

Lithium deficit threatens EV sales and energy transition

Lithium, a primary battery metal essential for electric vehicles, electric-grid battery storage systems and portable electronics, is in short supply globally. As a result, lithium prices have skyrocketed by more than 500% (for lithium carbonate) in the past year.

While markets are expanding in the Americas and Australia to meet growing lithium demand, soaring prices and a continued lack of supply through 2030, may decelerate the energy transition and threaten EV sales and adoption, according to new research from S&P Global Commodity Insights.

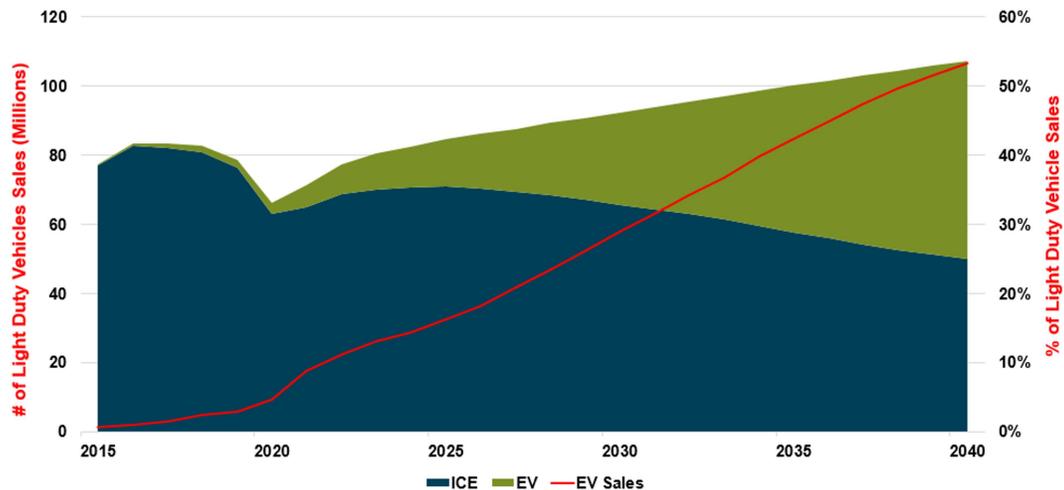
“Despite COVID, EV sales accelerated globally much faster than expected in the past year and went into hyperdrive. As a result, lithium demand, which is essential for EV batteries, is growing much faster than lithium supply, creating a market disconnect.”

Scott Yarham, metals pricing director with S&P Global Commodity Insights

EV sales racing past expectations

- EV sales grew an enormous 102% in 2021 to 6 million units globally, an increase of 38% year-over-year
- S&P estimates 6.5 million EV units sold in 2022, 10.5 million by 2025
- EV's accounted for almost 20% of recent new car sales in China
- EV sales represent more than 25% of European Union new car sales
- Global EV sales to increase ninefold between 2020-2030—or from 2 million units to more than 27 million units (nearly 30% of global market share)
- By 2040, S&P estimates EV sales to overtake vehicles powered by gasoline burning ICEs.

Plug-in Passenger Light Duty Electric Vehicle Sales – World



Source: Research & Insights by S&P Global Commodity Insights, Future Energy Outlooks

Producers announcing new projects, but challenged by financing and time

As demand soars, lithium producers are announcing expansion projects and new plans, however, financing and permitting are significant hurdles to lithium supply expansion, as smaller producers typically have financing hurdles and new projects often take 10 years or more to get to production, Yarham said. If lithium supply does not increase and battery metals costs do not decline significantly in the coming years, EV sales may be threatened.

“Falling battery costs were expected to be key to the adoption of EVs, and costs were expected to drop as battery prices declined over time, but we are now seeing battery pack prices increase for the first time in more than a decade due to the incredible cost pressures on these battery components.”

Scott Yarham, S&P Global Commodity Insights

Tesla and others seek diversity of supply to reduce dependence on China

China currently controls more than 80% of the global battery metals market due to its leadership in refining

and upgrading of the basic metal resources. Leaders in many countries, keenly aware that their industrial sectors are increasingly dependent upon a group of essential minerals and metals to produce a host of products, have made lithium (and other battery metals) supply security a top priority. Australia and the U.S. have made it a priority to increase mining of these resources, but also to invest in metals refining, to reduce their uncomfortable dependency on China for lithium processing.

