





GREEN ENERGY MINERAL: KEY FACTS

# Aluminum

<b>US CRITICAL MINERAL?</b> <span style="color: red;">YES</span>	
<b>MAIN USES IN GREEN ENERGY TECHNOLOGY</b>	<b>KEY DEVELOPMENT ISSUES IN MINING</b>
 Solar  Wind  Energy storage  Electric cars (batteries excluded)	 Environment  Governance  Land tenure

## DEMAND PROJECTIONS

Aluminum is used in multiple renewable technologies, including in electric vehicles which work better with lighter-weight bodies, but nearly 90% of projected use in the green energy transition stems from photovoltaic cells, specifically the panel frames. Of the 16 minerals, aluminum demand will increase the most in absolute terms with more than 5.5 million tons per year required for renewables by 2050 under a two-degree scenario (Hund et al., 2020). However, this is not a huge increase in relative terms, representing 9% of 2018 production levels. This reflects aluminum’s widespread use in a variety of industries, meaning that an increased use in renewables will increase but will not radically reshape demand. Gallium, a metal used in a subset of photovoltaic cell technologies, is obtained as a byproduct of bauxite refining. However, increased demand for gallium will unlikely influence the fundamentals of bauxite mining in USAID-presence countries.

## PRODUCTION/RESERVES



Source: OECD

Global resources of bauxite, the ore for aluminum, are estimated between 55 and 75 billion tons, which is sufficient to meet world demand for many years into the future. **Australia** was the world’s largest producer of bauxite in 2020 with 110 million tons (nearly 30% of global production) followed by **Guinea** (82 million tons) and **China** (60 million tons).

Bauxite is refined into alumina (aluminum oxide) and then smelted into aluminum. Alumina production is dominated by **China** (74 million tons, or 54% of production) followed by **Australia** (21 million tons). **China** is also the main producer of aluminum, accounting for 57% of global production, followed by **Russia, India** and **Canada**. The **US** accounted for less than 2% of aluminum production in 2020.

Between 42% and 70% of aluminum products are recycled, and new products with aluminum contain between 34% and 36% of recycled aluminum (Hund et al., 2020). Recycling will therefore offset future demand, but it will not replace the need for new mined aluminum.

Unrefined bauxite prices vary based on their quality but are generally between \$30 and \$50 per ton. Aluminum metal prices have generally been stable at an average of around \$2,000 per ton over the last five years, with a low at just below \$1,500 and a high of just under \$2,500 (NASDAQ, n.d.; LME, n.d.a). However, like many commodities, aluminum is facing increased volatility and upward pressure on prices.

## MINING IN USAID-PRESENCE COUNTRIES

As the world's second largest producer in 2020 and holder of the world's largest reserves, **Guinea** is the most important USAID-presence country for bauxite (7.4 billion tons, or nearly 25% of global known reserves). Other USAID-presence countries with significant production or reserves are **Vietnam** (3.7 billion tons in bauxite reserves), **Brazil** (world's 4th largest producer in 2020), **India**, **Indonesia**, **Jamaica**, **Kazakhstan**, and **Guyana**. Smaller or emerging producers include **Bosnia-Herzegovina**, **Cameroon**, **Colombia**, **Ghana**, **Montenegro**, **Mozambique**, **Sierra Leone**, **Solomon Islands** (limited presence), and **Tanzania**.

### MAJOR INDUSTRIAL COMPANIES

NYSE-listed **Alcoa** has ownership in seven active bauxite mines, including a minority stake in Guinea's main mine. Alcoa is also a major refiner and smelter. **Rio Tinto** (headquartered in London with public listings in London and Australia) also has a stake in the Guinea mine and like Alcoa is involved in mining, refining, and smelting worldwide. **Aluminum Corporation of China** (also called **Chalco**, listed in New York, Shanghai, and Hong Kong) is China's largest alumina refinery and aluminum smelter, and is increasingly involved in mining, including Guinea.

### ARTISANAL AND SMALL-SCALE MINING (ASM)

None known

## ISSUES IN USAID-PRESENCE COUNTRIES

**Environment, governance, and land tenure** issues are common in USAID-presence countries with bauxite mining. In **Guinea**, for example, there have been complaints about land expropriation, a lack of transparency and negative health effects caused by bauxite mining (Human Rights Watch, 2018). In **India**, there are tensions between promoters of bauxite and detractors who note the presence of indigenous populations who consider mining areas as sacred land (Oskarsson, 2017). In **Brazil**, there is also concern around the environmental impacts of bauxite mining concentrated in the Amazon region though companies invest significant amounts in rehabilitation (ABAL, 2017). Bauxite mining has also been linked to "minerals-for-infrastructure" deals such as the \$2 billion agreement between **Ghana** and Chinese company Sinohydro to build infrastructure in exchange for bauxite. Ghana's bauxite mining has also been controversial due to its location in a high-biodiversity forest area (Gbadamosi, 2020). Bauxite mining in the **Solomon Islands** (limited presence) has also been highly criticized for devastating environmental impacts (Puia, 2021).

## MINE DEVELOPMENT AND SUPPLY CHAIN DYNAMICS

Bauxite mining development is a long-term major investment often requiring infrastructure investments to export or refine massive quantities of ore. Like many industrially mined base metals, project development is influenced not by a shortage of bauxite but rather by deposit grade, politics, and logistics. When possible, it is optimal for refineries and smelters to be located near a bauxite source, such as AluHydro Norte in Brazil. Most large players like Alcoa and Rio Tinto tend to vertically integrate as much as possible.

Outside the majors, newer frontier projects consist of consortia that bring together shipping/logistics, refining and mining under one effort, such as smelter Shandong Weiqiao which is part of one of Guinea's major bauxite mining companies (SMB-Guinee, n.d.). Similarly, the smelter Emirates Global Aluminium is a shareholder in the Guinea Alumina Corporation SA, a new project (NS Energy, 2021c). In Jamaica, similarly, commodities trader Nobles Group is the majority shareholder in the country's main bauxite mine (Majumder, 2020).

## ORGANIZATIONS AND INDUSTRY GROUPS

The **Aluminum Association** is a US-based industry group that includes all the majors (The Aluminum Association, n.d.). The **Aluminium Stewardship Initiative (ASI)** is a global nonprofit organization that sets standards for sustainability in the aluminum value chain (ASI, n.d.).