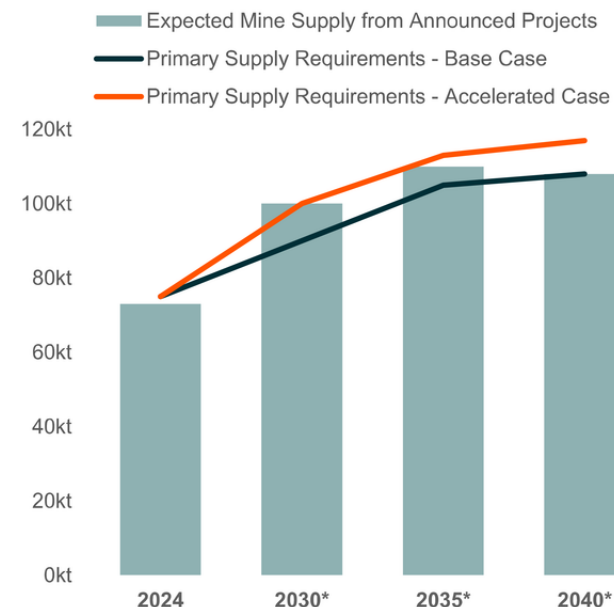
Rare Earths: Elevated Supply Risks Due to Limited Production Capacity Outside of China

China is the global leader in the REE market, and heightened geopolitical tensions have strained the supply chain. With REE supply and demand forecast to remain tightly balanced, any supply disruptions could lead to higher prices.

Global Mining and Refining Capacity of Rare Earth Elements



Rare Earth Element Mining Requirements & Expected Supply



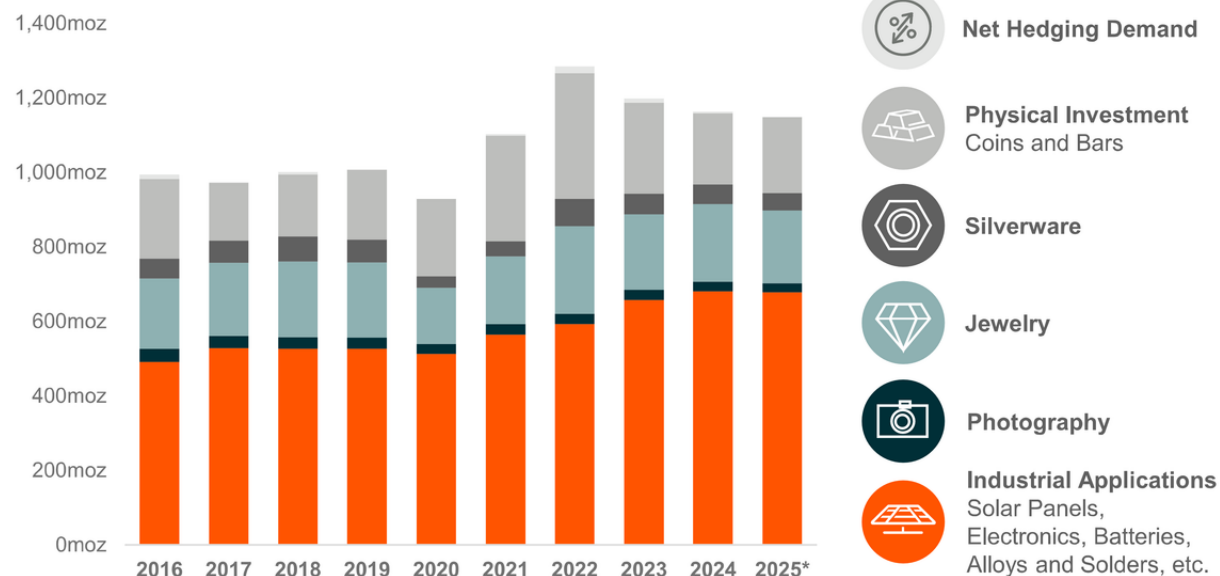
*Forecast; Note: Totals in charts cover four rare earths commonly used in magnets: praseodymium (Pr), neodymium (Nd), terbium (Tb), and dysprosium (Dy).
Sources: Charts: IEA, May 2025.

Silver: Industrial Applications Remains the Fastest Growing Category for Silver Usage

Demand for silver has grown significantly in recent years as a key component in power and data centers. Structural tailwinds from electrification and AI adoption could further accelerate this growth.