As with governments, lithium and battery metals supply and their costs are a key concern for technology, automotive, and other industrial companies in the U.S., Europe, and Asia.

Tesla said it will be “intensely focused” on cost reduction in 2022 by resourcing or redesigning components, and increasing manufacturing efficiencies, saying there is a “need for material diversification.” This was a point made in our recent **S&P Global Commodity Insights Energy Transition Report on Battery Metals and Implications for EV Sales**. Tesla and other EV manufacturers want supply diversity—not to be beholden to a single supplier, source, or even material. Many companies like Tesla are increasingly focused on supply regionalization, so resources are secured closer to their manufacturing facilities, with the goal of decreasing supply cost and risk.

This critical need for diversity of supply was evidenced by Tesla’s Q3 2021 earnings call, where battery metals (lithium, nickel, cobalt) drove a significant part of the conversation. The company leaders spoke about volatility and substantial raw material “cost headwinds,” particularly around volatile commodities and battery metals, which they said could continue to challenge their business in 2022. As a result, for approximately one-third of its global EV fleet, Tesla has changed its battery chemistries to lithium iron phosphate (LFP) a less expensive combination of metals that avoids the more expensive nickel and cobalt.

Continued deficit will buoy lithium prices

Due to the demand and supply disparity, the global lithium market has seen prices moving to new record highs almost daily and will remain strong during 2022, according to battery metals Research and Insights by S&P Global Commodity Insights and Market Intelligence.

- Seaborne lithium carbonate prices gained more than 650% since start of 2021
- Lithium hydroxide prices climbed more than 400% during the same period
- Platts pricing by S&P Global Commodity Insights assessed lithium carbonate at \$69,00/metric ton (mt) on March 1, a 30% increase month-over-month of Feb. 1 pricing, which was \$53,000/mt

Supply deficit until 2030

According to S&P Global Market Intelligence, lithium chemical supply is forecast to be 625,000 metric tons (mt) lithium carbonate equivalent (LCE) in 2022, up from 411,000 mt in 2020, and an estimated 505,000 mt in 2021.

Market Intelligence forecasts this will be met by chemical demand of 628,000 mt LCE in 2022, up from 341,000 mt in 2020, and an estimated 506,000 mt by 2021. S&P Global Market Intelligence forecasts an ensuing deficit of 4,000 mt LCE in 2022, compared to an estimated deficit in 2021 of 1,000 mt, and a surplus of 70,000 mt LCE in 2020.

As a result, S&P Global Market Intelligence anticipates the continued deficit will allow lithium prices to remain strong in 2022. Supply issues could be softer in the second half of 2022, as some new projects and expansions are expected to come online, but S&P Global metals analysts believe 2022's final lithium balance will be a deficit, and that a price correction will not occur this year.

Alice Yu, senior analyst for battery metals at S&P Global Market Intelligence, said in a [Platts Future Energy Podcast](#) with colleague Henrique Ribeiro, S&P Global Commodity Insights Latin America metals analyst. According to MI's Yu, due to strong prices for lithium, financing for new lithium projects increased by nearly 260 percent in 2021, but the project execution time is a risk to supply.

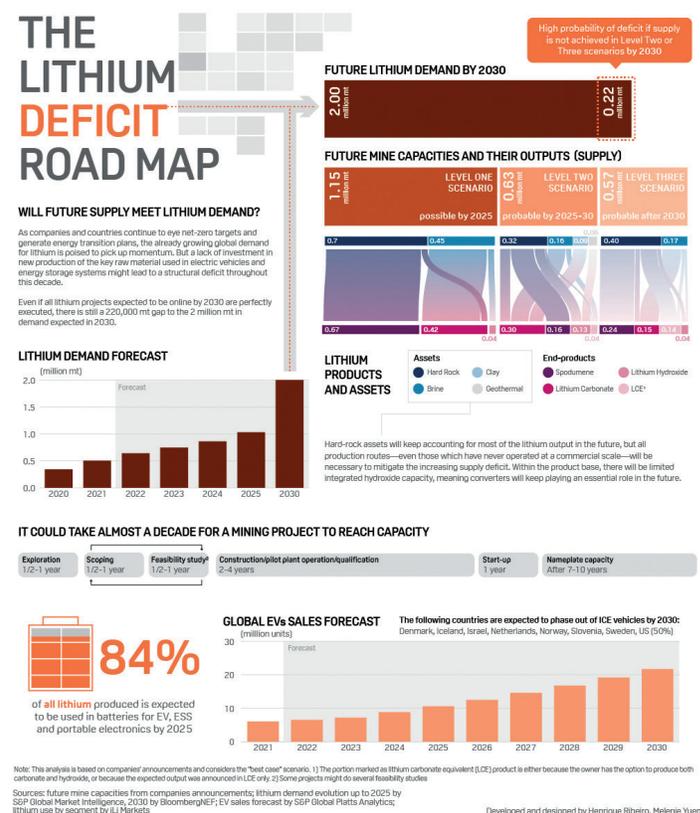
“Financing is key for a new pipeline of lithium. High prices are increasing investments, but if projects are not executed on time, the supply deficit will intensify. We do not see enough projects coming

