

Copper & Aluminium (grids & EVs)

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IEA Technology Definition

The IEA's Global Critical Minerals Outlook identifies copper and aluminium as foundational metals for electrification and grid expansion. Copper is essential for electrical conductors, motors, transformers, EV wiring, and renewable energy systems. Aluminium is used in transmission lines, solar panel frames, EV lightweight structures, and heat exchangers. The IEA tracks copper as the mineral with the largest established market among energy transition metals.

Technology Readiness & Deployment

Copper and aluminium mining and smelting are mature commercial industries. Copper demand from clean energy technologies is projected to grow by 30% by 2040 under current policies. The IEA's Global Critical Minerals Outlook 2025 warns of a potential 30% copper supply shortfall by 2035 due to declining ore grades, rising capital costs, limited new discoveries, and long development timelines. Aluminium supply is more diversified but energy-intensive smelting creates decarbonization challenges.

Key Metrics & Benchmarks

Global copper mine production reached approximately 22 million tonnes in 2024. An EV uses 2-4 times more copper than an internal combustion vehicle. A single offshore wind turbine requires 8-30 tonnes of copper. Electricity grids are the largest demand sector for copper. Aluminium production exceeds 70 million tonnes annually, with China producing over 55%. Recycled aluminium requires 95% less energy than primary production.

LATAM Relevance

Latin America accounts for 40% of global copper production, led by Chile (27%) and Peru (10%). The region's copper mines are critical to global electrification and grid expansion. Declining ore grades in Chilean mines and water scarcity in the Atacama are pressing challenges. Brazil is a significant bauxite producer (aluminium ore) and hosts aluminium smelters powered by hydroelectricity. Mexico and Colombia also contribute to regional copper and aluminium supply chains.

Critical Minerals Link

This is the core page for copper and aluminium in the energy transition. Copper faces the most acute supply-demand tension among transition minerals. Substitution options are limited for electrical applications. Aluminium can partially substitute for copper in some conductor applications but with efficiency penalties. Recycling rates for both metals are relatively high (copper ~30%, aluminium ~35% of supply from secondary sources) but insufficient to close projected gaps.

Cleantech Taxonomy Crosswalk

Maps to Cleantech Taxonomy sectors: IN (Industry) — mining, smelting, refining; ES (Energy Systems) — grid copper demand, transformer manufacturing; TR (Transport) — EV copper and aluminium demand; XS (Cross-Sectoral) — recycling, circular economy, water-energy-mining nexus.

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