Lithium – A Catalyst For Energy Transition

Mining Industry

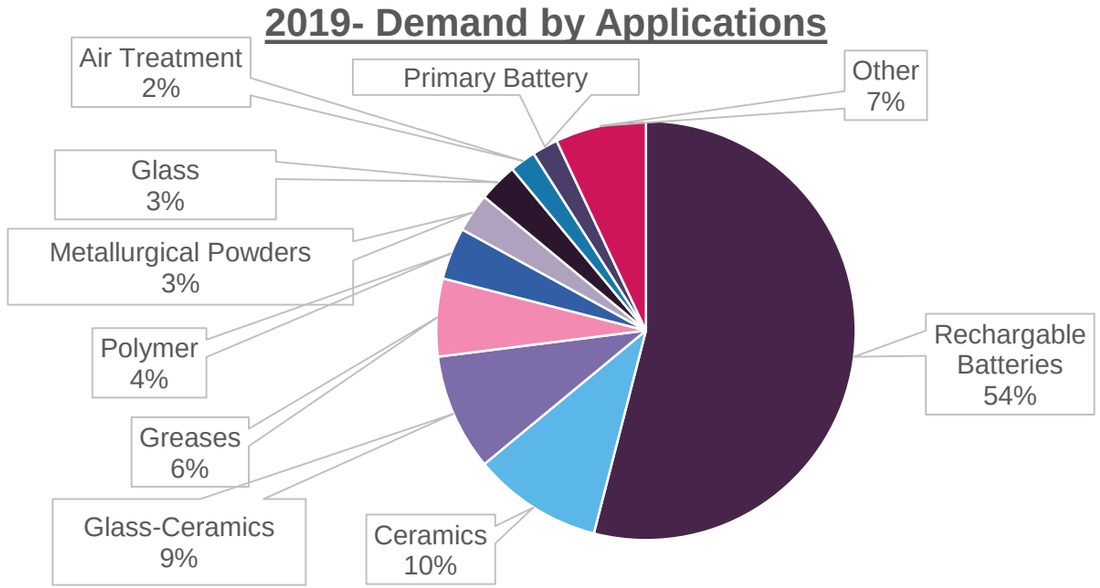
A Gold Rush for the “White Metal”

May 10, 2021

Out of the multiple Lithium applications, the “Li-Ion” batteries continue to command a majority share

Lithium provides the best combination of energy density (weight to power ratio) and price.

Making it an ideal component for Batteries!



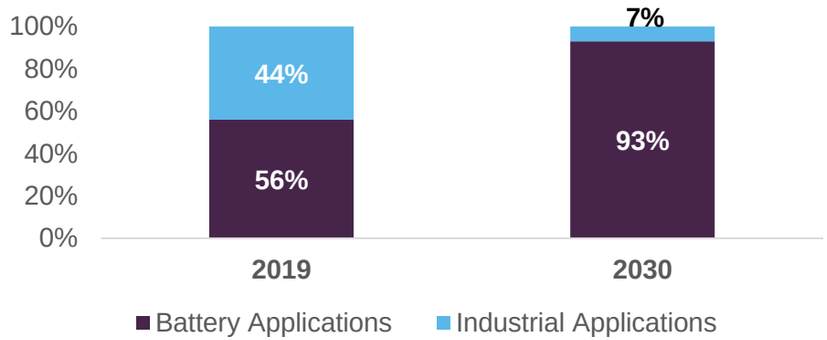
Why Lithium?

- Wide range of applications- Batteries of EV, Laptops & Cell phones. Other application include- grid scale energy storage, aircraft, glass ceramics, Aluminium alloys and pharmaceuticals
- **Favourable physical properties-** Discovered in the year 1817, Lithium is a lightest solid metal, and it provides high specific heat, high thermal conductivity, low density and low viscosity
- **Properties exhibited in batteries:** As compared to traditional battery technology, Lithium-ion batteries charge fast, last longer, provides high power density- twice as that of the standard nickel- cadmium etc.

