

GREEN ENERGY MINERAL: KEY FACTS

Lithium

US CRITICAL MINERAL?

YES

MAIN USES IN GREEN ENERGY TECHNOLOGY



Energy storage

KEY DEVELOPMENT ISSUES IN MINING



Environment



Governance



Conflict



Land tenure



Leveraging minerals for economic growth (local/national)

DEMAND PROJECTIONS

Lithium is fundamental to lithium-ion battery technologies. Lithium's reactivity and small size enables a higher voltage and charge per unit mass and volume compared to other options. Lithium-ion batteries have some downsides, such as a risk of fire, but so far no alternatives have been found that outperform at the same cost. As such analysts anticipate that lithium-ion batteries will be used in 100% of electric vehicles in 2050, 70-84% of energy storage at a grid level and about a third of storage at a decentralized level (Hund et al., 2020). With these assumptions, even taking into account increased efficiency of lithium usage, around 415,000 tons per year of lithium will be required by 2050 under a two-degree scenario, which translates to 488% above 2018 production levels.

PRODUCTION/RESERVES



Source: OECD

Most lithium is produced from two sources: a mineral source (spodumene crystals found in pegmatite) and lithium brine from seawater or salts. **Australia** is currently the world's main lithium producer with 40,000 tons produced in 2020, or almost half of the world's production. **Chile** was second with 18,000 tons, followed by **China** with 14,000 tons. In terms of reserves, the so-called "lithium triangle" between Argentina, Chile, and Bolivia dwarfs Australia's known reserves. Most resources are salt pans bordering or in the Atacama Desert.

Less than 1% of lithium is currently recycled, and future prospects for recycling lithium from batteries are not good given technical complexities though research is ongoing (Hund et al., 2020). Lithium is sold in several forms. Battery-grade lithium carbonate prices have varied between \$8,000 and \$17,000 per ton in the

last five years. In 2021 the price has reached \$1,350. Pure lithium metal sells for as high as \$80,000 per ton.

MINING IN USAID-PRESENCE COUNTRIES

As noted, **Chile** (limited presence) is the world's second largest producer and has developed resources faster than **Bolivia** (limited presence) and **Argentina** (non-presence), the other countries forming the "lithium triangle." In 2020 there were smaller producers in **Brazil** and **Zimbabwe**. Due to increasing demand and prices, many junior exploration companies developing projects in other frontier markets, including the **DRC** (Australian/Chinese) (Mining Technology, n.d.a), **Mexico** (Chinese) (Deslandes, 2020), **Peru** (Canadian) (Aquino, 2020), **Mali** (Australian/Chinese) (Reuters, 2021a), **Ghana** (Australian) (Mining Review Africa, 2021), **Kazakhstan** (unknown), and **Namibia** (Australia) (Mining Journal, 2019).

MAJOR INDUSTRIAL COMPANIES	ARTISANAL AND SMALL-SCALE MINING (ASM)
<p>Albermarle Corporation (US) and US-listed Sociedad Quimica y Minera de Chile (SQM) were the largest lithium producers in the world until recently, along with FMC Corp, and both remain in the top five. FMC Corp spun off its lithium interests in company Livent in 2019. The largest lithium producer today is Gangfeng Lithium (China) that mines and refines. Tianqi Lithium (China) and Mineral Resources (Australia) are also important companies.</p>	None

ISSUES IN USAID-PRESENCE COUNTRIES

The main issue associated with lithium mining, especially in the lithium triangle, is environmental. Current mining practices in the salt flats are water intensive and produce large amounts of waste (Flexer et al., 2018). The use of water has even led to the decline in water tables for surrounding communities (Liu & Agusdinata, 2021).

Community opposition to lithium mining has been a feature in Chile (Liu & Agusdinata, 2020). There have also been issues around human rights and free-and-prior informed consent (Heredia et al., 2020).

More broadly the scramble for lithium in South America has set off public debates on beneficiation and economic linkages, which is “creating space for a more dynamic debate about the social value of mining and the proper role of the state in development” (Barandiarán, 2019). In some countries this debate has swung between resource nationalism and inviting foreign investment, such as in Mexico (Garcia, 2021).

In other frontier markets community conflicts and capacity constraints might be key issues. Countries that have never engaged in lithium mining could become designated hubs for speculative “maverick” exploration companies, which can also raise the risk of corruption.

MINE DEVELOPMENT AND SUPPLY CHAIN DYNAMICS

Lithium has been in a “resource scramble” linked almost entirely to the anticipated surge in demand due to the green energy transition. This scramble has been driven by the supply chain rather than traditional mining actors. Strategic alliances and joint ventures between lithium-ion battery users like vehicle manufacturers, battery supply companies and junior mining companies have been burgeoning. There has also been increasing vertical integration across the supply chain.

ORGANIZATIONS AND INDUSTRY GROUPS

No major lithium mining focused industry groups.