

The green scene

The environmental risks of mining, disposal



Salt mounds pile up in Bolivia as part of a lithium-extraction operation.

By Dave Wilson

Add to the list of popular Australian exports lithium, atomic number 3, the lightest metal of all on the periodic chart of the elements and the world's lightest solid element.

It's an adaptive chemical artifact, the salts of which are used as a mood-stabilizing drug to treat bipolar disorders, but lithium can also be used as an additive for iron, steel and aluminum production.

Outside of Western Australia, where it is produced by typical mining methods like crushing rock and then processing it in China, lithium is found in the "lithium triangle" of Argentina, Bolivia and Chile, where it's extracted from brine evaporation pools.

However, contrary to popular belief, lithium can be found just about anywhere on the planet.

"One of the greatest misconceptions about lithium is that it is rare. It isn't," notes Chris Berry, a New York City-based independent analyst and consultant in the energy metals sector. "In fact, if the price of lithium ever got high enough, you could extract it from seawater."

Although lithium is often seen as a more environmentally responsible energy source than its disposable alkaline brethren or batteries found in internal combustion engines, some see the mining, transportation and destruction of lithium as being damaging to the environment.

Berry does equate the old-school Western Australian method of producing

lithium from hard-rock sources to traditional mining of items like coal, platinum, copper, and tin. "I'd say that lithium mining overall has no more or less of an effect on the environment than other extractive industries, though I'm sure there is room for debate here," he says.

Berry, who has worked with investment firms, banks, corporations and academic institutions "to better understand opportunities and threats that the rapidly changing global energy mix presents us with," notes that the traditional environmental hazards with any kind of mining also apply to the finding and production of lithium.

"Once lithium is mined, it is then further processed into lithium chemicals used in lithium-ion batteries or other industries,

An open-cut gold, lithium and iron ore mine in Leonora, in Western Australia.



such as ceramics,” Berry says. “The processing is well-known, and major producers and refiners continue to optimize costs to minimize any environmental issues. Lithium production is a relatively complicated process, but over time, lithium production techniques have evolved.”

Many experts note that any environmental impact created by lithium mining is optimal when compared with the damage caused by widespread dependence upon other energy sources.

David Deak, the chief technical officer of Lithium Americas, told the Financial Times in 2017, “In the short term, the CO₂ footprint from (lithium) hard rocks will be less than ideal.

But it is still extremely beneficial in offsetting the CO₂ emissions that otherwise would come from internal combustion engines.”

Within the lithium triangle, however, production relies on more organic (and less environmentally damaging) methods. “The process of producing lithium from brine pools is relatively benign in that you utilize the sun to evaporate water from lithium brine ponds and then further process the lithium crystals into lithium carbonate or other lithium chemicals,” Berry says.

But, according to Friends of the Earth-Europe, a compendium of more than 30 grassroots organizations, lithium mining does cause environmental damage.

According to that group, lithium is mined through “holes (that) are drilled into the salt flats and the brine is pumped to the surface, leaving it to evaporate in ponds. This allows lithium carbonate to be extracted through a chemical process. The extraction of lithium has significant environmental and social impacts, especially due to water pollution and resource depletion. In addition, toxic chemicals are needed to process lithium. The release of such chemicals through leaching, spills or air emissions can harm communities, ecosystems and food production. Moreover, lithium extraction inevitably harms the soil and also causes air contamination.”