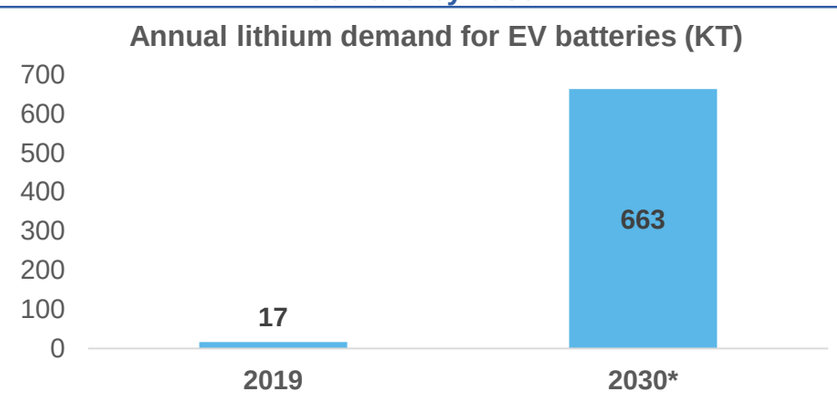
Sources : Secondary sources, Evalueserve Analysis

Lithium Outlook 2019-2030: The beginning of the decade of the “White Metal”, the protagonist for energy transition

$20 Bn CAPEX in greenfield projects required to meet this demand



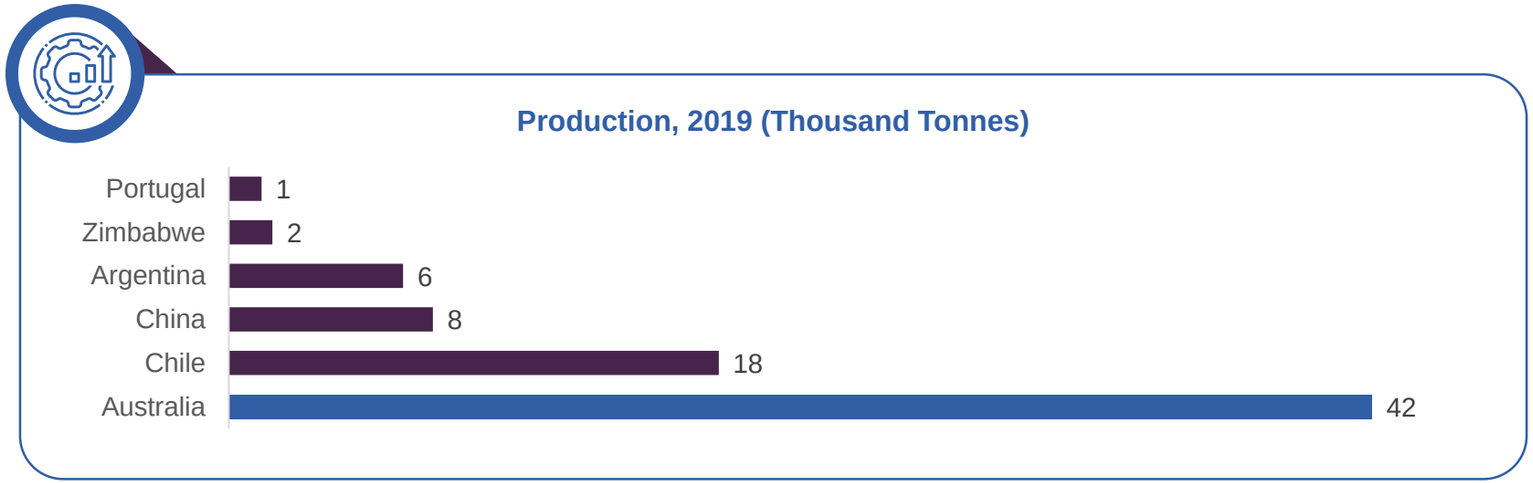
EV to account for 79% of lithium demand by 2030

