

LITHIUM

(Data in metric tons of contained lithium unless otherwise noted)

Domestic Production and Use: Commercial-scale lithium production in the United States was from one continental brine operation in Nevada. Lithium was also commercially produced from the brine-sourced waste tailings of a Utah-based magnesium producer. Two companies produced a wide range of downstream lithium compounds in the United States from domestic or imported lithium carbonate, lithium chloride, and lithium hydroxide. Domestic production data were withheld to avoid disclosing company proprietary data.

Although lithium markets vary by location, global end-use markets were estimated as follows: batteries, 80%; ceramics and glass, 7%; lubricating greases, 4%; continuous casting mold flux powders, 2%; air treatment, 1%; medical, 1%; and other uses, 5%. Lithium consumption for batteries increased significantly in recent years because rechargeable lithium batteries have been used extensively in the growing market for electric vehicles and portable electronic devices, and increasingly have been used in electric tools, and grid storage applications. Lithium minerals were used directly as ore concentrates in ceramics and glass applications.

<u>Salient Statistics—United States:</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022^e</u>
Production	W	W	W	W	W
Imports for consumption	3,420	2,620	2,460	2,640	3,400
Exports	1,660	1,660	1,200	1,870	2,700
Consumption, estimated ¹	3,000	2,000	2,000	2,000	3,000
Price, annual average-nominal, battery-grade lithium carbonate, dollars per metric ton ²	16,000	11,700	8,400	12,600	37,000
Employment, mine and mill, number	70	70	70	70	70
Net import reliance ³ as a percentage of estimated consumption	>50	>25	>50	>25	>25

Recycling: Construction of lithium battery recycling plants increased at a rapid pace. As of November 2022, about 44 companies in Canada and the United States and 47 companies in Europe recycled lithium batteries or planned to do so. Automobile companies and battery recyclers partnered to supply the automobile industry with a source of battery materials.

Import Sources (2018–21): Argentina, 51%; Chile, 40%; China, 4%; Russia, 3%; and other, 2%.

<u>Tariff:</u>	<u>Item</u>	<u>Number</u>	<u>Normal Trade Relations</u> <u>12–31–22</u>
	Lithium oxide and hydroxide	2825.20.0000	3.7% ad valorem.
	Lithium carbonate:		
	U.S. pharmaceutical grade	2836.91.0010	3.7% ad valorem.
	Other	2836.91.0050	3.7% ad valorem.

Depletion Allowance: 22% (domestic), 14% (foreign).

Government Stockpile:^{4, 5}

<u>Material</u>	<u>Inventory</u> <u>as of 9–30–22</u>	<u>FY 2022</u>		<u>FY 2023</u>	
		<u>Potential</u> <u>acquisitions</u>	<u>Potential</u> <u>disposals</u>	<u>Potential</u> <u>acquisitions</u>	<u>Potential</u> <u>disposals</u>
Lithium-cobalt oxide	752	—	—	—	—
Lithium-nickel-cobalt-aluminum oxide	2,698	—	—	—	—

Events, Trends, and Issues: Excluding U.S. production, worldwide lithium production in 2022 increased by 21% to approximately 130,000 tons from 107,000 tons in 2021 in response to strong demand from the lithium-ion battery market and increased prices of lithium. Global consumption of lithium in 2022 was estimated to be 134,000 tons, a 41% increase from 95,000 tons in 2021.

Spot lithium carbonate prices in China (cost, insurance, and freight [c.i.f.]) increased from approximately \$35,000 per ton in January to about \$67,000 per ton in November. For fixed contracts, the annual average U.S. lithium carbonate price was \$37,000 per ton in 2022, almost three times higher than that in 2021. Spot lithium hydroxide prices in China (free on board) increased from approximately \$35,300 per ton in January to about \$78,000 per ton in November. Spot spodumene (6% lithium oxide) prices in China (c.i.f.) increased from approximately \$4,900 per ton in January to about \$5,800 per ton in November.

LITHIUM

Six mineral operations in Australia, one mineral tailings operation in Brazil, two brine operations each in Argentina and Chile, and three mineral and two brine operations in China accounted for the majority of world lithium production. Additionally, smaller operations in Brazil, Canada, China, Portugal, the United States, and Zimbabwe also contributed to world lithium production. Owing to the rapid increase in demand and prices of lithium in 2022, established lithium operations worldwide increased or were in the process of increasing production capacity.