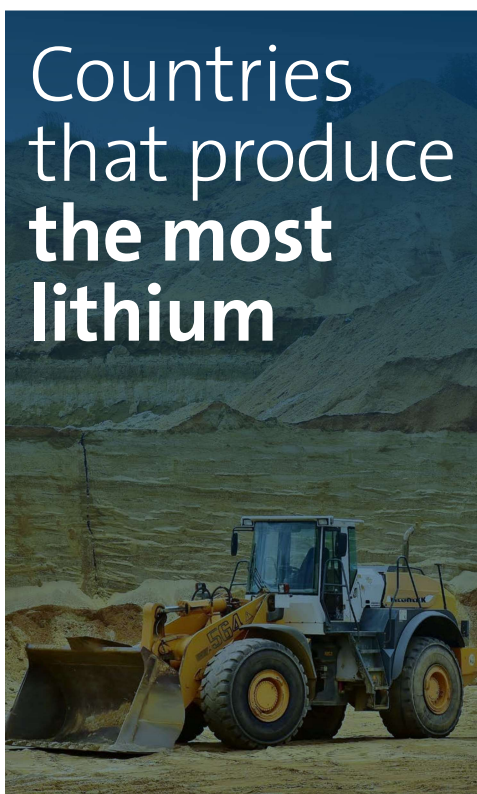
Siena Hacker, an energy policy associate with Pick My Solar, a group that seeks to “empower communities to adopt sustainable technologies through transparency and choice,” elaborates on several other lithium mining environmental side effects:

Countries that produce the most lithium

- 1. Australia**
Mine production: 18,700 metric tons*
- 2. Chile**
Mine production: 14,100 MT
- 3. Argentina**
Mine production: 5,500 MT
- 4. China**
Mine production: 3,000 MT
- 5. Zimbabwe**
Mine production: 1,000 MT
- 6. Portugal**
Mine production: 400 MT
- 7. Brazil**
Mine production: 200 MT
- 8. United States**
Mine production: unknown

*One metric ton equals 2,204.623 pounds

Source: Investing News



The world's largest lithium mining companies

1. SQM

Market capitalization*: \$14.89 billion

SQM has customers in 110 countries and offices in 20. The firm's efforts are mainly centered in Chile, with its largest brine operation in Salar de Atacama. Recently, the company announced plans to enter the Cauchari-Olaroz lithium project in Argentina, a joint venture with Lithium Americas that will begin production in 2020.

2. Albemarle

Market capitalization: \$12.84 billion

With 5,000 employees and customers in more than 100 companies, Albemarle is one of the world's largest lithium producers, owning lithium brine operations in Chile, Australia and in Nevada's Silver Peak mine in the United States. Last year, Albemarle introduced new technology that will increase its production of lithium without further brine pumping.

3. FMC

Market capitalization: \$12.06 billion

FMC's lithium operations are based in the Salar del Hombre Muerto in Argentina. Keeping its interests local, the company announced plans last year to increase its lithium production in Argentina.

4. Tianqi Lithium

Market capitalization: \$9.27 billion

A subsidiary of China's Chengdu Tianqi Group, Tianqi Lithium is the world's largest hard-rock-based lithium producer. In 2016, it purchased a 2.1 percent stake in global leader SQM.

