Lithium

Lithium is one resource that has been making the news and garnering investor interest lately, largely due to forecast demand growth in the rechargeable Li-ion battery market. This column is aimed at providing a brief overview of the upstream lithium industry and markets.

What is Lithium?

Lithium is an alkali metal; the lightest of all metals and the least dense of any elements that are solids at room temperature. Lithium can be cut by a knife. Because of its inherent instability and reactivity it never occurs freely in nature, but only in compounds.

What are its Uses?

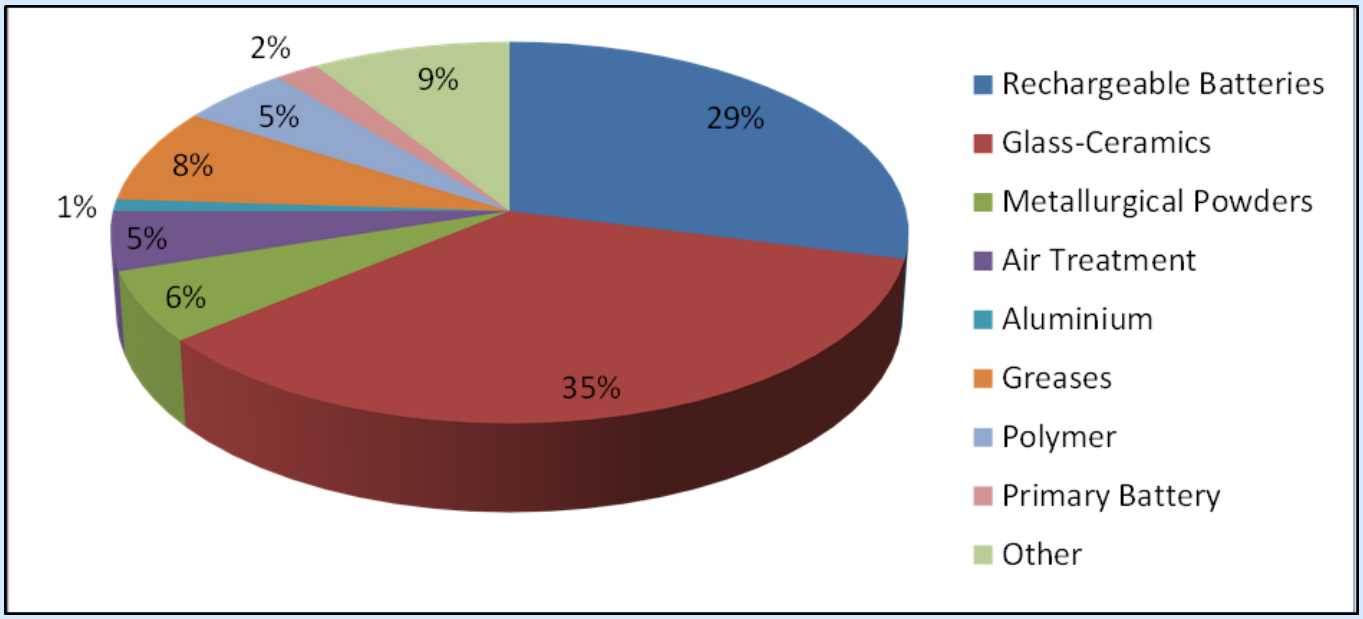
Lithium has a large number of uses, with the most relevant now being in rechargeable batteries, which in 2014 made up some 29% of the annual demand of around 200,000t of lithium carbonate equivalent ("LCE"), which is the form that lithium contents and prices are most commonly quoted in.

Lithium carbonate (Li_2CO_3) contains around 18.8% lithium; therefore one tonne of lithium is equivalent to 5.3 tonnes of lithium carbonate. Another compound that is often quoted is lithium oxide – Li_2O – which contains 46.5% lithium, around 2.5 times that of LCE, with lithium hydroxide (LiOH, 29% Li) also being used.

Care has to be used in comparing grades, tonnages and expected revenues between companies when they are quoted on different bases.

The following graph (adapted from Roskill data is a Pilbara Metals (ASX: PLS) presentation shows a breakdown of uses in 2013.

Lithium uses - 2013



Source: PLS presentation

Some forecasters have the market growing at +10% CAGR over the next 5-10 years, with this largely driven by demand for rechargeable batteries. This market has reportedly grown by 20% CAGR since 2000 (driven by the growth in consumer electronics and phones), and is forecast to accelerate post 2015, with an expected increasing demand for electric vehicles. Other growing battery uses include home storage, and the potential for grid scale storage to be used in conjunction with solar and wind power generation. In Australia we have seen AGL Energy recently launching a home storage product in Australia in line with Tesla's "Powerwall" announcements. The major battery producers are Japan, China and South Korea, with Tesla also now joining the fray.