online in 2022 to meet demand and expect a deficit through the end of the year.”

Alice Yu, senior analyst for battery metals at S&P Global Market Intelligence

Even well-capitalized major lithium companies have struggled to meet their expansion targets and new producers have seen their project timelines extended in many cases due to COVID and related supply chain issues. This is confirmed with Platts pricing by S&P Global Commodity Insights' comparison between the expected supply and the expected demand until 2030, which shows that supply should not reach the projected 2 million mt demand by the end of the decade.

To run the analysis, S&P Global Commodity Insights divided the projects into three levels depending on when they should reach the nameplate capacity, considering the best-case scenario. Even if all projects are perfectly executed, a lithium supply deficit of .22 million mt is likely by 2030. Lithium projects take considerable time and effort to gain government, community, and environmental approvals and permits, as well as funding, Yarham said, which makes net-new greenfield projects unlikely to ease supply tightness in the near-term.



[Click here](#) to see the full-sized infographic.

Global lithium producers are also facing greater pressure from communities near proposed mining projects to deliver greater environmental oversight and ESG accountability. At the same time, with lithium and battery metals values soaring, governments in metal-rich countries are reexamining their mining and contractual contracts for lithium and other battery metals.

Global Estimated Lithium Resources (not production) *, Top 10 Countries

Bolivia, 21 million tons

Argentina more than 19 million tons

Chile nearly 10 million tons

U.S. nearly 8 million tons

Australia nearly 7 million tons

China 5 million tons

Congo (Kinshasa) 3 million tons

Canada 3 million tons

Germany nearly 3 million tons

Mexico nearly 2 million tons

Source: U.S. Geological Survey, 2021.

*According to the U.S.G.S., other countries with approximately 1 million tons or less of lithium resources each include Czechia, Serbia, Peru, Mali, Zimbabwe, Brazil, Spain, Portugal, Ghana, Austria, Finland, Kazakhstan, and Namibia. **Resources do not equal production. Australia leads global production.**

Expanded supply on horizon in Australia, Argentina, and Chile

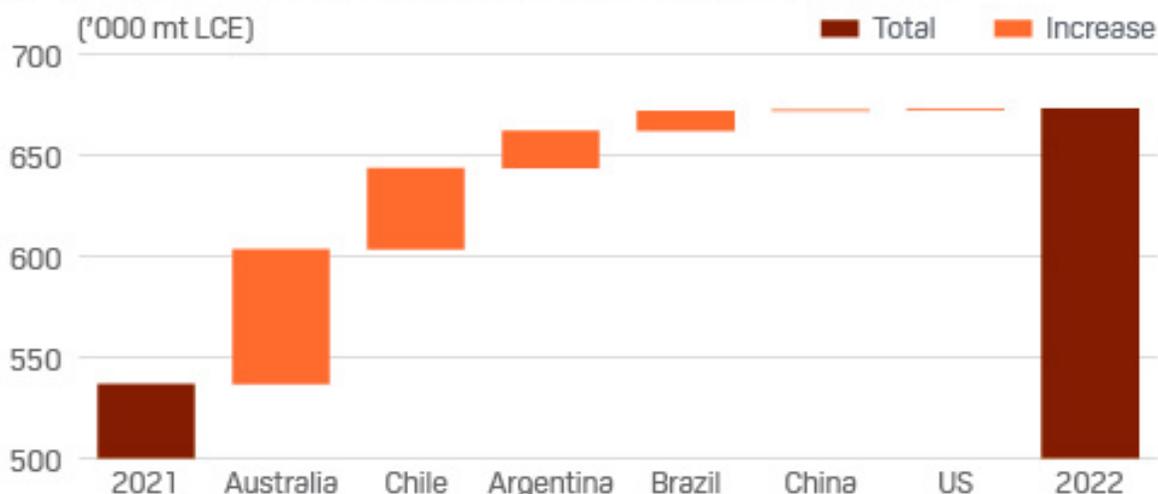
Lithium is typically found in brine deposits, but can also be found in geothermal brines, clay deposits and in hard rock. Lithium brines are accumulations of saline groundwater that are enriched in dissolved lithium, and typically found in closed basins in arid regions. Five mineral operations in Australia, two brine operations each in Argentina and Chile, and two brine and one mineral operation in China accounted for the majority of world lithium production in 2021, according to the U.S.G.S. (China refines much of the world's lithium production, especially that mined in Australia).

