



Lithium: The Fuel of the Green Revolution

Partner Perspectives

Oct 20, 2017 | 09:00 GMT

3 mins read

(DAVID MCNEW/AFP/Getty Images)

By Jeff Desjardins for Visual Capitalist





The lithium-ion battery solves this problem for **2** major reasons relating to lithium:

1 Lithium has extremely high electrochemical potential.

Lithium-ion (Cobatt)	3.6V
Lead Acid	2.0V
NiCd	1.2V
NiMH	1.2V

This means one lithium-ion cell can do more – making it much more efficient to use in everything from electronics to energy storage.



2 Lithium is the lightest metal on the periodic table. Batteries need to be as light as possible, especially in electric cars.

How Lithium Gets Used

LITHIUM GLOBAL MARKET

Non-Battery // Battery

2001

Many years ago, lithium was used in a variety of industrial purposes



Global Market

TOP USES

- Ceramics / Glass
- Aluminum production
- Catalyst for rubber production
- Lubricants
- Batteries



The world is shifting greener.

And while people have always wanted electric cars and inexpensive solar power, the reality is that until recently, battery technology just wasn't good enough to store energy on an economical or practical basis.

Things have changed, and the green revolution has been kickstarted by battery power. The commercialization of the lithium-ion battery has solved a crucial green energy problem for two major reasons that can be related back to the properties of lithium:

1) Lithium has extremely high electrochemical potential, and so do lithium-ion cells:

Battery cell	Typical Voltage
Lithium-ion (Cobalt)	3.6V
Lead Acid	2.0V
NiMH	1.2V
NiCd	1.2V

This means one lithium-ion cell can do more – making it much more efficient to use in everything from electronics to energy storage.

2) Lithium is also the lightest metal on the periodic table. Batteries need to be as light as possible, especially in electric cars.

HOW LITHIUM GETS USED

2001

Many years ago, lithium was used chiefly for a variety of industrial purposes. Major sources of lithium demand included ceramics, glass, aluminum production, lubricants, and as a catalyst for rubber production.

2015

In modern times, with the commercialization of the lithium-ion, batteries are now the major source of demand for lithium at 39%.

2025

According to a report by Deutsche Bank, in 2025 the battery market for lithium alone will be more than 2x bigger than the total lithium market today.

About 70% of all lithium will go to electric vehicles, e-bikes, traditional batteries,



and energy storage, making it the uncontested fuel of the green revolution.

MAJOR LITHIUM DRIVERS

Lithium-ion battery demand is primarily driven by rapid growth in the electric vehicle market, which is expected to make up 35% of all vehicle demand by 2040.

But renewable energy storage also plays a role in driving lithium demand. With solar and wind energy being installed at a rapid pace, that means more batteries must be procured to store this energy. This can be done for a home system with a product like Tesla's Powerwall 2.0, and it is being done on a utility scale as well.

TWO TYPES OF LITHIUM

Prices for lithium have skyrocketed in the last two years – and it is worth knowing the two different types of lithium used by the market.

Lithium carbonate:

This is the first chemical in the production chain, and as a result, sells for less than lithium hydroxide. It can be used as cathode material in some batteries, such as the Nissan Leaf, where it is used in a LMO with NMC formulation (Lithium manganese oxide/nickel manganese cobalt oxide chemistries)

Lithium hydroxide:

This is a by-product of lithium carbonate, created by a metathesis reaction with calcium hydroxide. It can be used to produce cathode material more efficiently and is actually necessary for some types of cathodes. It's used in the Tesla Powerwall and Model S, for example.

LITHIUM MINING

There are two basic ways to extract lithium: from brine or from hard rock. The latter mainly consists of spodumene production.

Brine deposits represent about 66% of global lithium resources, and are found mainly in the salt flats of Chile, Argentina, Bolivia, China, and Tibet.

The most famous area for lithium is known as the Lithium Triangle, located on the border between Chile, Argentina, and Bolivia. Salar de Atacama, the world's third largest salt flat, resides on the Chilean side, and contains about 50% of global reserves.

The largest lithium producers in 2015 were Chile (37%) and Australia (33%).



Argentina is the only other double-digit producer at 11%.

LITHIUM IS FUELING THE GREEN REVOLUTION

Here's the estimated amount of lithium that can be found in everyday items using lithium-ion batteries:

- Tesla Model S: 51kg
- Electric Vehicles: 10-63kg
- Tesla Powerwall 2.0: 10kg
- Hybrids: 0.8kg to 2.0kg
- Power tool batteries: 40-60g
- Laptops: 30-40g
- Tablets: 20-30g
- Mobile phones: 2-3g

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