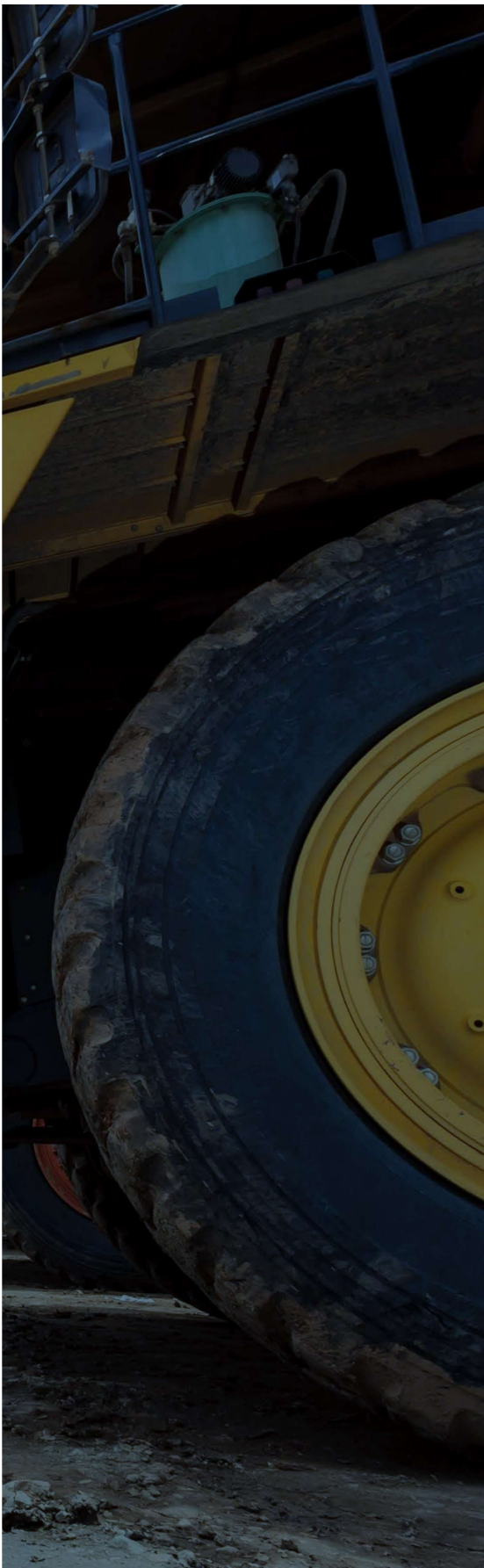
5. Jiangxi Ganfeng Lithium

Market capitalization: \$7.04 billion

Jiangxi Ganfeng Lithium is the second-largest lithium producer in China. The company also owns smaller stakes in other international mining companies, including International Lithium. Jiangxi Ganfeng Lithium is looking to expand beyond mining, having recently invested nearly \$300 million in lithium-ion battery technology.

Source: Investing News

*Market capitalization: Value of a company that is traded on the stock market, calculated by multiplying the total number of shares by the share price.



“As with many other minerals, mining lithium often releases dust containing toxins into the air. For local communities, overexposure to these toxins while lithium is mined and transported can become an environmental hazard resulting in birth defects and breathing problems.”

Post-mining, getting lithium through traditional supply chains (which Berry characterizes as “fragmented”) from its mines and brine pools to refinery production facilities, including destinations in China, involves a journey through oil-consuming methods like trucking and shipping.

“Lithium molecules do indeed travel thousands of miles during their journey from mine to end product,” Berry says. “After this step, the major battery producers are in Japan and Korea and the OEMs (original equipment manufacturers) are spread further afield still.”

Specifically, Hacker notes, “The additional transportation required for Australian-mined and Chinese-refined lithium certainly increases emissions.”

Berry says that plans are afoot for lithium producers to streamline both the cost and impact of production and transportation of the element. “In the future, lithium producers will look to vertically integrate

their operations to minimize environmental issues and reduce costs,” Berry notes.

After a lithium battery’s typical 10-year lifespan of automobile, scooter and cellphone powering, disposal is still a murky unknown in terms of environmental impact. Currently, less than 5 percent of the lithium-ion batteries found in cars are recycled, as opposed to 90 percent of the lead-acid batteries used in typical gas-driven vehicles, according to the Financial Times.

The ultimate resting place of lithium-ion batteries is poised to be a large emerging industry.

“Lithium battery disposal and recycling is going to become a much bigger business in the near future should (electron-volt) adoption continue on its current torrid pace,” Berry notes. “This will, of course, be led by China, and you’re already starting to see startups and existing companies incorporate lithium recycling into their long-term business plans. Storing lithium-ion batteries in landfills, with their risk of explosion, is not a viable long-term strategy, and so governments and the private sector are joining forces to get ahead of the curve here.”

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Workers mix cement in Rio Grande, Bolivia, as they work to extract salt brine to collect lithium. Brines in South America supply a good chunk of the world’s lithium, and harvesting it in evaporation ponds leaves behind salt waste.