Australian Equity Research
17 May 2016

Company	Rating	Price	Target
Specialty Minerals and Metals			
GMM-ASX	Spec Buy	A$0.63	A$0.85↓
previous			*A$0.95*
GXY-ASX	Spec Buy	A$0.43	A$0.60↑
previous			*A$0.50*
ORE-ASX	Buy	A$3.80	A$5.15↑
previous			*A$4.20*

Share price as of May 13 2016

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Industry Overview

Start Me Up - Electric vehicles & Grid storage to drive Lithium demand

We highlighted the investment opportunity in the lithium sector in our report "Lithium set to charge" (16/12/15). We identified that growth in the use of Lithium-ion batteries primarily in the electric vehicle and grid storage markets, would drive a significant increase in demand for lithium. In this report, we provide an overview of the lithium market, present the results of our lithium market supply/demand analysis and pricing forecasts, and update our valuations for our lithium sector coverage.

Lithium-ion (Li-ion) batteries forecast to drive significant demand growth for lithium: We forecast the lithium market to grow by 81% to 347kt lithium carbonate equivalent (LCE) by 2020, and by 259% to 687kt LCE by 2025, representing a CAGR of 14% across all demand sectors. We anticipate Li-ion battery-based electric vehicles (passenger vehicles & electric buses) to be a key driver of demand over the next decade, accounting for 38% of all lithium demand by 2025 (from ~6% in 2015). Similarly, we also anticipate significant demand for lithium from the grid storage sector, which we forecast will account for 13.6% of all demand by 2025.

Expect the supply side to respond, but longer term demand profile supports higher lithium prices: We estimate global supply at 176kt LCE in 2015, with production dominated by six operations owned by four major companies. In determining an expected supply side response, we have analysed over 60 lithium projects around the globe, with 19 advanced stage projects offering potential for additional production within the next 5-6 years. Of these, we see 7 new projects likely to advance to production before 2018/19, with our modelling suggesting the potential for modest oversupply in those years. However, to meet our base case demand forecasts, we estimate an additional +312ktpa LCE in new production would be required by 2025.

Increasing lithium price forecasts: based on our supply/demand modelling, we forecast lithium carbonate prices to rise from US$6,000/t in 2015 to US$10,500/t in 2025, with spodumene concentrate prices expected to experience a similar increase from US$450/t in 2015 to US$725/t in 2025. Under our "bull" case demand scenario, we forecast lithium carbonate prices to rise to US$12,000/t and spodumene concentrate to US $870/t by 2025.

CGAu lithium sector coverage - Target price changes:

Galaxy Resources (GXY:ASX | SPEC BUY) Increasing target to A$0.60 (from $0.50).

General Mining Corp (GMM:ASX | SPEC BUY) Decreasing target to A$0.85 (from A$0.95).

Canaccord Genuity (Australia) was the Lead Manager to the placement of a total of 40.3m shares at A$0.18/share to raise A$7.3m conducted in December 2015.

Orocobre Ltd (ORE:ASX ORL:TSX | BUY) Increasing target to A$5.15 (from A$4.20).

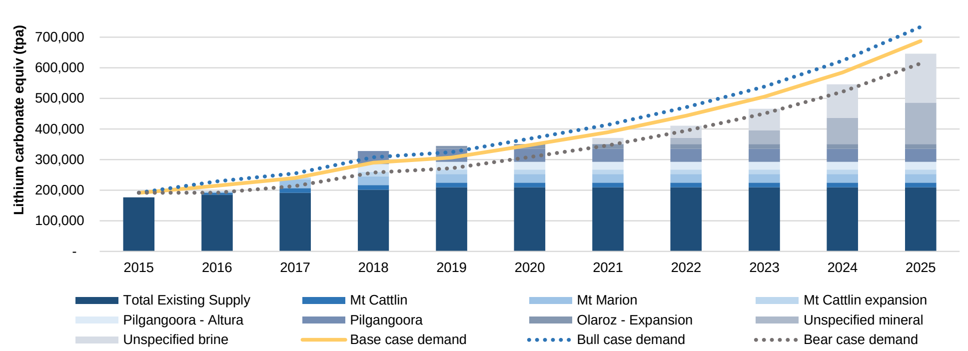
Canaccord Genuity (Australia) was the Lead Manager to the two tranche placement of ~25.3m shares at A$2.10/share to raise A$53.2m in Jan'16, and ~15.1m shares at A $2.10/share to raise A$31.7m conducted in Feb'16.

Investment Summary

Lithium-ion batteries forecast to drive significant growth in lithium demand

- We forecast an overall growth in lithium demand to 2020 of 81% to 347kt lithium carbonate equivalent (LCE), representing a CAGR of 6% across all demand segments (versus an estimated 2015 market size of 176kt). Within this, we forecast demand for lithium for use in Li-ion batteries as a proportion of the overall lithium market to increase from 36% to 54%, requiring an estimated 186kt LCE by 2020.

Figure 1: Lithium supply/demand curves



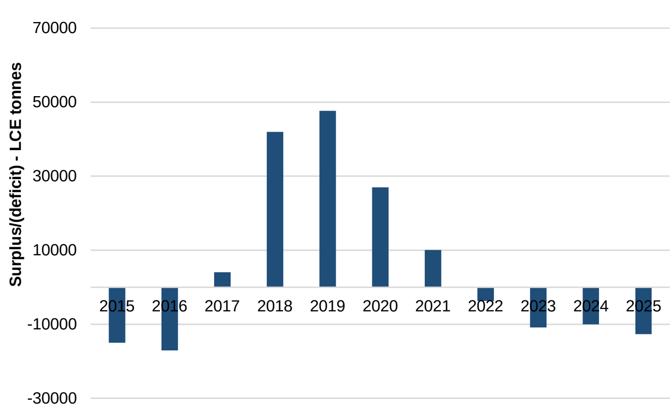
Source: Company reports, signumBox 2015, Canaccord Genuity estimates

- Looking further out to 2025, we forecast total lithium demand to grow by 259% to 687kt LCE, representing a CAGR of 14% across all demand segments. By 2025, we forecast demand from the Li-ion battery sector to account for 73% of overall lithium market demand.
- We anticipate significant growth in the electric vehicle market (electric passenger vehicles and E-buses) in the coming decade to be a primary driver of lithium demand. Our base case forecasts assume EV sales to grow by a CAGR of 15% to 2025, with an estimated 13.7% of all passenger vehicle sales to be EVs. Furthermore, by 2025, we estimate demand from EVs to account for 38% of all lithium demand (from ~6% in 2015).
- We also expect a major expansion of the grid storage sector, which by 2025, is forecast to comprise 13.6% of total lithium demand (CAGR 41% from 2016).

New market entrants see potential for modest market oversupply in 2018/19, but longer term demand supports potential for higher lithium prices

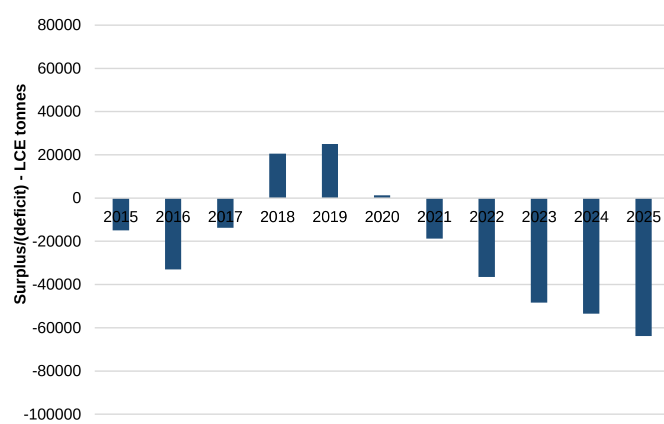
- We estimate global lithium supply from the six main operations was 176kt LCE in 2015. Production was dominated by four companies (6 operations) representing 91% of total market share, including Albemarle (ALB:NYSE | Not rated), SQM (SQM:NYSE | Not rated), FMC Corp (FMC:NYSE | Not rated), and Sichuan Tianqi Lithium Industries (002466:SHE | Not rated).
- In terms of projecting new supply, we have analysed over 60 lithium projects around the globe, with 19 advanced stage projects offering potential for a total of ~400kt LCE in new supply within the next 5-6 years. Within this, we forecast only two new sources of lithium production globally within the next 18 months, namely from Mt Cattlin (Galaxy Resources [GXY:ASX | rated SPEC BUY]/General Mining [GMM:ASX | rated SPEC BUY]) and Mt Marion (Ganfeng Lithium (002460:SHE | Not rated]/Mineral Resources [MIN:ASX | Not rated]/Neometals [NMT:ASX | Not rated]). Beyond this, we expect additional market supply from two new hard rock projects (Pilgangoora – Altura Mining [AJM:ASX | Not rated], Pilbara Minerals [PLS:ASX | Not rated]) and brownfield expansions from brine operations (Atacama/La Negra [Albemarle] and Olaroz Stage 2 expansion [Orocobre]) by 2018/2019.
- Based on the likelihood of these new projects being brought into production, and assuming our base case demand projections, we forecast the lithium market to move into surplus in 2018 (13%) and 2019 (14%), before returning to deficit by 2023. In our "bull" case demand scenario (+8% increase on annual demand estimates, assumes no change to supply projections), we forecast only modest surpluses in 2018/2019, with market deficits forecast for 7 out of 10 years in our forecast period.

Figure 2: Base case surplus/(deficit) forecasts



Source: Canaccord Genuity estimates

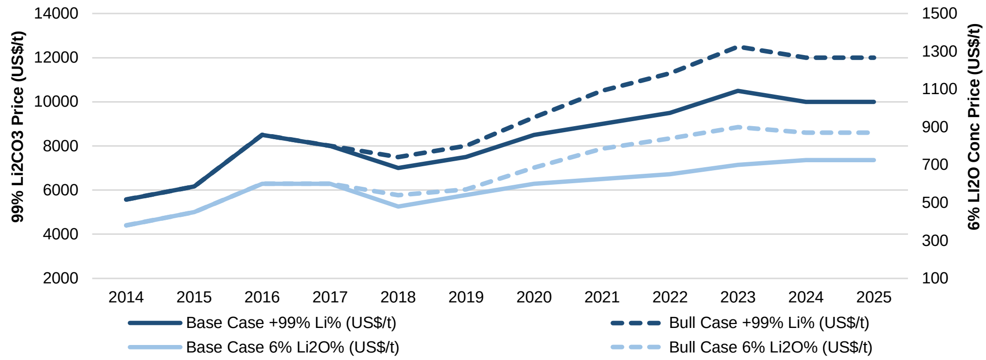
Figure 3: Bull case surplus/(deficit) forecasts



Source: Canaccord Genuity estimates

- Based on these supply/demand projections, we have forecast prices for lithium carbonate (+99% Li) and spodumene concentrate (6% Li_2O), as per Figure 4. Under our base case demand scenario, we estimate prices for lithium carbonate to rise from ~US$6,000/t in 2015 to US$10,000/t in 2025, and spodumene concentrate to rise from ~US$450/t in 2015, to US$725/t in 2025. Under our "bull" case demand scenario, we estimate prices in 2025 of US$12,000/t for lithium carbonate and US$870/t for spodumene concentrate.

Figure 4: CG lithium (LCE) and spodumene concentrate price forecasts



Source: Canaccord Genuity estimates

Canaccord Genuity (Australia) – Lithium sector coverage (valuation changes):

Galaxy Resources (GXY:ASX | SPEC BUY | Target increases from A$0.50 to $0.60)

- GXY is a globally diverse, lithium production and development company. Its key assets include the commissioning-stage Mt Cattlin spodumene operation in Western Australia (subject to 50% earn in by GMM:ASX), the 100-%-owned Sal de Vida lithium brine project in Argentina, and the advanced James Bay spodumene exploration project located in Quebec, Canada.
- We value GXY on a NAV basis, comprising estimated NPV10% for Mt Cattlin, a blended valuation (DCF and market benchmark approach) for Sal de Vida, net of corporate and other adjustments. With increased Li_2CO_3 prices and revisions to our spodumene concentrate pricing assumptions (2018 and 2019 down by 20% and 10% respectively, offset by 20% increases in LT prices), we lift our valuation/target price from A$0.50 to A$0.60.

General Mining Corp. (GMM:ASX | SPEC BUY | Target decreases from A$0.95 to $0.85)

- GMM's primary assets are the right to earn 50% of the Mt Cattlin spodumene project (from GXY:ASX) in Western Australia, and an option to earn 50% of James Bay spodumene exploration project in Quebec, Canada. At Mt Cattlin, GMM's remaining earn in milestone includes the payment of A$18m in cash consideration to GXY, having spent A$7m in restart capital during Q1'16. At James Bay, GMM can earn 50% through A$5m in exploration expenditure over 5 years.
- We value GMM on a NAV basis, comprising our estimated NPV_{10}% for Mt Cattlin, net of corporate and other adjustments. While our LT spodumene concentrate pricing assumptions have increased, medium term forecasts (2018-2019) have decreased by 20% and 10% respectively. As a result, our valuation/target price moves from A$0.95 to A$0.85.

Orocobre Ltd (ORE:ASX; ORL:TSX | BUY | Target increases from A$4.20 to $5.15)

- ORE is a lithium production company, with its primary asset a 66.5% interest in the operating Olaroz lithium brine project, located in Jujuy Province, Argentina. The project is operated under a joint venture with Toyota Tsusho Corporation (25%) and the Jujuy Provincial Government (8.5%). Olaroz commenced Li_2CO_3 production in late 2014, and following an extended commissioning phase, is now ramping up towards nameplate capacity of 17.5ktpa Li_2CO_3, with production costs estimated at <US$2,500/t. Current reserves support a mine life of +40 years.

- We value ORE on a NAV basis, comprising our estimated $NPV_{10\%}$ of future dividends from the Olaroz JV, NPV10% for the Borax operations, net of corporate and other adjustments. Following revisions to our Li_2CO_3 pricing forecasts, we increase our valuation from A$4.20 to A$5.15.

Risk to investment case (see page 58)

- We consider the main upside risks to our forecasts as:
  - Higher than forecast EV penetration rates
  - Increased roll out of residential and stationary grid storage
  - Delays to new supply
- Key downside risks to our forecasts include:
  - Slower than expected EV/grid storage penetration owing to changes in policy (i.e. removal of government subsidies)
  - Constraints on battery manufacturing capacity
  - Successful development of new, low cost lithium extraction technologies
  - Change in battery technology
  - Recycling – recycling of used Li-ion batteries offers a potential new source of lithium which we have not factored into our forecasts. However, we view the potential for recycling of lithium ion batteries as unlikely to meaningfully influence the supply and demand dynamics of the lithium market over the medium term.

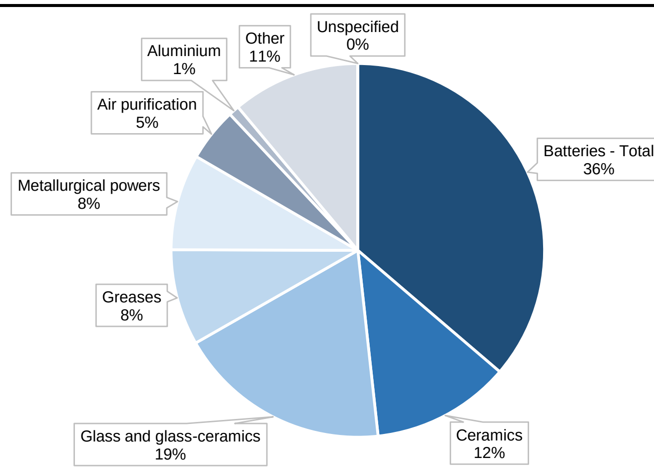
Contents

Lithium – the basics

WHAT IS LITHIUM?

- Lithium ("Li") is a soft, silver-white metal belonging to the Alkali group of metals, which under normal conditions is the lightest of all metals and the least dense solid element. Lithium has a number of unique properties including high electrochemical reactivity, a low thermal expansion co-efficient and high specific heat capacity.
- It is these properties which allow Lithium to be used in a wide range of industrial applications (Figure 5) including ceramics, lubricants and glass, but the largest (and highest growth segment) of the global lithium market is its use in the manufacture of Lithium-ion (Li-ion) batteries (Figure 38; see *"Demand"* page 24).

Figure 5: Lithium use breakdown



Source: signumBox, Canaccord Genuity estimates

- Due to its high reactivity, lithium only occurs naturally as compounds that require various treatment processes to yield specific grades/purities for the various end uses. As such, global lithium production comes in the form of a number of main lithium chemical compounds. These include:
  - Lithium carbonate (Li_2CO_3)
  - Lithium hydroxide (LiOH)
  - Lithium chloride (LiCl)
  - Butyl lithium (Organic compound such as C_4H_9Li).
  - Lithium metal
- Based on the differing purity requirements for each end-use, industry has categorised product specification (i.e. product purity) into 3 broad categories:
  - Industrial grade (+96% Li) - glass, casting powders and greases.
  - Technical grade (~99.5% Li) - ceramics, greases and batteries.
  - Battery grade (>99.5% Li) - high end battery cathode materials.

Figure 6: Various Lithium Carbonate product specifications

Supplier	Element Content (wt%)	Li (min)	H_2O	Na_2O	CaO	Mg	SO4-
FMC	Battery Grade Li_2CO_3	99.5	0.50	0.05	0.04		0.10
Albemarle	Technical Grade Li_2CO_3	99.3	0.60	0.20	0.05		0.10
FMC	Industrial Grade Li_2CO_3	96.0	0.70	0.50	0.10	0.10	0.20

Source: Company websites

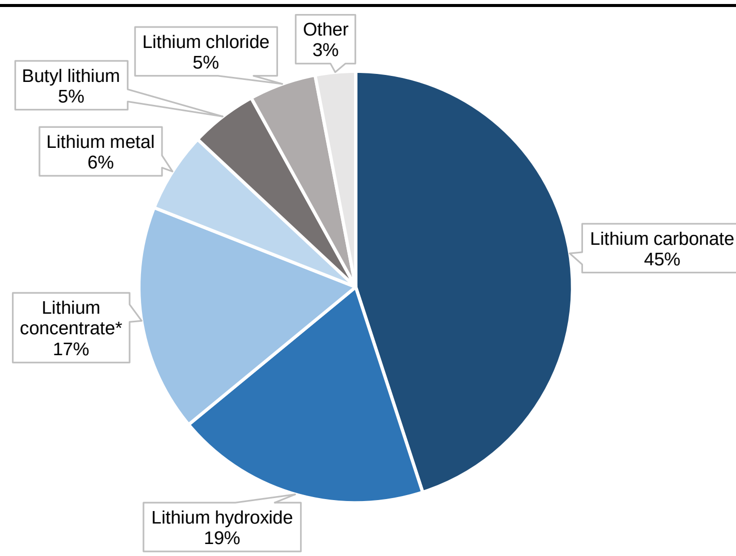
- Industry typically measures lithium and lithium compounds in terms of lithium carbonate equivalent (LCE). As such, we mostly refer to the various lithium compounds as lithium carbonate equivalents (LCE) in this report. Figure 7 below details the various lithium mineral/compound conversion factors:

Figure 7: Li mineral/compound conversion factors

		Convert to Li	Convert to Li_2O	Convert to Li_2CO_3
Lithium	Li	1.000	2.153	5.323
Lithium Oxide	Li_2O	0.464	1.000	2.473
Lithium Carbonate	Li_2CO_3	0.188	0.404	1.000
Lithium Hydroxide	LiOH	0.165	0.356	0.880

Source: Canaccord Genuity

Figure 8: Lithium market – breakdown by compound

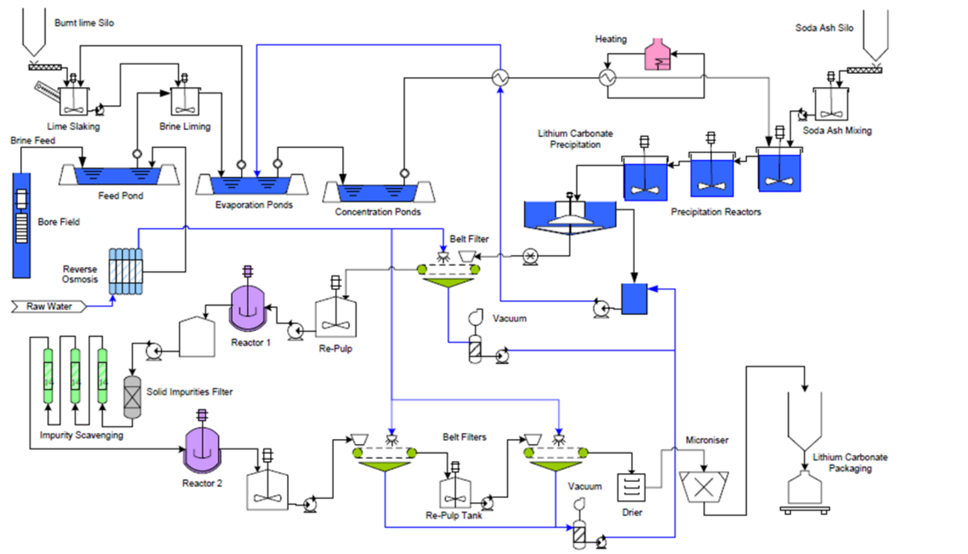


Source: signumBox

MINERAL SOURCES

- Lithium is produced from two primary mineral sources:
  - *Brines*: lithium brine deposits are formed through the leaching of volcanic rocks in basin depositional environments. Li is extracted from brines via a process involving the pumping of brine from the sediment basin, concentration via evaporation, and purification through solvent extraction, absorption, and ionic exchange, with the end product mainly in the form of refined Li_2CO_3. Lithium is unusually more soluble at lower temperatures than similar Alkali metals such as sodium and potassium and it is this property that provides the design basis for lithium brine processing.

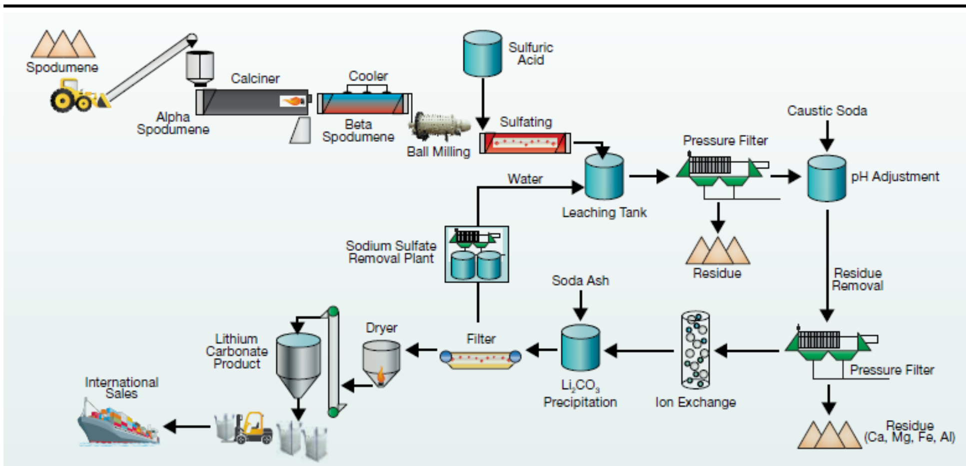
Figure 9: Flowsheet for lithium recovery from brines – Black line indicates flow of Li_2CO_3product



Source: Company Reports

– *Hard rock spodumene deposits*: Spodumene is a lithium-bearing, aluminium silicate mineral which mostly occurs in lithium-rich pegmatites (granite-like igneous rock composed of quartz, feldspar and mica). Spodumene is usually recovered through conventional open pit mining methods and beneficiated via gravity techniques where the ore is concentrated from 1-2% Li_2O to a grade of ~6% Li_2O. This concentrate product is then converted to Li_2CO_3 (>99.5% purity) through intensive thermal and hydrometallurgical processing (roasting > leaching > ion exchange) conducted at chemical converter plants mostly located within China.

Figure 10: Flowsheet of conversion process from spodumene concentrate to Li_2CO_3



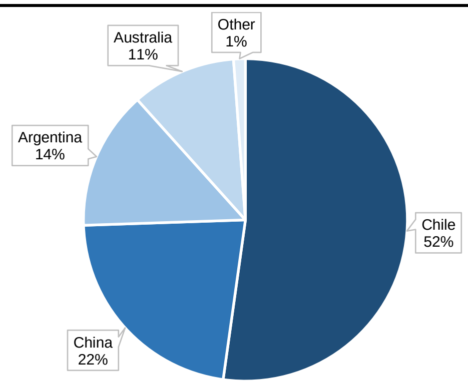
Source: Company reports

- Lithium can also be found in large concentrations in clay deposits, with the primary clay mineral being hectorite. Hectorite is a soft, greasy white mineral, and is formed through the weathering of volcanic rocks and micas. While there are presently no operating lithium clay projects, several companies are assessing the potential to enter production from Li-bearing clays via a process involving the separation of gangue minerals via scrubbing/cyclones/reverse flotation, followed by roasting (at +1000°C) and gypsum addition to produce a lithium sulphate product. This then undergoes leaching, filtration and precipitation before final product sizing to produce a 99.5% LCE product. Li concentration in clay deposits are typically lower than other hard rock lithium deposits such as spodumene (<0.3% Li_2O vs >1% Li_2O), but can be significantly more extensive in terms of overall deposit size.

GLOBAL RESOURCES

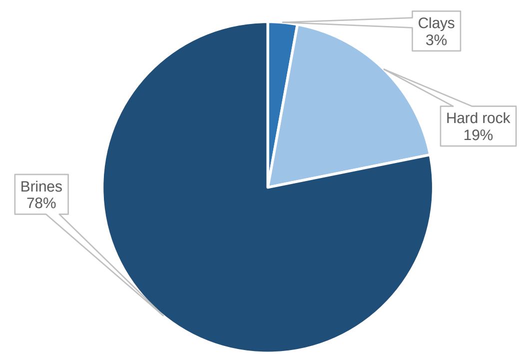
- The USGS estimates (2015) global lithium reserves at 14.3 Mt, or, 76.5Mt of LCE, with the largest known reserves in Chile (primarily at the Salar de Atacama). This Figure excludes resources at the massive Salar de Uyuni in Bolivia, with estimates (USGS) of a further 48 Mt LCE in resources.
- We estimate that approximately 78% of the world's lithium resources are hosted in brine deposits, mostly in Chile, Argentina and Bolivia. Of hard rock resources, the largest deposits include Greenbushes (Western Australia), Jadar (Serbia), and the lithium clay deposit at Sonora (Mexico).

