

LITHIUM

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

Domestic Production and Use: The only lithium production in the United States was from a brine operation in Nevada. 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 are estimated as follows: batteries, 56%; ceramics and glass, 23%; lubricating greases, 6%; polymer production, 4%; continuous casting mold flux powders, 3%; air treatment, 2%; and other uses, 6%. Lithium consumption for batteries has increased significantly in recent years because rechargeable lithium batteries are used extensively in the growing market for portable electronic devices and increasingly are used in electric tools, electric vehicles, and grid storage applications. Lithium minerals were used directly as ore concentrates in ceramics and glass applications.

Salient Statistics—United States:	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018^e</u>
Production	W	W	W	W	W
Imports for consumption	2,130	2,750	3,140	3,330	4,000
Exports	1,420	1,790	1,520	1,960	1,600
Consumption, estimated	12,000	12,000	13,000	13,000	13,000
Price, annual average, battery-grade lithium carbonate, dollars per metric ton ²	6,690	6,500	8,650	15,000	17,000
Employment, mine and mill, number	70	70	70	70	70
Net import reliance ³ as a percentage of estimated consumption	>25	>25	>50	>50	>50

Recycling: One domestic company has recycled lithium metal and lithium-ion batteries since 1992 at its facility in British Columbia, Canada. In 2015, the company began operating the first U.S. recycling facility for lithium-ion vehicle batteries in Lancaster, OH.

Import Sources (2014–17): Argentina, 51%; Chile, 44%; China, 3%; Russia, 1%; and other, 1%.

Tariff: Item	Number	Normal Trade Relations 12–31–18
Other alkali metals	2805.19.9000	5.5% ad val.
Lithium oxide and hydroxide	2825.20.0000	3.7% ad val.
Lithium carbonate:		
U.S. pharmaceutical grade	2836.91.0010	3.7% ad val.
Other	2836.91.0050	3.7% ad val.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

Government Stockpile:⁴

Material	Inventory As of 9–30–18	FY2018		FY 2019	
		Potential Acquisitions	Potential Disposals⁵	Potential Acquisitions	Potential Disposals⁵
Lithium cobalt oxide (kilograms, gross weight)	600	600	—	—	—
Lithium nickel cobalt aluminum oxide (kilograms, gross weight)	1,620	2,160	—	—	—
Lithium-ion precursors (kilograms, gross weight)	—	—	—	19,000	—

Events, Trends, and Issues: In May 2018, the U.S. Department of the Interior, in coordination with other executive branch agencies, published a list of 35 critical minerals (83 FR 23295), including lithium. This list was developed to serve as an initial focus, pursuant to Executive Order 13817, “A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals” (82 FR 60835).

Excluding U.S. production, worldwide lithium production in 2018 increased by 22% to 84,000 tons of lithium content from 69,000 tons of lithium content in 2017 in response to increased lithium demand for battery applications. This follows an increase of 74% in worldwide production in 2017 from that of 2016, owing primarily to a threefold increase in Australia’s spodumene production, including more than 11,000 tons of lithium content in direct shipping ore that

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was exported to China for processing. Consumption of lithium in 2018 was projected to be about 47,600 tons of lithium content, an increase of 20% from 39,700 tons of lithium content in 2017. Worldwide lithium production capacity was estimated to be 91,000 tons of lithium content per year.

Spot lithium carbonate prices in China decreased from approximately \$21,000 per ton at the beginning of the year to about \$12,000 per ton in the third quarter owing to worldwide lithium production exceeding worldwide lithium consumption. For large fixed contracts, however, Industrial Minerals reported an annual average U.S. lithium carbonate price of \$17,300 per metric ton in 2018, a 15% increase from that of 2017.

Five spodumene operations in Australia and two brine operations each in Argentina and Chile accounted for the majority of world lithium production. The leading spodumene operation in Australia increased its spodumene concentrate production by about 40% in 2018 and remained the world's largest lithium producer. Two new Australian spodumene operations ramped up production in 2017, and five additional spodumene operations ramped up production in 2018.

Lithium supply security has become a top priority for technology companies in the United States and Asia. 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 operations were under development in Argentina, Bolivia, Chile, China, and the United States; pegmatite mining operations were under development in Australia, Austria, Canada, China, Czechia, Finland, Mali, Namibia, Portugal, Serbia, and Spain; and lithium-clay mining operations were under development in Mexico and the United States.

World Mine Production and Reserves: Reserves for Brazil, Chile, China, and Zimbabwe were revised based on new information from Government and industry sources.

	Mine production		Reserves ⁶
	2017	2018 ^e	
United States	W	W	35,000
Argentina	5,700	6,200	2,000,000
Australia	40,000	51,000	⁷ 2,700,000
Brazil	200	600	54,000
Chile	14,200	16,000	8,000,000
China	6,800	8,000	1,000,000
Portugal	800	800	60,000
Namibia	—	500	NA
Zimbabwe	800	1,600	70,000
World total (rounded)	⁸ 69,000	⁸ 85,000	14,000,000

World Resources: Owing to continuing exploration, lithium resources have increased substantially worldwide and total about 62 million tons. Identified lithium resources in the United States—from continental brines, geothermal brines, hectorite, oilfield brines, and pegmatites—are 6.8 million tons. Identified lithium resources in other countries have been revised to 55 million tons. Identified lithium resources in Argentina are 14.8 million tons; Bolivia, 9 million tons; Chile, 8.5 million tons; Australia, 7.7 million tons; China, 4.5 million tons; Canada, 2 million tons; Mexico, 1.7 million tons; Czechia, 1.3 million tons; Congo (Kinshasa), Russia, and Serbia, 1 million tons each; Zimbabwe, 540,000 tons; Mali and Spain, 400,000 tons each; Brazil and Germany, 180,000 tons each; Peru and Portugal, 130,000 tons each; Austria, 75,000 tons; Finland and Kazakhstan, 40,000 tons each; and Namibia, 9,000 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. NA Not available. — Zero.

¹Defined as production + imports – exports. Rounded to one significant digit to avoid disclosing company proprietary data.

²Source: Industrial Minerals, IM prices: Lithium carbonate, large contracts, delivered continental United States.

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

⁴See Appendix B for definitions.

⁵Disposals are defined as any barter, rotation, sale, or upgrade of National Defense Stockpile stock.

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

⁷For Australia, Joint Ore Reserves Committee-compliant reserves were about 1.4 million tons.

⁸Excludes U.S. production.