

LITHIUM

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

Domestic Production and Use: The only lithium mine operating in the United States was a brine operation in Nevada. Two companies produced a large array of downstream lithium compounds in the United States from domestic or imported lithium carbonate, lithium chloride, and lithium hydroxide. Domestic production was not published to protect proprietary data.

Although lithium markets vary by location, global end-use markets are estimated as follows: batteries, 35%; ceramics and glass, 32%; lubricating greases, 9%; air treatment and continuous casting mold flux powders, 5% each; polymer production, 4%; primary aluminum production, 1%; and other uses, 9%. 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 worldwide.

Salient Statistics—United States:	2011	2012	2013	2014	2015^e
Production	W	W	¹ 870	W	W
Imports for consumption	2,850	2,760	2,210	2,120	2,980
Exports	1,310	1,300	1,230	1,420	1,770
Consumption:					
Apparent	W	W	1,800	W	W
Estimated	² 2,000	² 2,000	1,800	² 2,000	² 2,000
Price, annual average, battery-grade lithium carbonate, dollars per metric ton ³	5,180	6,060	6,800	6,690	6,400
Employment, mine and mill, number	70	70	70	70	70
Net import reliance ⁴ as a percentage of apparent consumption	>80%	>60%	>50%	>50%	>60%

Recycling: Historically, lithium recycling has been insignificant but has increased steadily owing to the growth in consumption of lithium batteries. One U.S. company has recycled lithium metal and lithium-ion batteries since 1992 at its facility in British Columbia, Canada. In 2009, the U.S. Department of Energy awarded the company \$9.5 million to construct the first U.S. recycling facility for lithium-ion vehicle batteries. Construction neared completion in 2015.

Import Sources (2011–14): Chile, 58%; Argentina, 38%; China, 3%; and other, 1%.

Tariff:	Item	Number	Normal Trade Relations
			12–31–15
	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.P. grade	2836.91.0010	3.7% ad val.
	Other	2836.91.0050	3.7% ad val.

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

Government Stockpile: The Defense Logistics Agency Strategic Materials planned to acquire 150 kilograms of lithium cobalt oxide and 540 kilograms of lithium nickel cobalt aluminum oxide in FY 2015.

Stockpile Status—9–30–15⁵

Material	Inventory	Disposal Plan	Disposals
		FY 2015	FY 2015
Lithium cobalt oxide (kilograms, gross weight)	91	—	—
Lithium nickel cobalt aluminum oxide (kilograms, gross weight)	450	—	—

Events, Trends, and Issues: Worldwide lithium production increased slightly in 2015 in response to increased lithium demand for battery applications. Production in Argentina increased by about 17% and production in Australia and Chile increased slightly. Major lithium producers expected worldwide consumption of lithium in 2015 to be approximately 32,500 tons, an increase of 5% from 31,000 tons in 2014. Owing to increased worldwide demand, spot lithium carbonate prices increased approximately 10% to 15% from those of 2014. For large fixed contracts, however, Industrial Minerals reported a 4% decrease in average U.S. lithium carbonate prices.

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In the late 1990s, subsurface brines became the dominant raw material for lithium carbonate production worldwide because of lower production costs compared with the mining and processing of hard-rock ores. Owing to growing lithium demand from China in the past several years, however, mineral-sourced lithium regained market share and was estimated to account for one-half of the world's lithium supply in 2015. Two brine operations in Chile and a spodumene operation in Australia accounted for the majority of world production. Argentina produced lithium carbonate and lithium chloride from brines. China produced lithium carbonate, lithium chloride, and lithium hydroxide, mostly from imported spodumene, but also from domestic brines and minerals. A new brine operation in Argentina began commercial production in 2015.

Lithium supply security has become a top priority for technology companies in the United States and Asia. Strategic alliances and joint ventures between technology companies and exploration companies have been, and are continuing 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, and the United States; spodumene mining operations were under development in Australia, Canada, China, and Finland; a jadarite mining operation was under development in Serbia; and a lithium clay-mining operation was under development in Mexico. Additional exploration for lithium continued, with numerous claims having been leased or staked worldwide.

Rechargeable batteries were the largest potential growth area for lithium compounds. Demand for rechargeable lithium batteries exceeds that of other rechargeable batteries. Automobile companies were developing lithium batteries for electric and hybrid electric vehicles. A leading electric car manufacturer was constructing a lithium-ion battery plant in Nevada capable of producing up to 500,000 lithium-ion vehicle batteries per year. The plant was expected to be vertically integrated, capable of producing finished battery packs directly from raw materials by 2020.

World Mine Production and Reserves: The reserves estimates for Argentina, Australia, and China have been revised based on new information from Government and industry sources.

	Mine production		Reserves ⁶
	2014	2015 ^e	
United States	W	W	38,000
Argentina	3,200	3,800	2,000,000
Australia	13,300	13,400	1,500,000
Brazil	160	160	48,000
Chile	11,500	11,700	7,500,000
China	2,300	2,200	3,200,000
Portugal	300	300	60,000
Zimbabwe	900	900	23,000
World total (rounded)	⁷ 31,700	⁷ 32,500	14,000,000

World Resources: Identified lithium resources in the United States have been revised to 6.7 million tons and total approximately 34 million tons in other countries. Identified lithium resources in Bolivia and Chile are 9 million tons and more than 7.5 million tons, respectively. Identified lithium resources in major producing countries are: Argentina, 6.5 million tons; Australia, 1.7 million tons; and China, 5.1 million tons. In addition, Canada, Congo (Kinshasa), Russia, and Serbia have resources of approximately 1 million tons each. Identified lithium resources in Brazil and Mexico are 180,000 tons each, and Austria has 130,000 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. Substitutes for aluminum-lithium alloys in structural materials are composite materials consisting of boron, glass, or polymer fibers in resins.

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

¹Source: Rockwood Holdings, Inc., 2014, 2013 annual report: Princeton, NJ, Rockwood Holdings, Inc., p. 16.

²Rounded to one significant figure to avoid disclosing company proprietary data.

³Source: Industrial Minerals, IM prices: Lithium carbonate, large contracts, delivered continental United States, annual average.

⁴Defined as imports – exports + adjustments for Government and industry stock changes.

⁵See [Appendix B](#) for definitions.

⁶See [Appendix C](#) for resource/reserve definitions and information concerning data sources.

⁷Excludes U.S. production.