Figure 11: Global lithium reserves by country



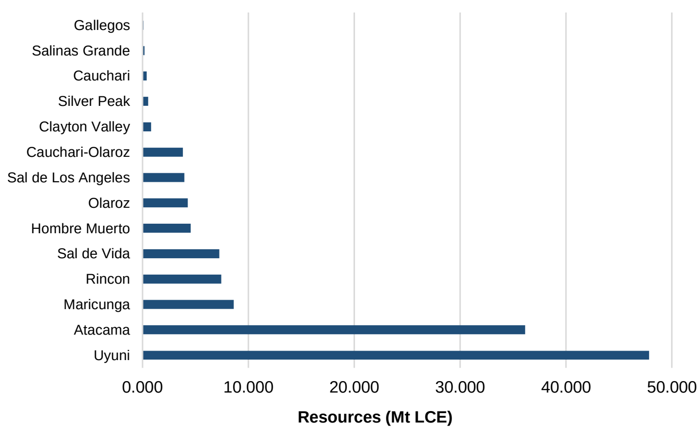
Source: US Geological Survey

Figure 12: Lithium resources by deposit type



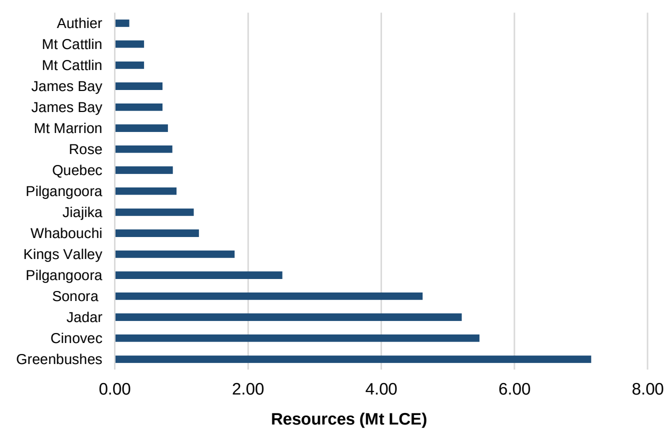
Source: SNL Mining, Company reports, Canaccord Genuity estimates

Figure 13: Brine resources (LCE)



Source: SNL Mining, Company Reports, Canaccord Genuity estimates

Figure 14: Hard rock resources (LCE)



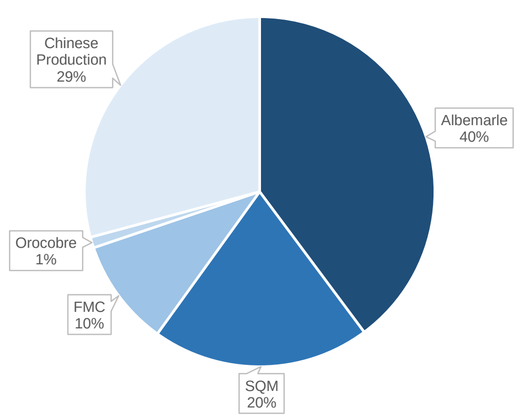
Source: SNL Mining, Company Reports, Canaccord Genuity estimates

- Based on 2015 demand estimates of 176k t LCE, global reserves (excluding Uyuni resources) are sufficient to support over 430 years of production. However, we highlight that while the lithium sector is not resource constrained, profitable extraction of lithium has been a bottleneck in the past, with factors such as supply/demand dynamics (especially in the case of hard rock deposits) and geography/chemistry (in the case of brines) acting as impediments to increased supply.

Current Market Supply

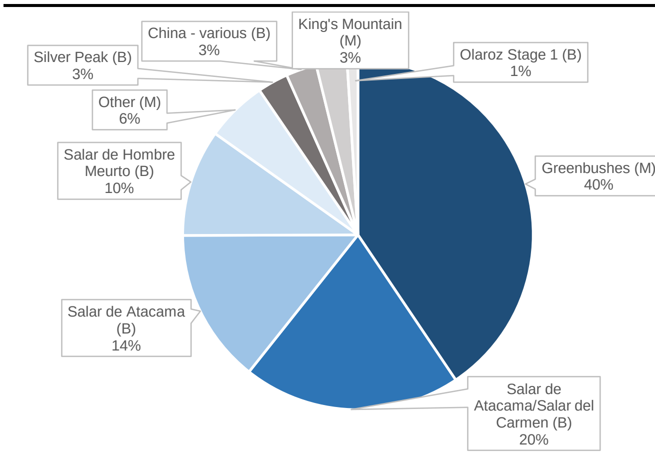
- We estimate global Li supply in 2015 at 176kt LCE, with primary mine production (i.e. extraction of lithium from mineral deposits) dominated by a handful of large, diversified chemical companies. These include Albemarle (ALB:NYSE | Not rated), FMC Corporation (FMC:NYSE | Not rated), and Sociedad Química y Minera de Chile (SQM:NYSE | Not rated). An estimated break-down of their respective share of world production is shown in Figure 15.
- China is also key player in global lithium supply, representing an estimated 29% of global production in 2015. Sichuan Tianqi Lithium Industries (Tianqi) is the largest, based on its 51% ownership of the Greenbushes hard rock operation. It's important to note the distinction between primary mineral and concentrate production from brines/hard rock, versus downstream conversion of mineral concentrates. China produces almost all of the world's refined lithium from mineral concentrates.

Figure 15: 2015 global lithium production breakdown



Source: Company report, signumBox, Canaccord Genuity estimates

Figure 16: 2015 global lithium production by operation



Source: Company reports, signumBox, Canaccord Genuity estimates; B – brine operation; M – hard rock operation

BRINE PRODUCTION

- As can be seen in Figure 17 below, there are relatively few operating brine projects globally. We estimate that approximately 51% (~90kt) of global LCE production in 2015 was sourced from brine operations, with the world's largest being Salar de Atacama (34% global share combining both Albemarle's and SQM separate operations).

Figure 17: Estimated lithium brine production (LCE) – 2014-2015

Existing Supply - brine					2014	2015
Company	**Operation**	**Location**				
Albemarle	Salar de Atacama	Chile	Production	t	27354	25200
			% global share		15%	14%
			Capacity utilisation		55%	50%
	Silver Peak	USA	Production	t	5000	5000
			% global share		3%	3%
			Capacity utilisation		88%	88%
SQM	Salar de Atacama/Salar del Carmen	Chile	Production	t	36390	35473
			% global share		20%	20%
			Capacity utilisation		76%	74%
FMC	Salar de Hombre Meurto	Argentina	Production	t	19295	17460
			% global share		11%	10%
			Capacity utilisation		96%	87%
Orocobre	Olaroz Stage 1	Argentina	Production	t	0	1762
			% global share		0%	1%
			Capacity utilisation			10%
China - various	Various	China	Production	t	13268	5000
			% global share		7%	3%
			Capacity utilisation		37%	14%
			TOTAL BRINE	**t**	**101307**	**89895**
			Capacity utilisation		63%	51%

Source: USGS, signumBox, Company Reports, Canaccord Genuity estimates

Capacity utilisation

- We estimate that brine production was operating at only 55% utilisation in 2015 (excludes Olaroz which was in commissioning/ramp up). This low capacity utilisation rate is a key characteristic of the lithium brine sector, as it demonstrates that despite evidence of an improved demand outlook in recent years, existing producers have not been able to increase production.
- Key factors behind low capacity utilisation rates and hurdles to increasing production include:
  - Atacama (Albemarle/SQM): constraints on increased production were primarily related to permitting and licensing issues relating to the volume of brine that was permitted to be extracted from the salar. For Albemarle, increased brine volumes had been slated to feed the recently completed La Negra LiOH plant in Chile (20ktpa LCE). Note that in Q1'16 Albemarle successfully concluded negotiations with the Chilean government to increase brine pumping volumes from 80,000m^3/year to 170,000m^3/year which is expected to allow for annual production of 70kt (for 27 years based on reserves) LCE annually from 2017 (subject to construction of additional processing capacity).
  - Figure 18 below reflects planned plant capacity only noting timing is estimated and subject to change. Not pictured is the estimated 3 year ramp-up for plants to reach full utilization after coming on-line.
  - At the time of writing, SQM had not been granted similar concessions, and has reportedly lodged an injunction against Albemarle's permit extension.

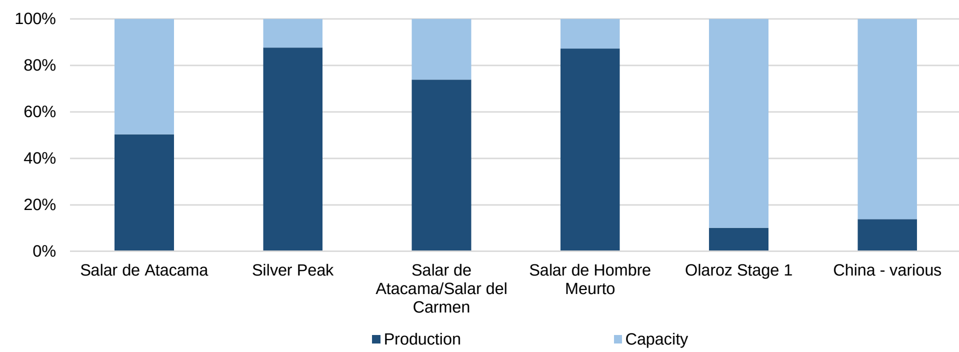
Figure 18: Regulatory parameters at Salar de Atacama

Company	Surface (km^2)	Max Brine Consumption (l/s)	Current Capacity (LCE/year)	2015 Production	Capacity Utilisation (%)	Contract Expiration	Quota (T Li)	LOM Production at end 2015 (T Li)
SQM	819	1700	48000	35473	74%	2030	180100	91000
Albemarle	167	142 ↑ 442	48000	25200	53%	5 year renewal	200000	84735

Source: signumBox

- Hombre de Muerto (FMC): production levels have been reported to have been impacted by technical issues relating to unlined evaporation ponds and stressed relations with local government (leading to temporary cutting off of water supply).
- Olaroz (Orocobre): commissioning and production ramp up behind schedule.

Figure 19: Lithium brine capacity utilisation (2015)

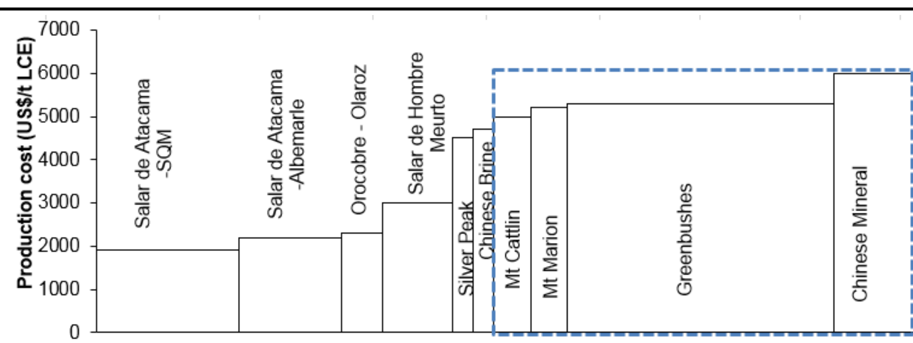


Source: USGS, signumBox, Company Reports, Canaccord Genuity estimates; Note: Olaroz in commissioning and ramp up

Production costs

- Production costs from brine operations are typically much lower than those of hard rock operations. This is due primarily to the relatively lower cost of pumping brine from an aquifer versus conventional hard rock mining involving drill, blast, excavation and ore haulage. Furthermore, the production process from brines typically results in the production of a refined Li_2CO_3, versus production from hard rock operations which involves concentration of ore, freight, and a significant cost to convert the concentrate to Li_2CO_3 (US$2,500-3,000/t) most often undertaken by third parties.
- This is illustrated below in Figure 20, which depicts our estimated global production cost curve (2016e).

Figure 20: Global production cost curve (2016e) with hard rock operations highlighted*



Source: Company Reports, signumBox, Canaccord Genuity estimates
* Non-brine cost estimates assumes chemical conversion costs of US$2500/t.

HARD ROCK PRODUCTION

- As is the case with brine operations, there are also relatively few hard rock operations currently in production (Figure 21). We estimate that production from hard rock sources totalled 87kt LCE in 2015 (49% global share), and of this, Albemarle/Tianqi's Greenbushes operation in Western Australia dominates market share with production of 72kt LCE.

Figure 21: Estimated hard rock production (LCE) – 2014-2015

Existing Supply - Mineral				2014	2015
Company	**Operation**	**Location**			
Albemarle 49%	Greenbushes	Australia	Production	63932	71631
Tianqi (51%)			% global share	36%	41%
			Capacity utilisation	58%	65%
Albemarle	King's Mountain	USA	Production	4400	5000
			% global share	2%	3%
			Capacity utilisation	40%	45%
China - various	China - various	China	Production	10000	10000
			% global share	6%	6%
			Capacity utilisation	25%	
Rest of World	Various	China/Zim/Port.	Production	0	0
			% global share	0%	0%
			Capacity utilisation		
			TOTAL MINERAL	78332	86631
			Average Utilisation	44%	49%

Source: Company Reports, Canaccord Genuity estimates

Capacity utilisation

- We discuss capacity utilisation for hard rock lithium production in terms of converter plant capacity. We estimate that following significant investment in production capacity in recent years, Chinese converter plant capacity utilisation was approximately 46% in 2015.
- Moving upstream to mine production, the world's largest source of spodumene concentrates, Greenbushes, is estimated to be currently operating at ~65% of capacity.

Production costs

- The two key components of production costs for refined lithium compounds from hard rock mineral sources are the purchase of spodumene concentrate (factors in mining, processing, and freight costs, plus mining company margin), and conversion of the concentrate to lithium carbonate/lithium hydroxide.
- In Figure 22 below, we illustrate how spodumene concentrate prices can influence lithium carbonate production costs, which in itself, can act as a benchmark for lithium carbonate prices given an estimated 49% of the world's LCE is produced from hard rock/converter sources.

Figure 22: Spodumene concentrate – converter production costs

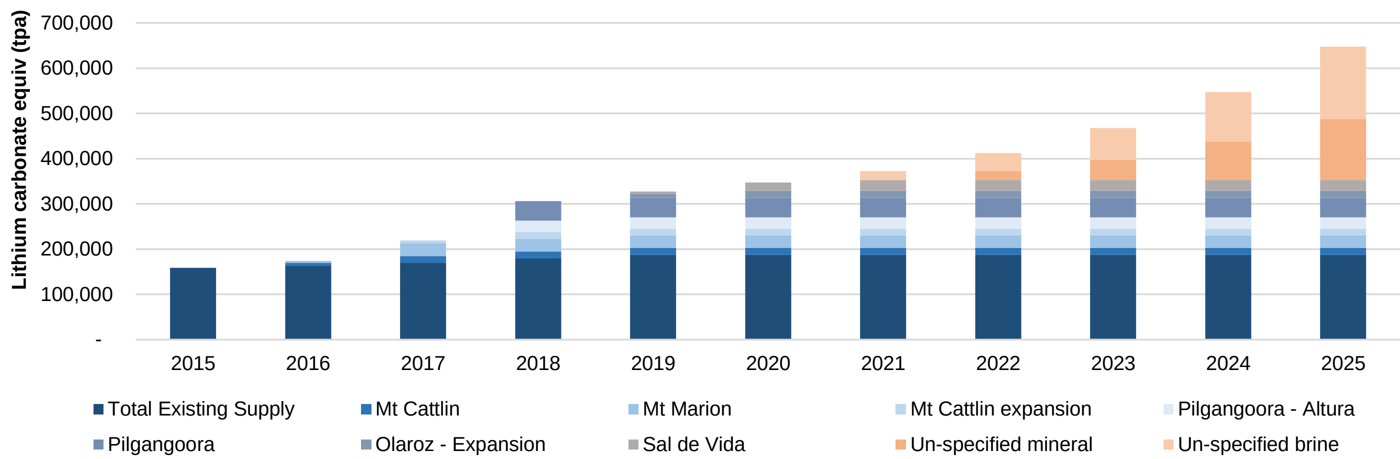
Spodumene concentrate	**US$/t**	**450**	**600**	**750**
Factor @ 6% Li_2O		6.69	6.69	6.69
Conversion recovery	%	93%	93%	93%
Input cost of concentrate	US$/t	2,800	4,316	5,395
Conversion cost to +99% LCE	US$/t	2,500	2,500	2,500
Total cost/tonne Li_2CO_3	**US$/t**	**5,300**	**6,816**	**7,895**
Assumed converter margin	*%*	*20%*	*20%*	*20%*
Effective LCE price	*US$/t*	*6360*	*8179*	*9474*

Source: Canaccord Genuity estimates

Projected supply

- Figure 23 below depicts our modelled projected supply forecasts.

Figure 23: Projected market supply curve



Source: Canaccord Genuity estimates

Figure 24: Projected supply by operation/project

		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Salar de Atacama	t LCE	25,200	27,000	30,000	40,000	47,500	47,500	47,500	47,500	47,500	47,500	47,500
Silver Peak	t LCE	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Atacama/Salar d Carmen	t LCE	35,473	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Salar de Hombre Meurto	t LCE	17,460	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Olaroz Stage 1	t LCE	1,762	13,100	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000
China brine - various	t LCE	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Greenbushes	t LCE	71,631	71,631	71,631	71,631	71,631	71,631	71,631	71,631	71,631	71,631	71,631
King's Mountain	t LCE	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Other	t LCE	10,000	-	-	-	-	-	-	-	-	-	-
Total Existing Supply	t LCE	*176,526*	*184,731*	*191,631*	*201,631*	*209,131*	*209,131*	*209,131*	*209,131*	*209,131*	*209,131*	*209,131*
Mt Cattlin	t LCE	-	6,500	15,200	15,200	15,200	15,200	15,200	15,200	15,200	15,200	15,200
Mt Marion	t LCE	-	5,000	28,500	28,500	28,500	28,500	28,500	28,500	28,500	28,500	28,500
Mt Cattlin expansion	t LCE	-	-	6,000	14,250	14,250	14,250	14,250	14,250	14,250	14,250	14,250
Pilgangoora - Altura	t LCE	-	-	-	25,650	25,650	25,650	25,650	25,650	25,650	25,650	25,650
Pilgangoora	t LCE	-	-	-	42,750	42,750	42,750	42,750	42,750	42,750	42,750	42,750
Olaroz - Expansion	t LCE	-	-	-	-	9,000	15,300	15,300	15,300	15,300	15,300	15,300
Sal de Vida	t LCE	-	-	-	-	4,954	18,715	23,750	23,750	23,750	23,750	23,750
Unspecified mineral	t LCE	-	-	-	-	-	-	-	20,000	45,000	85,000	135,000
Unspecified brine	t LCE	-	-	-	-	-	-	20,000	40,000	70,000	110,000	160,000
Total New Supply		-	*11,500*	*49,700*	*126,350*	*140,304*	*160,365*	*185,400*	*225,400*	*280,400*	*360,400*	*460,400*
TOTAL SUPPLY	**t LCE**	**176,526**	**196,231**	**241,331**	**327,981**	**349,435**	**369,496**	**394,531**	**434,531**	**489,531**	**569,531**	**669,531**

Source: Canaccord Genuity estimates

PROJECTED SUPPLY - ASSUMPTIONS

Existing Supply - capacity utilisation

- In deriving our market supply forecasts, we have assumed existing operations remain at current levels of production, with no change to our estimated capacity utilisation as shown in Figures 21 and 22, except for the following:
  - *La Negra expansion, 20ktpa from (Albemarle, brine)*: La Negra is located near Antofagasta, Chile, and comprises a Li_2CO_3 production facility which initially commenced production in 1984. The facility commenced production of LiCl in

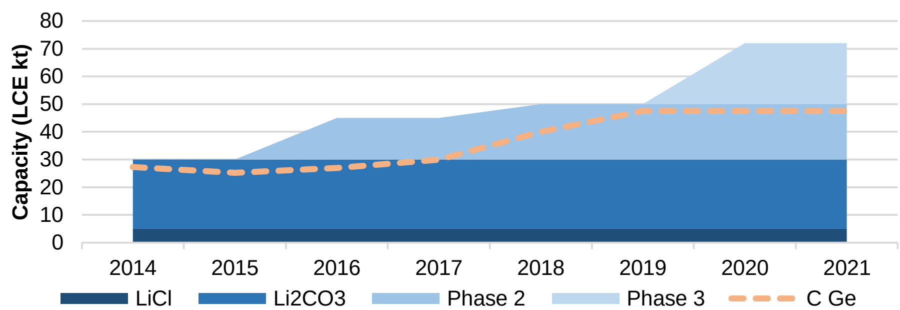
1998, with total production capacity of 30ktpa LCE. It was subsequently expanded to include a LiOH circuit, with total additional capacity of 20ktpa LCE. Utilisation of this additional capacity at La Negra has been limited by restrictions on brine extraction volumes imposed by CORFO (Corporación de Fomento de la Producción de Chile; Chilean economic development organisation) as part of the original lease agreements at Salar de Atacama (see Figure 18)

In Feb'16. Albemarle was granted approvals by the Chilean Environmental Assessment Commission to increase its brine extraction rate to support production of up to 50ktpa LCE. Further, Albemarle also announced that it had signed an MoU with the Chilean government which defined terms for an increase in the total lithium production to 70ktpa LCE + 6ktpa LiCl over 27 years, to be supported by the construction of a third production facility.

We note that it has been reported however that SQM has requested Chilean authorities to invalidate the MoU on the grounds of violations of environmental regulations during the evaluation process.

Our modelled assumptions see the La Negra expansion achieving steady state production (90% of 20ktpa LCE) in 2019. We have not modelled a phase 3 expansion in our forecasts.

Figure 25: Proposed profile at Albemarle's Salar de Atacama Operation



Source: Company Reports, Canaccord Genuity estimates

– Olaroz Stage 1 (Orocobre): we currently expect Olaroz to achieve steady state production (90% of 17.5ktpa nameplate capacity) by end 2016.

New Supply

- Our research has revealed 19 advanced lithium projects globally, which could achieve production within the next 5-6 years (Figure 26). Of this, we expect two to commence production before the end of 2016, with the balance still at feasibility study stage.
- As part of our supply side modelling, we have categorised our modelled new supply sources into various categories (Figure 27). These include:
  - Committed (funded, construction/commissioning, production within 12 months),
  - Uncommitted (feasibility completed within 6 months, relatively modest funding hurdles, proven extraction processes and relatively low technical risk, resource quality considerations with production potentially achieved within 3 years), and
  - Unspecified (these projects are those that have completed feasibility studies, but have materially higher capital costs or propose to employ extraction technologies that are yet to be proven at commercial scale, and have uncertain

lead times to production, but could potentially achieve production within 5 years).

Figure 26: Global lithium development projects

Project	Company	Location	Ownership	Type	Status	Resources	Grade	LCE Resources	Brine Chemistry	
						Mt/km^3	(%Li_2O/ ppm Li)	Mt	ppm K	Mg:Li
Sal de Vida	Galaxy Resources	Argentina	100%	Brine	DFS	1.8	753	7.3	8,377	2.4
Cauchari-Olaroz	Lithium Americas[3]	Argentina	45%	Brine	DFS	2.4	670	3.8	5,127	2.9
Sal de Los Angeles	Lithium Energy X[4]	Argentina	80%	Brine	PFS	1.7	556	4.0	6,206	3.5
Rincon	Sentient - Enirgi Group	Argentina	100%	Brine	Feasibility	3.5	397	7.4	7,513	8.6
Gallegos	Everlight Resources	Argentina	100%	Brine	Scoping	0.0	684	0.1	7,404	1.4
Clayton Valley	Pure Energy Minerals	USA	100%	Brine	Scoping	1.5	102	0.8	5,655	1.4
Mt Cattlin	Galaxy/General Mining[1]	Australia	Various	Mineral	Pre-prod'n	16.4	1.1%	0.9		
Mt Marrion	Ganfeng/Min Res/Neometals[2]	Australia	Various	Mineral	Pre-prod'n	23.2	1.4%	1.7		
Quebec	RB Energy	Canada	100%	Mineral	C&M	50.3	0.7%	0.9		
Pilgangoora	Altura Minerals	Australia	100%	Mineral	PFS	35.7	1.1%	0.9		
Whabouchi	Nemaska Reosurces	Canada	100%	Mineral	DFS	32.7	1.6%	1.3		
Pilgangoora	Pilbara Minerals	Australia	100%	Mineral	PFS	80.2	1.3%	2.5		
Kings Valley	Lithium Americas	USA	99%	Mineral	PFS	234.4	0.3%	1.8		
Sonora	Bacanora Minerals	Mexico	70%	Mineral	PFS	719.0	0.3%	4.6		
Authier	Glen Eagle Resources	Quebec	100%	Mineral	PFS	9.1	1.0%	0.2		
James Bay	Galaxy/General Mining[1]	Canada	50%	Mineral	Scoping	22.2	1.3%	1.5		
Cinovec	European Metal Holdings	Serbia	100%	Mineral	Scoping	514.8	0.4%	5.5		
Rose	Critical Elements Corp	Canada	100%	Mineral	Scoping	37.2	0.9%	0.9		
Jadar	Rio Tinto	Serbia	100%	Mineral	Scoping	117.0	1.8%	5.2		

Source: Company Reports, Canaccord Genuity
1 General Mining earning 50%
2 Ganfeng 43%, Mineral Resources 43%, Neometals 14%
3 SQM earning 50%
4 earning 80%

Figure 27: New supply – committed vs uncommitted vs unspecified

COMMITTED					UN-COMMITTED					UN-SPECIFIED				
Project	Status	Capex	Prod'n	Timing	Project	Status	Capex	Prod'n	Timing	Project	Status	Capex	Prod'n	Timing
		US$m	ktpa LCE				US$m	ktpa LCE				US$m	ktpa LCE	
Mt Cattlin (M)	Comm.	A$8m	16	Q2'16	Pilgangoora[1] (M)	PFS	A$180m	45	Q1'18	Cauchari-Olaroz (B)	PFS	n/a	40	n/a
Mt Marrion (M)	Const'n	US$89m	28	Q4'16	Pilgangoora[2] (M)	PFS	A$130m	27	Q1'18	Sonora (M)	PFS	US$417m	35	2019
					Mt Cattlin Expan	n/a	A$14m	14	2018	Whabouchi (M)	PFS	US$439m	28	n/a
					Olaroz Stage 2 (B)	DFS	US$140m	15	2019	Rose (M)	PEA	C$305m	27	n/a
					Sal de Vida (B)	DFS	US$369m	25	2019	Quebec Lith. (M)	C&M	n/a	20	n/a
										Rincon (B)	Scoping	n/a	n/a	n/a
										Clayton Valley (B)	Pilot	n/a	n/a	n/a
										S d Los Angeles (B)	PFS	US$144m	15	n/a
										Kings Valley (M)	PFS	US$250m	26	n/a
										James Bay (M)	Scoping	n/a	n/a	n/a
										Authier (M)	PFS	US$15m	15	n/a
										Jadar (M)	Expl'n	n/a	n/a	n/a
										Cinovec (M)	Scoping	US$326m	19	n/a
										Gallegos (B)	Scoping	US$90m	8	n/a

Source: Company Reports, Canaccord Genuity estimates
1 Pilbara Minerals, 2 Altura Mining

Committed New Supply

- Our research indicates that there are only two committed sources of new supply expected to come into the market in the coming 18 months. These include Galaxy Resources/General Mining's Mt Cattlin spodumene operation (commissioning) and the under construction Mt Marrion spodumene project owned by a consortium consisting of Jiangxi Ganfeng Lithium, Mineral Resources and Neometals.

- *Mt Cattlin (Galaxy Resources 50%/General Mining earning 50%; Mineral)*: The Mt Cattlin spodumene project is located near the town of Ravensthorpe in Western Australia. It was previously in operation from 2011-2012 (placed on care and maintenance in 2012), with concentrate supplied to Galaxy's then owned 17.5ktpa Li_2CO_3 chemical conversion plant located in Jiangsu, China.

  In 2015, Galaxy announced that it would re-commence production at Mt Cattlin, with newly formed joint venture partner General Mining funding re-start capital to earn a 50% project interest (plus A$18m in cash consideration). The project is capable of producing 120ktpa of +5.5% Li_2O spodumene concentrate (~16ktpa LCE), with estimated operating costs of ~A$300/t (net of tantalum by-product credits). Nameplate production is expected from Q1'17 (commissioning commenced in Q2'16).

  There is potential to increase production to +205ktpa of spodumene concentrate (~28ktpa LCE) from 2018. Galaxy/General Mining have secured offtake for 60ktpa of concentrate at US$600/t for CY16, and 120kt of concentrate in CY17.