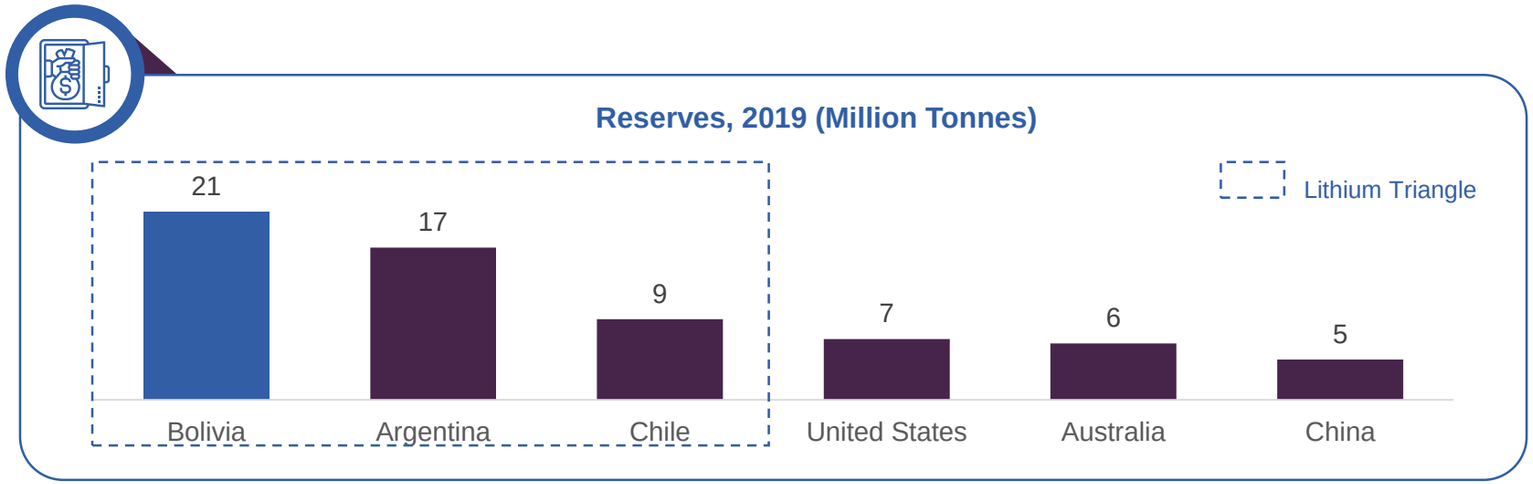


- Market Size ~**$4.0 Bn** (2019) . Growth driven by increasing demand for lithium-ion (Li-ion) batteries in various applications, especially the automotive industry.
- Lithium supply set to near **triple by 2025**. Major suppliers Australian and South American are expected to increase supply by **139% and 199%,** respectively.
- The Lithium market is **consolidated** with production concentrated in the hands of a few key players such as Albemarle, FMC Corporation, SQM etc.
- By 2025, the planned capacity of Li-ion battery to surpass 1,447 GWh, from 455 GWh in 2020.
- As per latest reports, EVs to account for **~79%** of lithium demand by 2030.
- However, looming concerns that **fall in upstream investment** could push the market into **undersupply**.

Sources : Secondary sources, Evalueserve Analysis

“The Lithium Triangle” holds majority of Lithium reserves. Lithium production is expected to increase substantially on the back of rising demand





- More than half of the world’s supply is concentrated in the ‘Lithium Triangle,’ which covers Argentina, Bolivia, and Chile.
- The US, Canada and Zimbabwe are rapidly ramping up production.
- By 2030, the global lithium production will grow to 1.46Mt in 2030, from 381,000 tonnes in 2019.
- China controls a significant portion of downstream lithium processing: China’s control of the lithium-ion supply chain includes mining (23%), chemical refining (80%), Cathodes & Anodes (66%), lithium-Ion battery cells (73%).
- Countries looking to expand the lithium production by offering favorable policies:
  i. Chile has announced that it will amend mining rules for the lithium industry to boost production to 230,000 tonnes per year by 2023.
  ii. Bolivia is looking to partner with firms to seek more investments to develop its lithium reserves (~21 MMT).

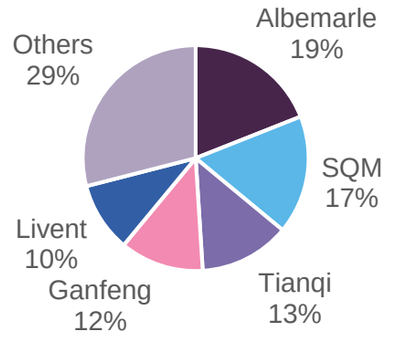
Sources : Secondary sources, Evalueserve Analysis

~70% of global Lithium production is dominated by five players; companies are engaging in M&A and long-term contracts to reap benefits of the growing demand

Key Players

Top Miners	HQ	Operating Regions	Recent Development
Albemarle	US	Europe, NA, SA, Australia and Asia	• In 2021, Albemarle announced the expansion of its Nevada site. It planned to invest $20–30 Mn to double its production by 2025
Sociedad Química y Minera (SQM)	Chile	Chile	• By 2023, SQM plans to increase its capacity to 180,000 and 30,000 tons of lithium carbonate and lithium hydroxide
Tianqi Lithium	China	Australia, Chile and China	• In 2020, Tianqi secured a $1.4 Bn investment in its Australian operations from IGO Ltd.
Jiangxi Ganfeng Lithium	China	Australia, Argentina and Mexico	• In 2019, the company signed a 5-year lithium supply deal worth $599 Mn with BMW
Livent	US	Europe, NA, SA, and Asia	• In 2021, Livent signed a $335 Mn supply deal with BMW to secure its market

Production share- 2019



Emerging Themes

M&A at play to fortify position

In Apr-21, announced merger in a $3bn deal the fifth-largest global lithium chemicals company

In Nov-20, Livent formed a JV with Pallinghurst to acquire Nemaska,to boost lithium production and to strengthen its competitive position

Companies expanding operations

In Dec-20, invested in a lithium project in Serbia and started production of lithium in its US Boron mine as well.

