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Minerals of the future: Lithium in Argentina

By

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The views expressed are those of the author and do not necessarily reflect the views of UNCTAD.
Minerals of the future: Lithium in Argentina: trends, challenges...
Lithium...what is?

- Lithium is a soft, silver-white metal, with a symbol Li and atomic number 3
- Highly reactive, not found in Earth in elemental form
- Lightest of all metals
- Least dense solid element
- Highest specific heat capacity
- High electrochemical potential
The total Lithium market is a little part vs. Copper and Gold

Lithium is not a standard commodity. The prices of lithium carbonate and hydroxide are negotiated individually through contracts between buyers and sellers – there is little transparency in pricing, but some price recognition is available through analysis of trade statistics.

While for Gold and Copper 10 producers have only 30% and 50% market share.

4 Lithium producers have more than 80% market share.

Source: Subsecretaría de Desarrollo Minero
The Global Lithium Mining Market segments

➢ **Source:**

- Brines (continental, geothermal, and oil field)
- Hard rocks

➢ **Type:**

- Lithium carbonate (Li$_2$CO$_3$)
- Lithium hydroxide (LiOH)
- Lithium Chloride (LiCl)

➢ **Application:**

- Batteries
- Glass
- Ceramics
- Air conditioning equipment
- Greases
- Pharmaceuticals
Potential sources of Lithium worldwide:

- Salars: 58%
- Pegmatites and Granites: 26%
- Clays: 7%
- Petroleum brines: 3%
- Geothermal brines: 3%
- Zeolites: 3%

Location of Lithium deposits:

- Canada
- EEUU
- Mexico
- Bolivia
- Chile
- Argentina
- Brazil
- Portugal
- Finland
- Austria
- Germany
- Zimbabwe
- China
- Australia
- Germany

Source: Subsecretaría de Desarrollo Minero
**Lithium Resources and Reserves**

**Resources 2016**
*(160,2 MM t LCE)*

- **China**: 17% (27,1 MM t)
- **Chile**: 21% (34,1 MM t)
- **Argentina**: 17% (26,8 MM t)
- **Bolivia**: 30% (47,9 MM t)
- **Rest of the world**: 8% (12,6 MM t)

**The Lithium Triangle**: 68%

**Reserves 2016**
*(67,4 MM t LCE)*

- **China**: 25% (17,1 MM t)
- **Chile**: 50% (34,1 MM t)
- **Argentina**: 17% (26,8 MM t)
- **Bolivia**: 0% (5,1 MM t)
- **Rest of the world**: 6% (3,9 MM t)

**Source**: Subsecretaría de Desarrollo Minero
Lithium production vs Reserves

Production 2016 (202 Mt LCE)

- China: 12234, 6%
- Argentina: 30851, 38%
- Australia: 74468, 38%
- Chile: 76064, 38%
- Rest of the world: 1064, 6%

Reserves (68,5 MM t LCE)

- China: 25%
- Chile: 50%
- Australia: 10%
- Argentina: 9%
- Bolivia: 0%

Source: Subsecretaría de Desarrollo Minero
Batteries demand evolution

**2012**
- Other Uses: 11%
- Air conditioning: 6%
- Polymers: 5%
- Metalurgy: 6%
- Grease & lube: 9%
- Ceramic and Glass: 35%
- Batteries: 29%

**2016**
- Other uses: 10%
- Air conditioning: 3%
- Polymers: 5%
- Metalurgy: 5%
- Grease and lube: 8%
- Ceramic and Glass: 30%
- Batteries: 39%

**2026**
- Other uses: 15%
- Ceramic and Glass: 15%
- Batteries: 70%
Lithium: From deposits to final use

**DEPOSITS**
- Brines
- Mineral deposits
  - Mineral concentrate

**PRODUCTS**
- Lithium Carbonate
  - Lithium Hydroxide
    - Lithium Chloride
      - Metallic Lithium

**END USES AND APPLICATIONS**
- Air conditioning
- Glass & Ceramics
- Pharmaceutical
- Steel continuous casting
- Aluminium Industry
- Li-ion Batteries
  - Al-Li Aircraft Materials
  - Primary Batteries
  - Elastomer Production
- CO2 Scrubbing
- Non-recharge Batteries
- Lithium Grease
- Catalysts
Lithium production, some facts.