- *Mt Marion (Jiangxi Ganfeng Lithium 43%/Mineral Resources earning 43%/Neometals diluting to 14%; mineral)*: Mt Marion is located 40km from Kalgoorlie, Western Australia. The project is currently under construction, with a planned total production capacity of 280ktpa spodumene concentrate (200ktpa 6% Li_2O + 80ktpa 4% Li_2O), or, 28ktpa LCE. Feasibility studies (2012) estimated total establishment capital of US$89m.

  First production is scheduled for Q3'16, and nameplate production during 1H'17. LOM offtake (100% take or pay) has been secured with Ganfeng.

Un-committed new supply

- There are a further four additional sources of new supply in the uncommitted category. These projects are at an advanced stage with completion of definitive feasibility studies expected in the next 6 months, relatively modest capital hurdles, and potential to enter production within 3 years. We note that projects residing in this category are yet to secure full funding for project development.
  - *Pilgangoora (Pilbara Minerals 100%; mineral)*: Pilgangoora is located in the Pilbara region of Western Australia, 90km from Port Hedland. The project features a substantial resource comprising 80Mt at 1.27% Li_2O, equivalent to 2.5 Mt LCE. A PFS was completed in Q1'16 which assessed the viability of a 2Mtpa open pit project, producing 330ktpa of 6% Li_2O spodumene concentrate (~45ktpa LCE) and 274,000lbpa of tantalite, over an initial 15 year mine life. Project capital was estimated at A$180m, with operating costs estimated at US$205/t concentrate product FOB. The reported development schedule suggests first production can be expected in late CY17/early CY18.
  - *Pilgangoora (Altura Minerals 100%; mineral)*: located adjacent to Pilbara Minerals' Pilgangoora project, Altura's project hosts resources of 35.7Mt at 1.1% Li_2O, equivalent to 0.9 Mt LCE. A PFS was completed in Apr'16 which demonstrated the viability of a 1.4Mtpa OP operation, producing 215ktpa of 6% Li_2O spodumene concentrate (~27ktp LCE) over 14 years. The PFS estimated capital costs of A$130m, and operating costs of A$298/t concentrate product FOB. A DFS is planned for completion by Q3'16, with first production currently scheduled for late 2017/early 2018. Altura has secured offtake for planned production, with a binding agreement with China-based group, Lionergy, covering 100ktpa for 5 years, and an additional MoU with Chinese Li-ion battery maker, Optimum Nano, covering 100-150ktpa for the LOM.

- *Olaroz Stage 2 (Orocobre 66.5%, brine):* Olaroz Stage 2 expansion envisages an increase in production capacity from 17.5ktpa to 35ktpa Li_2CO_3. Detailed studies on the expansion have commenced, with Orocobre suggesting commencement of construction in CY17, with total estimated capital costs of US$140m.

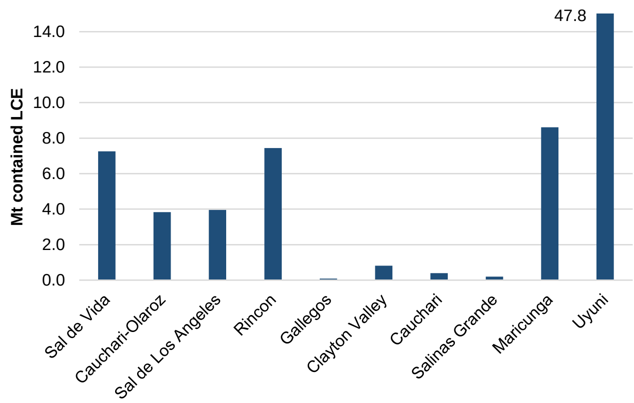
  We currently assume Stage 2 to commence production in 2019 following a 2 year construction and commissioning.
- *Sal de Vida (Galaxy Resources 100%, brine)*: Sal de Vida is located in the Catamarca and Salta provinces in Argentina. A DFS was completed in 2013 which contemplated a +40 year, 25ktpa LCE and 95ktpa potash project, with capital costs of US$369m and production costs (net of potash by products) of US$2,200/t.

  Galaxy has commenced a review of the DFS (expected to be completed in mid'16), with a view to updating project parameters, capex and operating costs. Our current assumptions are based on the 2013 DFS, with 25ktpa LCE production capacity. We currently assume Sal de Vida achieves first production from 2019.

Unspecified new supply

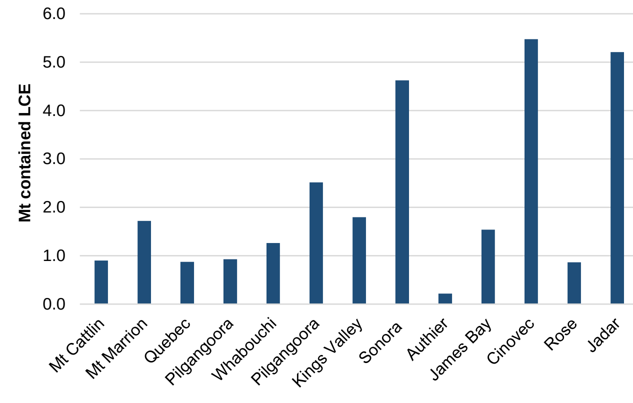
- As per Figure 27, we have identified a number of potential new sources of supply (both brine and hard rock) that could achieve production within 5-6 years. However, we highlight that these projects are mostly at earlier stages of development, are proposing to utilise un-proven extraction/processing techniques, have relatively high capital costs or uncertain lead times to production.
- Given the current uncertain nature of various aspects of these projects, we have categorised them into our unspecified category, which in our supply/demand model would constitute "likely" new supply in the event of significant increases in market demand.
- In Figures 28 to 35 on the following page, we compare what we consider to be the key attributes to assess the potential of projects in our unspecified category and the order/timeframe on which they may be brought into production. These include:
  - Brines – chemistry (grades and impurity levels such as magnesium and boron have an impact capital and operating costs), capex, and lead time to production.
  - Hard rock – grade (impacts operating costs via achieving required concentrate specifications and acceptance among converters), and capital costs.

Figure 28: Contained LCE resources – Brine deposits



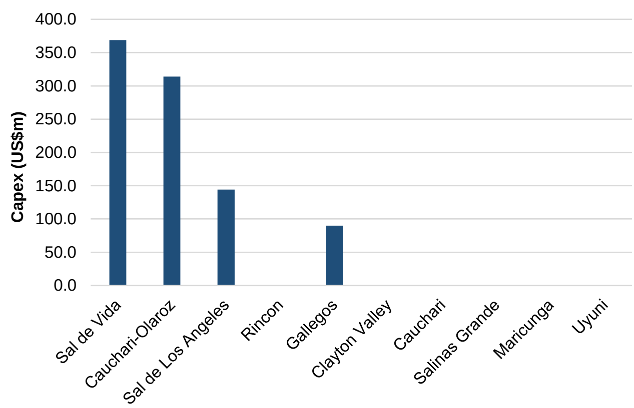
Source: Company Reports, SNL Mining, Canaccord Genuity estimates

Figure 29: Contained LCE resources – Hard rock deposits



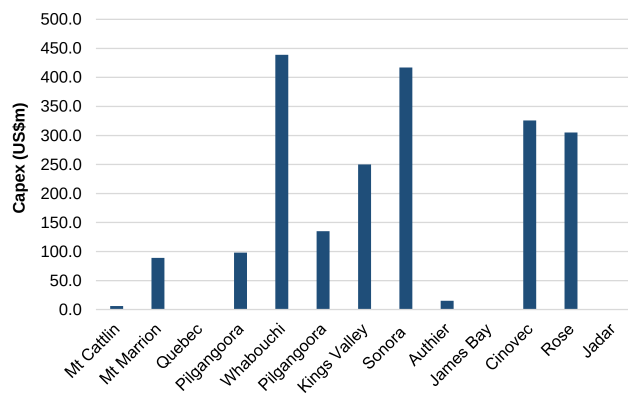
Source: Company Reports, SNL Mining, Canaccord Genuity estimates

Figure 30: Capital costs (brines)



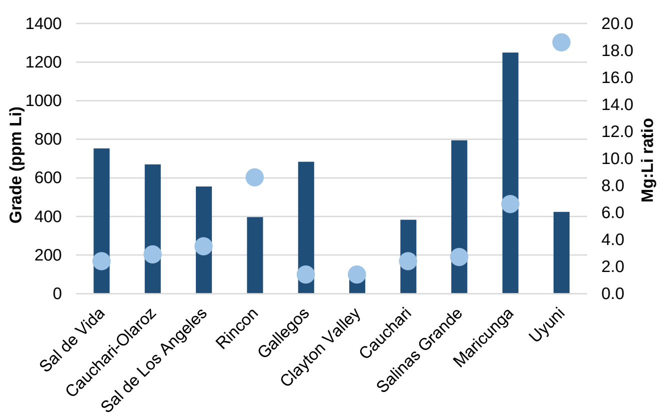
Source: Company Reports, Canaccord Genuity estimates

Figure 31: Capital costs (hard rock)



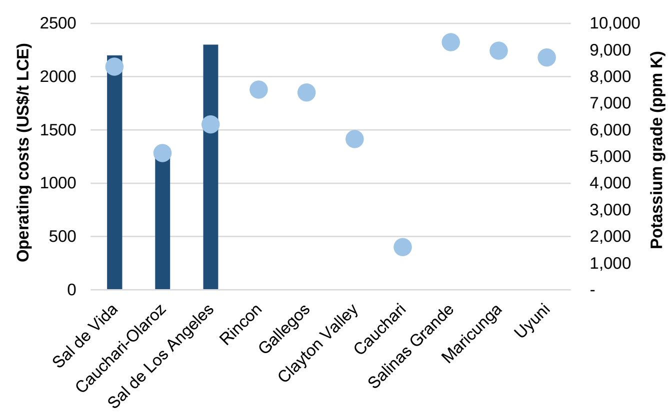
Source: Company Reports, Canaccord Genuity estimates

Figure 32: Brine deposit chemistry



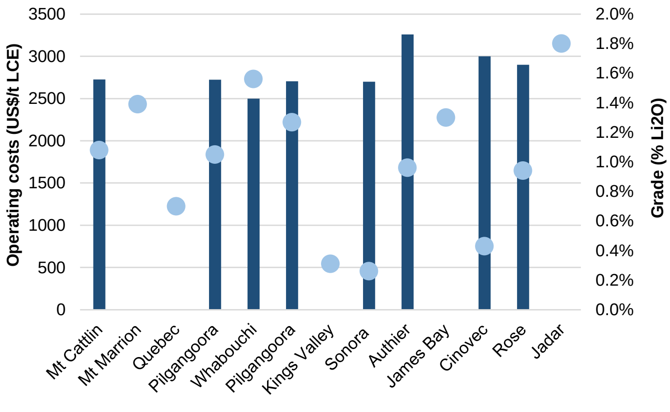
Source: Company Reports, Canaccord Genuity estimates

Figure 33: Operating costs & by product grades



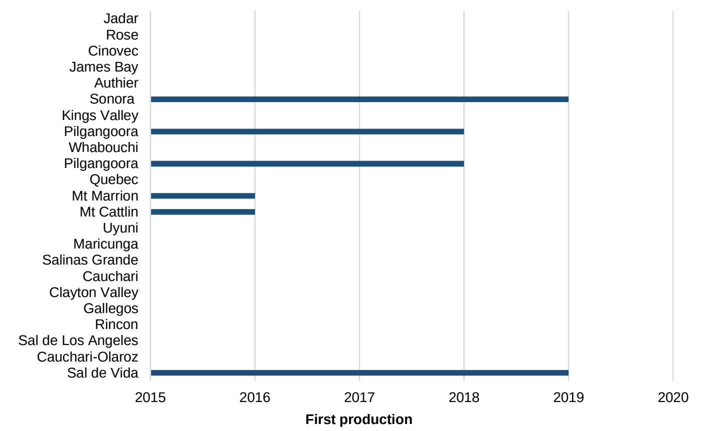
Source: Company Reports, Canaccord Genuity estimates

Figure 34: Operating costs & grades (hard rock)



Source: Company Reports, Canaccord Genuity estimates

Figure 35: Lead time to production*



Source: Company Reports, Canaccord Genuity estimates
*where companies have announced project development schedules

- Projects that are classified under the Unspecified new supply category include:
  - *Cauchari-Olaroz (Lithium America 100%/SQM earning 50%; brine)*: Cauchari Olaroz is located in Jujuy Province, Argentina, adjacent to Orocobre's Olaroz operation. A PFS was completed in 2013, which assessed a 20ktpa Li_2CO_3 + 40ktpa potash project. Capex was estimated at US$314m, with operating costs of US$1,332/t (net of potash credits). The project had been subject to a potential partnership with POSCO for the deployment of a proprietary Li_2CO_3 and LiOH extraction technology, however, POSCO withdrew from the project in early 2016. In Apr'16, Lithium Americas announced it had entered into an agreement with SQM, whereby SQM could earn 50% of the project through spending US$10m on a feasibility study for a 40ktpa Li_2CO_3 project and making a US$25m equity investment in Lithium America.
  - *Sonora (Bacanora 70%; lithium clay deposit; mineral)*: Sonora is a lithium bearing clay deposit (hectorite), located in northern Mexico, and hosts resources of 719Mt at 0.31% Li_2O, for 4.62Mt LCE. An updated PFS was completed in 2016, which assessed a staged project with potential to produce up to 35ktpa LCE. The project is designed around a production process incorporating the removal of clay gangue to produce a concentrate, roasting, leaching and ion exchange to produce a refined Li_2CO_3 product. The PFS estimated capital costs totalling US$417m for full production capacity of 35ktpa LCE. The current reported timetable calls for pilot plant trials to commence in Q3'17, and subject to outcomes of the pilot program, first production in late 2018.
  - *Whabouchi (Nemaska 100%; mineral)*: Whabouchi is located in Northern Quebec, Canada. The project hosts resources of 37.2 Mt at 1.56% Li_2O for 1.26 Mt LCE. An updated PFS was completed in early 2016, which assessed a 26 year, OP+UG project, producing 28ktpa LCE (27.5ktpa LiOH and 3.2ktpa Li_2CO_3) through construction of a concentrator and offsite (300km road/rail to Shawinigan, Quebec) hydrometallurgical plant (roast > leach > ion exchange > electrolysis). Capex was estimated at US$439m, and production costs of US$2,500/t product. Nemaska secured funding for its 426tpa pilot plant in early 2016, which subject to the outcomes of the pilot program and financing, sees a reported timetable of Q1'17 for commencement of mining and commercial production from Q3'18.

– *Rose (Critical Elements 100%; mineral)*: Rose is located in Northern Quebec, Canada. A Preliminary Economic Assessment was completed in 2011, which contemplated a 1.5 Mtpa OP project feeding an onsite concentrator and Li_2CO_3 chemical plant with capacity of 27ktpa LCE. Capex was estimated at C$305m, with production costs (net of tantalum credits) of US$2,900/t LCE product. In late 2015 Critical Elements announced it had secured an offtake agreement with "a leading chemical company", as well as the commencement of an updated feasibility study.

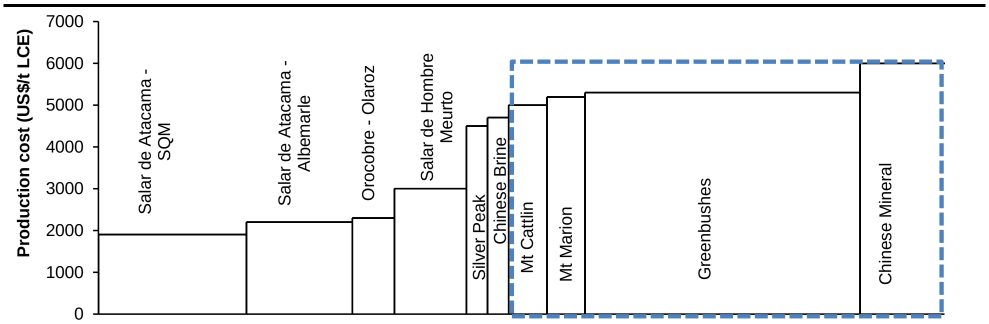
Unspecified New Supply – brownfield expansions

- Given the typically high hurdles (capex, lead times, technical risks) for new brine production, we anticipate that brownfield expansion of existing operations will be a meaningful source of new supply in the medium-long term. Brine projects are characterised by large resource bases/long reserve lives, with any incremental production from brownfield expansion likely to come at materially lower capital intensity than greenfield developments.
- Outside of Olaroz, we are not aware of any un-announced expansion plans for existing producers, but do note that as part of Albemarle's MoU with the Chilean Government to increase brine extraction rates at Atacama, Albemarle has purported to the potential construction of a third processing facility at La Negra to lift total production capacity to 70ktpa LCE (see Figure 25).

Production costs

- Obtaining accurate production cost data is a difficult exercise due to most of these projects residing within large, diversified chemical companies (Albemarle, FMC, SQM, Sichuan Tianqi). In addition each project is likely to process lithium to various levels of product specification, which combined with brine chemistry will influence overall production cost.

Figure 36: Global lithium production cost curve 2016e

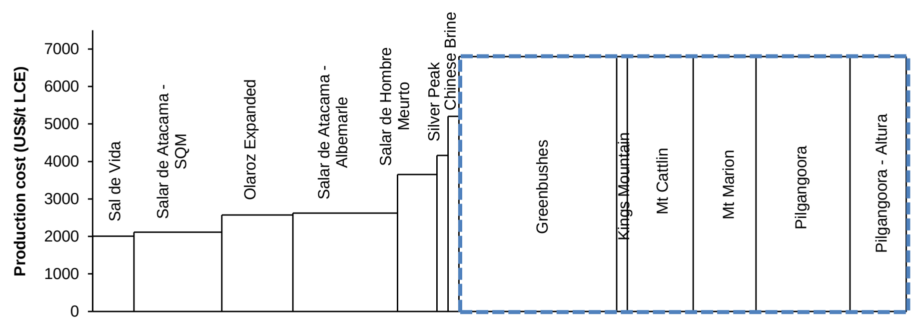


Source: Roskill, Company Reports and Presentations, Canaccord Genuity estimates

- For the purposes of modelling new and existing supply as at 2020, we have used company provided data and baseline costs from 2016 noting:
  – For brine producers we have assumed that production costs at 2016 reflect our estimates of the current product markets and compounds as outlined in Figure 5 and 8. Hence, brine producers are assumed to produce ~36% battery grade material (+99.9% Li) with the balance being technical and industrial grade material.

- Within our pricing forecast model we have modelled our estimated production costs to reflect the increased proportion (73% by 2025) of battery grade material being produced.
- We have assumed that converter capacity will be adequate to process the increased spodumene concentrate that is entering the market from 2016. This capacity is assumed to include re-starting existing facilitates or construction of new facilities. We view this as being dependent on the level of consolidation of converter facilities and the vertical integration of companies (such as Ganfeng Lithium and Sichuan Tianqi) along the lithium ion battery supply chain.
- For the purposes of our pricing model we continue to ascribe an assumed US$2,500/t cost to convert a benchmark (6% Li_2O) spodumene concentrate product to benchmark (99% Li) lithium carbonate product. We have assumed a 93% conversion recovery.

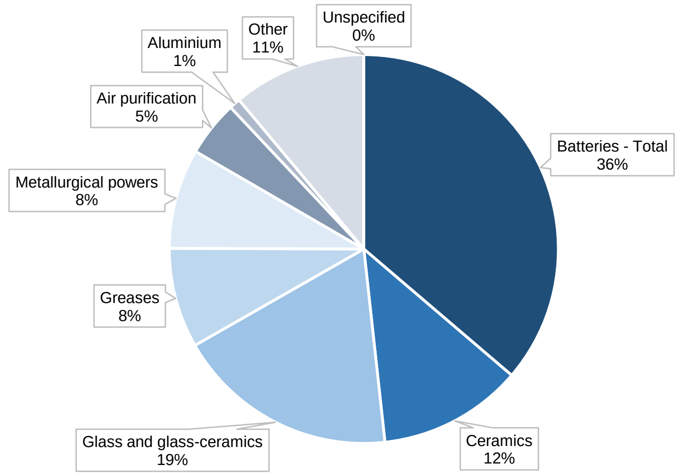
Figure 37: Global lithium production cost curve 2020e



Source: Canaccord Genuity estimates

Market Demand - Overview

Figure 38: 2015 Global lithium market demand breakdown



Source: Canaccord Genuity estimates

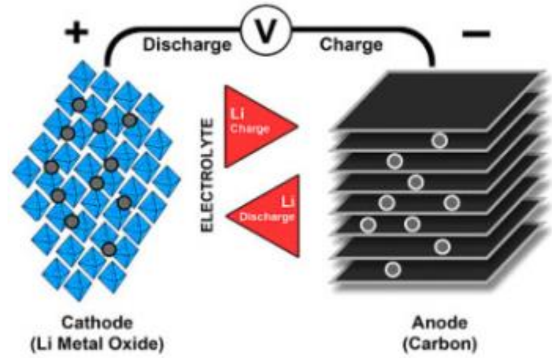
- Our estimated breakdown of global lithium demand in 2015 is presented in Figure 38 above. In the following sections, we break down the key demand drivers for lithium, the most important of which are Li-ion batteries, driven by expectations of significant growth in the Electric Vehicle (EV) market and grid storage markets.

Demand – Lithium-Ion batteries

How a Li-ion battery works

- All types of rechargeable batteries, whether lead-acid, nickel-metal hydride (NiMH), nickel-cadmium (NiCd) or the various lithium-ion (Li-ion) batteries described in Figure 40 operate according to the same principle. They each contain a cathode (+ve), an anode (-ve), and an electrolyte as a conductor, as shown in Figure 39.
- The cathode usually consists of a metal oxide (as listed in Figure 42) and the anode porous carbon (usually graphite). During discharge, the ions flow from the anode to the cathode through the electrolyte and separator; charge reverses the direction and the ions flow from the cathode to the anode.

Figure 39: Schematic diagram of ionic flow in a Li-ion battery



Source: Battery University website

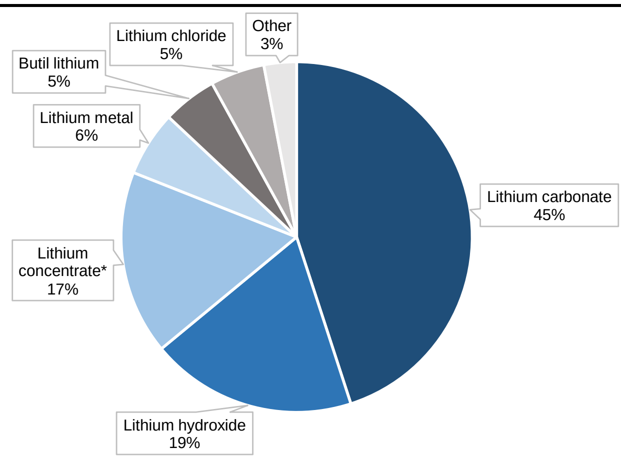
Breaking down the Li-ion battery

- The bill of materials for a Li-ion battery are well established, and consist of the following components:
  - *Anode*: A porous carbon is used to facilitate the flow of ions and storage of charge within its crystal lattice. Due to its more consistent purity, synthetic graphite (costing ~US$8,000/t to produce) is mostly used, with a small proportion of natural flake graphite also used as feed stock (in the form of spherical graphite). Spherical graphite with a size of d_{50} < 20μm and purity of +99.95% carbon currently trades for ~US$7,000/t, and in our view, offers the most likely growth channel for potential natural graphite producers as they displace the more costly synthetic graphite.
  - *Cathode*: A lithium-metal oxide compound is used which provides the stability to host (intercalate) lithium ions, and facilitate the flow back and forth to the anode. Due to its very low atomic number, lithium is the most reactive of the Alkali metals, with the popularity of Manganese Oxide as a host compound owing to its low cost and charging potential. The molecular formula of $LiMn_2O_4$ dictates that only 4% of the mass of the cathode is elemental lithium, or 20% in LCE terms.
  - *Electrolyte*: This is usually a liquid solvent that contains lithium ions with the standard electrolyte being Lithium Hexafluorophosphate ($LiPF_6$).
  - *Separator*: A permeable membrane is used to reduce the occurrence of short circuiting between the anode and cathode. This is most commonly in the form of High Purity Alumina (artificial sapphire).
  - *Housing*: Within a typical Electric vehicle battery cell a PP3 dry assembly is used. This housing is comprised of base metals such as Aluminium and stainless steel.
  - *Laminating*: Foil to protect the cell from moisture and dust contact comprised mostly of Aluminium and Nickel.
- Lithium-based battery technology is particularly appealing for two key reasons. Lithium has the highest standard potential of all alkali metals, lending itself to batteries with higher voltages (typically 3-4 V), versus other types of rechargeable batteries (1.2 to 1.5 V for nickel-based batteries). Additionally lithium is the lightest metal (atomic mass of 6.9 gmol-1) allowing it to store more electric charge per kilogram than other metal (around 3.86 Ah/g compared to 0.26 Ah/g for lead).

Cathode chemistry – lithium carbonate vs lithium hydroxide

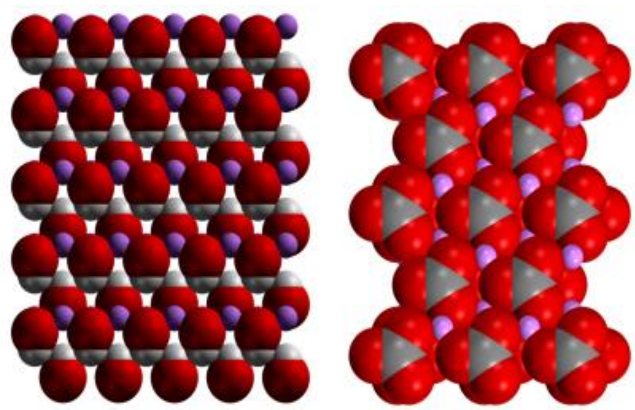
- The cathode chemistry employed in Li-ion battery manufacturing predominately uses lithium carbonate (Li_2CO_3) as a feedstock over lithium hydroxide (LiOH) by about 2-3 times. This is primarily on account of cost, with LiOH typically trading at a price of ~25% above Li_2CO_3 due to the additional conversion step required to form battery grade material (in the form of LiOH) from Li_2CO_3 that is sourced from brine or mineral converters.
- Li_2CO_3 currently accounts for approximately 45% of all manufactured lithium compounds (see Figure 20), but the growing preference for LiOH for use in Li-ion batteries can be attributed to the following factors:
  - *Crystalline Structure*: Within the cathode LiOH maintains a lattice structure while LCE forms a flat, angular structure comprised of weaker bonds. This results in ions flowing more readily within the LiOH lattice improving energy storage characteristics.
  - *Energy Density*: LiOH comprises ~29% by mass of Li+ ions in comparison to 19% for Li_2CO_3.
  - *Solubility*: The solubility of LiOH is 268g/l vs LCE of 10g/l indicating a superior concentration of electrolyte within the battery.
- Due to these characteristics, Li-ion batteries using LiOH cathodes are preferred for use in high performance applications such as EVs. Given that Li-ion battery demand is expected to be dominated by EV uptake, we anticipate that LiOH will display the highest relative demand growth of the various lithium compounds.

Figure 40: Breakdown of lithium market by compound



Source: signumBox

Figure 41: Molecular structure of LiOH (left) vs Li_2CO_3 (right)



Source: Power stream

Li-Ion Battery types

- Figure 42 below sets out the various types of Li-ion battery by the primary metal oxide used to construct the cathode. More detail on their application in electric vehicles can be found in Figures 45 and 47.

