

GREEN ENERGY MINERAL: KEY FACTS

Copper

US CRITICAL MINERAL?

NO

MAIN USES IN GREEN ENERGY TECHNOLOGY



Solar



Wind



Energy storage



Electric cars
(batteries excluded)



Geothermal

KEY DEVELOPMENT ISSUES IN MINING



Environment



Governance



Labor and
working conditions



Conflict



Land tenure

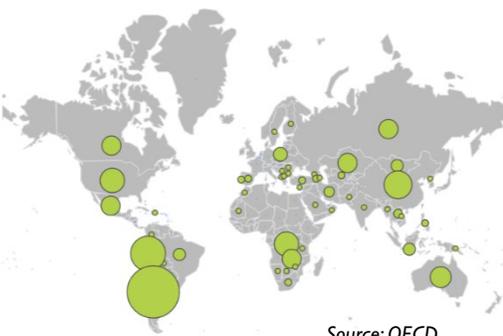


Leveraging minerals
for economic growth
(local/national)

DEMAND PROJECTIONS

Copper is the most cross-cutting metal in renewable technologies. Around three-quarters of future demand will come from solar photovoltaics and wind generation (Hund et al. 2020), but copper is also used in batteries, in electric vehicle wiring, grid transmission and geothermal plants. In photovoltaics, the copper-indium-gallium-selenide (CIGS) technology will be used in about a fifth of panels by 2050, and copper coils are an essential component for induction generators used in wind turbines. By 2050, annual copper demand due to renewables is projected at 1.38 million tons per year under a two-degree scenario (Hund et al., 2020), which is about how much copper the DRC produced in 2020. This amount is only 7% of 2018 production, demonstrating how copper demand is spread across multiple industries. However, some industry leaders have recently expressed concern about the capacity to respond to an economy-wide doubling of copper demand anticipated by 2050 (Reuters, 2021c).

PRODUCTION/RESERVES



Source: OECD

Copper is abundant but not always in sufficient grades for profitable mining. USGS estimated, for example, that there are 2.1 billion tons of copper resources. However, global production and reserves today is dominated by South American producers. **Chile** was the largest copper producer in 2020 with 5.7 million tons or around 30% of global production in that year. In second position was **Peru** with 2.2 million tons and **China** in third with 1.7 million tons. The **US** produced roughly 1.2 million tons, which was slightly less than the **DRC's** 1.3 million tons. Products containing copper are recycled at rates between 43 and 53%, and recycled copper is around 20-37% of total copper content in new products (Hund et al., 2020).

Copper prices fluctuate based on worldwide economic conditions given its role a broad range of industries. In the last five years, the price per ton was lowest in 2016 at \$4,350. After growing steadily, it plummeted to about that level in March 2020 at the outset of the COVID-19 pandemic. It has since rallied to record highs, going past \$10,000 per ton in early 2021.

MINING IN USAID-PRESENCE COUNTRIES

Top producer **Chile** is a limited USAID presence country, and the second largest producer **Peru** is a USAID presence country. Other major producers with USAID presence are the **DRC, Zambia, Mexico,** and **Kazakhstan**.

Smaller production or likely future production exists in more than 30 USAID-presence countries including **Albania, Armenia, Azerbaijan, Bolivia (limited presence), Botswana, Brazil, Burma, Colombia, Dominican Republic, Ecuador, Georgia, India, Indonesia, Kyrgyz Republic, Laos, Mauritania, Mongolia, Morocco, Namibia, North Macedonia, Pakistan, Panama, Papua New Guinea (limited presence), Philippines, South Africa, Tajikistan, Tanzania, Uzbekistan, Vietnam,** and **Zimbabwe.**

MAJOR INDUSTRIAL COMPANIES

Codelco, the national company of Chile, is the largest, followed by **BHP** which also operates in Chile. BHP also operates in Australia and the US. American company **Freeport-McMoRan** operates the world's largest gold mine in Indonesia which produces copper as a by-product. **Glencore** is the largest copper company active in the DRC, and Mexico-based **Southern Copper** operates in Mexico and Peru (NS Energy, 2021a). **Jiangxi Copper** is a major Chinese company in copper and other metals; it is also the fifth largest overall mining company in the world (Murray, 2021).