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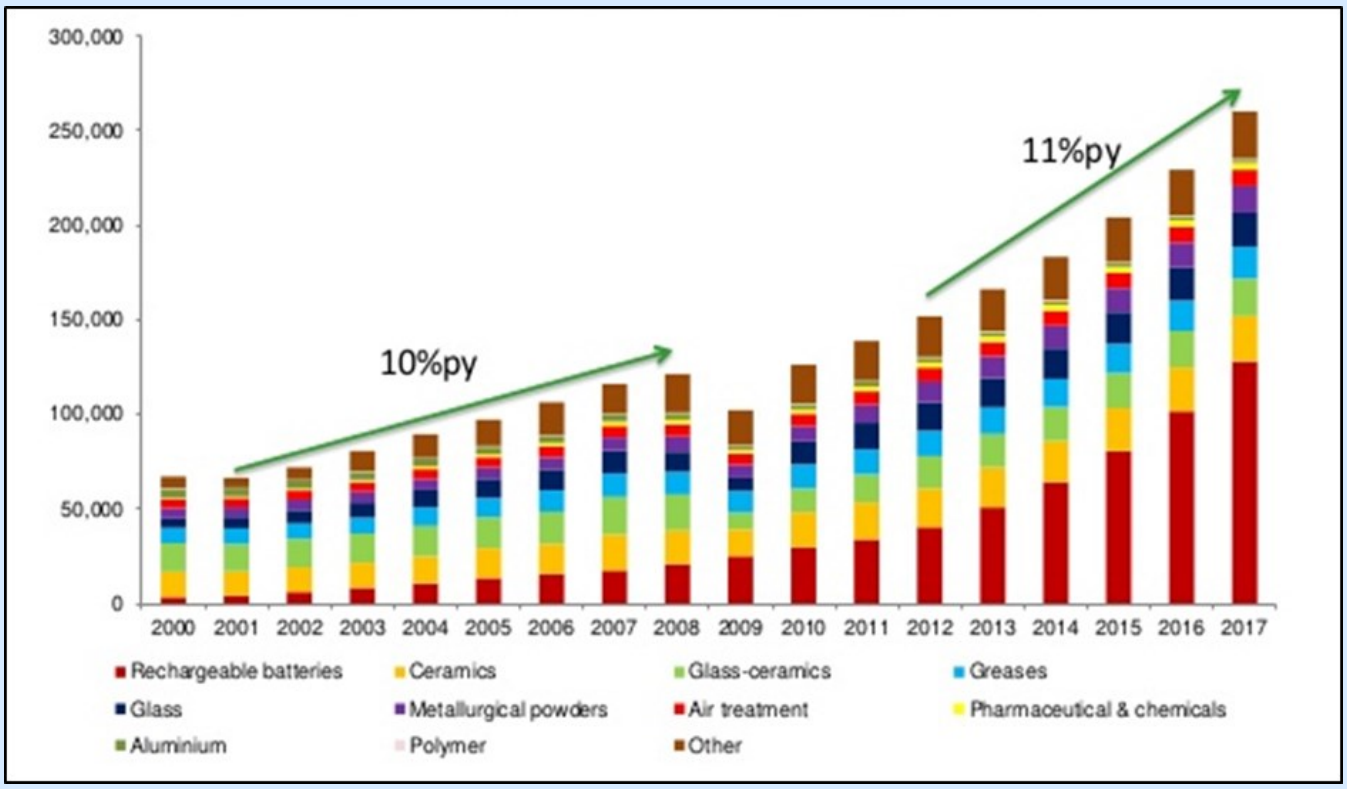
Lithium consumption by end use (t LCE) – 2000-2017

Stormcrow, in their 121 Hong Kong conference presentation,
presented the possibility that by 2025 minimum additional LCE demand *from batteries alone* will be 104,000tpa, a 50% increase on current total LCE production; a 4% CAGR.

The following graph shows historic and forecast demand for lithium from Roskill Information Services – this forecasts an 11% CAGR.



Source: Roskill Information Services presentation – 2013

How, Where and Who?