Figure 42: Various Battery Types

Battery Chemistry	Lithium Cobalt Oxide	Lithium Manganese Oxide	Lithium Iron Phosphate	Lithium Nickel Manganese Cobalt	Lithium Nickel Cobalt Aluminium Oxide
Short Form	LCO	LMO	LFP	NMC	NCA
Specific energy	Excellent	Good	Fair	Excellent	Excellent
Specific Power	Fair	Good	Excellent	Excellent	Good
Heat Capacity (J/g)	1100	820	300	850	950
Safety	Fair	Good	Excellent	Good	Fair
Performance	Good	Fair	Good	Good	Good
Life Span	Fair	Fair	Excellent	Good	Good
Cost	Good	Good	Good	Good	Fair
% as LCE content	23.17%	8.50%	9.68%	11.33%	15.63%
In use since	1991	1996	1996	2003	1999
Voltage	3.60V	3.70V	3.30V	3.60/3.70V	3.0/3.70V
Cycles	1000	700	2000	1500	500
Applications	Mobile phones, tablets, laptops, cameras	Power tools, medical devices, electric powertrains	Portable and stationary (grid storage). Buses	E-bikes, medical devices, EVs, industrial	E-bikes, medical devices, EVs, industrial

Source: Battery University

ESTIMATING LITHIUM CONSUMPTION IN LI-ION BATTERIES

- Our modelled lithium demand is based on calculations from first principles to determine the theoretical Li_2CO_3 required to generate sufficient electric charge within a battery unit.
- This is governed by the flow of electrons to and from the cathode described in Figure 39, and via the Equation $Li_{1-x}MO_2 + xLi^+ + xe^- \leftrightarrow LiMO_2$ where M represents the Metal oxide used in the cathode, such as Cobalt, Manganese or Nickel.

Figure 43: First Priniciples Li_2CO_3 Requirement calculation based on 85 kWh Tesla Model S

Parameter	Symbol	Value	Units	Description	Calcuation
Elementary Charge	e	1.6022E-19	Columbs	Electric Charge carried by a single proton	Physical Constant
Avogardo constant	NA	6.02E+23	mol-1	Number of particles per mole	Physical Constant
Atomic Mass of Lithium	M	6.941	g/mol	Mass of Lithium per mol	Physical Constant
Cell Charge Potential	-e	1.39E+04	Columbs	Electric charge in each gram of contained Lithium	=A*B/C
Step Down Voltage	V	**3.6**	Volts	Plug in Voltage available to charge the cell	Given
Power within Lithium	P	50.04	KJ/g	Power per gram of lithium	=D*E/1000
Lithium to LCE ratio		5.32		Lithium to Lithium Carbonate Stoichiometry	Physical Constant
Specific energy	Cp	2.61	kWh/kg	Contained Energy per kg of LCE	=F/G/3.6
Battery Capacity		**85**	KWh	Rated Total Capacity of Battery	Given
Relative Density	φ	64%		Random close packing density of spheres	Physical Constant
Battery Grade Li2CO3		**50.85**	**kg**		=H/I/J
Theoretical LCE required		0.60	kg/kWh		=K/I

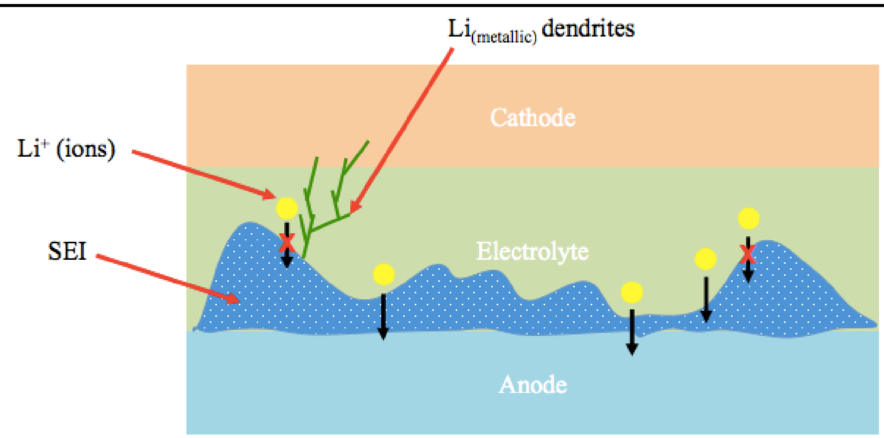
Source: Canaccord Genuity estimates

- Based on these calculations, we estimate a theoretical Li_2CO_3 requirement of 0.6kg/kWh of energy supplied. However, we note this is likely to understate the amount of lithium required in practice. Several factors are likely to affect the overall discharge efficiency of the battery unit, with the most significant of these including:

– *Rate of dissipation of free energy:* Battery performance will reduce from 100% efficiency once it commences discharging. The simplest explanation of this is the loss in free energy as the chemical reaction occurs within the battery upon the application of an external voltage. In addition, energy generated is lost to the battery exterior and through degradation of anode components which is dependent on reaction kinetics and thermodynamic properties. As a result additional lithium is required to compensate for this deterioration over time of contained lithium.

– *Interaction with the electrolyte:* A significant factor in the capacity fade of a Li-ion battery is also due to the loss of lithium from the cathode due to the reaction with the electrolyte. As illustrated below, lithium ions have a tendency to form a solid electrolyte interface (SEI) which initially coats the graphite anode to offer protection against solvent degradation (within the electrolyte) at higher voltages. However, when lithium metal reacts with the electrolyte it creates long branches (dendrites) which increase the deposition on the interface. As a result it is likely that increased concentration of lithium ions are required to maintain charging characteristics over the cycles.

Figure 44: Solid Electrolyte Interface formation in a Li-Ion battery



Source: Goodnight Earth Website

– *Rate of Discharge:* The efficiency of a battery can be calculated as the amount of power discharged divided by the amount of power delivered to the battery. This takes into account the loss of energy mostly as heat, which warms up the battery. The charge-discharge efficiencies of Li-ion batteries are typically around 80-90% which is usually quoted over a long discharge duration (>50 hours) when the battery is most likely to operate close to the applied open circuit voltage. For example, this relationship can be demonstrated in electric vehicle applications where greater acceleration leads to increased discharge rates. In these higher end applications it is likely that baseline battery capacity will be diminished.

Li-Ion Battery Market Segments

PASSENGER ELECTRIC VEHICLES

- For the purposes of simplifying our demand assumptions, we have assumed that passenger electric vehicles are segmented into three different types.
  - ***Hybrid Electric (HEV):*** HEVs operate under the principle of using a conventional internal combustion engine (ICE) in combination with a battery cell to generate electricity to the drive motor. There are various modes in existence that offer different circuit arrangements of the engine and battery to optimise performance, emissions or range. These include such models as Extended Range Electric Vehicles where a small standard ICE is incorporated to provide additional range should the primary battery power source be depleted.
  - ***Plug in Hybrid (PHEV)***: These operate with a similar drive train set up as the HEV with the difference being that the on-board battery is charged through connection to mains power as opposed to the ICE. While these units provide the benefit of minimising emissions, a limitation is the "All Electric Range" (AER) - that is, the distance travelled exclusively on the electric battery pack. Most early stage PHEVs have an AER of <40km, limiting these vehicles to mainly urban travel.
  - ***Battery Electric Vehicles (BEV):*** The most technologically advanced of electric vehicles, these use a Li-ion battery to power a synchronous electric motor. The battery pack is expected to retain 70-80% of its capacity over 10 years with adverse operating temperatures (+50°C or -25°C), top up charging (from +80% state of charge) and excessive motor rpm (due to driving speed) among the key factors which impact battery life.

EV Li-Ion batteries – battery types

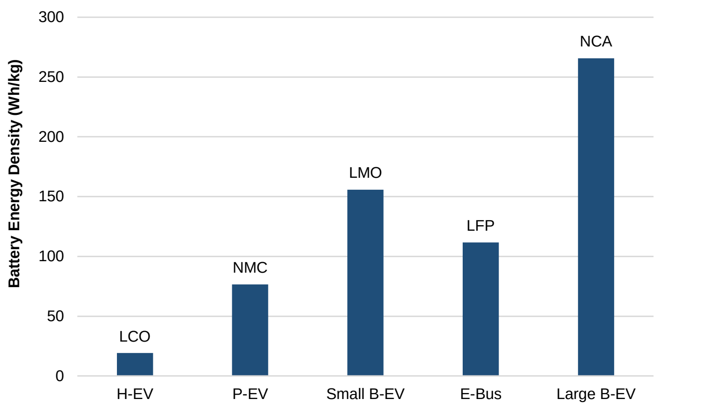
- Following on from our theoretical lithium requirement analysis, Figure 45 below sets out the various battery types typically used in different EVs. Battery chemistry plays a significant role in the battery variant used in each EV (see "Li-ion battery types", Figure 42), with energy density and weight being the main considerations.
- Given the typical lithium requirement differs for each EV and battery variant, the estimated lithium consumption figures (highlighted) form the basis for our lithium demand forecasts.

Figure 45: Battery variants typically used in EVs & other mobility

Segment	Theoretical LCE consumed (kg/battery)	Battery Type	Battery mass (kg)	Battery kWh	Actual LCE consumed (kg/kWh)
Hybrid Vehicle	1.27	LFP	55	1.8	0.70
Plug-In Vehicle	6.06	LMO	183	10.00	0.63
Battery Electric Vehicle - Small	13.00	LMO	154	24	0.75
Battery Electric Vehicle - Large	50.80	LMO	320	85	0.79
Hybrid Vehicle Bus	18.34	LFP	500	32.40	0.72
Battery Electric Bus	183.38	LFP	2904	324.00	0.72
E-Bikes	0.07	NCA	1.0	0.5	0.50
E-Scooters	0.30	NCA	3.0	1.5	0.50
E-Motorbikes	0.50	NCA	5.0	2.4	0.50

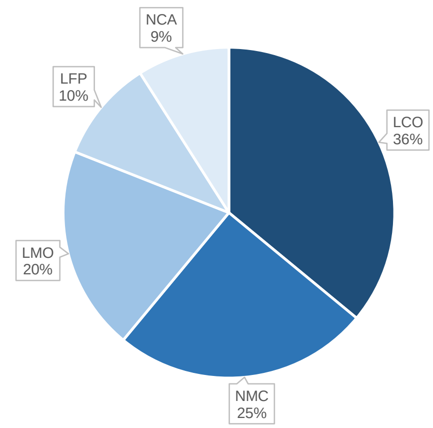
Source: Canaccord Genuity estimates

Figure 46: Energy density of various battery types



Source: Battery University website

Figure 47: Breakdown of Battery type used in Electric Vehicles in 2014



Source: Environmental & Energy Study Institute

EV Li-Ion batteries - Raw material requirement

- For the purposes of our demand forecasting for EVs, we have considered the two leading EV models on the market. These are the entry-level 24kWh Nissan leaf (RRP ~ US$25,000; 200,000 units sold since 2011) and the more appointed 85kWh Tesla Model S (RRP US$95,000; ~25,000 units sold in 2015). We have investigated the composition of the batteries used within these vehicles to break down the bill of materials and derive subsequent raw materials required as presented in Figure 49 below.

Figure 48: EV Battery specifications

	Nissan Leaf	Tesla Model S
Motor Capacity (kWh)	24	85
Number of modules	4	1
Number of Cells	192	7104
Weight of Cell (g)	800	45
Effective Battery Cell Weight (kg)	153.6	320
Total Battery Weight (kg)	294	544
Cell Chemistry	LMO	NCA
Specific Energy (Wh/kg)	157	266

Source: Avicenne Energy, Canaccord Genuity Estimates

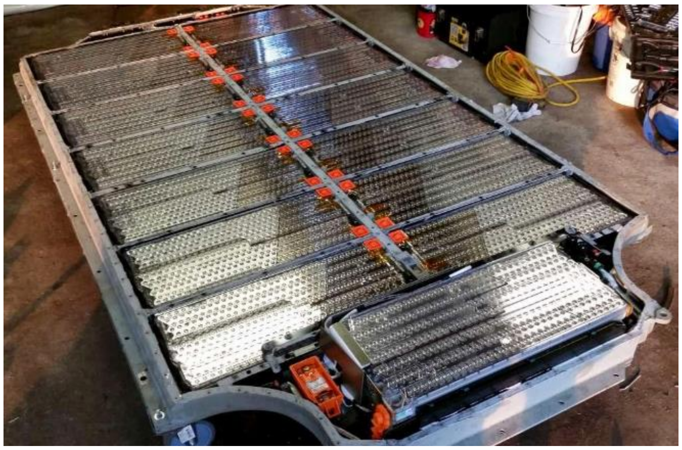
Figure 49: Raw Materials used within each battery type

Component	Total Chemical Element required per Vechile (kg)	Compound Type	Nissan Leaf	Tesla Model S
Anode	Carbon	Spherical Graphite	18.4	39.0
	Copper	Cathode	10.8	39.0
Cathode	Lithium	$LiMn_2O_4$ powder	**1.4**	
	Lithium	LiNiO powder	**0.6**	
	Lithium	$LiNiCoAlO_2$		**5.1**
	Cobalt	$LiNiCoAlO_2$		19.8
	Nickel	$LiNiCoAlO_2$		16.3
	Manganese	LiNiMnCoO2		31.9
Electrolyte	**Lithium**	**$LiPF_6$ powder**	**2.2**	4.7
	Raw Material required per Vechile (kg)	**Purity**	**Nissan Leaf**	**Tesla Model S**
	Graphite Flake	>95%	46.1	97.5
	Copper Cathode	>99.99%	10.8	39.0
	Cobalt Cathode			19.8
	Manganese Powder			31.9
	Li_2CO_3	**>99.5%**	**22.6**	**51.8**

Source: Navigant Research, Canaccord Genuity Estimates

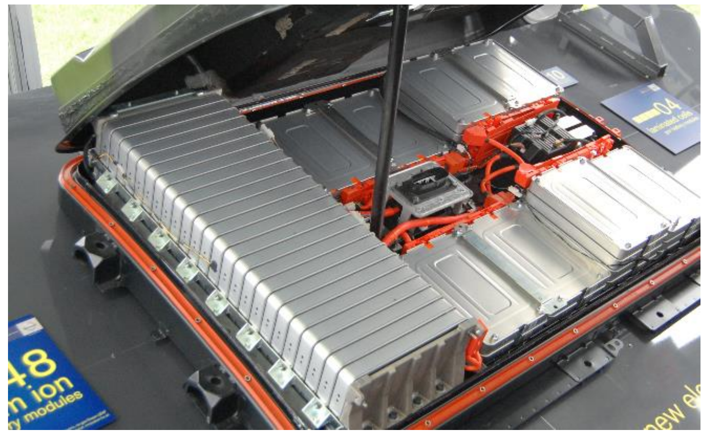
- Figure 49 breaks down our estimated raw material requirements based on the various battery chemistries. In a Tesla Model S, we estimate 51kg of lithium (LCE) is required in the standard 85kWh model, with a further 54kg of copper and 135kg of spherical graphite.
- The Nissan Leaf, powered by a 24kWh battery unit, currently has an AER of ~130km, with the Tesla Model S purporting to an AER of +300km. This owes much to the battery chemistry employed with the Nissan Leaf (and other small passenger vehicles) using a LMO or NMC battery versus Tesla's use of a NCA battery. More critical however is the unit weight with a Nissan Leaf assembly (Figure 48) weighing 294kg while a Tesla battery weighs 544kg.

Figure 50: Tesla Model S 18650 Battery Pack cell –NCA type



Source: QNovo

Figure 51: Nissan Leaf Battery Module Cell – LMO type

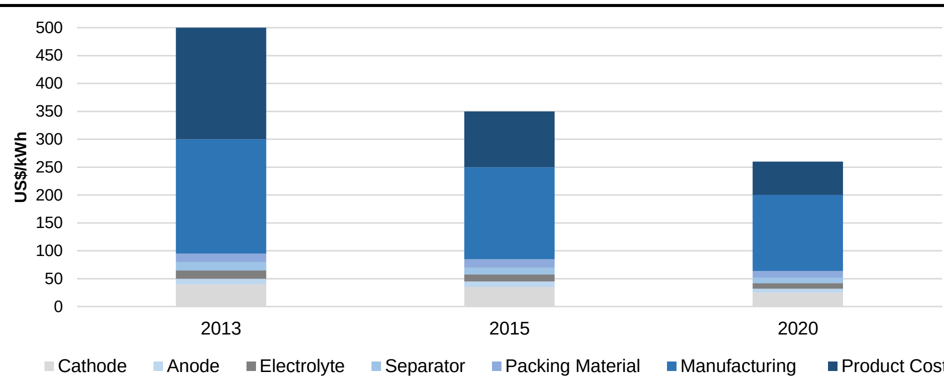


Source: QNovo

EV Li-Ion batteries – battery costs

- Figure 52 below illustrates the breakdown of individual Li-ion battery components and their proportionate cost in terms of US$/kWh. It is estimated that in 2015, battery costs were approximately US$350/kWh, with the Li-metal oxide cathode comprising ~13% of this.
- Using our raw material requirement calculations (Figure 43), we estimate that the contained lithium in a typical EV battery comprises ~3% of the total battery cost. We see this as a key contributing factor in modelled EV demand – even if lithium prices continue to increase, it is not likely to materially impact the cost of a battery (and the overall cost of the vehicle), and negatively impact demand.

Figure 52: Lithium Ion Battery Cost Breakdown



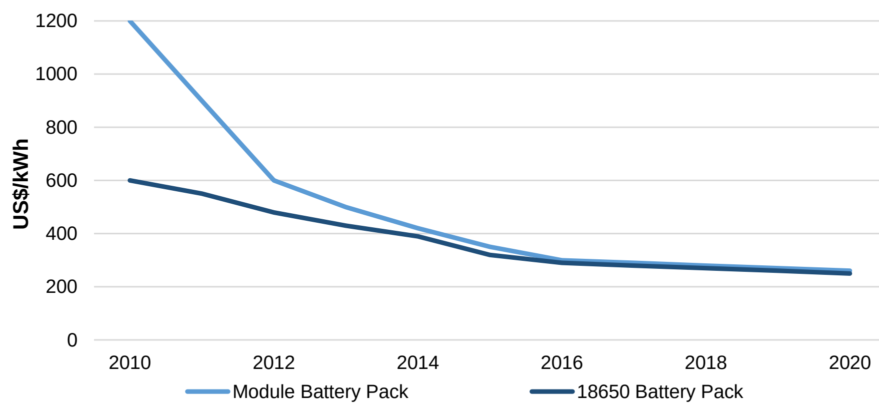
Source: Avicenne Energy, Canaccord Genuity estimates

- Car makers disclose scant detail on the cost of their battery units however we anticipate that prices for Li-ion batteries will continue to fall below US$300/kWh by 2020 (Figure 52) due to the following factors that are consistent with the concept of the experience curve:
  - *Manufacturing at scale:* Scale effects and manufacturing productivity improvements, representing about one-third of the potential price reductions through 2025, could mostly be captured by 2015. Savings can be attributed to

improved manufacturing processes, standardising equipment, and spreading fixed costs over higher unit volumes.

– ***Lower component prices.*** Reductions in materials and components prices, representing about 25% of the overall savings opportunity, could mostly be captured by 2020. Under competitive pressure, margins could fall to half of today's estimates of 20-40%. It is expected that component suppliers could reduce their costs dramatically by increasing manufacturing productivity and moving operations to locations where costs are optimised
– ***Battery capacity-boosting technologies.*** Research being undertaken by the US Department of Energy suggests that technical advances in cathodes, anodes, separators and electrolytes could increase the capacity of batteries by +100% by 2020–25. These efforts represent a majority of identified price reductions. New battery cathodes that incorporate layering using high purity aluminium separators and manganese crystals using nanotechnology, could eliminate dead zones leading to improvements in battery cell capacities.

Figure 53: Forecast Lithium Ion Battery Cost Breakdown for module and cell arrangements

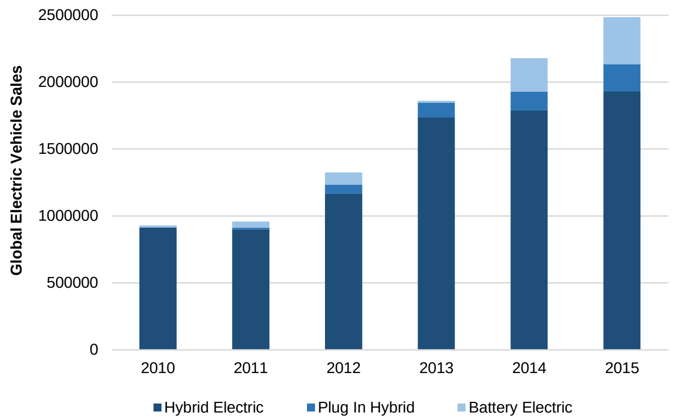


Source: Navigant Research, Canaccord Genuity estimates

EV Penetration rates

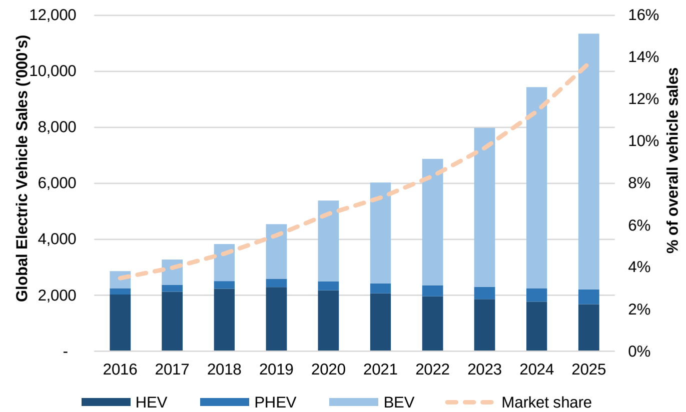
- According to leading consultant HIS Automotive it is estimated that 82m passenger cars were sold globally in 2015. We estimate that of this, penetration rates were <1% (554,000 units sold globally across PHEV, BEV classes, excluding HEV). Overall, we estimate that HEVs comprised the majority of passenger EVs sold in 2015 at 85% market share. Further, we estimate that 2.9% of total vehicle sales in the USA were EVs, versus only 1.4% in China.
- In Figure 55, we present our modelled EV penetration into the global passenger vehicle market, as part of our demand side modelling.

Figure 54: Global Electric Vehicle Sales 2010-2015



Source: IEA, EV Obsession, China Association of Automobile Manufacturers

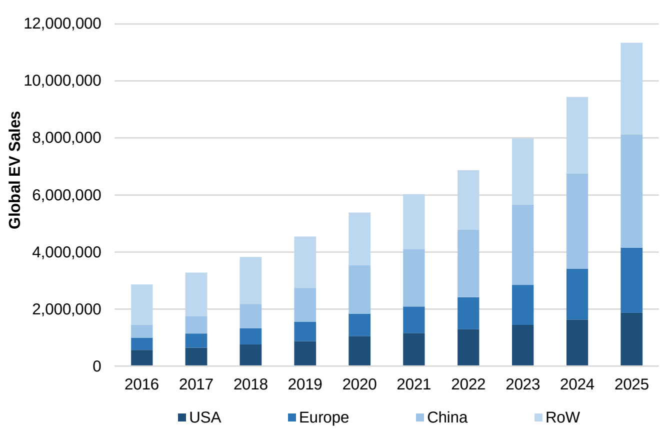
Figure 55: Global Electric Vehicle Sales forecasts



Source: Avicienne Energy, signumBox, Canaccord Genuity estimates

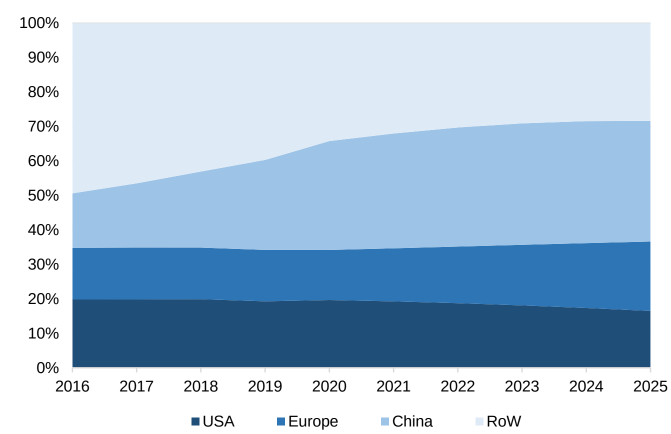
- Key forecast (Figure 53) assumptions include:
  - Mostly flat global passenger vehicle sales over 2016-2025 (~82 million units per year).
  - Falling HEV demand as a proportion of overall EV sales with a modelled CAGR of -2% (71% market share in 2016 to 40% in 2020). In our view, improved performance (AER), improvements in charging infrastructure, increased product offering (most major global auto manufacturers have announced development of full PHEV/BEV product ranges in the coming years) and lower price points could see PHEVs and BEVs significantly increase market share of total EV sales.
  - A flat proportion of 20% electric vehicles being classified as larger units such as the Tesla S 85kWh (vs 2015 actual of 14.2%).
  - 2016-2025 CAGR's for PHEVs and BEVs of 9% and 31% respectively, with estimated EV market shares in 2025 for PHEVs of 5% and BEVs 82%.
  - Total estimated EV penetration (as a % of overall passenger vehicle sales) of 6.5% in 2020 and 13.7% in 2025.

Figure 56: Forecast EV sales by country/region



Source: Canaccord Genuity estimates

Figure 57: Global market share of EVs by country



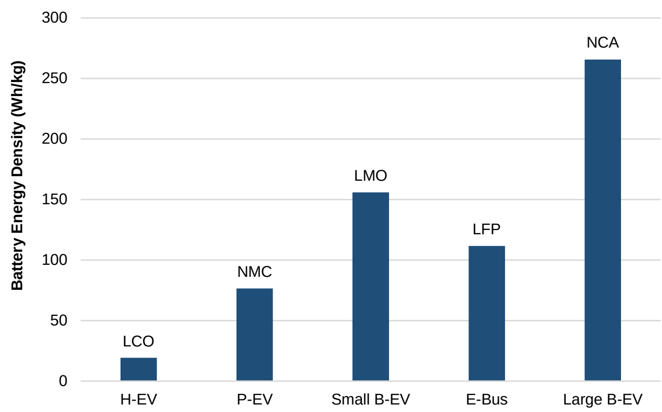
Source: Canaccord Genuity estimates

– Broken down by country, we model a CAGR (2016-2025) in total EV sales of 13% for the USA, 18% for Europe, 24% for China, and 44% for Rest of World. Our modelled EV market share by country is illustrated in Figure 55.

Impact on lithium consumption

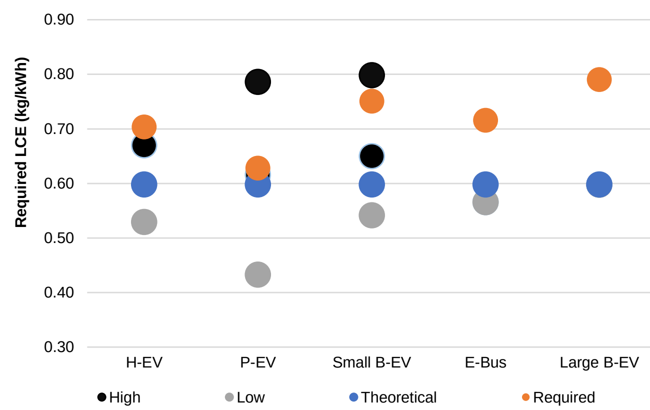
- The lithium carbonate required per kWh of battery capacity across our modelled EV segments is presented in Figure 59 below. The ranges here are used to incorporate the various multiples to estimate subsequent lithium carbonate requirements.
- Since the lithium requirement is dependent on various battery chemistry used, we have researched a number of resources to determine the likely range across our electric vehicle segments.
- We have used these estimated requirements, and our EV and E-bus market penetration assumptions to derive lithium demand from road transport applications.