In Apr-21, Savannah received a regulatory approval from Portugal's regulator- APA, to conduct preliminary assessment for the lithium mine

Long-term contracts in place

In Dec-20, SQM signed a Eight-year deal (2021-2029) with LG Energy Solutions to supply 55,000 tonnes of lithium carbonate equivalent

In Apr-21, Livent signed $335 Mn lithium supply deal with BMW. BMW expects ~50% sales to come from EV by 2030

Sources : Secondary sources, Evalueserve Analysis

The industry is bracing itself for soaring Lithium prices, which have already increased more than 51% since that start of 2021

Price Outlook

Demand side Prices

China Prices

Lithium prices have been rising in China and the trend to continue the back of heavy demand for lithium iron phosphate (LFP) batteries. Benchmark's battery-grade lithium carbonate midpoint price for mid-March shows the prices are up 88% just since the start of the year to over $12,600 a tonne, the highest level since March 2019

COVID Impact

Largest Application

Slower EV production in late 2019 and COVID-19 in 2020 reduced the demand for Lithium and as a result, lithium carbonate prices fell from a global average of US$16,031/t in November 2017 to US$6,387/t in October 2020

Price Recovery

Price Increase

The lithium carbonate CIF Asia price rose 11% in Mar 21 to $10,000 per tonne. This is the biggest monthly increase since the price recovery began in Jan 21.

Positive Outlook

Price Outlook

It is expected that global prices will increase by 30-100% in next four years on the back of increased demand for EVs which is expected to push the lithium market into undersupply in 2022. The material shortages will emerge from 2025

Sources : Secondary sources, Evalueserve Analysis

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In the “Lithium Decade” (2020-2030) the demand is expected to grow exponentially, but there could be potential roadblocks

Limited EV Infrastructure

- The slow pace of charging infrastructure deployment might hinder lithium growth
- In the EU and the UK, there were 250,000 charging stations in Sep 2020. In order to achieve a target of 1 million public charging points by 2025 to meet GHG emissions target of 2050, about 3,000 charging stations should be added each week

Geopolitical Concerns

- In the next decade, demand is expected to outstrip supply. This will shift geopolitical power in favor of lithium-producing nations
- Lithium-producing nations can form an organization (such as OPEC), which can manipulate global lithium prices

Alternatives for EV batteries

- Solid-state batteries could prove to be a competitor for li-ion batteries and can consequently limit the demand growth for lithium
- Solid-state batteries offer the following advantages: lightweight, greater energy density, more range, lower cost, and faster recharge times. Volkswagen, Toyota, General Motors, Hyundai, and Ford have invested in solid-state battery technology companies

ESG Concerns

- The two most widely used extraction methods – hard rock mining and brine – emit lots of CO2 and use lots of water and land in the process
- In Chile, lithium uses approximately 500,000 gallons of water per tonne extracted, which diverts away 65% of available water in some regions, causing adverse impacts on local farmers
- However, Geothermal water is one such area being tested where the environmental impact of lithium extraction can be minimized. The US, Germany and UK hold potential reserves for lithium extraction from Geothermal water
- Less than 5% of lithium-ion batteries are currently being recycled. Increasing recycling rates will be crucial to offset the negative environmental impact of these batteries

Parameter	Hard Rock Mining	Underground Reservoirs
Emission of CO2	15,000 Kg	5,000 Kg
Use of Water	170 m^3	469 m^3
Use of Land	464 m^2	3,124 m^2

Sources : Secondary sources, Evalueserve Analysis

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Anticipated demand creates a positive investment outlook for lithium, it is time for miners to enter the race for ‘future’ metal

Demand outlook making an investment sense

- **Lithium demand will outpace supply**. It is imperative for mining companies to make a calculated investment
- In order to meet the 2050 global climate targets, we need **five times** of the lithium mined currently

Partnerships/Collaborations to create synergies

- To **capture lithium market,** upstream players need to actively scout for Partnership/ collaborations opportunities in key demand centers.
- EV manufacturers are also looking out to secure their lithium supplies and are engaging in a long-term supply agreements with lithium producers

Extraction while keeping Environmental Footprint to minimum

- **Extraction of** ‘green lithium’ will gain traction as companies in entire supply chain want to reduce emissions.
- As per reports, CO2 emissions from Lithium production will also triple by 2025. The mineral concentrate is largely responsible for the carbon emission footprint compared to brine lithium.

Forward Integration with downstream to strengthen the position

- As majority of the demand for lithium comes from li-Ion battery, miners can follow forward integration strategy.
- China currently dominates the downstream processing of lithium.

Sources : Secondary sources, Evalueserve Analysis

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