There are two main sources of lithium – brine deposits and hard rock spodumene deposits. Production from brine deposits (for example SQM's Salar de Atacama operation in Chile) involves the extraction by pumping of lithium rich brines in salt lakes, followed by concentration by evaporation in evaporation ponds. From this, the concentrated solutions are processed to end products, including lithium carbonate. Common by- or co-products include potassium and boron salts. Key points that affect potential brine operations include lithium content, magnesium content (this is relatively expensive to remove, with a rule of thumb stating that the ratio of Mg to Li in brines must be below 10:1 for a brine deposit to be economical) and evaporation and rainfall rates – high evaporation rates results in lower costs as smaller ponds and shorter residence times are required.

Spodumene (which is a lithium pyroxene – $LiAl(SiO_3)_2$ deposits are commonly hosted in pegmatites, and are mined by conventional open cut mining, followed by crushing and grinding, and extraction using a mixture of gravity, heavy media separation, magnetic separation and flotation to produce a concentrate, largely comprised of spodumene, but also commonly containing quartz and feldspar. Two concentrate qualities are often produced from the same deposit – a premium technical grade ("TG") concentrate and a chemical grade ("CG") concentrate, dependent upon customers' requirements. A common by-product is tantalite and other tantalum minerals. The concentrate is then further treated to produce ß-spodumene for ceramics, and LCE for other uses.

Lithium consumption by end use (t LCE) – 2000-2017

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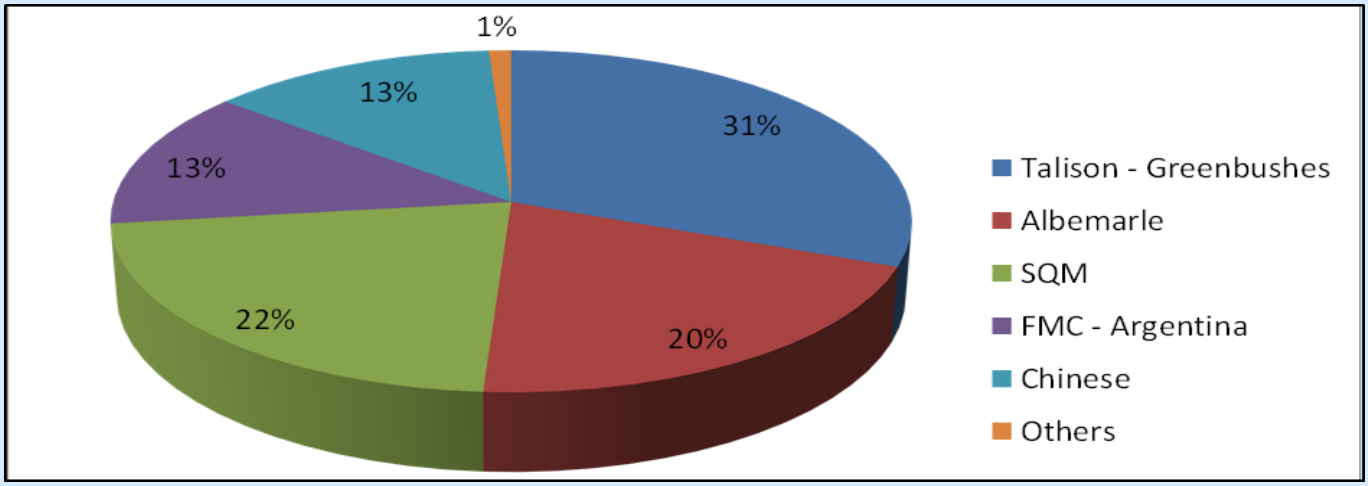
TG concentrates, which are largely used in glass and ceramics applications, particularly in low thermal shock ceramics, require low iron contents (maximum of 1% Fe_2O_3, but significantly lower is preferred), and with LiO_2 grades of at least 6.5%. Specifications for CG concentrate, as used in battery applications, are less strict, with concomitant lower prices.

The following graph shows a breakdown of the major producers. What this shows is that production outside of China is highly concentrated, with only a few companies in the business.

Lithium producers by market share 2014



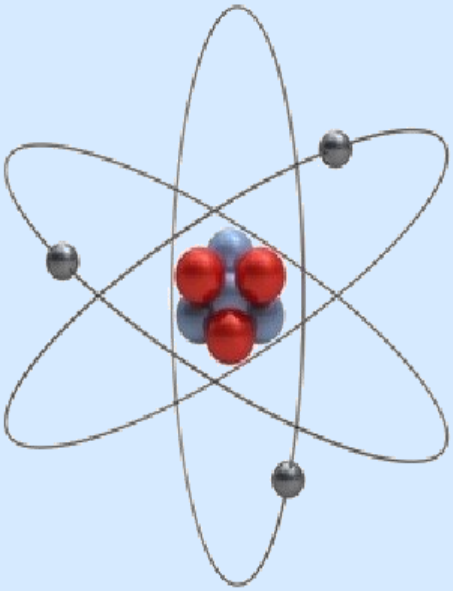
Source – Albemarle Lithium Day presentation - 2015

Both FMC and SQM operate brine operations in the altiplano of Chile/Bolivia/Argentina – another company starting up there is the ASX listed Orecobre (ASX: ORE), which is currently ramping up production.