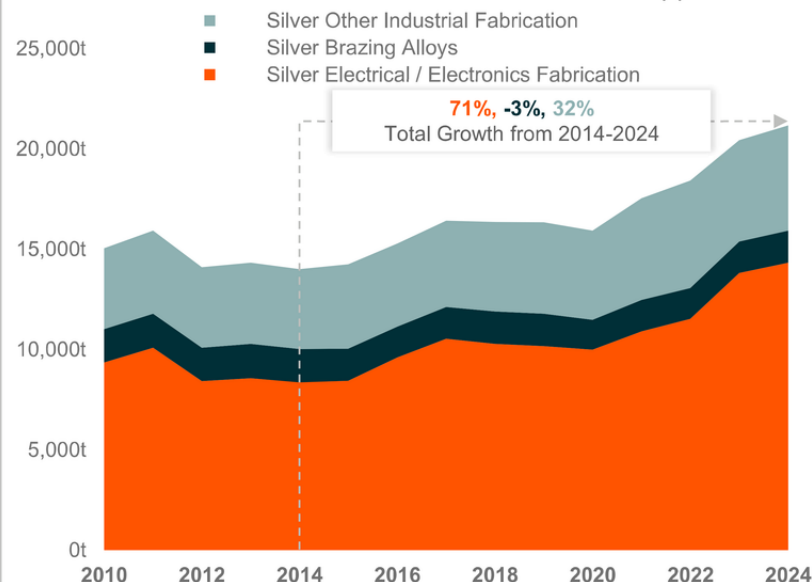
Industrial Use Remains Silver's Fastest Growing Application

Historic Silver Demand by Category



Silver's Use in Electronics Keeps Growing

2010-2024 Silver Demand Growth from Industrial Applications

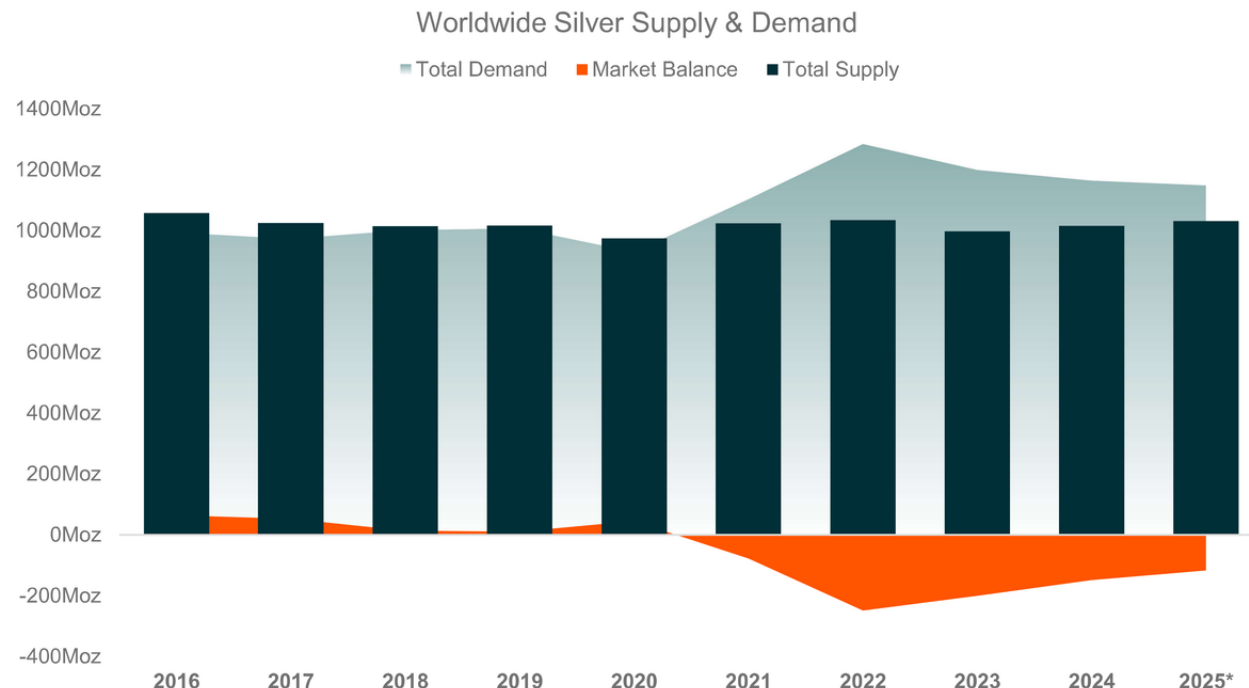
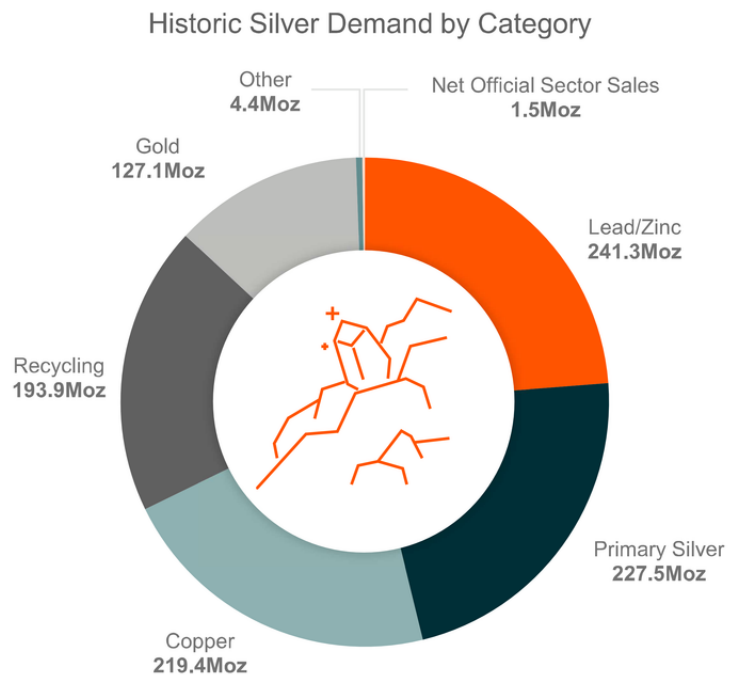