- Battery grade lithium products have significantly higher costs to produce from mineral sources than from salt lake brines.
- But brine operations have significant lead times to develop and ramp-up production.
- Mineral operations’ higher cost of production is driven by a technically more complex and energy intensive process to reach battery grade lithium carbonate and hydroxide products.
- Brine operations also exploit economies of scale and don’t have the associated expenses of hard rock deposits.
Lithium Price evolution (LCE)

Source: Metalary.com
Since 2010, battery costs have fallen by more than 70%  
The viability of electric vehicles will ultimately depend on how well each car can compete across segments and geographies  
EV stock around the world to increase from 2 million in 2016 to 125 million in 2035  
By 2035, 1.8 million b/d of global oil demand will be displaced by Evs  
Buses LIB can be push the demand

<table>
<thead>
<tr>
<th>Y</th>
<th>Country</th>
<th>Proposal</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>2025</td>
<td>Norway</td>
<td>Change to taxes and incentives to achieve only zero or low emission sales</td>
<td>Agreement amongst all relevant parties</td>
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<td></td>
<td>Netherlands</td>
<td>Change to taxes and incentives to achieve only zero or low emission sales</td>
<td>Passed by parliament's lower house – needs approval by upper house</td>
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<td>EEUUS</td>
<td>No country-wide proposal although California aims to have a 1.5 million ZEV fleet</td>
<td>State approved mandate</td>
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<td>China</td>
<td>“New energy” vehicles to make up at least 20% of vehicle sales</td>
<td>Approved in latest five year plan</td>
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<td>EEEUU</td>
<td>No country-wide proposal although California aims to have a 1.5 million ZEV fleet</td>
<td>State approved mandate</td>
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<td>Japan</td>
<td>50 to 70% of vehicle sales to be of “next-generation” vehicle</td>
<td>Government set target</td>
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<td>2030</td>
<td>India</td>
<td>End the sale of petrol and diesel cars</td>
<td>Policy proposal</td>
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<td>China</td>
<td>Change to taxes and incentives to achieve only zero-emission vehicle sales EU-wide</td>
<td>Non-binding resolution by parliament's upper house</td>
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<td></td>
<td>Germany</td>
<td>Change to taxes and incentives to achieve only zero-emission vehicle sales EU-wide</td>
<td>Non-binding resolution by parliament's upper house</td>
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<td>France</td>
<td>End the sale of cars emitting greenhouse gases</td>
<td>Policy proposal</td>
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<td>2040</td>
<td>England</td>
<td>End the sale of all new conventional petrol and diesel cars and vans</td>
<td>Policy proposal</td>
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Source: woodmac.com/Metals & Mining
Lithium demands – BESS (Battery Energy Storage Station)

Tesla world’s largest Li-On battery
South Australia
100 MW/ 129 MWh.
Capacity: 30,000 homes for an hour

AES & SIEMENS – Escondido, California, EEUU
30 MW/ 120 MW/h
Capacity: 20,000 homes for about 4 hours
The Lithium Triangle (Argentina, Bolivia and Chile)

Source: Dirección de Infraestructura Minera/ Subsecretaría de Sustentabilidad minera
Argentina Lithium mines and projects status

- **2 mines in Production. Both expanding production capacity**
- **2 mines under Construction**
- **10 projects from Feasibility to Advanced Exploration**
- **> 40 projects in Early-Stage Exploration phase, 6 of them from pegmatites deposits**
Investment projection

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<th>Year</th>
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<th>2019</th>
<th>2020</th>
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<td>Gallego Project</td>
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</table>

| Total Investment | 3.973 |
Employment projection

- Tres Quebradas
- Gallego Project
- Sal de Los Ángeles
- Cangrejillos
- Salar de Pozuelos
- Sal de Vida
- Salar de Centenario Ratones
- Salar del Rincón
- Cauchari-Olaroz
- Mina Fénix
- Amp. Olaroz
- Olaroz


- 2017: 483 employees
- 2018: 483 employees
- 2019: 1,193 employees
- 2020: 2,538 employees
- 2021: 2,838 employees
- 2022: 3,408 employees
Lithium exports projection (MM USD)

At 75% of projected production capacity and 9.000 USD/t LCE price
Prices are still rising...

- Infrastructure (Roads, railways, gas, electricity, telecomunicaciones)
- Skills development for the specific salar production system
- Accelerate the process between projects and production
- Local development plans
- Consider seriously the impact in local and aboriginal communities.
- Hydrogen cells and graphene can be competitors.
- Recycling by 2040 would cover 50% of the demand for lithium.
- Australia alone could supply the demand for world lithium for the next 60 years.
- Technological advances can create new sources.
Commissioning and process residence times are a specific risk to brine production and will hamper the progress of expansion. These obstacles for new brine developments may sustain the current market deficit in the short term.