Figure 58: Estimated Energy Density of various batteries used in EVs



Source: Battery University website, Company websites

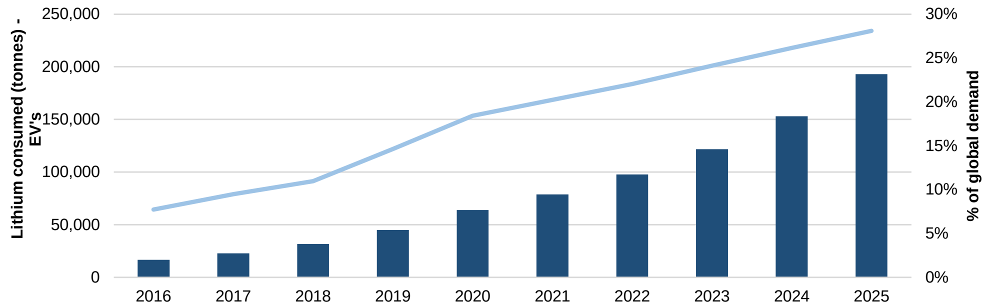
Figure 59: Estimated LCE requirement (kg/kWh)



Source: Company reports, Canaccord Genuity estimates

- For illustrative purposes, assuming an average battery capacity of 35 kWh across all EV variants, we estimate 25kg of lithium (battery grade LCE) is consumed in each vehicle.
- Our estimates suggest that EV production in 2015 resulted in lithium demand (LCE) of 10,880t, equivalent to ~6% of our estimated market size in 2015. Based on our forward projections, we estimate lithium consumed by EVs will grow at a CAGR of 27%, with our estimates of 2025 demand representing 110% of the total 2015 market size.

Figure 60: Estimated annual lithium consumption (LCE) – EVs



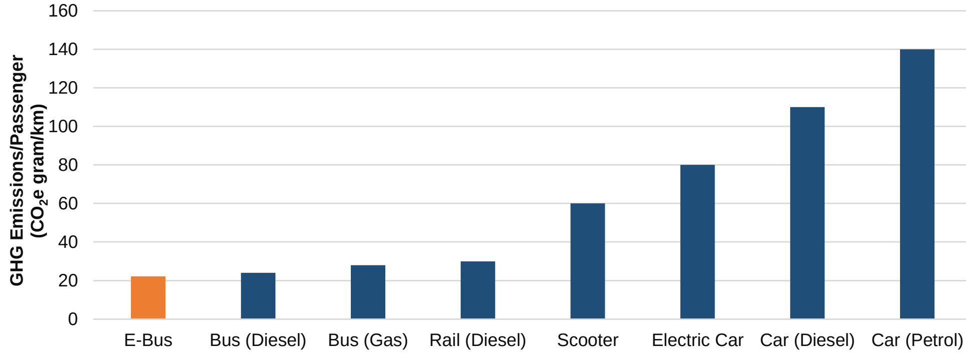
Source: Company Reports, Canaccord Genuity estimates

ITS NOT JUST CARS..... INTRODUCING THE E-BUS

Electrification of road-based public transport expected to be a key demand driver in the medium-long term

- As previously noted, we have segmented our demand side modelling for passenger electric vehicles into HEV, PHEV and full BEVs. In our view, we anticipate EV penetration rates to be characterised by more rapid transition to full BEVs as battery technology increases performance, and costs decrease. In addition, we expect regulatory and abatement pressures across governments as likely to accelerate this transition through the use of subsidies and regulation.
- We do not view the electrification of road transport to be restricted to passenger vehicles. The progress in market acceptance from hybrid to fully electric vehicles has started to extend to the mass transport sector, most notably in China. According to the International Association of Public Transport, bus systems account for 80% of all public transport passengers, and given that increased use of buses as a mode of road transport offers the benefits of reducing emissions and congestion, **we view electric busses as a source of rapid lithium demand growth over the medium to longer term.** According to the IEA's Energy Technology Perspectives 2014 report, buses were identified as the road transport mode with the most electrification options available, including battery swapping, overhead lines, and stationary charging.
- Our view of the positive outlook for demand for Li-ion batteries from E-buses is driven by a number of factors including:
  - Given the large population and high density, China has rapidly adopted mass transit. It is estimated that there are currently more than 500,000 buses in use, and as of 2015 less than 10% have some degree of electrification.
  - At present, petrol operated mass transport is subsidised in China to reduce the dependence on individual vehicle ownership. This is likely to be supplanted by the updated regulations released by the Chinese Ministry of Transport in November 2015. According to these regulations "new energy" buses that are deployed have to comply with energy efficiency and new energy vehicle standards. These efforts build upon *The Clean Action Plan 2014* announced by the Chinese government which aimed to increase the share of new energy vehicles to 65% of the total bus fleet by 2020.
  - Buses are one of the largest contributors to surface pollution in cities, due in part to the fact that they operate almost 5-10x more than the average passenger car. As shown in Figure 61, E-buses offer the most meaningful drop in emissions intensity from the transportation sector.

Figure 61: GHC Emissions Intensity in Transportation



Source: Inside EVs, Chinese Automobile Association

- According to industry research from Frost and Sullivan, it is estimated that an electric bus, over its entire life cycle of ~12 years is expected to offer fuel savings of ~US$300,000 compared to diesel buses, and ~US$200,000 compared with natural gas buses. Longer term benefits include decreased maintenance costs, noise reduction and improved condition monitoring.
- We anticipate that the Chinese electric bus market is expected to grow significantly over the medium to long term, owing to the surging urbanisation and development of many newly built advanced public transit systems in the cities of China. According to an industry report from Research & Markets, by 2020, China is expected to account for more than 50% of the global electric bus market. In 2014, 8 out of the top 10 electric bus manufacturers had more than 90% of their total revenue from the Chinese market with only AB Volvo, BYD and Yutong Group selling full electric buses across all geographies.

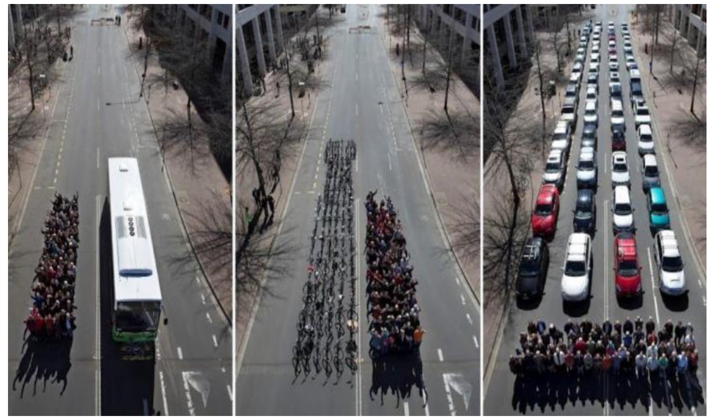
Beyond the Middle Kingdom... a potentially very large addressable market

- In our view, the benefits of moving to electric buses are applicable beyond just the cities of China. As such, we anticipate gradual replacement of ICE powered bus fleets across all major global cities and regional centres over the long term, as a means of reducing emissions from public transport while concurrently reducing congestion.
- Buses are likely to present as more suitable for electrification over passenger cars for a number of reasons. Higher utilization rates, coupled with lower maintenance costs, translate to comparatively lower payback periods. Predictable routes and centralized facilities limit the capital expenditure for recharging facilities and range anxiety.

Figure 62: First fully electric bus in London (BYD K9) – March 2016

Source: : PR Newswire

Figure 63: Urban Space for 60 people in China via bus, bike and car



Source: Frost & Sullivan

- While we earlier acknowledged the potential for significant growth in the passenger EV market based on low penetration rates at present, we also see a large opportunity for E-buses. Accurate data is hard to obtain, but it is estimated that there are approximately 6m buses in operation around the world, with key markets including China (~500,000), India, and the USA (~480,000 school buses). Based on the size of the world's bus fleet, we consider the electrification of bus fleets around the world to be a major demand driver for Li-ion batteries in the medium to longer term.

E-bus market penetration

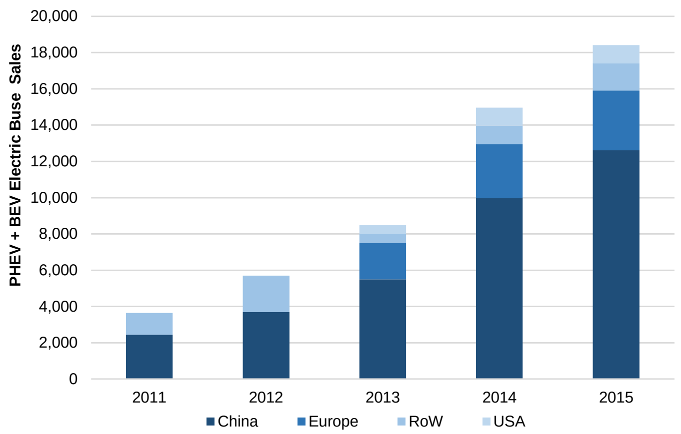
- For the purposes of our demand modelling we have assumed an overall CAGR of 35% in this sector (from 23,000 units in 2015). This objective is consistent with our analysis in Figure 59 where electric buses offer the most meaningful drop in emissions intensity from the transportation sector.
- Penetration rates are likely to be contingent on government subsidies and purchasing quota. This is particularly apparent in China where the most updated *Clean Transportation Program* from 2015 called for subsidies based on the specific energy consumption and length of the bus. The policy is aimed at encouraging buses that consumed less power and those that have faster charging cycles as indicated in Figure 62.

Figure 64: Chinese Electric Vehicle Subsidies 2016-2020

Subsidies (k, RMB)		Bus Length (m)		
Type	Energy Consumption (E_{kg} Wk/km.kg)	6<L<8	8<L<10	L>10
BEV	<0.3		400	500
	<0.4		360	460
	<0.5		320	420
	<0.5	300		
	<0.6	260		
	<0.7	220		
PHEV		170	200	230
Fast Charger E Bus		100	120	150

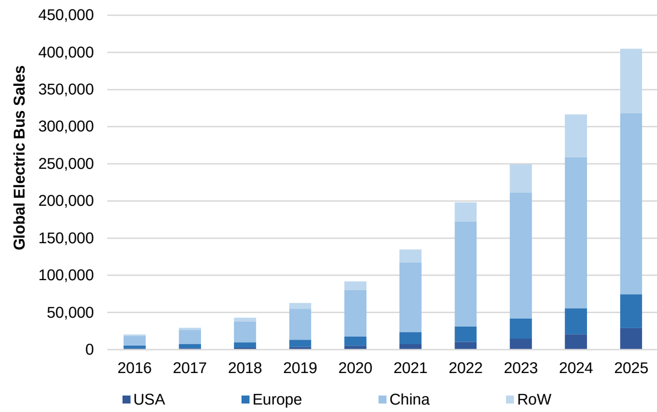
Source: Innovation Centre for Energy and Transportation China

Figure 65: Global Electric Buses Sales 2011-2015



Source: EV Obsession

Figure 66: Global Electric Buses Sales 2016-2025



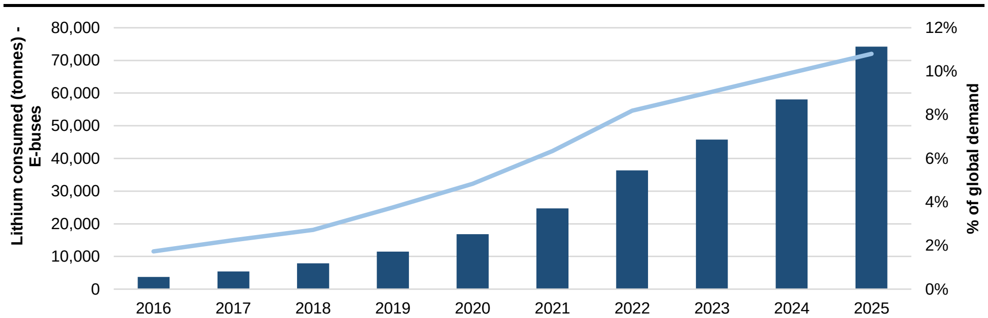
Source: Canaccord Genuity estimates

- Figure 66 above presents our modelled E-bus sales to 2025, which sees the size of the market increasing by +2000% to 405,000 units. While we identify that there are similar opportunities for electric engines within other larger transport motors such as trucks we have not incorporated any of these into our forecasts.

Impact on lithium consumption

- Our estimates of lithium consumption from E-buses are based on an average battery capacity of 324kWh, and using our estimated theoretical lithium requirement of 0.6kg/kWh, we estimate the average E-bus requires +180kg of battery grade lithium. For the purposes of our modelling we have assumed that electric buses will utilise LFP battery chemistry (as currently used by leading manufacturer BYD).
- Our estimates suggest that E-bus production in 2015 resulted in lithium demand (LCE) of 2.6kt. Based on our forward projections, we estimate lithium consumed by E-buses will grow at a CAGR of 35%, with our estimates of 2025 demand representing 42% of the 2015 market size.

Figure 67: Estimated annual lithium consumption (LCE) – E-buses

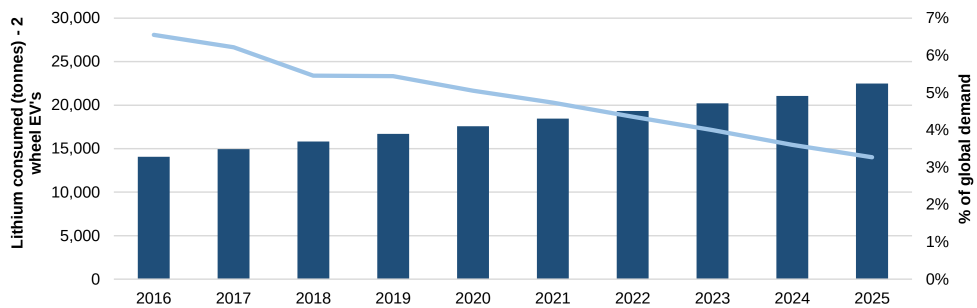


Source: Canaccord Genuity estimates

PERSONAL ELECTRIC MOBILITY

- This segment of the market has seen rapid growth within China mostly due to improved electric bicycle technology - in particular battery technology. In 2014 it was estimated that of the ~500 million bicycle commuters in China, over a third (140 million) have converted their units to some form of electrification. Of this it is estimated that ~16 million units are classified as electric scooters of motor cycles, which is reflected in our estimates in Figure 66 below.
- We understand that these units will predominately use NCA and NMC battery types due to the favourable recharge durations. For the purposes of our modelling this subsequently yields the following lithium requirements (on an LCE basis)
  - E-Bikes: 70 grams for the 1kW Piaggio Wi-Bike
  - E-Scooters: 300grams such as the Samsung SDI E-scooter
  - E-Motorbikes: 500 grams for 2.4kw motor for the Piaggo MP3 bike.

Figure 68: Estimated annual lithium consumption (LCE) – 2 wheel EVs



Source: Canaccord Genuity estimates

GRID STORAGE

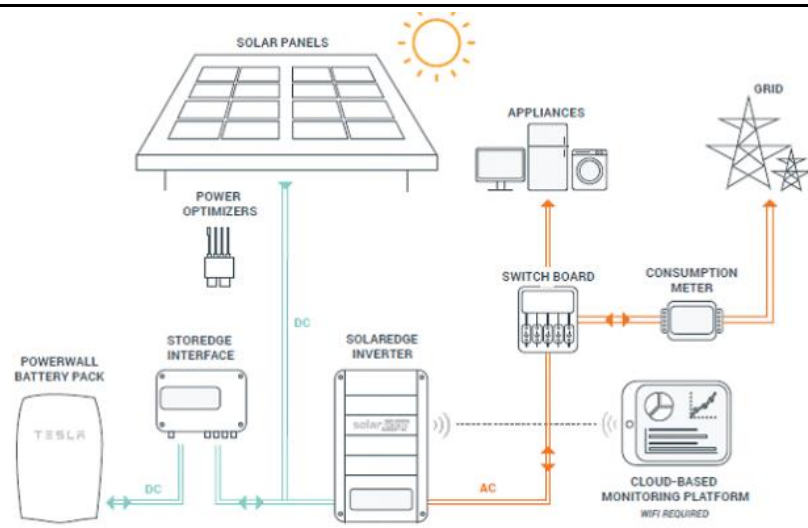
Residential Energy Storage Systems

- Another key application for Li-ion batteries is in grid storage systems for both industrial and residential applications. Most commonly in the form of an Integrated Solar + Battery Storage system (IPSS), we view this as a sector with significant growth potential. This comprises both the retrofitting of existing solar photovoltaic (PV) installations, and expectations for significant growth in new solar PV installations. We view the opportunity for this sector to be driven by providing increased substitution versus higher cost grid supplied electricity, power backup, and peak demand shaving (the changing shape of the "duck curve").
- We view the uptake of IPSS as likely to be driven by the following factors, dependent on the country including:
  - A significant decline in battery storage costs, similar to the decline in the price of Solar Photovoltaics.
  - High retail electricity prices.
  - A desire to be more, or completely, independent from the grid.
  - In the case of Australia, excellent solar resources.

How they work

- Solar panels convert sunlight to DC (Direct Current) electricity for use in typical domestic applications through the below steps, and as indicated in Figure 69 below.
  - Any surplus DC electricity charges the Tesla Powerwall or similar unit.
  - The inverter converts the DC electricity to AC (Alternating Current) for use in the home.
  - An auxiliary inverter can also convert AC to DC to charge the Powerwall using cheap off-peak mains power.

Figure 69: Residential Peak management energy storage via Tesla Powerwall



Source: Energy Matters Website

- Although lead acid batteries are still used for residential storage applications, many multinational battery manufacturers (including Panasonic, Samsung, LG, and Tesla) are rapidly moving towards lithium-ion technology. Due to the market acceptance of these batteries for EVs, and the growing manufacturing capacity for these batteries, costs for such units are expected to continue to decrease.
- The Tesla power wall for instance features two different models using a NMC battery chemistry; The 7kWh capacity unit (6.4kWh usable) has a 3.3kW continuous/peak output capacity. Other popular lithium ion battery models include the 7kWh AU Optronics Power Legato and the Panasonic LJ-SK84A models.
- The current retail price for installing these lithium-ion based storage units within Australia is ~AUD$10,000 with the payback time typically ~5 years for the average household.

Figure 70: Tesla 7kWh Powerwall

Source: Tesla Website

Figure 71: Au Optronics 7kWh Power Legato

Source: AU Optronics

Figure 72: Reflow 8kWh Zinc Bromide Unit

Source: Redflow

- While Li-ion batteries have well established claims to penetrate the residential storage market, the advent of more "fit-for-purpose" flow batteries such as Zinc Bromide present the most likely impediment to a broad-based adoption of Li-ion batteries in this sector. A comparison of the various storage battery technologies is shown in Figure 73 below.

Figure 73: Comparison of Energy Storage Battery Technologies

Battery comparison	Zinc Bromine	Vanadium	Lithium-ion	Lead-acid
Up front cost / kWh	$300-800	$500-2000	$350-1000	$1000-2000
Cost / kWh (LCOE) / kWh	$0.15-0.30	$0.10-0.50	$0.15-0.75	$0.25-0.50
Energy density	Medium	Low	High	Low
Storage duration	Medium (4-10h)	Medium (4-10h)	Short (1-4h)	Medium (4-10h)
Cycles	1000-10000	10000	500-5000	1000-5000
Depth of discharge	100%	100%	75%	50%
Self discharge 1 year	<1%	<1%	20-30%	10-20%
Maintenance	Minimal	Minimal	Medium	Medium
Size / Weight	Large	Large	Small	Small
Temperature tolerance	10-50C	10-50C	5-35C	5-50C
Safety	Low risk	Some toxicity	Fire risk	Low risk
Ingredients	Common	Uncommon	Rare	Common
Recyclability	High	High	Low	High

Source Battery University, irena.org, arena.gov.au;

Stationary Grid Storage

- Power supply has traditionally been regulated to account for the difference between generation and demand throughout the day. This has been achieved through demand side management where off-peak power has been on-sold to larger consumers at lower rates, to encourage these users to shift their loads to off-peak hours. While these practices are well embedded in power distribution, we expect the impact of renewables and grid storage as likely to influence future pricing mechanisms.
- To promote a greater level of energy independence, governments across the globe are moving to implement large scale grid storage infrastructure. These systems

provide the most likely mechanism to implement broad scale renewable energy technologies through capturing energy at off peak times and feeding this back into the grid when demand is high. A recent example is California in 2014 signing a bill for 1.3 GW (~2.5% of forecast power demand) to be stored at any one time.

- When assessing the technologies currently deployed for energy storage these can be broadly classified as follows:
  - ***Mechanical Energy Storage:*** This is the most widely used form of bulk energy storage with the most common application being pumped hydropower storage (PHS). PHS accounts for over 95% of large scale grid storage globally owing to the key advantages of low running costs, reliability and responsiveness to meet power demands. Expansion of this sector however is limited by permitting, capital expenditure and geographic footprint.

    An additional mechanical driven system is through compressed air energy storage (CAES), which involves driving turbines during periods of demand. Due to the much lower capital and construction time over PHS, it has gained popularity in moderate utility scale of 10MW-100MW (up to 50,000 homes) and to integrate into wind farm facilities. Other mechanical methods to regulate power load include flywheel systems that store kinetic energy in the form of a rotor that accelerates or decelerates according to the prevailing energy demand. These systems however suffer from limited storage time due to the inherently high friction losses.
  - ***Thermal Energy Storage***: In these applications heat is stored within a medium to extract when the energy demand is required. These systems can be "recharged" through introducing heat at a later date which is typically via two methods:
    - In Pumped Heat Electrical Storage (PHES) an inert gas (such as Argon) is compressed to heat crushed rock with the subsequent cooling and expansion of the gas through a Carnot cycle generating electricity at typical efficiency of ~70-80%. This method is most suitable of 2-5MW scale when short response times are not required.
    - The second more capital intensive method concentrates solar power on an array of mirrors to a central point to generate extreme heat to molten salt. This stored heat subsequently can provide super critical steam to drive a turbine. A current limitation of this technology is currently the degradation of the molten salt and the subsequent drop in capacity upon re-heating.
  - ***Electro-Chemical Energy Storage:*** Based on the market research we have conducted, this nascent segment offers the most appealing growth characteristics due to falling costs, improved energy retention and portability making these systems readily deployable. The more robust technologies include the incumbent lithium-ion (Li-ion), lead acid and the emerging sodium sulphur (NaS) and flow batteries. Lead acid batteries were used in the initial hybrid vehicles such as the Toyota Prius however have been surpassed by advances in Li-ion battery technology.
    - ***Sodium Sulphur (NaS) batteries*** were first established in the 1960's by the Ford motor company and have been deployed at over 190 sites in Japan for peak shaving purposes with the largest unit for 34MW (245MWh) for stabilizing wind energy. NaS batteries are somewhat behind Li-ion battery technology in terms of energy density and cycle time, but they can maintain longer discharges (four to eight hours), hence it's suitability for load leveling operations.
    - ***Redox Flow Battery:*** This has recently been popularized by the Red Flow Zinc Bromide battery with the basic difference to its electrochemical peers

being that the energy is contained within the electrolyte fluid rather than an electrode material. This reversal process between discharge and offers inherent advantages - the most prominent being the 100% depth of discharge (DoD) for over 10,000 cycles. As a comparison, a lithium-ion battery lasts 3,000 to 5,000 cycles (8-14 years) at a DoD of 100%. Just as significant for grid storage applications is the tolerance to temperature variability from 10-50ºC. Lithium ion batteries require auxiliary cooling at operating environments above ~35°C.

Figure 74: Photovoltaic Solar Tower

Source: Enviromission

Figure 75: Flow Battery Assembly

Source: Redflow Website

Figure 76: AES 100MW Li-ion battery plant

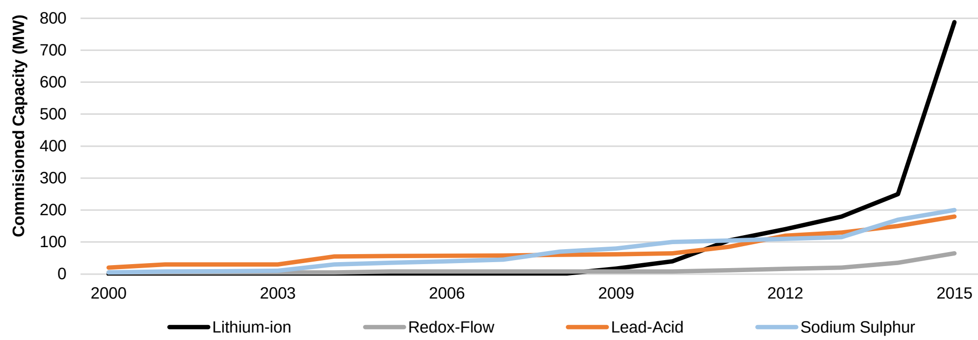
Source: AES Corporation

- ***Lithium Ion Batteries:*** As highlighted previously Li-ion batteries were released ~1991 and the high energy density quickly popularized these batteries in the consumer goods market. We anticipate that larger applications such as grid storage becoming more common place as falling unit price (see Figure 7) and safety aspects are improved. The existing limitation on lithium ion batteries within grid storage is its poor discharge capacity with literature indicating 2-4 hours of discharge as common in most large scale applications. An example of this is one of the largest peak power storage facilities currently in operation that is located in Southern California by AES Corp. This 100MW unit can deliver ~400MWh of energy over a 4 hour discharge period and is 3 times larger than other existing battery based units.

Quantifying the Li-ion battery opportunity in grid storage

- According to research provided by the US Department of Energy, Li-ion batteries are more “fit for purpose” for smaller discharge capacity (Figure 77) with most applications at less than 10MW capacity. This verifies lithium ion as being the battery technology most likely to be used as a “peak” manager rather than independent grid storage.

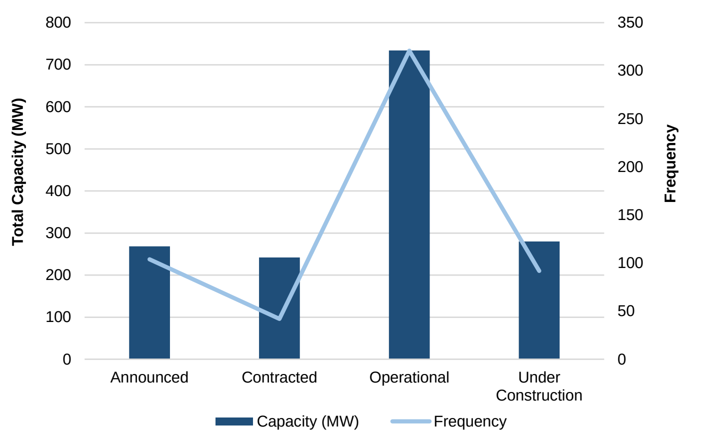
Figure 77: Commissioned Grid Stationary Capacity using Chemical Storage



Source: US Department of Energy

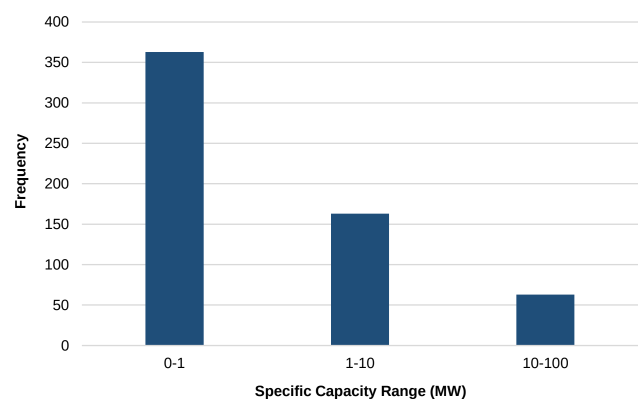
- Figure 78 shows the number and status of grid storage projects utilizing Li-ion battery technologies. We note that most of these are in smaller scale applications owing to the comparative shorter discharge duration of lithium ion batteries.

