'Substantial Shortfall' in Copper Supply Widens as the Race for AI and Growing Defense Spending Add to Accelerating Demand, New S&P Global Study Finds

Supply deficit would reach 10 million metric tons by 2040 as demand surges 50%

WASHINGTON, Jan. 8, 2026 /PRNewswire/ -- A looming copper supply gap is poised to widen as electricity demand accelerates and new vectors—such as the race for artificial intelligence and surging defense spending—add to the call on copper. According to *Copper in the Age of AI: The Challenges of Electrification*, a comprehensive new study by S&P Global (NYSE: SPGI), the emerging supply deficit constitutes a "systemic risk for global industries, technological advancement and economic growth."

The study finds that the "accelerating pace of electrification" is projected to swell copper demand to 42 million metric tons by 2040, a 50% increase from current levels. Yet, existing supply is currently poised to decrease in coming years as the mining sector faces challenges across the copper value chain.

The study projects that global copper production will peak in 2030 at 33 million metric tons. Unless significant adjustments are made, the widening disconnect will result in a supply deficit of 10 million metric tons by 2040—25% below projected demand.

This "substantial shortfall" occurs despite what the study expects will be a more than doubling of recycled copper scrap, from 4 million metric tons today to 10 million metric tons by 2040.

"Here, in short, is the quandary: copper is the great enabler of electrification, but the accelerating pace of electrification is an increasing challenge for copper," said **Daniel Yergin, Vice Chairman, S&P Global** who co-chaired the study. "Economic demand, grid expansion, renewable generation, AI computation, digital industries, electric vehicles and defense are scaling all at once—and supply is not on track to keep pace. At stake is whether copper remains an enabler of progress or becomes a bottleneck to growth and innovation."

The study leverages S&P Global expertise and proprietary data across the company's Energy and Market Intelligence divisions. Projections are based on a detailed bottom-up, technology-by-technology approach to quantify demand at its point of consumption, as opposed to production. This enables a better estimate of the embedded demand for the metal and the potential shortages or surpluses countries could face due to disruptions across the supply chain.

"Several countries have deemed copper a 'critical metal' over the past half decade, including, in 2025, the United States. And with good reason," said **Carlos Pascual, Senior Vice President, Geopolitics and International Affairs, S&P Global Energy** and study co-chair. *"Copper is the connective artery linking physical machinery, digital intelligence, mobility, infrastructure, communication and security systems; the future availability of copper has become a matter of strategic importance."*

The Future of Copper Demand

S&P Global Energy projects global electricity demand will increase by almost 50% by 2040. Meeting this demand will require adding the equivalent of roughly 330 Hoover Dams, or over 650 one-gigawatt nuclear reactors, each year between now and then.

The new study finds demand for copper—as the enabling material for this massive growth in power demand—accelerating

across four key vectors, two of which are:

- **Core economic demand**—from construction, electric appliances, internal combustion engine vehicles, rail, shipping, aviation, power generation, and more—constitutes the largest overall share of demand, reaching 23 million metric tons (53% of global demand) by 2040.

- **Energy transition and addition demand**—from electric vehicles, battery storage, renewable power capacity and power transmission and distribution, as well as electrification in developing countries—commands the largest amount of total growth, increasing by more than 7 million metric tons to a total of 15.7 million metric tons over the same period.

Demand from just these two categories will exceed copper supply by more than 7 million metric tons in 2040, the study finds. The gap widens further when you consider additional areas that have emerged in just the past few years, namely the **rapid growth in AI and data centers** and **rising defense spending**.

S&P Global expects total installed capacity for all data centers to be roughly 550 gigawatts by 2040—more than 5 times what it was in 2022. At the same time, global defense spending could double to $6 trillion by 2040 amid increased international tensions and the emergence of new threats, the study says.

- **AI & Data Center demand and Defense demand**—these two emerging vectors are each expected to roughly triple by 2040, representing a combined 4 million metric tons of additional demand.

The study also identifies a potential fifth vector of demand—humanoid robots. While the technology remains in the early stages, s*ome project that there could be 1 billion to 10 billion humanoid robots in operation by 2040. One billion humanoid robots in operation by 2040 would mean about 1.6 million metric tons of copper required annually, or 6% of current copper demand, the study says.*

Closing the Supply Gap

Overcoming the impending supply shortfall will ultimately depend on the development of new mines and the expansion of existing assets. The study estimates that an additional 10 million metric tons of this "primary supply" will be required by 2040, on top of increased recycling. However, absent significant investment, global primary supply could produce just 22 million metric tons by 2040—1 million metric tons less than today.

Reversing the current supply trajectory will be no small task, the study says. The copper sector faces a host of challenges above and below ground, ranging from declining ore grades; rising costs for energy, labor and other inputs; increasingly complex and difficult extraction conditions; environmental opposition, lengthy judicial reviews, and pressures from investors and governments. It takes 17 years, on average, for a new copper mine to go from discovery to production.

"Primary production—mining—remains the irreplaceable foundation of copper supply," said **Eleonor Kramarz, Global Head of Critical Minerals and Energy Transition Consulting, S&P Global Energy.** "Bridging the impending supply gap depends not only on geology, engineering, and logistics and investment, but also on governance and policies. That translates into timeliness in permitting and consultation, a time clock on litigation and stability in governance and regulation. The alternative is uncertainty, and uncertainty comes at a hefty cost."

Concentration of the supply chain presents another challenge, the study finds. Six countries are responsible for roughly two-thirds of mining production. Processing capacity is even more concentrated, with a single country—China—commanding roughly 40% of total smelting capacity and 66% of the imports of the main input, mined copper concentrate. Such concentration makes global supply and pricing vulnerable to disruptions, policy shocks and complex trade barriers, the study says.

"The future is not just copper-intensive, it is copper-enabled. Every new building, every line of digital code, every renewable megawatt, every new car, every advanced weapon system depends on the metal," said **Aurian De La Noue, Executive Director, Critical Minerals and Energy Transition Consulting, S&P Global Energy**. "Multilateral cooperation and regional diversification will be crucial to ensure a more resilient global copper system—one commensurate with copper's role as the linchpin of electrification, digitalization and security in the age of AI."

About the Study:

Copper in the Age of AI: The Challenges of Electrification is available at https://www.spglobal.com/en/research-insights/special-reports/copper-in-the-age-of-ai

The study analyzes the global outlook for copper supply and demand through 2040, focusing on copper's essential role in electrification, digitalization, and emerging technologies such as AI, data centers, electric vehicles, and defense. Leveraging S&P Global's cross-divisional expertise and proprietary data across the company's Energy and Market Intelligence divisions, the report uses a bottom-up, sector-by-sector approach to quantify future copper requirements and assess the ability of mining, recycling and processing to meet projected demand.

The study examines the operational, regulatory and market challenges facing copper supply chains, including above-ground risks, permitting delays, trade dynamics and talent shortages. It benchmarks the scale of the potential supply shortfall and highlights the factors that could constrain or enable future growth.

This report does not make policy recommendations. It is intended to inform and support dialogue on the challenges and opportunities shaping copper's role in the global energy transition and digital economy.

The analysis and metrics developed during the course of this research represent the independent analysis and views of S&P Global.

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S&P Global is exclusively responsible for the analysis, content and conclusions of the study.

Media Contacts:

Jeff Marn
S&P Global Energy
+1 202 463 8213
jeff.marn@spglobal.com

Orla O'Brien
S&P Global
+1 857 407 8559
orla.obrien@spglobal.com

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