Lithium: fueling the clean energy revolution

The transport sector alone contributes roughly one-quarter of all energy related CO_2 and is still primarily dependent on fossil fuels. But that's changing thanks to the lightest solid on Earth, which some are even calling the "new gasoline."

Lithium, it's the soft, silvery-white metal that's become a critical component in hundreds of applications, including the auto industry's new shining star – the electric vehicle (EV). While EVs have been around for some time, it's due to much-improved lithium-ion (Li-ion) battery technology that we're actually seeing them on the road in greater numbers. These super-tech batteries keep their charge for long periods (100 to 300 miles), are lightweight and recharge quickly (ca. 30 minutes via a super charger) – key criteria for buyers.

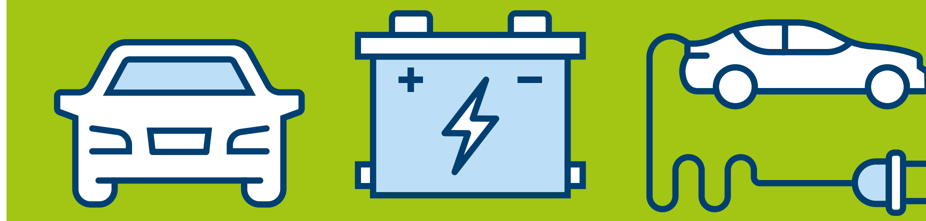
And, if you look around at the devices and equipment you're using today, you'll find Li-ion batteries powering everything from your mobile phone, laptop, digital camera, your cordless hand drill and your e-bike. They're also used to store energy from wind and solar, which removes even more CO_2 from the environment.

21ST CENTURY GOLD RUSH

Lithium does not occur as a metal in nature, but is extracted from igneous rocks – primarily spodumene – or from bodies of water with high salt content or brine deposits. And while not classified as a "critical" raw material, lithium is a coveted commodity. It traded for a whopping US$16,500 per ton in 2018 – up 45 percent from 2017. However, prices vary widely because it's traded directly between buyers and sellers versus through an exchange.

Latin America is leading the world in production. Its "Lithium Triangle," made up of Chile, Argentina and Bolivia, hold anywhere from 54 to 80 percent of the world's lithium resources, much of it in brines. Brine extraction is a less expensive process than obtaining it from ore, but is a longer process, given that it can take up to two years for the evaporation phase.

Australia, the world's second largest producer, holds the most lithium reserves. Most of it has to be crushed out of rock, so to balance the costs, it is largely shipped to China for processing. China also has its own reserves and is buying rights to mine lithium in other countries. In the U.S., lithium is recovered from brine pools, although how much is produced has not been published. Zimbabwe, and to a lesser extent Portugal and Brazil are also producing lithium in smaller quantities.



Global lithium-ion battery production capacity will increase by 521% between 2016 and 2020.

WHO'S SUPPLYING THE DEMAND?

The massive price jump for lithium is due to the rise – and the even greater expected rise – in the production and sale of EVs, domestic solar usage and digital devices, all of which require Li-ion batteries.

Globally, more than 120 different EV models are expected to hit the road by 2020, in countries like the U.S., China, India and Norway, among others. To power them, both China and the U.S. have ramped up Li-ion battery production, with China in the lead. In the U.S., Tesla has two gigafactories for EV battery and component production and is building another in China. However, EV growth in the U.S. has been slower than expected, making up less than 2 percent of auto sales and it could be another six to seven years before they become mainstream. In 2016, global Li-ion battery production capacity reached 28GWh and by 2020 it is expected to reach 174GWh – an increase of 521 percent. Not surprisingly, lithium materials demand is projected to grow at a 13.8 percent CAGR between 2018 and 2023.

TIPPING THE BALANCE

Different lithium compounds have different end uses, therefore lithium is not homogenous, like aluminum, for example. This, and the fact that it is a relatively small market dominated by a few players, makes it more difficult to set a "price" for lithium, trickier to hedge, and therefore, secure financing for new extraction projects.

The ramp up of lithium production is primarily dependent on increasing EV adoption. This of course requires consumer buy-in. However, it also requires persuading others along the chain – investors, chemical processors, battery/cathode manufacturers, carmakers and politicians – that lithium supply will be reliable, of high-quality and affordable. Likewise, EVs and Li-on batteries are not without their critics, who are quick to point out that a structure for recycling Li-ion batteries is still largely missing. Finding closed-loop solutions for recovering and reusing Li-on battery materials would boost the technology's green credentials and further solidify lithium's future.

On the consumer side, drivers are warming up to EVs, as concerns about product safety, battery durability and range subside. The combined technical improvements, increased model choices and drop in price, as well as the appearance of more charging points, suggest that we're in for a brighter and cleaner future.

And the award goes to ...

In 2017, GEA was recognized with the "Award for Excellent Supplier" by Shenzen BTR New Energy Materials.

A globally leading lithium battery anode and cathode material solutions provider, BTR recognized GEA's top performance. In particular, the Chinese company recognized GEA's technology, as well as innovative and pragmatic solutions, which have contributed significantly to the production of high-quality lithium.

How to do it: Processing battery-grade lithium

Lithium hydroxide, and to a lesser extent, lithium carbonate, are used to make Li-ion batteries and must be exceptionally high-grade – 99.5 percent pure – to meet manufacturer specifications. Given extraction costs, it is critical to get as much value as possible out of each ton of ore or brine during processing. Here's how it's done:

GEA covers nearly the entire value chain of lithium processing – from evaporative concentration, precipitation, crystallization to purification and drying – tailoring the powder to specific end-use requirements. Our award-winning customer service and unrivaled technologies are valued by lithium manufacturers globally because we deliver a competitive advantage due to higher rates of production, reduced costs and more efficiency, while complying with stringent regulations. GEA test centers allow customers to pre-test their lithium samples so they can make informed decisions before committing to industrial level production.

Crystallization

Irrespective of its source – brine (lithium chloride) or spodumene (lithium sulfate) – GEA has developed state-of-the-art technologies for concentration and crystallization. As the source solution goes through precipitation steps to become a lithium hydroxide solution, sodium chloride or sodium sulfate is generated as a byproduct. They are separated out from the lithium solution and once isolated, the salt (table or Glauber's salt) is melted down, recrystallized and dried so that it can be sold. GEA's double stage crystallization method utilizes both vacuum and surface cooling to limit fouling and minimize lithium losses.

Spray drying

When it comes to spray drying, GEA powder engineers tailor each solution to a specific downstream component, utilizing one of two types of atomization devices: rotary or nozzle. Nozzles are available with pressure and pneumatic configurations as are combination or multi-flow systems.

Rotary atomization is the best solution for most scenarios given the equipment is easy to operate and energy efficient. The GEA COMBI-NOZZLE™ combines the best features of pressure and pneumatic nozzles and is specifically designed for Li-ion battery material, offering unique advantages over other nozzle types. Regardless of the atomization approach, GEA offers compact, single-line spray drying plants for any capacity.