All existing suppliers of lithium are planning expansions to meet growing demand. Several lithium producers are planning to expand capacity for existing projects, while others are adding new projects to their portfolios. Most new capacity additions are expected from Argentina, Chile, and Australia, with Argentina expected to deliver most new capacity in the near-term. According to the lithium and cobalt outlook from S&P Global Market Intelligence, these three lithium powerhouses will supply nearly 92% of new global capacity in 2022.

In the case of project expansions, much of the additional volumes that have been announced are expected to be available in the second half of 2022, but COVID impacts on supply chains could threaten delivery of some of those capacities, according to Platts Analytics.

Additional, brine-based lithium projects are in various stages of development in Argentina, Bolivia, Chile, China, and the U.S., while mineral-based lithium sources are in various stages of development in Australia, Austria, Brazil, Canada, China, Congo (Kinshasa) Czechia, Finland, Germany, Mali, Namibia, Peru, Portugal, Serbia, Spain, and Zimbabwe. Lithium-clay sources are in various stages of development in Mexico and the U.S.

AUSTRALIA, CHILE, ARGENTINA TO ACCOUNT FOR 91.1% OF LITHIUM RAW MATERIAL SUPPLY GROWTH IN 2022



Note: Data as of 24-Jan-22. LCE=lithium carbonate equivalent.

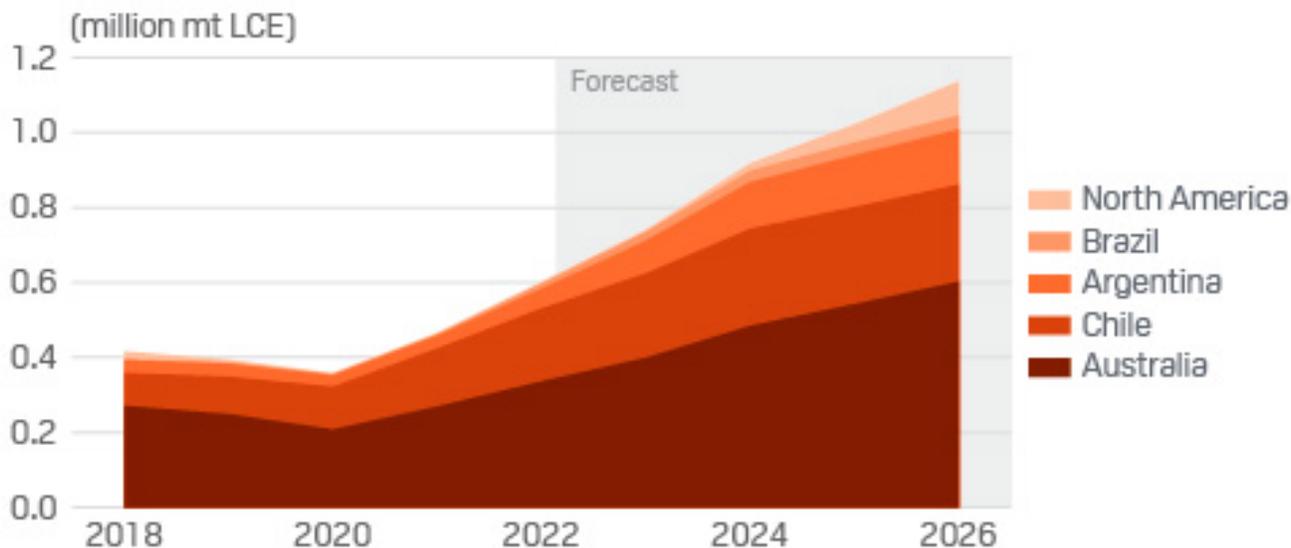
Source: S&P Global Market Intelligence; Company announcements