Figure 78: Status of Lithium Ion Storage projects



Source: US Department of Energy

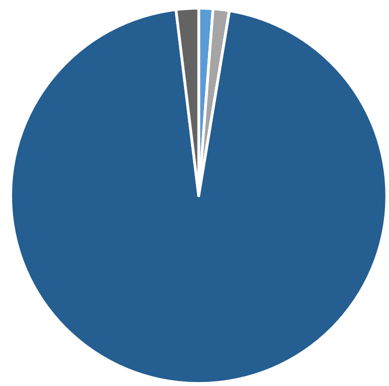
Figure 79: Lithium Ion Storage projects - capacity



Source: US Department of Energy

- When viewed in a broader context, pumped hydro systems (PHS) are likely to dominate as the preferred method for large scale grid storage for the foreseeable future with Figure 78 indicating over 95% of expected capacity to be derived from PHS systems. Of the remaining 5% of planned capacity this is likely to be spread evenly between mechanical (CAES), thermal (PHES) and chemical systems.

Figure 80: Grid storage types



Source: US Department of Energy

- Figure 81 provides a breakdown of the various grid storage projects that utilize electro-chemical energy. This highlights the popularity of lithium ion batteries mostly due to cost considerations. The lower capital cost of Lithium-ion based storage systems is due to the falling cost for the balance of plant (i.e supporting infrastructure and components) in line with improving integration.

Figure 81: Breakdown of Chemical Grid Storage Projects by Type

	Capacity (MW)	Projects (no.)	Capex (US$/kW)	LCOE (US$/kWh)
Flow	134	99	3500	0.3
Sodium Sulphur	223	75	5500	0.2
Capacitor	79	31		
Lead-Acid	189	88	1750	1
Metal Air	77	6		
Nickel	32	7	3000	0.3
Lithium Ion	**1534**	**568**	**1400**	**0.37**

Source: US Department of Energy

- The levelised cost of energy (LCOE) represents the cost (in real dollars) of building and operating a generating plant over an assumed financial life and duty cycle. The LCOE can also be regarded as the minimum cost at which electricity must be sold in order to break-even over the lifetime of the project. While lithium ion battery based systems show a slightly higher LCOE than a flow battery, this is more influenced by the short duty cycle rather than absolute costs. We have considered this factor in modelling our grid storage demand.

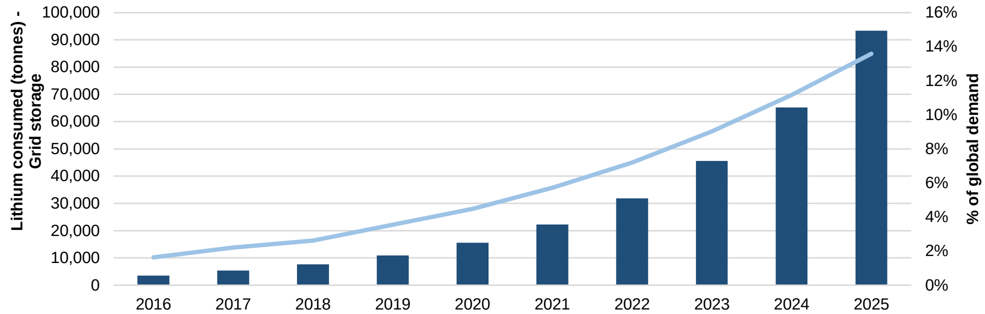
Impacts on Lithium Consumption

- While there appears to be a significant opportunity for lithium ion battery technology within stationary storage applications, for the purposes of our demand side modelling we have only considered residential and grid storage. We view electro-chemical systems as the most suitable for domestic applications due to the accessible entry price (<US$10k), compact size and ability to integrate into renewable and traditional grid storage power sources.
- While early stage storage systems have used more mature batteries such as lead acid we have conservatively assumed that the residential sector will mirror the acceptance of lithium ion that has become apparent in the large grid storage

sector. We have hence assumed that lithium ion batteries will constitute 50% of future residential battery demand.

- Australia, as an early stage adopter of IPSS, provides a comprehensive testing ground to determine the potential of domestic storage systems. Leading consultancy, AECOM published a detailed investigation into domestic grid storage within Australia in 2015, the conclusions from which we have adopted as the basis for our forecasts. Hence we have incorporated an annual growth rate of 30% in capacity conversion for our estimates.
- When our forecasts for Australia are extrapolated on a global scale, we note that this is scaled upon population growth forecast by the IEA. Commencing from 2016, we predict that the global capacity of domestic storage systems will be at a rate equivalent to 2% of Australia's. This is to highlight the significant obstacles that developing countries will experience when implementing domestic storage in comparison to more progressive countries such as Australia.
- We do note however the long term opportunity that may exist in developing countries that energy independence from grid infrastructure that IPSS systems may ultimately deliver.
- Within the stationary grid storage segment, demand forecasting is likely to be influenced by the following factors;
  - We note that the advancement of grid storage projects will be contingent on government policy, sector regulation and pricing structures. US Department of Energy data suggests that of the total storage capacity within its database, 78% is currently in operation with the balance either planned or under construction. Given the comparatively low capital requirements of chemical systems we view it likely that this will substantially increase, providing the basis for our modelled CAGR of total power capacity of 30%.
  - While we acknowledge that lithium ion batteries have some limitations in larger scale grid storage (current largest unit <500MW) we note that this is more than likely to be offset by the favourable aspects of lithium ion batteries (responsiveness for peak shaving management, accepted technology) in assessing the likelihood of demand. We understand that as the energy sector becomes more deregulated and consumers move towards greater levels of energy independence (ie willingness to "get off the grid"), flexible solutions such as lithium ion batteries will become an emerging trend.
  - Run time: We acknowledge that a limitation of lithium ion batteries within grid storage is the shorter discharge cycle. It is our understanding that LFP batteries offer the most "fit for purpose" units by having a comparatively lower specific heat capacity (hence a broader operating temperature range) with a resultant lower specific energy (hence resulting in a larger battery footprint). We currently model a discharge cycle of 3 hours however note that this could increase to 4 hours over the forecast period due to advancements in battery technology.
- Our modelled estimates for lithium demand from grid storage applications are illustrated in Figure 82. We estimate that grid storage applications will consume 16kt of LCE in 2020, increasing to 93kt LCE in 2025. Based on these forecasts, we estimate that grid storage will represent 19% of total lithium demand for Li-ion batteries, and 13.6% of overall lithium demand.
- We stress that grid storage as an industry is in the very early stages of development, with our projections based on conservative assumptions. Of all the segments where lithium ion batteries may have potential, we believe this offers the most immense opportunity yet also has the associate highest barriers to entry (government influence, infrastructure, consumer impact).

Figure 82: Estimated annual lithium consumption (LCE) – grid storage



Source: Canaccord Genuity estimates

CONSUMER ELECTRONIC PRODUCTS

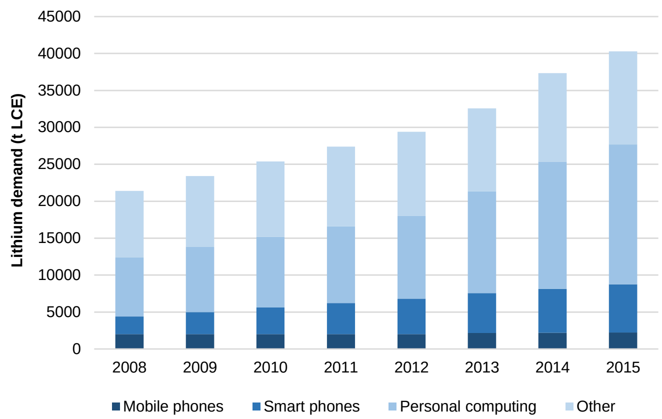
- Consumer Products incorporate two main battery types:
  - Primary batteries are disposable (non-rechargeable) and are most commonly produced as 18650 cells incorporating a NCA battery cathode. According to research from signumBox it was estimated that ~4kt of LCE was consumed in 2015 in the disposable battery market.
  - The secondary (re-chargeable) market which was historically dominated by nickel metal hydride (Nickel Cadmium) batteries. Due to a higher operating voltage and increased specific energy, Li-ion batteries (mostly as LMO) have emerged over recent years as the dominant secondary battery type within the consumer product sector.

Impact on lithium consumption

- For the purposes of our demand modelling, we have grouped the consumer market along with industrial applications as the traditional market, and as such, have applied relatively flat growth projections as the basis for our forecasts. While it is likely that the proliferation of electronic consumer goods will continue over our forecast period, we acknowledge the risk of some cannibalisation of demand of redundant technology and likely lower magnitude in scale compared to electric vehicle growth. Our modelling is based on the following four key consumer product markets;
  - ***Mobile Phone:*** Typical battery chemistry for a 3.7V LMO cell results in ~2 gram of lithium (LCE) being required for a typical operating time of ~24 hours. signumBox estimates of 1.1B unit sales in 2014 have been used within our growth projections. We model a slower annual growth rate of ~1.5% due to the falling cost of smart phones (internet enabled phones/devices).
  - ***Smart Phone:*** Using the same assumptions of battery chemistry as mobile phones we estimate ~6 grams of lithium (LCE) is used in each device. signumBox estimates of 1.0B unit sales over 2013 have been used within our growth projections. Subsequently we have seen annual growth ~15% over 2014-2015 and we estimate that this is likely to remain around this level over the forecast period owing to two main factors 1) The likely proliferation of connectivity devices driven by “the internet of things” and 2) the adaption of fixed communication to mobile devices validating this assumed growth rate.
  - ***Personal Computing:*** The move to thinner, lighter, more portable devices has translated to an increased demand for Li-ion batteries in preference to NiMH alternatives. Much like the basis of smart phones we have assumed a growth rate over our forecast period of 10% on 2014 unit sales of 250m, noting a typical usable lifetime of batteries of ~2 years.

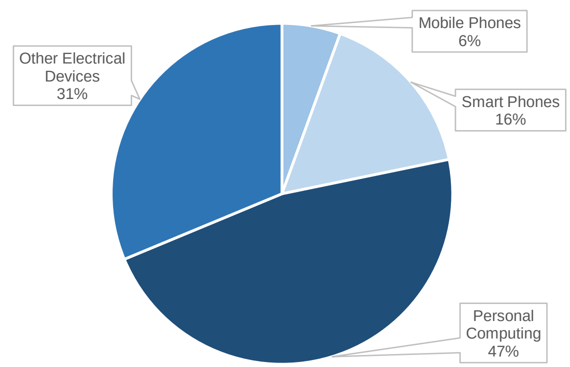
– *Other Electrical:* This broad category includes primary batteries and those used in power tools and other hand held electrical devices. For modelling purposes we have assumed that this sector will be dominated by NCA battery chemistry (6 x "18950" type cells in each unit) and have applied a steady 5% growth rate.

Figure 83: 2015 Consumer electronic devices product spilt



Source: signumBox, Company Presentations, Canaccord Genuity estimates

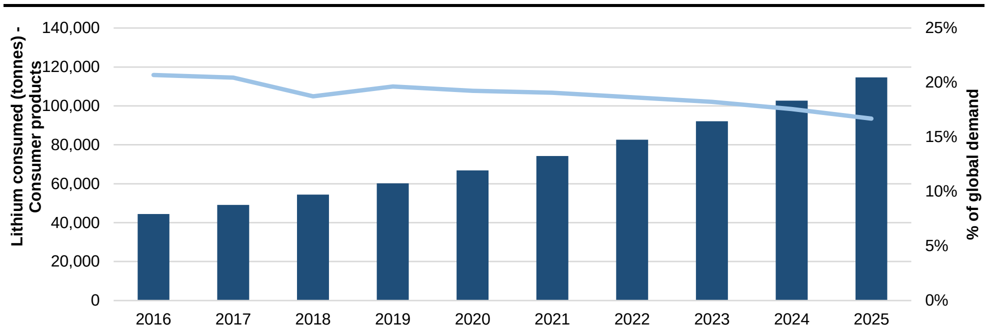
Figure 84: 2015 Consumer electronic devices product spilt



Source: signumBox Canaccord Genuity estimates

- Our forecasts are based on a modelled average CAGR of 10% for lithium consumed in electronic consumer devices, with an estimated 114,000t of LCE required in 2025. This represents a 285% increase on 2015 volumes.

Figure 85: Estimated annual lithium consumption (LCE) – Consumer electronic devices

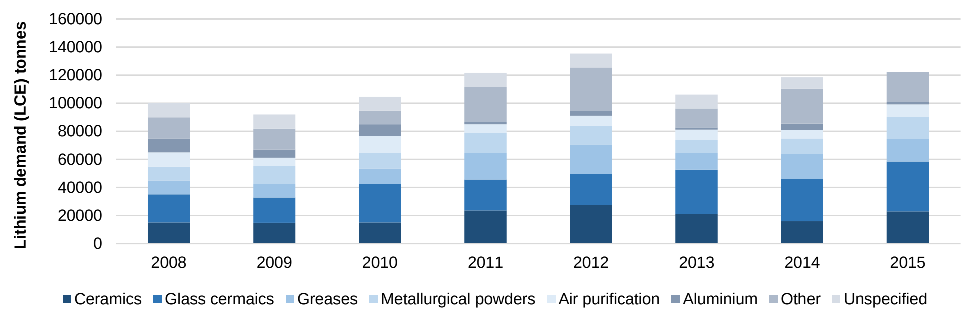


Source: Canaccord Genuity estimates

Demand - Industrial Applications

- Industrial Applications have been the dominant source of historic lithium demand. Most of these applications make use of some of lithium's favourable properties (corrosion resistance, light weight and viscosity), across a broad range of applications. We have grouped these according to the below segments noting the historic breakdown presented in Figure 86.

Figure 86: Historical industrial use breakdown



Source: signumBox, Roskill, US Geological Survey, Canaccord Genuity estimates

CERAMICS & GLASS CERAMICS

- Lithium in the form of purified products or more primary derivatives such as spodumene or other lithium oxides is used as an additive to the ceramics and glass industry for the following reasons:
  - Increases strength of ceramic bodies.
  - Lowers firing temperatures and thermal expansion
  - Improves viscosity for coating, as well as improving the glaze's color, strength and luster
  - In glass manufacturing, lithia (Li_2O) improves thermal shock resistance, durability and viscosity, assisting in the manufacture of highly sophisticated electrical componentry.
  - Other lithium salts such as chloride, fluoride, phosphate, silicate, or sulphate are also used in specific applications.
  - The glass and ceramics segments combined account for ~45% of industrial consumption in 2015, representing the largest segment of lithium consumption outside of lithium ion batteries.

GREASES & LUBCRICANTS

- Lithium in the form of lithium hydroxide has been a long-used additive to lubricants within the automotive, mechanical and heavy machinery industries. Lithium acts as a thickener to increase the durability, water resistance and operating temperature of the grease.
- We estimate that greases represent ~7% of the traditional applications, and view that it is unlikely that it will be displaced as an additive in the near future given they represent >70% of traditional industrial applications.

METALLURGICAL POWDERS

- Lithium is used as an additive across a broad range of industries and we estimate that this segment represented 11kt (or 10%) of LCE demand over 2015.
- Some applications include:
  - Dyes and Pigments: Lithium hydroxide and carbonate is used to enhance appearance and shear (coating) within paints.
  - Metallurgy: Lithium is added (typically 1-3%) to reduce weight and improve stiffness/tensile strength within alloys, a key consideration within the aerospace sector.
  - Rubber and Plastics: Butyl lithium is employed as an initiator for polymerization. This offers an alternative to emulsion based methods and can be performed at higher temperatures which results in improved rubber products.
  - Catalysts: For over 50 years lithium has been used as a carrier material for use in hydrocarbon refining.
  - Metal Casting Powders: Lithium is employed as a flux modifier within the casting process in the global steel industry. Lithium powders assist with improving viscosity and phase chemistry during the cooling process. This lowers operating temperatures (and costs) while delivering a superior product.

AIR PURIFICATION

- Lithium salts in the form of lithium chloride/bromide are commonly used to provide a solute for process brine for use in industrial air treatment systems. Lithium based solutes as a CFC free, antibacterial product have established themselves as a preferred refrigerant for use in air treatment and humidity control. Air purification represents ~7.5% of the total industrial demand of 2015 and we model an annual growth rate of 2.8% p.a.

ALUMINIUM

- Lithium based additives are used in the aluminium smelting process as a method of reducing bath temperature, increasing current efficiency and subsequently reducing energy consumption. More pertinently, lithium additives assist in reducing fluorine emissions (~20-30%) and subsequent greenhouse gas emissions.
- Use in aluminium manufacture currently only represents a negligible amount of overall LCE demand (~1.7kt) in 2015, with our forecast growth rate of 2.8% p.a. in line with our assumptions for other industrial applications.

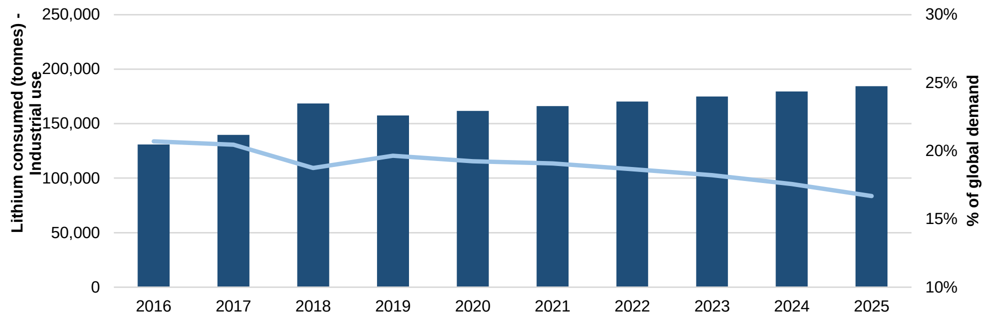
OTHER/UNSPECIFIED SEGMENTS

- Other and unspecified segments include:
  - Electronics
  - Building products such as cement additives.
  - Organic Synthesis
  - Pharmaceuticals – requiring the highest purity lithium products.

IMPACT ON LITHIUM DEMAND

- Our modelled demand projections for industrial applications sees a CAGR of 2.5% to 2025, with total demand requirements in 2025 of 184kt LCE. This represents a 50% increase on 2015 estimates of 122kt LCE.

Figure 87: Estimated annual lithium consumption (LCE) – Industrial applications

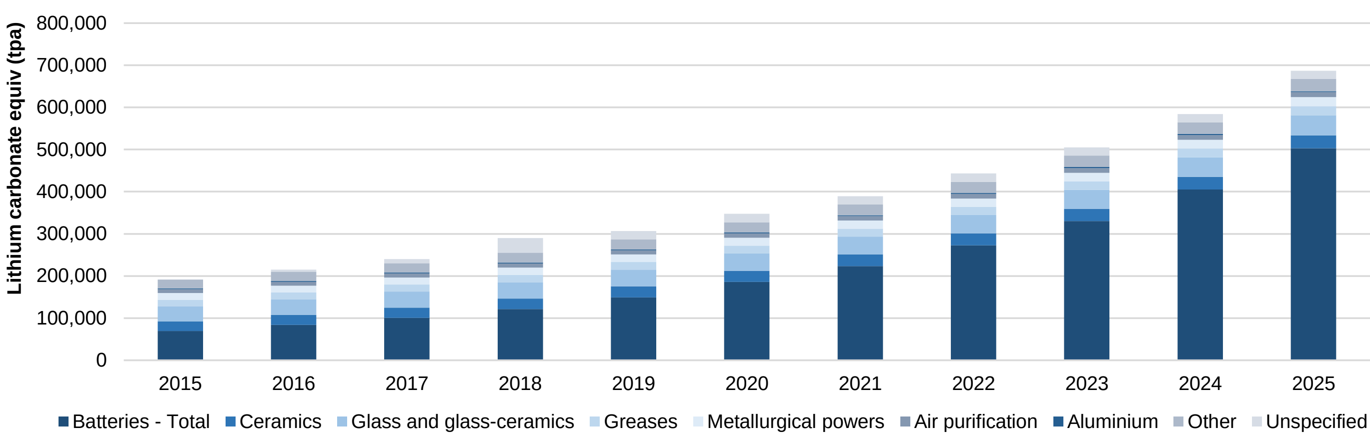


Source: Canaccord Genuity estimates

Lithium demand forecasts

DEMAND FORECAST SUMMARY

Figure 88: Lithium demand forecasts: Base case



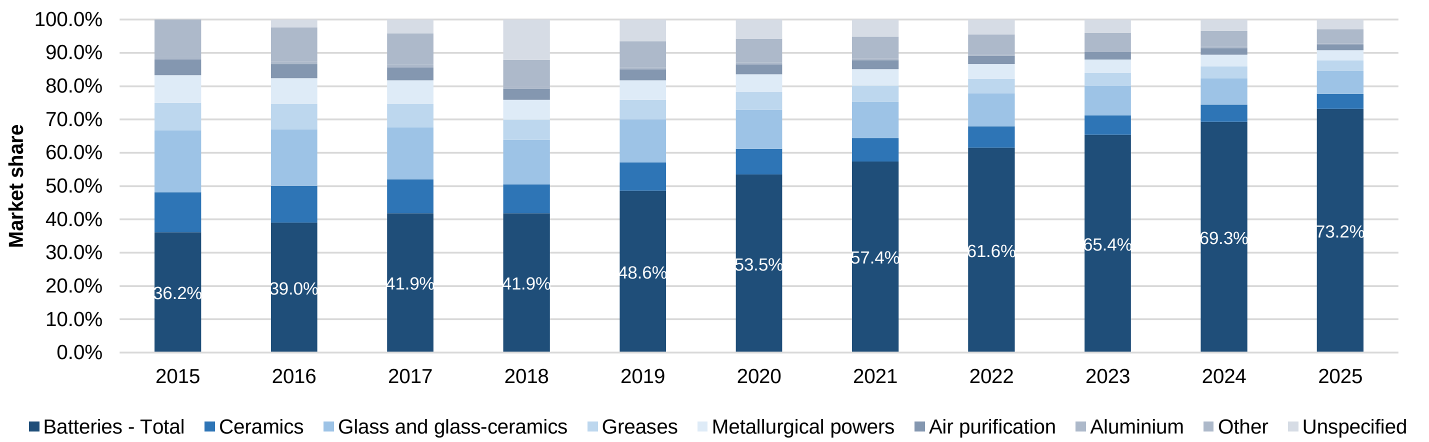
Source: Canaccord Genuity estimates

- We present our forecast demand projections in Figure 88 above. We estimate an overall growth in lithium demand to 2020 of 81% to 347kt LCE, representing a CAGR of 6% across all demand segments.
  - Within this, we forecast demand for lithium for use in Li-ion batteries as a proportion of the overall lithium market to increase from 36% to 54% (Figure 89), requiring an estimated 186kt LCE by 2020 (versus estimated total supply in 2015 of 176kt LCE).
  - Over that same period, we forecast lithium demand for industrial applications to increase by 32% to 161kt LCE based on a CAGR of 2.8% across the various industrial applications.
- Looking further out to 2025, we forecast total lithium demand to grow by 259% to 687kt LCE, representing a CAGR of 14% across all demand segments.
  - By 2025, we forecast demand from the Li-ion battery sector to account for 73% of overall lithium market demand with a total of 503kt required, with an estimated CAGR of 22% from 2016 estimates

- – Of the forecast demand for Li-ion batteries, we estimate demand from the EV sector to account for 28% of all lithium demand, from 5.3% in 2016, and the E-bus sector to account for 10.8% of overall market demand.
- – In 2025, we forecast demand from grid storage applications to be the third largest demand centre (behind consumer electronic products), with 13.6% market share at 93kt LCE (CAGR 41% from 2016).

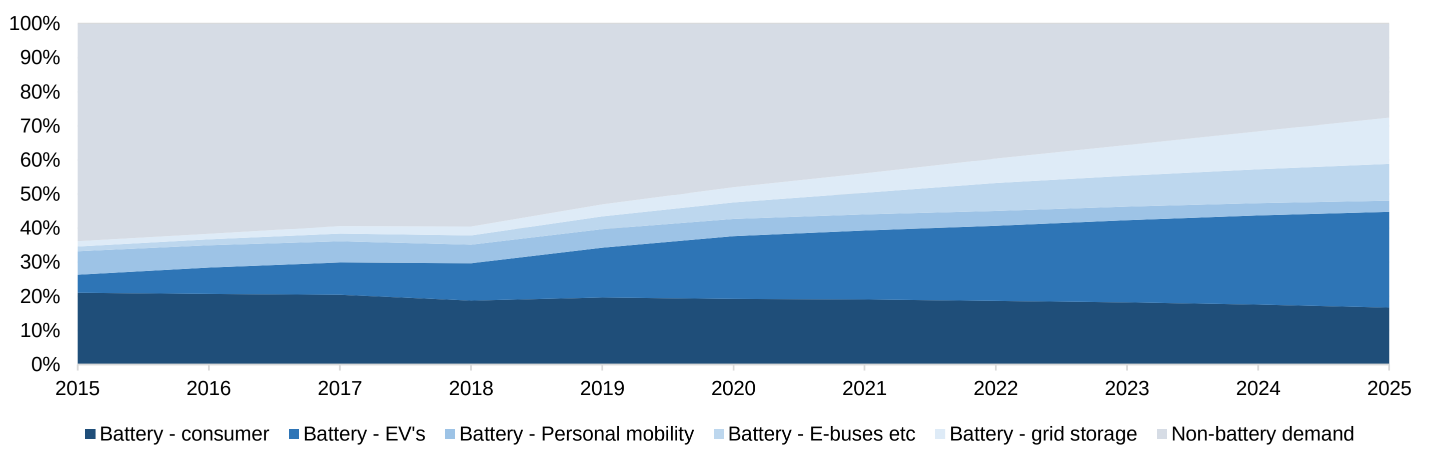
- These forecasts and estimates highlight the impact on the lithium market from growth in the EV market, with the growing importance of grid storage applications also expected to play a significant role in the market by 2025.

