



LITHIUM: A look at the substantial investment in new lithium hydroxide capacity

By Daniel Saxton
Analyst

Background: The lithium industry and batteries

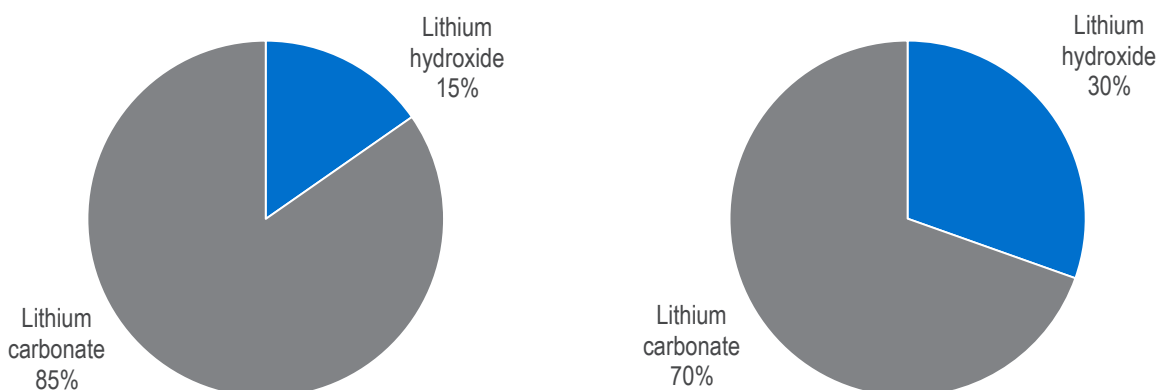
The electric vehicle revolution is a game-changer and one of the major trends affecting the mineral and energy industries. Enigmatic elements such as lithium have seen massive publicity as a result and investors have flocked to Australia and South America to get in on the act. But is the bubble set to pop soon? We look at the case of lithium hydroxide and ask

- *Will the magnitude of announced capacity exceed growth in demand and drive down prices?*
- *Why are producers looking to build so much if demand can't keep pace?*
- *What are the expected outcomes from these investments?*

Lithium has seen a renaissance due to the emergence of electric vehicles as a major solution to the challenges of climate change and air quality in cities. Lithium-ion batteries have been a common source of portable energy since the early 1990s, when Sony first commercialised the technology. Since the rise of electric vehicles, demand has sky-rocketed and battery applications now consume about half of all lithium carbonate and a third of lithium hydroxide.

Focus: Lithium hydroxide

Figure 1: Lithium Demand in Battery Applications by Compound



So, why the particular focus on lithium hydroxide?

While some battery applications are growing steadily, the major driver of demand is the automotive industry. Lithium-iron phosphate (LFP), nickel-cobalt-aluminum (NCA) and nickel-cobalt-manganese (NCM) are the preferred battery chemistry for automotive applications. Production of these batteries typically requires lithium hydroxide as lithium carbonate can impact cathode quality. Given the high forecast growth in electric vehicles, there will be corresponding high growth in demand for lithium hydroxide. While predictions vary, Nexant expects lithium hydroxide demand growth to exceed lithium carbonate growth.

Present day: Australia and the race to add capacity



The pendulum for
downstream processing
is swinging to
AUSTRALIA

Announced lithium hydroxide capacity additions (LCE basis), 2018 to 2028:

Company	Capacity addition
Albemarle	120 000
FMC	12 000
Nemaska	23 000
Neometals	10 000
SQM	44 500
Tianqi Lithium	48 000
Chinese*	30 000
Total	287 500

*Nexant estimate

The stalwarts of the lithium industry are reacting to the expected high growth in lithium hydroxide demand.

Tianqi Lithium has been the most active in this respect with Stage 1 of its 24 000 tpa lithium hydroxide plant in Kwinana, Western Australia nearing completion and Stage 2 set for completion in 2019.