The largest single operation is the Greenbushes Mine in Western Australia, which is a hard rock spodumene producer. Talison is a joint venture between Albemarle (49%) and Sichuan Tianqui Lithium (51%). Greenbushes provides some 78% of global spodumene concentrates, with the balance made up largely by Chinese producers, with no other major western producers.

Albemarle's other 20% share in the above graph comes from a number of brine operations in the US and Chile, with, when added to its holding in Talison, makes it the world's largest single producer of lithium with 35% of market share.

Pricing



Like most specialty metals, pricing is opaque and set by direct negotiation between producer and customer. Pricing is also dependent upon the product, whether a concentrate or LCE, and the relative quality of the product.

According to lithium engineering consultants the TRU Group, 2014 prices for LCE out of Chile were in the order of US$4,500/tonne, or US$11,200/ tonne of contained Li_2O, and had risen around 10% over the preceding four years, however other groups have LCE prices at around US$5,000t, with battery grade product at a premium of $500-$1,000/tonne.
The TRU Group states that the major companies had responded to increasing demand through increases in production, thus resulting in relatively flat prices.

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Spodumene concentrate prices vary according to grade and levels of contaminants, however currently these are in the order of US$300-450/tonne, or US$4,500-7,000/tonne of contained Li_2O, with prices tracking that for LCE.

Where to From Here, and Factors to Consider?

This depends upon who you listen to! Given the demand side, there would appear to be an excellent future in the space, which has excited the market over recent years. Recent examples have included Pilbara Minerals, whose share price has appreciated significantly on recent activities. However there is the ready potential for the current oligopoly to increase production to meet any demand increases, and also the potential to price new players that are considered a threat out of the market.

As in all resources there are a number of factors that need to be considered in the space, and not all hopefuls will get up. Over recent years there have been some notable failures in the sector, and some issues with current developers and producers.

As alluded to earlier there are certain technical issues when assessing individual projects and companies.
With the brine deposits these include factors such as brine chemistry (particularly grade and Mg content), rainfall and evaporation rates. In addition the major producers (and prospective salars) are in remote locations, and in the case of Argentina, a jurisdiction not known for its stability or economic well-being. In Chile lithium is considered a strategic mineral, and hence has more onerous permitting laws than other resources.

In hard rock deposits key factors include grade and concentrate chemistry. Grade is important, as hard rock operations generally involve significantly higher capital and operating costs than brine operations, and the spodumene chemistry is important mainly due to deleterious element contents, particularly iron. This will affect the markets that the product can be sold into, or whether it can be sold at all.

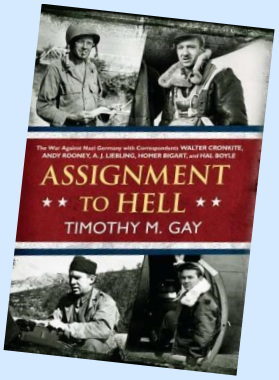
On my Soapbox

Strangely enough for me, there is nothing new to get on the soapbox about that I haven't covered previously. Or maybe I am getting so used to people trashing the resources industry that it doesn't have the same effect that it used to….I certainly hope not!

I'll find something special for Christmas to include in next month's edition.

From my Bookshelf

When in Canberra I always relish the thought of visiting Paperchain bookshop in Manuka, for which my rummaging through the $10 special tables out the front always yields some gems that would otherwise remain hidden from my knowledge. (and increases the demand for new bookcases).



One such book I acquired recently is "Assignment to Hell", written by Timothy Gay. This is not your typical WW11 book – it follows the wartime assignments of five correspondents, namely Walter Cronkite, Andy Rooney, A. J. Liebling, Homer Bigart and Hal Boyle. This is an entertaining, and above all informative read, and presents the reader with a different perspective of the conflict.

It concentrates on the US involvement in North Africa and Europe, naturally given that the correspondents covered were all working for American news services. This not only covers ground forces, but also includes chapters on the 8th Air Force.

If you are interested in WW11 history and/or journalism and can get a copy I thoroughly recommend this book.

Mark Gordon