Figure 89: Lithium demand segments – estimated market share



Source: Canaccord Genuity estimates

Figure 90: Breakdown of battery market share vs non-battery demand segments

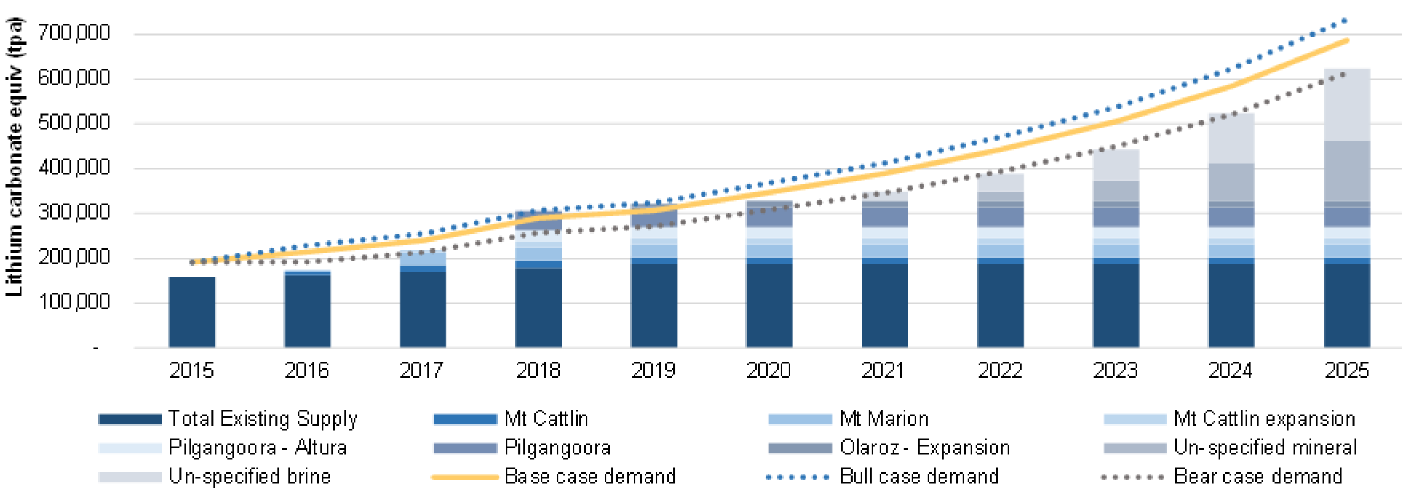


Source: Canaccord Genuity estimates

Market surplus/deficit forecasts & Pricing

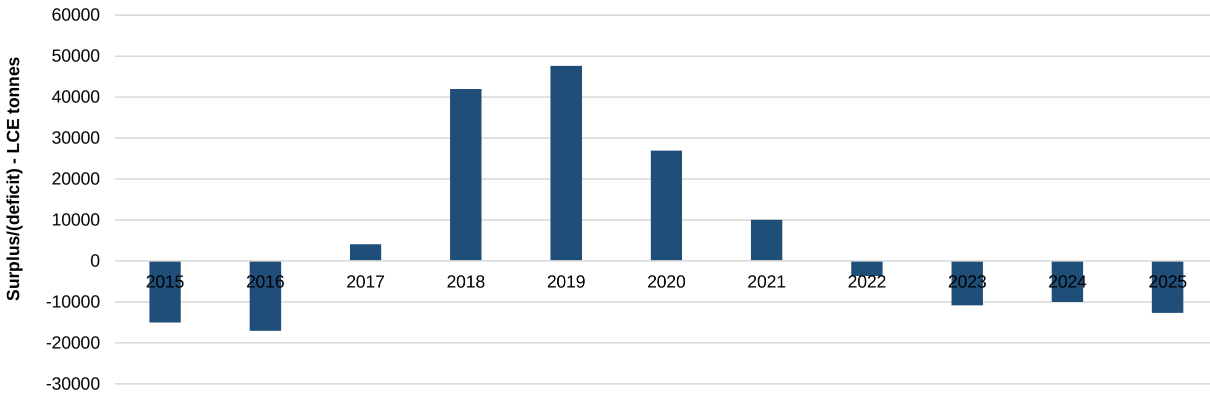
- We present our modelled market supply/demand balance in Figure 91 below.
  - Based on our modelled market supply assumptions (uncommitted and unspecified new supply comes on as modelled) and our base case demand projections (estimated CAGR of 14% to 2025), we forecast market oversupply of 13% in 2018 (38kt LCE) and 14% in 2019 (43kt LCE). That said, we also forecast the market to swing back to balance/deficit by 2021, and by 2025, estimate that an additional 510kt (above 2015 supply estimates of 176kt LCE) of LCE production is required to meet our modelled demand estimates.
  - Figure 91 also illustrates our "bull" case demand projections, which assumes an 8% annual increase in demand over our base case projections. Under this scenario, which assumes no change to our supply assumptions, we estimate a peak market surplus of 25kt LCE in 2019, and a market deficit in 7 out of 10 years to 2025. However, with our research indicating there are at least 18 advanced projects globally representing a potential ~400kt of new supply that could potentially be brought on stream within 5-6 years, we would expect in reality that any deficits may be much less severe.
  - Under our modelled "bear" case scenario (assumes 8% less demand versus our base case), we estimate that the market would remain in constant oversupply over our forecast period, with peak oversupply of 29% in 2019, and a surplus of 9% in 2025.

Figure 91: Forecast Lithium Supply/demand curves



Source: Company Reports, signumBox 2015, Canaccord Genuity estimates

Figure 92: CG forecast lithium market surplus/(deficit)



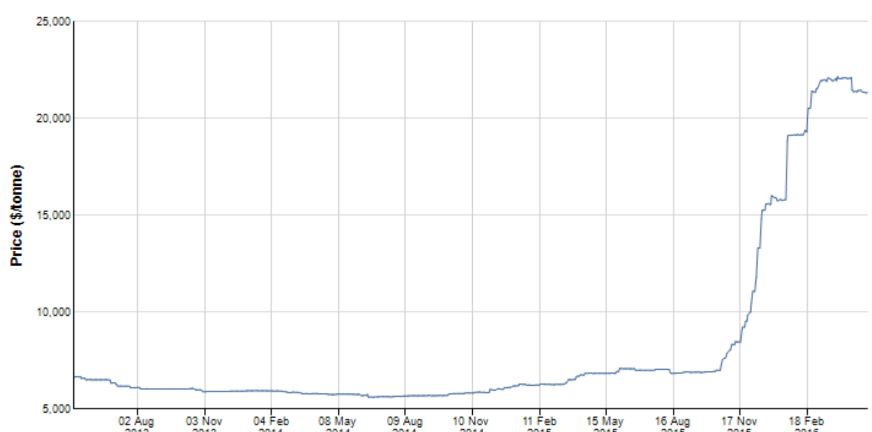
Source: Canaccord Genuity estimates

IMPACT ON PRICING – CG FORECASTS

Lithium market pricing structure

- Given the two primary product markets within the lithium sector (refined lithium compounds vs mineral concentrates), it is important to draw the distinction in the pricing structure between the two products:
  - Most lithium carbonate (and/or the various other refined lithium compounds), is sold on a contract basis with various influences such as product specification (i.e. purity), contract duration and quantity being the key determinants of price.
  - Spodumene concentrate prices are determined by prevailing lithium carbonate prices, in that prices paid by converter plants for concentrate are set with reference to margins after adding costs to convert the concentrate to lithium carbonate. This is illustrated best in Figure 22.
- While most lithium compounds are traded via contracts, there is a market for “off contract” material in China, which typically comprises small volumes of material. This material is usually material converted from hard rock sources and has usually undergone further downstream processing aimed at higher end applications such as the battery market.

Figure 93: China lithium carbonate 99.5% Li (US$/tonne)



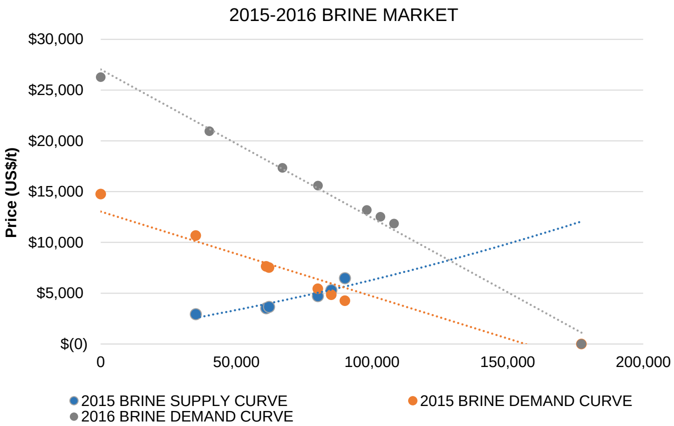
Source: SNL Mining

Pricing history & outlook

- Contract pricing averaged US$5,500-6,000/t for most of 2013-2015, with prices for off-contract material rising dramatically in late 2015 to recent highs of +US$24,000/t. In our view, this increase has been driven by the realisation of downstream lithium consumers of the current tightness in the market, which we consider to be driven by the following factors:
  - Rapid improvement in the demand outlook based on the growing Li-ion battery sector
  - Historically poor capacity utilisation from brine producers with new market entrants still in ramp up phase
  - Changing dynamics of the lithium concentrates market, where by the dominant producer (Greenbushes) has announced cessation of sales to third party converters, and lack of alternative concentrate supply
- Based on our supply/demand model as above, we have derived pricing forecasts for both lithium carbonate (brine derived) and spodumene concentrate (hard rock).
- Our forecasting methodology is based on assessing the fundamental supply and demand dynamics (price and quantity for LCE) that occur within each forecast year. In doing so we have considered the following influences to determine a benchmark price for +99% Li lithium carbonate product.
  - *Production Cost Base*: We have taken our production cost data estimates indicated in Figure 20 into account for the product markets that this represents (36% batteries). Given the forecast demand (73% within the batteries segment by 2025) we envisage that it is likely that higher production costs (impurity removal, additional equipment) will occur in line with improved product specification (+99.5% Li). To capture this we have inflated YoY production costs of current producers in proportion to be in line with the increased market share of the battery segment.
  - *Marginal Cost Base*: To obtain an effective industry supply curve we have added a CIF (freight) charge of US$500/t to place the product within the end user market (Battery factories within Asia mostly). In addition we have added a nominal 15% margin which combined with the freight charge enables us to produce an effective "marginal" cost of production for use within our model.
  - *Supply Frontier Curve*: For each year we have ranked the producers according to their marginal cost profile to produce a supply frontier curve. This enables us to assess the effect of additional supply onto the market on the previous year's established (equilibrium) price. For the purposes of unspecified additional supply coming onto the market from 2020 we have positioned this supply (cost and quantity) on the supply frontier curve using the average costs that prevail that year.
  - *Demand Curve*: The prevailing demand for brine sourced LCE has been established by determining the quantity that remains after converted spodumene sourced LCE has been accounted for. This provides the quantity (position on x axis) that is likely to be established within market equilibrium. The slope of the demand curve is fixed between the points of infinite and zero quantities. In practise this translates to the maximum brine capacity that exists ($Q \to \infty$, $P \to 0$) and the maximum price that customers will pay in the event of a perceived lack of supply in the market ($Q \to 0$, $P \to \infty$).
  - *Market Behaviour*: We have assumed that end users are likely to be forward looking in their likely demand for lithium products and as such have considered the effect of YoY demand change on the established supply frontier curve. It is noted that pricing appears to become more inelastic (steeper demand curve)

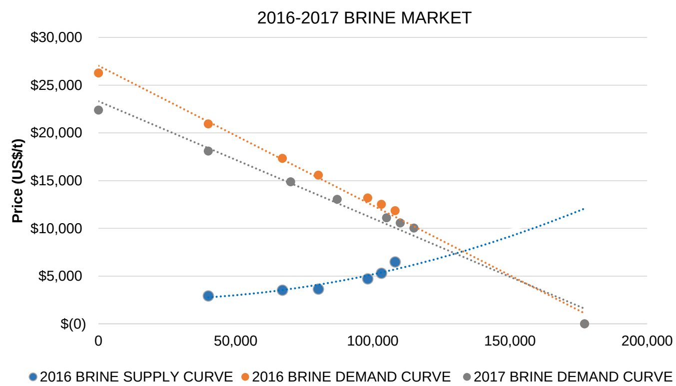
as market conditions tighten such as over 2016 and ultimately as illustrated in our forecast for 2025.

Figure 94: Equilibrium pricing model – 2015-2016



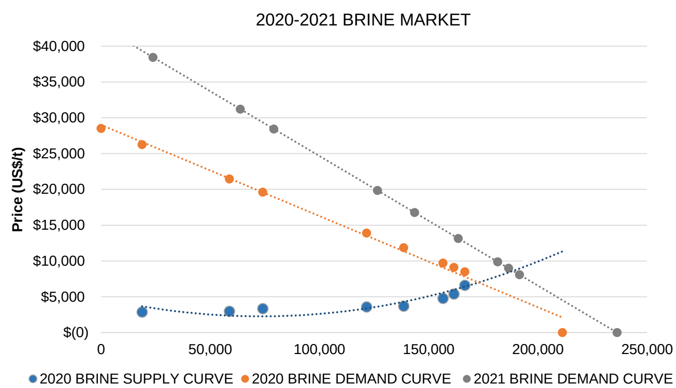
Source: Canaccord Genuity estimates

Figure 95: Equilibrium pricing model – 2016-2017



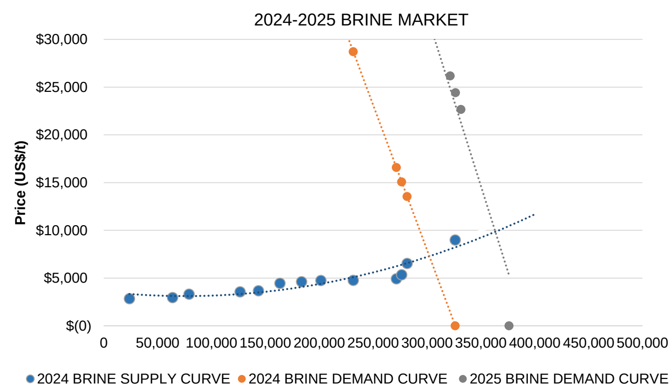
Source: Canaccord Genuity estimates

Figure 96: Equilibrium pricing model – 2020-2021



Source: Canaccord Genuity estimates

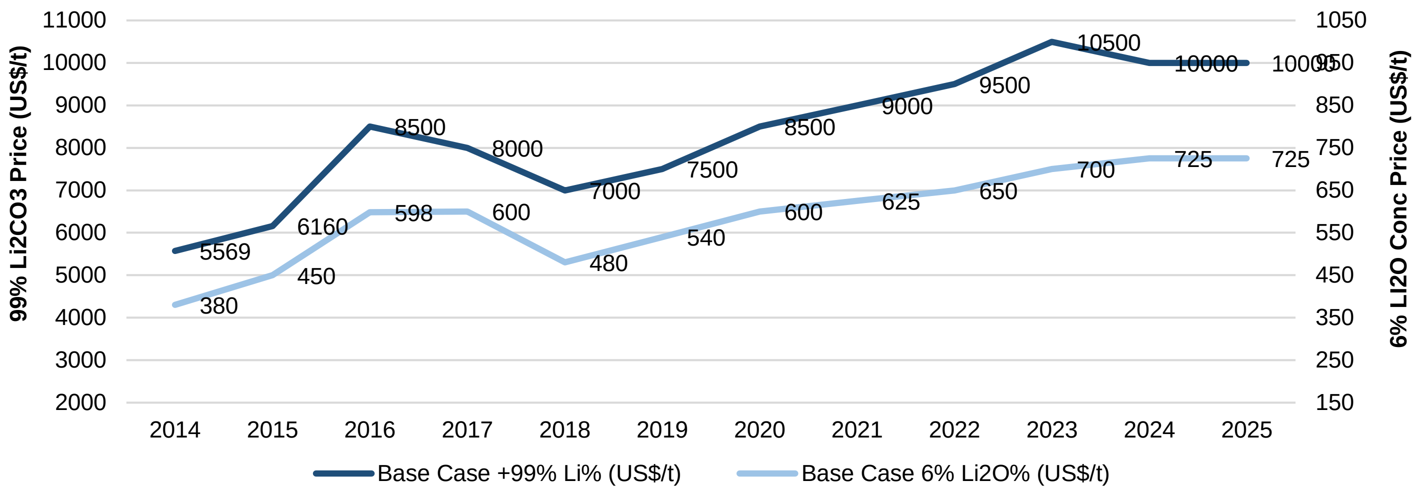
Figure 97: Equilibrium pricing model – 2024-2025



Source: Canaccord Genuity estimates

- Our resulting price forecasts for lithium carbonate (+99% Li) and spodumene concentrate (6% Li_2O) products are shown in Figure 98 below.

Figure 98: +95% Li lithium carbonate (LCE, dark blue, LHS) and 6% Li_2O spodumene concentrate (light blue, RHS) price forecasts



Source: Canaccord Genuity estimates

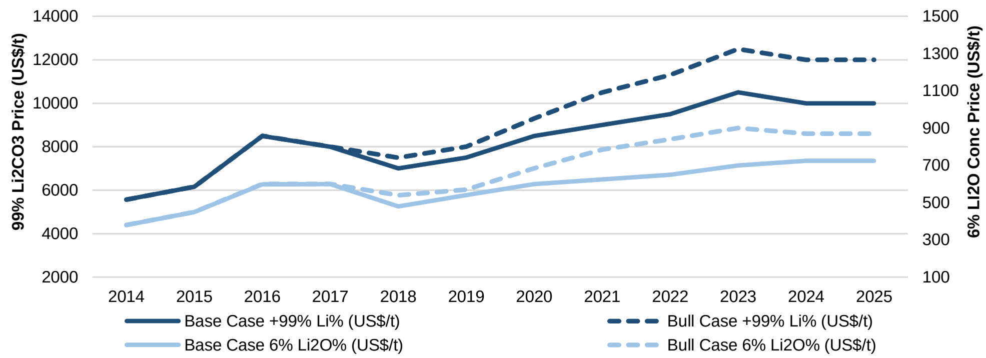
Spodumene concentrate pricing

- We have used the benchmark lithium carbonate price shown in Figure 96 above to establish the prevailing price that hard rock converters would be expected to receive for a comparable (+99% Li) product. Assuming conversion costs remain constant at US$2,500/t of product and converter operating margins are within a tolerance range of 15-28% we obtain a benchmark (6% Li_2O) price forecast for spodumene concentrate as per Figure 98 above.
- We note that converter margins will be a function of prevailing market conditions (product purity, input costs, converter capacity, end user demand) and industry factors (company consolidation, government regulation). As a higher cost processing route to produce lithium products we note that converters' profitability (and hence hard rock suppliers) remain the most susceptible to downside risks such as declining demand or a disruptive increase in supply (through new extraction techniques, brownfields expansion).

"Bull" case pricing scenario

- As per our "bull" case demand scenario illustrated in Figure 89, we have derived an upside pricing scenario (Figure 99), which results in peak price of US$12,000/t for lithium carbonate, and US$870/t for spodumene concentrate in 2025.

Figure 99: Base case vs "bull" case lithium pricing scenarios



Source: Canaccord Genuity estimates

Risks to our forecasts

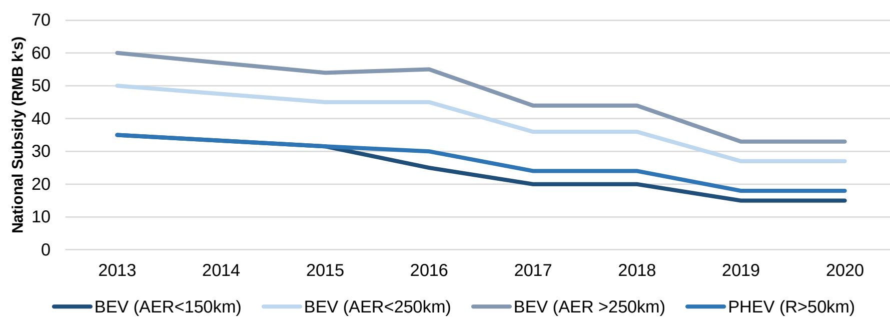
UPSIDE RISKS

- We consider the main upside risks to our forecasts as:
  - Higher than forecast EV penetration rates – as the key driver of demand, a higher than modelled CAGR of 27% (to 2025) is likely to have a significant impact on overall lithium demand. This is best illustrated in our "bull" case demand projections in Figure 89, with estimates of material market deficits with only an 8% annual increase on our base case forecasts.
  - Increased roll out of residential and stationary grid storage – the grid storage sector is only in its early stages of development, and given it represents (based on our estimates) the third largest demand segment, accelerated roll out of residential and stationary grid storage would lead to a significant impact on demand.
  - Delays to new supply – our base case supply forecasts are based on both committed and un-committed new supply achieving targeted production rates according to reported schedules. We note however the track record of new lithium projects suffering from permitting/environmental issues (Atacama), technical issues (Hombre Muerto), extended ramp ups (Olaroz), or complete failures (Quebec Lithium). As with any new mining project, there is the potential for permitting, financing, and project execution risk (especially with new brine projects). As such, any delays to new supply would be expected to have a positive impact on the market supply/demand and hence price.

DOWNSIDE RISKS

- Key downside risks to our forecasts include:
  - Slower than expected EV/grid storage penetration owing to changes in policy (i.e. removal of government subsidies). By way of example we highlight the current situation in China.
    - The Chinese government included Electric Vehicles as a key project within the 11th Five-Year Plan. The Plan is targeting total electric vehicles to reach 500,000 units by 2015 and 5 million by 2020. In 2020, production capacity is targeted to reach 2M vehicles (vs CGe of 1.5M), with battery costs falling to Rmb1,500 per kW (US$230/kWh) vs Tesla's current target of US$250kWh (see Figure 51).
    - To accomplish these goals, in September 2013 the government has introduced financial incentives such as purchase subsidies and tax incentives outlined in Figure 98 below along with non-financial incentives such as exemptions from license-registration lotteries and the aggressive development of infrastructure such as recharge stations.
    - These subsidies have been subject to change with the Chinese government's initial plan to lower subsidies each year by 10% being revoked. In April 2015 the Ministry of Finance published a new set of guidelines that outlined a decline in subsidies with 2020 being 60% of 2016 as indicated in Figure 100 below.

Figure 100: Declining Purchase Subsidies in China

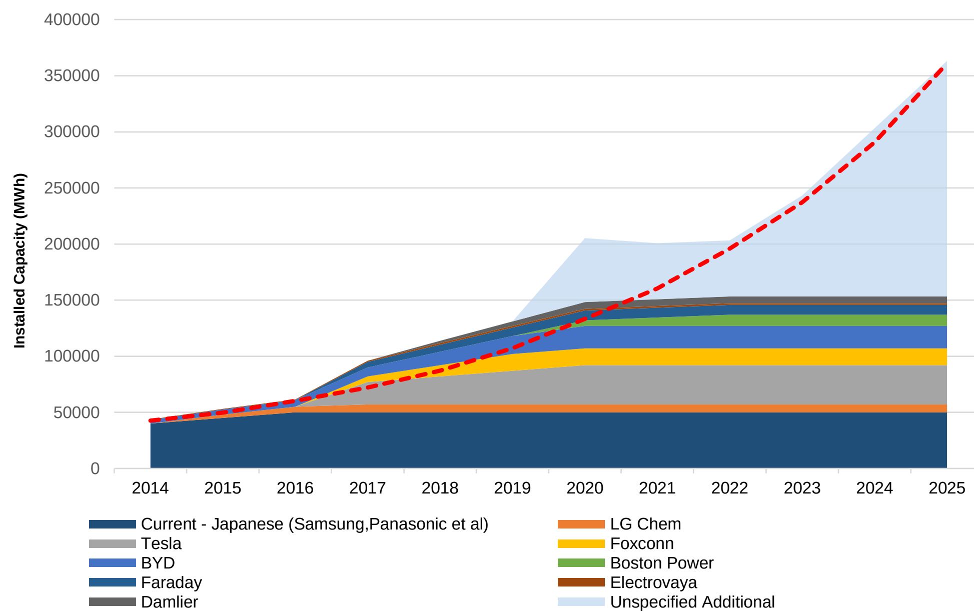


Source: China Ministry of Finance

-
  -
    - It should be noted that in addition to central subsidies China and other countries have implemented local purchase subsidies for approved vehicles.
    - Charging Station infrastructure: In November 2015 within the Chinese Government's Guideline on Development of EV charging Infrastructure plan to build in excess of 12,000 recharge stations (to accommodate 5m EVs by 2020) against 780 recharge stations as at the end of 2014.
  - Battery Manufacturing Capacity: A likely restriction on the large scale implementation of electric vehicles is the development of sufficient battery manufacturing capacity to support growth projections. Recent announcements by Automobile manufacturers Daimler (6 GWh March 2016) and Faraday Future (~9GWh in December 2015) to join Tesla (35 GWh) in integrating upstream battery manufacturing facilities highlight the investment that companies are likely to continue to make to control battery technology. In

addition it is likely that upstream integration will mitigate the forecast supply risk that the strong growth in lithium ion batteries is likely to produce.

Figure 101: Forecast Battery Manufacturing Capacity



Source: Company Reports, Canaccord Genuity estimates, Benchmark Minerals

– Successful development of new, low cost lithium extraction technologies could have a marked effect on the lithium production cost curve. We note that a number of proprietary extraction technologies are being developed, which if successful, could lead to additional market supply through recovering lithium from previously un-economic deposits. While the extraction of lithium from brines using the "Silver Peak" process is industrially accepted, several new process routes highlighted on the following page could drop this previous barrier to entry.

Figure 102: Alternative Processing Technologies (Li_2CO_3 & LiOH)

Company	Name of Process	Description	Project	Development Stage
LI3 Energy	POSCO	Properitary techonlogy	Maricunga	Scoping Study
Nemaska	Electroysis	Direct extraction of LCE and LIOH through roasting, leaching and eletrolyisis of spoduemene concentrate Capex - US$439m; costs ~US$2500/t Li2CO3 & LiOH. Process to produces 27.5ktpa LiOH and 3.2ktpa Li2CO3. Q1'17 mine and construciton start - commercial production Q3'18	Whabouchi	DFS completed
Neometals	E-Li	10kt of LiOH and 9kt of LCE produced using an acidic hydrolysis process from 6% Li2O from Mt Marion project. Opex is estimated at US$3,800/t to produce Battery Grade LiOH. Capex of US$83m.	Mt Marion	DFS due Mid 2016
Orocobre	LiSX	Currently conducting testw ork w ith Tenova Batemen on a 2t/month pilot plant to produce LiOH at Olaroz using a solvent extraction directly on concentrated brine. ORE have exclusive license to 2019	Olaroz	Scoping Study
POSCO	Direct	Properitary techonlogy	Pozuelos	Operating end of 2016
Pure Energy	LiSX	Partnership w ith Tenova Batemen	Clayton Valley	Scoping Study

Source: Company Reports, Canaccord Genuity estimates

– Change in battery technology – we acknowledge that as the market for rechargeable batteries continues to grow, further R&D may lead to the development of competing battery technologies. However, we consider the risk of this during our forecast period to be minimal given 1) incumbency of Li-ion batteries, 2) the long lead times to commercialisation (Li-ion battery market has so far taken ~26 years to develop), and 3) requirement for return on capital from battery manufacturing facilities will in our view ensure Li-ion remains the pre-eminent battery technology for the foreseeable future.

– Recycling – recycling of used Li-ion batteries offers a potential new source of lithium which we have not factored into our forecasts. However, we view the potential for recycling of lithium ion batteries as unlikely to meaningfully influence the supply and demand dynamics of the lithium market over the medium term for the following reasons:

- *Comparison with Lead acid not relevant:* The recycling of Lead acid (Pb-acid) batteries has become increasingly prevalent (+90%) due to tighter environmental regulations (prevention of groundwater leaching) and increased land fill costs. The recycle process for Pb-acid batteries is well established owing to the relatively simple and uniform design, which enables large scale automation. The disassembly of a Li-ion battery on the other hand involves several more intensive processes to effectively separate out the various components of the battery. Lithium is usually contained within the slag formed in the smelting process and recovery is neither economic nor at a required product purity to be considered usable.

- *Various cell packages and components:* There are ubiquitous cell assemblies within lithium ion batteries, with the Tesla Model S85 for instance containing over ~7000 individual NCA cells. This combined with the fact that Li-ion batteries have only been in use within electric vehicles for less than a decade means that it is likely that there has been a small number of batteries that have been retrieved for recycling. This combined with a recent decline in the price of valuable materials (Nickel, Copper and Magnesium) has subdued the incentive to pursue recycle programs, not to mention the relatively low input costs of lithium in the overall battery manufacture.