*Forecast

Sources: Charts: LHS: The Silver Institute & Metals Focus, Apr 2025; RHS: Bloomberg Intelligence, n.d., accessed Sep 19, 2025.

Silver: Limited Production Capacity Against Growing Consumption

In 2024, only 22% of silver came from primary silver mines, with most supply sourced as a by-product of other mining activities or recycling.¹ Limited capacity to scale production may drive a growing deficit and could support rising prices.



*Forecast

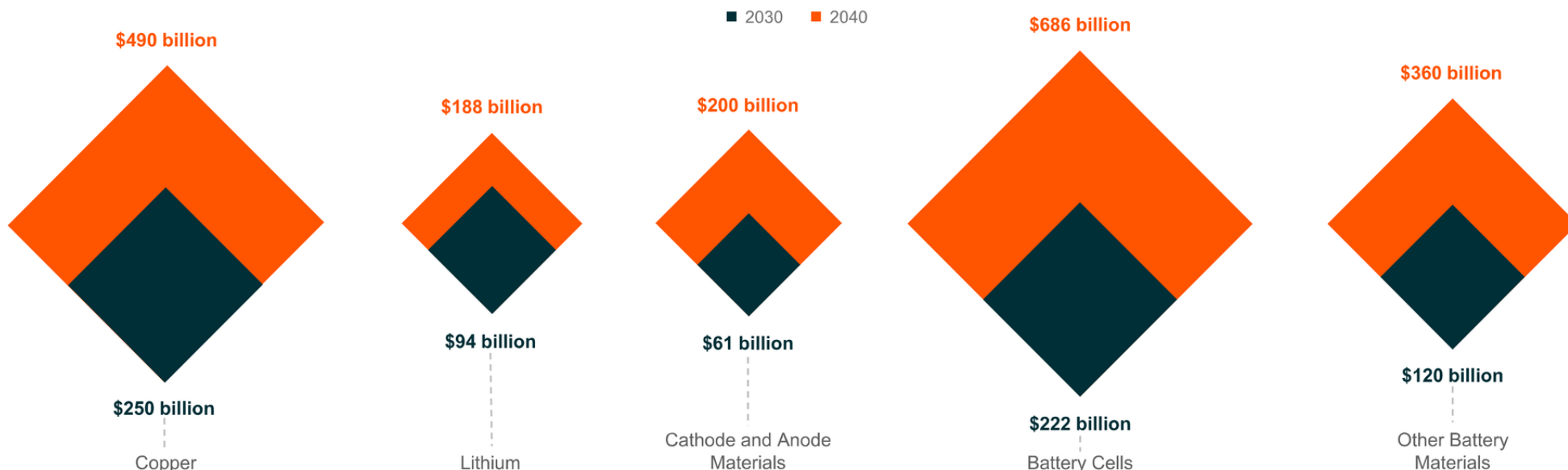
Sources: Text: 1. The Silver Institute & Metals Focus, Apr 2025; Charts: The Silver Institute & Metals Focus, Apr 2025.