Global lithium producers—Australia leads, but Americas rising

Australia leads global lithium production (although nearly 100 percent of its production is currently shipped to China for processing). Chile and Argentina are second and third, respectively, in terms of production. Brazil is

fourth, and China is fifth in terms of lithium production (refining is not considered here, otherwise it would move to number 1).

LITHIUM RAW MATERIAL SUPPLY FORECAST TO RISE 132.2% OVER 2021-26, LED BY AUSTRALIA, CHILE, ARGENTINA



Note: Data as of 24-Jan-22. LCE=lithium carbonate equivalent.
Source: S&P Global Market Intelligence; Company announcements

Australia

Production rank: 1—Produced more than 536,00 metric tons in 2021, *according to S&P Global Market Intelligence

Australia, like Chile, is one of the world's oldest and largest miners, and it has a well-established lithium sector in Western Australia, where it produces mostly spodumene, a mineral that contains lithium. Spodumene concentrate is an intermediate product, and without refining it has little value. Traditionally, Australia has shipped its spodumene production to China for refining into lithium carbonate or lithium hydroxide, but the country now has two spodumene refineries in construction that should come online in the second half of 2022, with more projects likely to follow.

“Adding lithium refining capacity is a natural step for Australia. Australian companies want to have more control over their finished product and seek to capture more of its value. For now, most of their spodumene production goes to China for refining, but eventually, Australians can refine it domestically and eventually send it straight to Europe.”

Yarham, S&P Global Commodity Insights

Recently, Albemarle's MARBL joint venture with Minerals Resources in Western Australia announced plans to restart one of the Wodgina's mine three 250,000 mt/year processing lines in Q3 2022. Pilbara Minerals is forecasting production capacity of approximately 180,000-200,000 mt/year from its Ngungaju plant at the Pilangoora operation in Western Australia from mid-2022, as it ramps up. This will complement existing production capacity from the adjacent Pilgan Plant, which is also increasing capacity from around 330,000mt/year to 360,000-380,000 mt/year through improvement works.

Chile

Lithium production rank: 2—*Produced more than 603,000 metric tons in 2021

Chile has a very established lithium market and was previously the world's largest lithium supplier before being surpassed by Australia. The Atacama is a desert region in Northern Chile and home to most of the country's lithium and copper production.

Lithium in Chile is extracted from underground reservoirs and pumped into evaporation ponds where the lithium salts are condensed. From there, they are gathered and transferred to a chemical processing facility where they are concentrated into lithium carbonate. The carbonate powder is then exported in bags via Chile's plentiful ports.

“Lithium brine assets in Chile are top-quality and low-cost, which makes them very attractive to buyers. Chile has been a mining country forever—it has free-trade agreements with most countries, a tremendous knowledge base, and transportation infrastructure, including plenty of ports—key considerations for these projects.”

Scott Yarham, S&P Global Commodity Insights

SQM (Chilean company) and Albemarle are the primary lithium producers in Chile. Codelco, the Chilean state-owned mining company, is developing the Maricunga brine project, but it is still years away from production.

SQM expects to achieve 140,000 mt of total lithium production in 2022 from its Chilean brine operation and is targeting a total capacity of 180,000 mt for 2023. These represent increases of approximately 40,000 mt/year for 2022 and 60,000 mt/year, respectively, from 2021.

In Chile, lithium resources are controlled by the government, which just launched a new round for lithium licenses. Five companies participated in the tender, including Albemarle and SQM—the only two companies with licenses to mine lithium in the country besides the state company. Others included nitrates miner Cosavach, Chinese electric-vehicle producer BYD, and mining firm Servicios y Operaciones Mineras del Norte S.A.