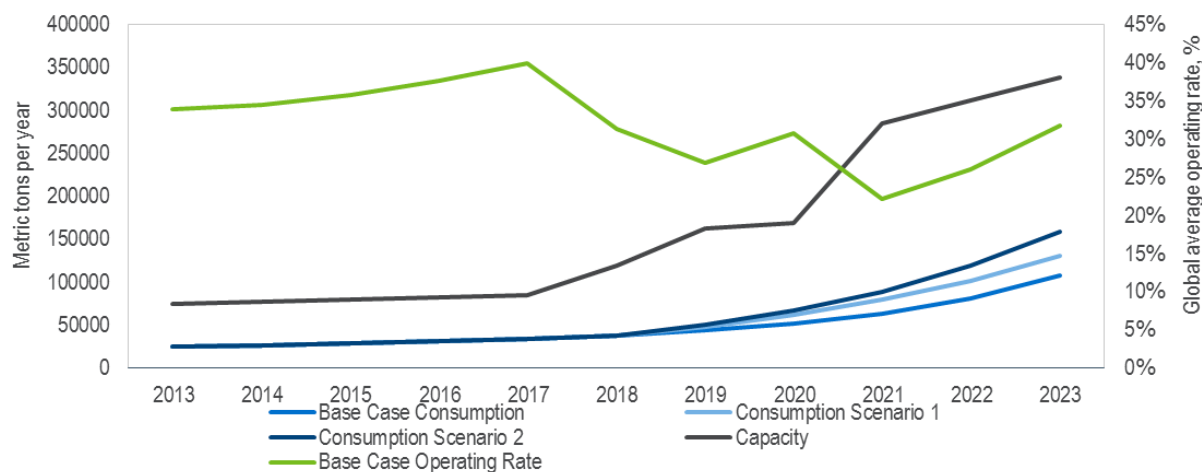
Other majors such as **Albemarle**, **SQM** and **FMC** are following suit with declarations of lithium hydroxide plants to be built in Australia and China. Albemarle is arguably the most ambitious with 100 000 tpa of potential lithium hydroxide capacity in Kemerton, Australia.

These announcements also show that the pendulum for downstream processing is swinging to Australia, with producers preferring a plant back-integrated to the mine. Capacity additions in Australia account for three-quarters of all announced additions globally over the next ten years.

Evaluation: Will demand keep pace?

Our base case estimates for lithium hydroxide demand put the global market at 38 000 metric tons in 2018, with demand growth of 23 percent per year to 2023 (42 percent growth per year specifically from battery applications). With capacity for lithium hydroxide set to reach 285 000 metric tons by 2021 (based on announced capacity additions), we expect operating rates to fall to a low of 22 percent globally. Even using one of our more optimistic scenarios, assuming greater EV penetration, the global average operating rate won't exceed 40 percent until after 2023.

Figure 2: Global supply and demand of lithium hydroxide (LCE basis in metric tons), 2013 to 2023



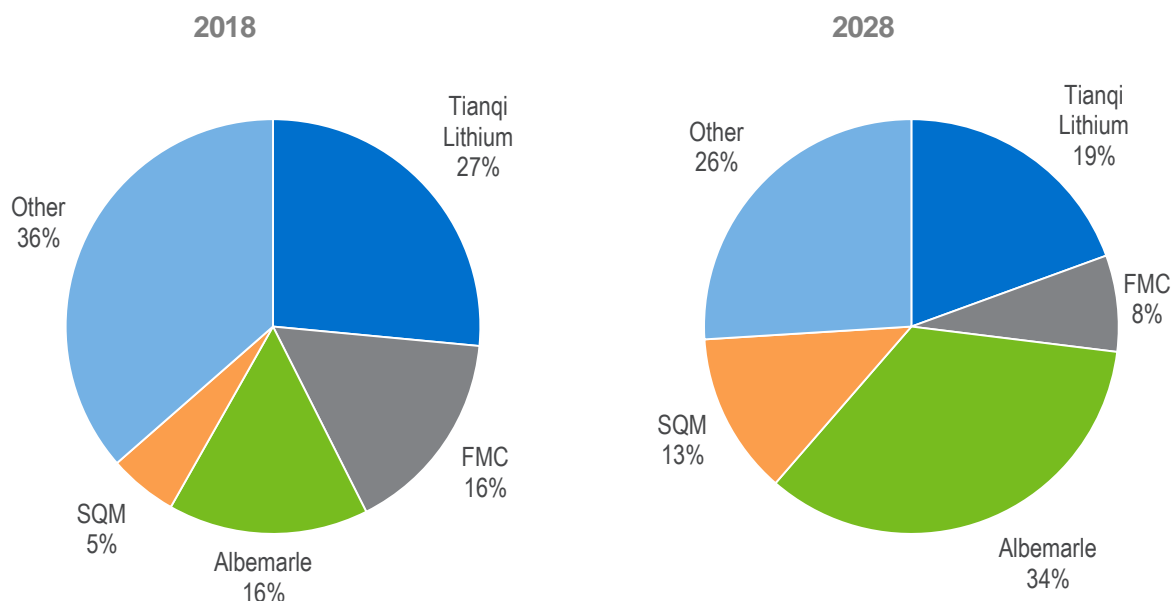
Evaluation: Why invest?