ARTISANAL AND SMALL-SCALE MINING (ASM)

While ASM cobalt has garnered widespread international attention, the same **DRC** miners that produce cobalt are also producing copper as both metals occur in the same ore bodies. A 2019 German study noted that average reported copper grades in ASM core was 13.6% and cobalt grade was 4.2%, and prices are set based on both metals' content; however, DRC's copper exports are likely less than 1% from ASM at those levels (BGR, 2019). ASM copper has also been documented in **Chile** though generally as a by-product of gold (Castro, 2003). ASM was also documented in **Tanzania** with Chinese buyers operating widely until 2014 price drops (Schoneveld et al., 2018).

ISSUES IN USAID-PRESENCE COUNTRIES

The same labor and human rights issues cited in DRC's cobalt sector apply to its copper, albeit with less acuteness given the relatively small proportion of DRC copper from ASM. DRC's general mining governance challenges with respect to corruption also are relevant to its copper sector.

In the industrial copper sector in South America, development challenges revolve more about how mineral wealth contributes to the broader economy and macroeconomic stability. For the last two decades, for example, 10% of Chile's GDP has come from copper mining (International Copper Association, 2018). Policy-makers and academics have studied how the broader economy can suffer from price shocks as well as how to build better economic linkages (Rehner & Rodriguez, 2021).

Industrial copper mining is also a major policy issue in national politics, including recent elections in Peru and Chile where the benefits of multinational mining companies on average citizens were called into question by left-leaning candidates. Indeed, resource nationalism is an issue affecting the copper industry, including proposals for higher taxes or nationalization. Mining companies also wield considerable influence in producing countries as evidenced by their request to participate in revising Chile's constitution (Reuters, 2021e).

MINE DEVELOPMENT AND SUPPLY CHAIN DYNAMICS

Copper supply and demand dynamics are linked to the broader global economy, especially China, which is by far the largest consumer of copper followed by Germany at a distant second. China's imports are therefore closely followed by market analysts. China also actively influences prices such as the recent release of copper and other metals from its strategic reserves in a bid to bring down record high prices of several metals that were creating a risk of inflation given their broad role in the economy (Nguyen, 2021). Copper like other base metals is also influenced by investor speculation (commodities are used as a hedge against inflation) as well as fiscal policy, mainly interest rates, which move inversely to prices.¹

Like other base metals, there is inertia in responding to price movements given the amount of capital and time required to develop new mines. As a result, there can be periods of supply deficit as well as excess supply if new mining projects are ill-timed with market demand. Analysts point to a current supply deficit.

The COVID-19 pandemic showed other vulnerabilities such as the dependence on South American mines in Chile and Peru. Indeed, the closure of some mines due to COVID-19 has been a factor limiting supply and pushing up prices, as well as worldwide

¹ As the cost of borrowing increases, companies tend to reduce commodity reserves, which puts downward pressure on market prices. Conversely, when borrowing is cheap, companies will be able to hold more reserves, which decreases overall supply and puts upward pressure on prices. See recent market reaction: Reuters (2021, June) Home: funds flee cyclically confused copper market. *Mining[dot]com*. Accessed via <https://www.mining.com/web/home-funds-flee-cyclically-confused-copper-market/>

shipping logistic constraints (Wallace, 2021). As noted politics and resource nationalism is also a feature in the copper sector, with some recent calls for nationalization in Peru (Marques, 2021) as well as a copper mining company nationalization in Zambia this year (Mushinge, 2021).

ORGANIZATIONS AND INDUSTRY GROUPS

The **International Copper Association** is the main industry group (Copper Alliance, n.d.). In Chile, the Copper Commission (**COCHILCO**) is an important national and international actor (COCHILO, n.d.).