The Ministry awarded two lithium exploration and production licenses in the tender to BYD and Servicios Y Operaciones Mineras del Norte S.A., the Chilean Mining Ministry said in a statement Jan. 12. The ministry said it had awarded contracts to produce 80,000 mt of lithium metal equivalent each. The companies made the two highest bids in the tender, offering \$61 million and \$60 million, respectively, for the rights to explore for lithium.

The Chilean government had originally planned to award five contracts for 80,000 metric tons (mt) each. However, Chile's president-elect, Gabriel Boric, elected in December 2021 in a landslide, called for the tender to be suspended so his administration could study its consequences. The left-aligned politician, who took office in March, has called for the creation of a national lithium company to develop Chile's mineral and downstream industries.

Argentina

Lithium production rank: 3—*Produced nearly 644,000 metric tons in 2021

Argentina is quickly becoming a key supplier for lithium (carbonate from brine) production, and its resource potential, combined with greater flexibility for investment, is attractive to many potential investors and its production is expected to grow considerably. Currently Argentina has two operators mining lithium—Allkem and Livent, but interest in the country's lithium resources is significant, with numerous junior players coming in and Chinese companies taking an active role in Argentinean lithium development.

By 2025, Argentina could surpass Chile as a producer of lithium, but that will largely depend on the speed with which Chilean projects can come online, S&P Global battery metals experts say. The Argentine lithium projects are all brine projects and are concentrated in the country's northern region of Salta.

The quality of Argentina's lithium resources is as good as those in Chile, and the country lacks the infrastructure Chile has, but Argentina does not require a license concession for lithium operators to search for resources in the country.

“Less steps are required to secure the opportunity to explore in Argentina, which is attractive to those seeking to enter the country’s lithium sector.”

Scott Yarham, S&P Global Commodity Insights

In addition to attracting new exploration activity, the country’s existing producers are expanding their production efforts in Argentina. Livent is adding an initial 10,000 mt lithium carbonate in Argentina, although this is only due to reach commercial production in the first quarter of 2023, with another 10,000 mt to be added in the second phase by the end of 2023. Livent has its production base in Argentina, but its carbonate is refined in the U.S., where its principal customer is the automaker Tesla.

The 25,000 mt/year Stage 2 expansion of Allkem’s Olaroz brine project in Argentina is continuing and is expected to be completed during the first half of 2022. Production at the 25,000 mt/year expansion is slated for the second half, bringing the project’s total capacity to 42,500 mt/year. New Argentinian projects should also start in 2023, including Lithium Americas’ 40,000 mt/year carbonate operation.

China

Lithium Production Rank: 4—*Produced nearly 672,000 metric tons in 2021

China is considered fourth in terms of lithium production (producing both brine and hard rock), but due to the fact it refines nearly 100 percent of Australian production, it would be ranked number one if processing was considered.

U.S. (production not ranked)

The only U.S. lithium production currently resides in Nevada, but other states have resource potential or past production. According to the U.S. G.S., lithium resources can be found in the tin-spodumene belt of the Carolinas, which was first developed during World War II. Prior to the war, South Dakota was the chief source of lithium minerals, and the state’s deposits still contain significant reserves. Lithium from brines has been produced in California since 1938. Other states containing lithium reserves include New Mexico, Colorado, Wyoming, Utah, Connecticut, Maine, and Massachusetts. Lithium exploration is also currently underway in Texas.

Livent resumed its expansion plan in the U.S. and will add 5,000 mt of lithium hydroxide capacity at its Nevada operations, which is expected to reach commercial production by Q3 2022.

Growing anti-mining activism is challenging U.S. lithium production potential. This activism may force Americans to make a choice regarding investments in materials necessary to enable the energy transition and reduce the climate impacts from emissions, which most American consumers appear to support. The Thacker Pass Lithium Project in Nevada is currently being discussed, but it is being disputed by activists.

While higher, new sustained prices for lithium are driving new project announcements, it is difficult to estimate how quickly many of those projects will come online or when the supply and demand gap will begin to close. This is due, in part, to the long cycles for approvals, financing, and development. Despite the positive signs of new projects being announced, the key challenge for EV automakers and battery suppliers that is underinvestment in new resources means the lithium market is on a much slower road to ramp up than is EV production, and for much of 2022 and 2023, the roads for both will mean less than a smooth ride for battery and EV manufacturers.

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