The U.S. Department of Energy selected 12 lithium-based projects funded with \$1.6 billion from the 2022 U.S. Bipartisan Infrastructure Law to support new commercial-scale domestic facilities to extract and process lithium, manufacture battery components, recycle batteries, and develop new technologies to increase U.S. lithium reserves.

Lithium supply security has become a top priority for technology companies in Asia, Europe, and North America. Strategic alliances and joint ventures among technology companies and exploration companies continued to be established to ensure a reliable, diversified supply of lithium for battery suppliers and vehicle manufacturers. Brine-based lithium sources were in various stages of development or exploration in Argentina, Bolivia, Chile, China, and the United States; mineral-based lithium sources were in various stages of development or exploration in Australia, Austria, Brazil, Canada, China, Congo (Kinshasa), Czechia, Ethiopia, Finland, Germany, Ghana, Kazakhstan, Mali, Namibia, Nigeria, Peru, Portugal, Russia, Serbia, Spain, Thailand, the United States, and Zimbabwe; lithium-clay sources were in various stages of development or exploration in Mexico and the United States.

World Mine Production and Reserves: Reserves for Argentina, Australia, Brazil, Canada, Chile, China, the United States, Zimbabwe, and “Other countries” were revised based on information from company and Government reports.

	Mine production		Reserves ⁶
	2021	2022 ^e	
United States	W	W	1,000,000
Argentina	5,970	6,200	2,700,000
Australia	55,300	61,000	76,200,000
Brazil	^e 1,700	2,200	250,000
Canada	—	500	930,000
Chile	28,300	39,000	9,300,000
China	^e 14,000	19,000	2,000,000
Portugal	^e 900	600	60,000
Zimbabwe	^e 710	800	310,000
Other countries ⁸	—	—	3,300,000
World total (rounded)	⁹ 107,000	⁹ 130,000	26,000,000

World Resources:⁶ Owing to continuing exploration, identified lithium resources have increased substantially worldwide and total about 98 million tons. Identified lithium resources in the United States—from continental brines, claystone, geothermal brines, hectorite, oilfield brines, and pegmatites—are 12 million tons. Identified lithium resources in other countries have been revised to 86 million tons. Identified lithium resources are distributed as follows: Bolivia, 21 million tons; Argentina, 20 million tons; Chile, 11 million tons; Australia, 7.9 million tons; China, 6.8 million tons; Germany, 3.2 million tons; Congo (Kinshasa), 3 million tons; Canada, 2.9 million tons; Mexico, 1.7 million tons; Czechia, 1.3 million tons; Serbia, 1.2 million tons; Russia, 1 million tons; Peru, 880,000 tons; Mali, 840,000 tons; Brazil, 730,000 tons; Zimbabwe, 690,000 tons; Spain, 320,000 tons; Portugal, 270,000 tons; Namibia, 230,000 tons; Ghana, 180,000 tons; Finland, 68,000 tons; Austria, 60,000 tons; and Kazakhstan, 50,000 tons.

Substitutes: Substitution for lithium compounds is possible in batteries, ceramics, greases, and manufactured glass. Examples are calcium, magnesium, mercury, and zinc as anode material in primary batteries; calcium and aluminum soaps as substitutes for stearates in greases; and sodic and potassic fluxes in ceramics and glass manufacture.

^eEstimated. W Withheld to avoid disclosing company proprietary data. — Zero.

¹Defined as production + imports – exports ± adjustments for Government and industry stock changes. Rounded to one significant digit to avoid disclosing company proprietary data.

²Lithium carbonate price assessments for spot and long-term contracts. Source: Benchmark Mineral Intelligence Ltd.

³Defined as imports – exports ± adjustments for Government and industry stock changes.

⁴See Appendix B for definitions.

⁵Units are kilograms, gross weight.

⁶See Appendix C for resource and reserve definitions and information concerning data sources.

⁷For Australia, Joint Ore Reserves Committee-compliant or equivalent reserves were 3.8 million tons.

⁸Other countries with reported reserves: Austria, Congo (Kinshasa), Czechia, Finland, Germany, Ghana, Mali, Mexico, Namibia, Serbia, and Spain.

⁹Excludes U.S. production.