Significant Investment Will Be Needed to Avoid Shortfalls Across Mineral Supply Chains

Potential investment opportunities span the entire lithium battery supply chain – from mining to components – and extend to other critical minerals, such as copper. This metal alone could require \$490 billion in investment by 2040.¹

EV and Critical Mineral Supply Chains Could Require \$900 Billion in Investment by 2030 and \$1.98 Trillion by 2040^{2,3}

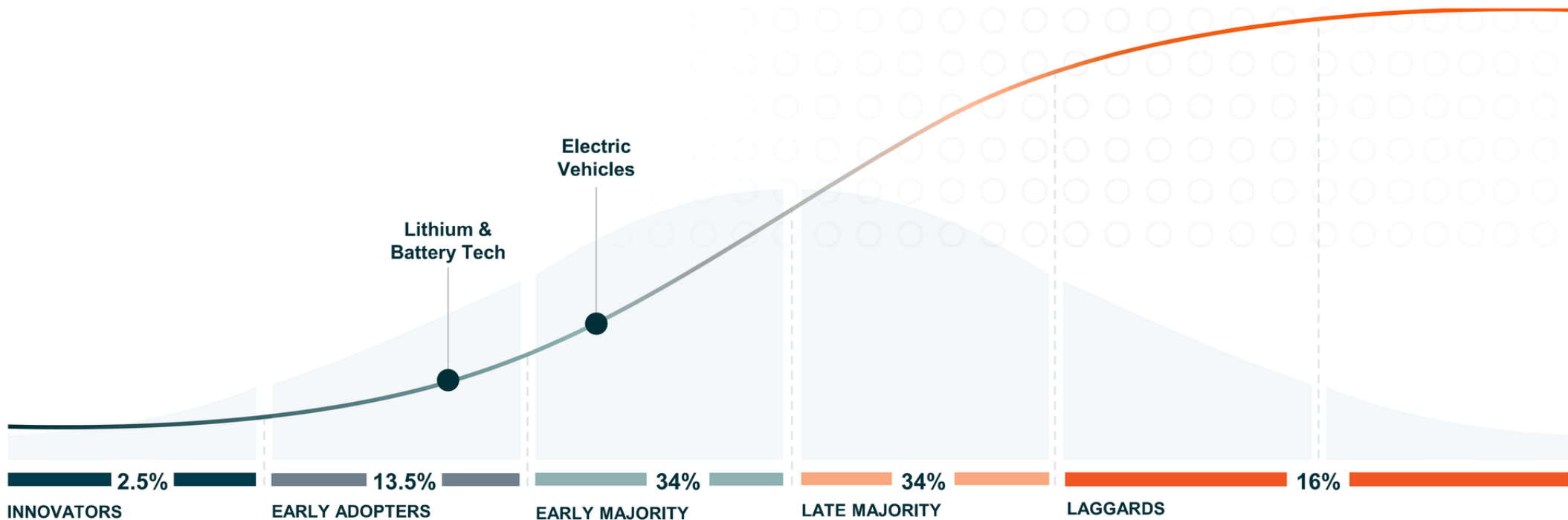
Investments Needed in Critical Mineral and Battery Supply Chains to Fill Shortfall Estimates by 2030 and 2040



Sources: Text: 1. IEA, May 2024; 2. Benchmark Mineral Intelligence, n.d., accessed Aug 20, 2025; 3. UNCTAD, May 2025; Chart: IEA, May 2024; UNCTAD, May 2025; Benchmark Mineral Intelligence, n.d., accessed Aug 20, 2025.

S-Shaped Curve of Adoption: Critical Minerals

The modern economy – spanning AI data centers, clean energy, EVs, and defense – runs on critical minerals and materials like copper, lithium, and rare earth elements.



PHASES OF ADOPTION

Displayed for illustrative purposes. Curve shape not indicative of mathematical transformation.