So why are producers looking to invest so much if demand won't keep pace in the short-term? Three reasons behind the push could be:

- 1. Producers may be over-optimistic in their assessment of lithium hydroxide demand.** As with any significant market shift, an optimistic growth scenario can be considered to estimate demand growth. However, it is unlikely that these experienced players have estimated demand growth to be astronomically high and we suspect a different reason is more likely.
- 2. Larger producers' close customer intimacy and awareness of future raw material requirements.** Companies such as Albemarle and Tianqi Lithium have long-standing customer relationships and some visibility over future lithium hydroxide demand.
- 3. A longer-term plan may be in place with some short-term margin sacrifice to secure market share.** The larger producers could be looking to maintain or even grow their market share at the expense of smaller producers. As a long-term strategy, this would allow them to become the largest suppliers of lithium to the battery markets and secure significant future revenue. (See chart below)

Based on our analysis, we see points two and three being the major factors driving this significant capacity expansion. Most incumbent producers are likely to enjoy above-average operating rates if their plans are realised due to existing relationships and established reputations. And the likes of Albemarle, Tianqi Lithium, FMC and SQM will be keen to maintain their market share and keep-out new competitors in one of the fastest growing global markets.

Figure 3: Capacity Share by Company, 2018 and 2028



Source: Nexant estimates (assuming all additions are realized).

Possible consequences: Margins, financing and costs

Although the full capacity additions are unlikely to be realised, we expect capacity additions to outpace demand growth, leading to a decrease in global average operating rates in the near term. But what does this mean for the industry?

Lithium hydroxide price

- Lithium hydroxide prices have spiked as a result of high demand and speculated growth. In light of new capacity and lower operating rates, prices are expected to normalise to the cost of production plus a lower producer margin.

Producer margins

- Producer margins will decrease – the drop in operating rates will also have an effect on producer margins, as fixed costs will contribute a higher percentage to the cost of production.

Market consolidation

- The market will consolidate with the current big four producers gaining a greater share of the lithium hydroxide market and a knock-on effect on the following players:
- Chinese producers
 - With the majority of world-scale facilities to be built outside of China, we can expect pressure on the smaller, sub world-scale facilities within China where most of the current capacity is located.
- Conversion producers
 - Producers that utilise lithium carbonate conversion technology could also be affected more significantly as they are higher cost producers than the newer lithium hydroxide facilities that process directly from spodumene resources.⁽¹⁾
- Junior producers
 - Junior producers with exposure to the lithium hydroxide market and seeking financing through equity or debt markets may start having issues. With the fall in prices, once attractive projects may present too large a risk to banks and lenders meaning that development of some deposits stops or slows dramatically.

⁽¹⁾ This is based on market lithium carbonate prices or the cash cost for lithium carbonate from a mineral processing plant.



The Future of Energy and Chemicals

Nexant offers our clients a suite of products and advisory services with an exclusive focus on the energy, chemicals, and related industries. Using a combination of business and technical expertise, with deep and broad understanding of markets, technologies and economics, we provide solutions that these industries have relied upon for over 45 years.

Our clientele ranges from major oil and chemical companies, utilities, regional and national governments, renewable energy and bio-based materials producers to financial institutions, development agencies and law firms.

Nexant provides a range of consulting and advisory services across multiple industries:

- Strategic Business Advice
- Investment Studies
- Commercial, Technical and Environmental Due Diligence
- Strategic Growth Plans
- Project Feasibility Studies
- Industry Analytics, Forecasting and Market Research
- Litigation Support and Expert Testimony

Nexant Subscription programs and online product search portal provides customers with insightful analytics, forecasts, and planning tools for the chemicals, polymers, oil & gas, energy, and clean tech sectors. For more information regarding our reports and data simulators, please visit: www.NexantSubscriptions.com.

"Lithium Extraction Technologies" is one in a series of reports published as part of the 2018 TECH Program.

The Technoeconomics – Energy & Chemicals (TECH) program (formerly known as PERP) is globally recognized as the industry standard source of process evaluations of existing, new and emerging technologies of interest to the chemical and energy industries. TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends.

Daniel Saxton is an Analyst in Nexant's Energy and Chemicals Advisory business and is based in London, UK. Having joined Nexant in 2017, Daniel has worked on market analysis, feasibility studies, technical evaluations and transaction support projects.

Daniel has developed a deep understanding of the raw materials for the EV battery markets with a focus on the lithium and cobalt markets. At Nexant, he is the author of a study titled "Lithium Extraction Technologies" which provides a detailed and up-to-date analysis of the commercial technologies, emerging technologies, process economics and lithium compound markets involved with this industry. As part of his postgraduate studies, Daniel wrote his dissertation on the cobalt industry which included in-depth studies of its markets, a risk analysis of existing refining technologies and financial modelling of a nickel-cobalt laterite deposit in Australia.

Before Nexant, Daniel worked in an operational capacity for Total at their UK refinery and also as Chemical Engineer for Grupo Familia in Medellin, Colombia. He holds an MEng in Chemical Engineering and MSc in Metals and Energy Finance.

Daniel Saxton
Analyst
dsaxton@nexant.com
+44 20 7950 1575