- *Evolving Battery Chemistry:* Based on our analysis in Figure 47 on data from November 2014, LCO batteries theoretically offer the most likely candidate for recycling due to the proportion of contained valuable metal (Cobalt). In practise however it should be noted that LCO batteries are mostly used within smaller devices (mobile phones etc) in which we forecast lower overall raw material demand than battery chemistries that are more suitable for larger scale applications (EV-buses, grid storage etc).

Canaccord Genuity (Australia): Lithium Sector Coverage

Galaxy Resources

GXY:ASX | Rating: SPECULATIVE BUY | Target: A$0.60 (from A$0.50)

Overview

GXY is a globally diverse, lithium production and development company. Its key assets include the commissioning-stage Mt Cattlin spodumene operation in Western Australia (subject to 50% earn in by GMM:ASX), the 100-%-owned Sal de Vida lithium brine project in Argentina, and the advanced James Bay spodumene exploration project located in Quebec, Canada.

Mt Cattlin one of only two new sources of lithium production globally in the next 18 months

Mt Cattlin is a +1 Mtpa open pit operation, with base case production capacity of +110ktpa of 5.5% Li_2O spodumene concentrate at estimated costs of <A$300/t concentrate product. The operation recently commenced commissioning after a low cost (<A$10m) plant refurbishment program, with the development plan seeing initial concentrate production from the plant's fines circuit during JunQ'16, followed by production from the coarse circuit in mid'16. First sales are expected in Jul'16, with the project expected to achieve nameplate production rates by end'16. There is potential to increase production to +205ktpa of spodumene concentrate via a low cost de-bottlenecking program, which we currently anticipate will be completed by early 2018. Current resources support a mine life of +10 years, with recent exploration results supporting the potential for extensions to the current resource. The Mt Cattlin JV recently secured off-take arrangements, covering 60ktpa of concentrate in CY16 at US$600/t, and 120ktpa for CY17.

Sal de Vida – one of the world's highest quality, un-developed lithium brine deposits

Sal de Vida is located between the Salta and Catamarca provinces of Argentina, at an elevation of 4,000m. The project is estimated to host total resources of 7.2Mt LCE, and features favourable characteristics such as brine chemistry (good Li grades, low Mg:Li ratios), and access to infrastructure. A DFS was completed in 2013 which contemplated a +40 year, 25ktpa Li_2CO_3 + 95ktpa potash project, with estimated capital costs of US$369m and operating costs of US$2,200/t (net of by-product credits). GXY has commenced a review of the DFS with a view to updating operating parameters and financial metrics (potential for lower production and capital costs), which is expected to be completed in mid'16. Following this, we anticipate GXY to assess financing options with a development decision possible before the end of 2016.

James Bay – resource-stage project moving to feasibility by end 2016

The James Bay spodumene project is located in NW Quebec, Canada. The project is subject to an earn in by GMM:ASX where it has the right to earn up to 50% interest. The project hosts total resources (Indicated + Inferred) of 22.2Mt at 1.3% Li_2O for 0.28 Mt Li_2O (0.7Mt LCE). An infill drilling program is planned for 2H'16, ahead of the commencement of feasibility studies in late 2016/early 2017.

Valuation

We value GXY on a NAV basis, comprising estimated NPV10% for Mt Cattlin, a blended valuation (DCF and market benchmark approach) for Sal de Vida, net of corporate and other adjustments. With increased Li_2CO_3 prices and revisions to our spodumene concentrate pricing assumptions (2018 and 2019 down by 20% and 10% respectively, offset by 20% increases in LT prices), we lift our valuation/target price from A$0.50 to A$0.60.

FINANCIAL SUMMARY

Galaxy Resources Ltd **ASX:GXY**

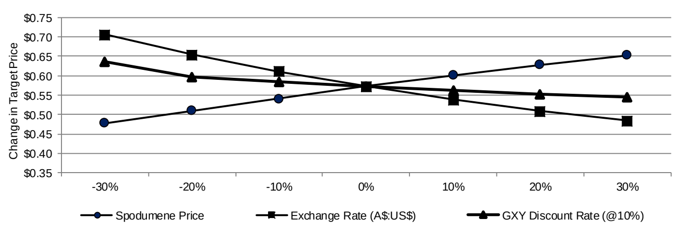
Analyst:	Reg Spencer
Date:	15/05/2016
Year End:	December
Rating:	**SPEC BUY**
Target Price:	**$0.60**

Market Information		
Share Price	A$	0.43
Market Capitalisation	A$m	543.7
12 Month Hi	A$	0.49
12 Month Lo	A$	0.02
Issued Capital	m	1264.43
ITM Options	m	37.00
Fully Diluted	m	1301.43

Valuation		**A$m**	**A$/share**
Mt Cattlin	NPV10%	336.0	0.27
Sal de Vida	Estimate	419.1	0.33
Exploration & Other (James Bay)	Estimate	40.0	0.03
Corporate		(49.6)	(0.04)
Cash		8.4	0.01
Debt		(31.0)	(0.02)
TOTAL		**723.0**	**0.57**
Target Price			0.60
P/NAV			0.72x

Assumptions	**2015a**	**2016e**	**2017e**	**2018e**
Lithium Carbonate (US$/t)	6,000	7,813	8,500	8,000
Spodumene Concentrate (US$/t)	402	565	700	480
Tantalum (US$/lb)	75	75	75	75
AUD:USD	0.76	0.75	0.74	0.74

Valuation Sensitivity



Production Metrics	**2015a**	**2016e**	**2017e**	**2018e**
Mt Cattlin (100%)				
Spodumene concentrate (kt)	0.0	64.9	158.3	206.2
LCE production (kt)	0.0	0.0	0.0	0.0
Tantalum concentrate (Mlb)	0.0	1.4	5.5	7.2
AISC (A$/tonne LCE)	0.0	300	225	181
Sal de Vida (100%)				
Lithium Carbonate (kt)	0.0	0.0	0.0	0.0
AISC (US$/tonne LCE)	0.0	0.0	0.0	1.0

Reserves & Resources				
Mt Cattlin (50%)	**Mt**	**Grade (Li_2O)**	**Mt LCE**	**Ta2O5 (Mlbs)**
Resources	16.4	1.08%	0.178	5.68
Reserves	10.0	1.04%	0.104	3.28
James Bay (50%)	**Mt**	**Grade (Li_2O)**	**Mt LCE**	
Resources	22.2	1.25%	0.278	
Sal de Vida (100%)		**Vol (km3)**	**Li (ppm)**	**Mt LCE**
Resources		1.8	753	7.25
Reserves		0.4	489	1.14

Directors & Management	
Name	**Position**
Martin Rowley	*NE Chairman*
Anthony Tse	*Managing Director*
Charles Whitfield	*Exec Director*
Jian-Nan Zhang	*Non-exec Director*

Substantial Shareholders	**Shares (m)**	**%**
Acorn Capital	87.48	6.9%
Paradice Investment Mgt	66.49	5.3%

Company Description

Galaxy Resources Limited (ASX:GXY) is an Australian based, globally diversified lithium development company. Its primary assets are Mt Cattlin spodumene operation in WA (earning out to 50%), the Sale de Vida lithium brine development project in Argentina (100%) and the James Bay spodumene exploration project in Canada (earning out to 50%).

Profit & Loss (A$m)	**2015a**	**2016e**	**2017e**	**2018e**
Revenue	0.02	5.89	45.69	40.91
Operating Costs	-3.6	0.0	0.0	0.0
Corporate & O'heads	-5.5	-5.9	-6.1	-6.3
Exploration (Expensed)	-0.3	-0.3	-0.6	-0.8
EBITDA	**-9.5**	**-0.3**	**38.9**	**33.8**
Dep'n	-0.1	0.0	0.0	0.0
EBIT	**-9.6**	**-0.3**	**38.9**	**33.8**
Net Interest	-8.7	-4.0	-2.6	-0.5
Tax	0.0	0.0	0.0	0.0
NPAT	**-18.3**	**-4.2**	**36.4**	**33.3**
Abnormals	73.2	0.0	0.0	0.0
NPAT (reported)	**54.9**	**-4.2**	**36.4**	**33.3**

Cash Flow (A$m)	**2015a**	**2016e**	**2017e**	**2018e**
Cash Receipts	2.2	5.9	45.7	40.9
Cash paid to suppliers & employees	-7.2	-5.9	-6.1	-6.3
Tax Paid	0.0	0.0	0.0	0.0
Net Interest	-13.3	-4.0	-2.6	-0.5
Operating Cash Flow	**-18.3**	**-3.9**	**37.0**	**34.1**
Exploration and Evaluation	-1.8	-1.6	-2.0	-2.0
Capex	-0.0	-0.0	0.0	0.0
Other	87.2	4.5	6.0	6.0
Investing Cash Flow	**85.3**	**2.9**	**4.0**	**4.0**
Debt Drawdown (repayment)	-72.6	-6.5	-10.0	-14.5
Share capital	0.0	0.0	0.0	0.0
Dividends	0.0	0.0	0.0	0.0
Financing Expenses	0.1	0.0	0.0	0.0
Financing Cash Flow	**-72.5**	**-6.5**	**-10.0**	**-14.5**
Opening Cash	13.6	10.7	3.1	34.0
Increase / (Decrease) in cash	-5.4	-7.5	31.0	23.6
FX Impact	2.8	-0.1	0.0	0.0
Closing Cash	**11.0**	**3.1**	**34.0**	**57.7**

Balance Sheet (A$m)	**2015a**	**2016e**	**2017e**	**2018e**
Cash + S/Term Deposits	10.7	3.1	34.0	57.7
Other current assets	1.8	1.5	11.5	10.6
Current Assets	**12.5**	**4.6**	**45.6**	**68.2**
Property, Plant & Equip.	1.7	1.7	1.7	1.7
Mining, Expl'n & Develop.	124.0	125.3	126.7	128.0
Other Non-current Assets	1.5	1.5	1.5	1.5
Payables	1.4	0.9	3.7	3.4
Short Term debt	6.5	10.0	14.5	0.0
Long Term Debt	24.5	14.5	-0.0	-0.0
Other Liabilities	4.6	9.1	22.4	27.8
Net Assets	**102.8**	**98.6**	**134.9**	**168.3**
Shareholders Funds	459.2	459.2	459.2	459.2
Reserves	-6.6	-6.6	-6.6	-6.6
Retained Earnings	-354.0	-358.2	-321.8	-288.5
Total Equity	**102.8**	**98.6**	**134.9**	**168.3**

Ratios & Multiples	**2015a**	**2016e**	**2017e**	**2018e**
EBITDA Margin	nm	nm	85%	83%
EV/EBITDA	nm	nm	12.5x	13.1x
Op. Cashflow/Share	-$0.01	$0.00	$0.03	$0.03
P/CF	-29.7x	-137.9x	14.7x	15.9x
EPS	$0.05	$0.00	$0.03	$0.03
EPS Growth	nm	-962%	-8%	29%
PER	8.3x	-129.0x	15.0x	16.3x
Dividend Per Share	$0.00	$0.00	$0.00	$0.00
Dividend Yield	0%	0%	0%	0%
ROE	53%	-4%	27%	20%
ROIC	-2%	0%	8%	7%
Debt/Equity	24%	15%	0%	0%
Net Interest Cover	-2.3x	-0.1x	20.6x	nm
Book Value/share	$0.08	$0.08	$0.11	$0.13
Price/Book Value	5.3x	5.5x	4.0x	3.2x

General Mining Corporation Limited

GMM:ASX | Rating: SPECULATIVE BUY | Target: A$0.85 (from A$0.95)

Overview

GMM's primary assets are the right to earn 50% of the Mt Cattlin spodumene project (from GXY:ASX) in Western Australia, and an option to earn 50% of James Bay spodumene exploration project in Quebec. Canada. At Mt Cattlin, GMM's remaining earn in milestones include the payment of A$18m in cash consideration to GXY, having spent A$7m in restart capital during Q1'16. At James Bay, GMM can earn 50% through A$5m in exploration expenditure over 5 years.

Mt Cattlin one of only two new sources of lithium production globally in the next 18 months

Mt Cattlin is a +1 Mtpa open pit operation, with base case production capacity of +110ktpa of 5.5% Li_2O spodumene concentrate at estimated costs of <A$300/t concentrate product. The operation recently commenced commissioning after a low cost (<A$10m) plant refurbishment program, with the development plan seeing initial concentrate production from the plant's fines circuit during JunQ'16, followed by production from the coarse circuit in mid'16. First sales are expected in Jul'16, with the project expected to achieve nameplate production rates by end'16. There is potential to increase production to +205ktpa of spodumene concentrate via a low cost de-bottlenecking program, which we currently anticipate will be completed by early 2018. Current resources support a mine life of +10 years, with recent exploration results supporting the potential for extensions to the current resource.

The Mt Cattlin JV recently secured off-take arrangements for spodumene concentrate, covering 60ktpa of concentrate in CY16 at US$600/t, and 120ktpa for CY17. Prices for CY17 are expected to be finalised in Q4'16, but we understand that pricing could be >US$700/t.

James Bay – resource-stage project moving to feasibility by end 2016

The James Bay spodumene project is located in NW Quebec, Canada. The project is subject to an earn in from GXY:ASX where it has the right to earn up to 50% interest. The project hosts total resources (Indicated + Inferred) of 22.2Mt at 1.3% Li_2O for 0.28 Mt Li_2O (0.7Mt LCE). An infill drilling program is planned for 2H'16, ahead of the commencement of feasibility studies in late 2016/early 2017.

In our view, the market is ascribing little value to James Bay, despite its relatively advanced status and similarities to other, advanced Western Australian spodumene deposits.

Valuation

We value GMM on a NAV basis, comprising our estimated NPV10% for Mt Cattlin, net of corporate and other adjustments. While our LT spodumene concentrate pricing assumptions have increased, medium term forecasts (2018-2019) have decreased by 20% and 10% respectively. As a result, our valuation/target price moves from A$0.95 to A$0.85.

FINANCIAL SUMMARY

General Mining Corporation Ltd **ASX:GMM**

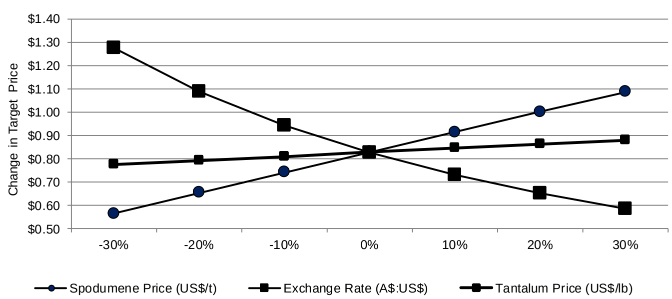
Analyst:	Reg Spencer
Date:	15/05/2016
Year End:	June
Rating:	**SPEC BUY**
Target Price:	**$0.85**

Market Information		
Share Price	A$	0.63
Market Capitalisation	A$m	196.4
12 Month Hi	A$	0.74
12 Month Lo	A$	0.04
Issued Capital	m	311.70
ITM Options	m	0.00
Fully Diluted	m	311.70

Valuation		A$m	A$/share
Mt Cattlin	$NPV_{10\%}$	244.9	0.73
Exploration & Other (James Bay)	Estimate	40.0	0.12
Corporate		(13.9)	(0.04)
Cash		6.2	0.02
Debt (Product Prepayment)		-	-
Unpaid capital		2.3	0.01
TOTAL		279.4	0.84
Target Price			**0.85**
P/NAV			0.74x

Assumptions	2016e	2017e	2018e
Lithium Carbonate (US$/t)	6,813	8,250	8,250
Spodumene Concentrate (US$/t)	466	650	590
Tantalum (US$/lb)	75	75	75
AUD:USD	0.76	0.74	0.74

Valuation Sensitivity



Production Metrics	2016e	2017e	2018e
Mt Cattlin (50%)			
Spodumene concentrate (kt)	0.0	114.7	195.1
LCE production (kt)	0.0	3.3	10.8
Tantalum concentrate (Mlb)	0.0	3.6	6.8
AISC (A$/tonne)	547	182	175

Reserves & Resources	Mt	Grade (Li2O)	Mt LCE	Ta_2O_5
Mt Cattlin (50%)				
Resources	16.4	1.08%	0.178	5.682
Reserves	10.0	1.04%	0.104	3.276
James Bay (50%)				
Resources	22.2	1.25%	0.278	

Directors & Management	
Name	**Position**
Michael Fotios	*Executive Chairman*
Alan Still	*Non-exec Director*
Michael Kitney	*Non-exec Director*

Substantial Shareholders	Shares (m)	%
Investmet	45.00	14.4%

Company Description

General Mining (ASX:GMM) is operator of the Mt Cattlin spodumene operation in a 50%:50% JV Galaxy Resources Limited (ASX:GXY). Initial production from the facility will be for ~100ktpa of spodumene concentrate grading ~5.5% Li2O with additoinal tantalum credits. GMM also have 50% earn in on the James Bay hard rock lithium project in Canada.

Profit & Loss (A$m)	2015a	2016e	2017e	2018e
Revenue	0.00	0.00	0.00	0.00
Other income	0.00	8.08	22.55	50.84
Operating Costs	-0.4	0.0	0.0	0.0
Corporate & O'heads	-0.2	-1.2	-1.6	-1.7
Exploration (Expensed)	-0.0	-0.2	-0.5	-0.4
EBITDA	**-0.6**	**6.6**	**20.4**	**48.8**
Dep'n	0.0	0.0	0.0	0.0
EBIT	**-0.5**	**6.6**	**20.4**	**48.8**
Net Interest	0.0	0.1	0.4	0.8
Tax	0.0	-2.3	-6.4	-14.9
NPAT	**-0.5**	**4.4**	**14.4**	**34.7**
Abnormals	0.0	-0.5	0.0	0.0
NPAT (reported)	**-0.5**	**3.9**	**14.4**	**34.7**

Cash Flow (A$m)	2015a	2016e	2017e	2018e
Cash Receipts	0.0	8.1	22.5	50.8
Cash paid to suppliers & employees	-0.4	-1.1	-1.6	-1.7
Tax Paid	0.0	-2.3	-6.4	-14.9
Net Interest	0.0	0.1	0.4	0.8
Operating Cash Flow	**-0.3**	**4.7**	**14.9**	**35.1**
Exploration and Evaluation	-0.2	-1.3	-1.6	-1.2
Capex	0.0	-7.2	-6.2	-3.2
Other	-0.1	-1.5	-6.0	-6.0
Investing Cash Flow	**-0.3**	**-10.0**	**-13.8**	**-10.4**
Debt Drawdown (repayment)	0.0	6.0	0.0	0.0
Share capital	0.9	15.0	0.0	0.0
Dividends	0.0	0.0	0.0	0.0
Financing Expenses	-0.1	-0.4	0.0	0.0
Financing Cash Flow	**0.8**	**20.6**	**0.0**	**0.0**
Opening Cash	0.1	0.3	15.7	16.8
Increase / (Decrease) in cash	0.2	15.4	1.1	24.7
FX Impact	0.0	0.0	0.0	0.0
Closing Cash	**0.3**	**15.7**	**16.8**	**41.5**

Balance Sheet (A$m)	2015a	2016e	2017e	2018e
Cash + S/Term Deposits	0.3	15.7	16.8	41.5
Other current assets	0.1	1.7	4.8	10.8
Current Assets	**0.4**	**17.4**	**21.6**	**52.3**
Property, Plant & Equip.	0.0	7.5	13.7	16.9
Mining, Expl'n & Develop.	0.7	26.0	27.1	28.0
Other Non-current Assets	0.0	0.0	0.0	0.0
Payables	0.9	2.4	6.9	15.5
Short Term debt	0.0	0.0	0.0	0.0
Long Term Debt	0.0	0.0	0.0	0.0
Other Liabilities	0.0	29.2	21.9	13.4
Net Assets	**0.2**	**19.2**	**33.6**	**68.3**
Shareholders Funds	13.0	28.0	28.0	28.0
Reserves	0.4	0.4	0.4	0.4
Retained Earnings	-13.2	-9.3	5.2	39.9
Total Equity	**0.2**	**19.2**	**33.6**	**68.3**

Ratios & Multiples	2015a	2016e	2017e	2018e
EBITDA Margin	nm	82%	91%	96%
EV/EBITDA	9.1x	9.9x	8.8x	7.8x
Op. Cashflow/Share	$0.00	$0.01	$0.04	$0.11
P/CF	nm	nm	14.1x	6.0x
EPS	$0.00	$0.02	$0.10	$0.09
EPS Growth	nm	nm	538%	-17%
PER	-135.4x	38.9x	6.1x	7.3x
Dividend Per Share	$0.00	$0.00	$0.00	$0.00
Dividend Yield	0%	0%	0%	0%
ROE	-220%	20%	43%	51%
ROIC	-4%	15%	50%	121%
Debt/Equity	0%	0%	0%	0%
Net Interest Cover	nm	nm	nm	nm
Book Value/share	$0.00	$0.06	$0.10	$0.20
Price/Book Value	nm	11.0x	6.3x	3.1x

Orocobre Limited

ORE:ASX; ORL:TSX | Rating: BUY | Target: A$5.15 (from A$4.20)

Overview

ORE is a lithium production company, with its primary asset a 66.5% interest in the operating Olaroz lithium brine project, located in Jujuy Province, Argentina. The project is operated under a joint venture with Toyota Tsusho Corporation (25%) and the Jujuy Provincial Government (8.5%). Olaroz commenced Li_2CO_3 production in late 2014, and following an extended commissioning, is now ramping up towards nameplate capacity of 17.5ktpa, with production costs estimated at <US$2,500/t. Current reserves support a mine life of +40 years, after which only 15% of total resources will have been depleted.

The company also operates the 100% owned Borax Argentina business, which produces ~40ktpa of borate mineral products used in the fertiliser and industrial chemical sectors.

Olaroz production ramp up – nameplate rates expected in DecQ'16

After a prolonged commissioning of the Li_2CO_3 plant, production at Olaroz is now meeting ramp-up targets following the completion of plant rectification works in early 2016. ORE reported MarQ production from the Olaroz JV at 2,332t Li_2CO_3, against quarter guidance of 2,400t. Production for the JunQ has been guided to 3,000t Li_2CO_3, comparing to CGe of 3,050t. Guidance for achieving nameplate production rates (17.5ktpa) has been maintained for SepQ'16 (CGe steady state DecQ'16).

Olaroz Stage 2 expansion

ORE has commenced studies into an expansion of production at Olaroz to 35ktpa Li_2CO_3. Capital costs for the expansion have been flagged at ~US$140m, some 50-60% lower than total establishments costs for existing production capacity. Studies are expected to be completed in SepQ'16, ahead of a development decision by end'16.

We currently model the Olaroz JV to commence construction of Stage 2 in late 2017, and following a 2 year construction and production ramp up, achieve annualised production of 32ktpa Li_2CO_3 (based on a 90% capacity utilisation) in early 2020.

Update on LiOH project with Tenova-Bateman expected soon

In Nov'15, ORE announced that it had entered into an MoU with Bateman Advanced Technologies (subsidiary of global advanced technologies and products group Tenova S.p.A) for the staged development of a LiOH production facility. The MoU envisages using Bateman's proprietary LiSX lithium extraction technology, which permits the production of LiOH directly from brines. The MoU outlines a staged program including a mini-pilot plant (underway), a full scale pilot program of 24tpa, a feasibility study, and subject to success of earlier stages, development of a 15-25ktpa LiOH production facility (at a location yet to be determined).

The first results from testing of the suitability for the LiSX process on Olaroz brines is expected in the next 6-8 weeks. We continue to see the potential for production of LiOH as a positive given the positive outlook for LiOH pricing based on demand from the rapidly growing Li-ion battery sector.

Valuation

We value ORE on a NAV basis, comprising our estimated NPV10% of future dividends from the Olaroz JV, NPV10% for the Borax operations, net of corporate and other adjustments. Following revisions to our Li_2CO_3 pricing forecasts, we increase our valuation from A$4.20 to A$5.15.

FINANCIAL SUMMARY

Orocobre Limited **ORE:ASX; / ORL:TSX**

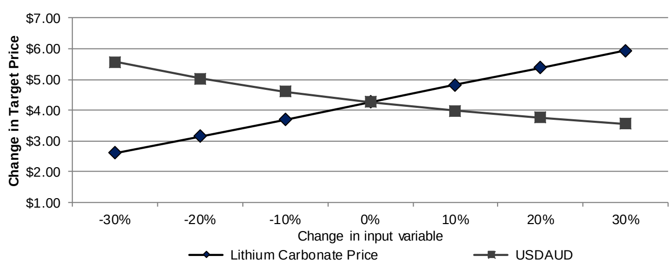
Analyst:	Reg Spencer / Tim McCormack	Rating:	**BUY**
Date:	15/05/2016	Target Price:	**A$5.15**
Year End:	June		

Market Information		
Share Price	A$	3.80
Market Capitalisation	A$m	791.6
12 Month Hi-Lo	A$	3.2-2.09
Issued Capital	m	208.3
Options	m	0.0
Fully Diluted	m	208.3

Valuation	**Equity**	**A$m**	**A$/share**
NPV10% ORE divs + loan receivables	100%	954.83	4.58
Borax Argentina	100%	55.58	0.27
Exploration & Resources	100%	89.43	0.43
Corporate		(64.71)	(0.31)
Cash (net - MarQ estimate)		48.23	0.23
Debt		(10.49)	(0.05)
TOTAL		**1,072.9**	**5.15**
P/NAV			0.74x
Price Target			**5.15**

Assumptions	**2015a**	**FY16e**	**FY17e**	**FY18e**	**FY19e**	**FY20e**
Lithium Carbonate (US$/t)	5,875	7,000	8,250	7,500	7,250	8,000
Potash (US$/t)	380	380	380	508	550	550
Boric Acid (US/t)	741	535	620	620	620	620
AUD:USD	0.84	0.73	0.76	0.74	0.74	0.73
ARS:USD	8.67	12.52	14.50	14.50	14.50	14.50

Valuation Sensitivity



Production Metrics	**FY15a**	**FY16e**	**FY17e**	**FY18e**	**FY19e**	**FY20e**
Olaroz (100%)						
Lithium Carbonate (kt)	0.03	6.15	16.23	17.96	21.46	30.09
Cash Costs (US$/t)	80,879	5,501	2,362	2,167	2,155	2,197
Borax Argentina						
Boric Acid Equiv (kt)	44.4	35.2	31.1	31.1	31.1	51.0
Cash costs (US$/t)	529	433	359	359	359	359

Reserves & Resources		**Area km²**	**Thickness metres**	**Volume km³**	**Conc. (mg/L)**	**Li (Mt)**
Olaroz (100%)						
Resources	Measured	93	54	0.42	632	0.27
	Indicated	93	143	1.33	708	0.94
	Total	**93**	**197**	**1.75**	**690**	**1.21**

Directors & Management		
Name	**Position**	**Shares Held (m)**
J Calaway	*NE Chairman*	8.6
R Seville	*MD & CEO*	5.0
J Gibson	*NE Director*	0.0
F Nicholson	*NE Director*	0.0
F Oris de Roa	*NE Director*	0.0
C Pratt	*NE Director*	0.0
R Hubbard	*NE Director*	0.0

Substantial Shareholders	**Shares (m)**	**%**
Management	17.25	8.3%
Henderson Global Investors	12.30	5.9%

Source: Company reports and Canaccord Genuity estimates

Company Description

Orocobre is a Lithium development company whose primary asset is the Salar de Olaroz Lithium-Potash project in NW Argentina. ORE has secured a debt financing package along with a significant equity injection allowing it to commence construction. Production is forecast to commence in Q4 2014 targeting 17,500tpa of lithium carbonate.

Profit & Loss (A$m)	**FY15a**	**FY16e**	**FY17e**	**FY18e**	**FY19e**	**FY20e**
Revenue	24.9	25.7	25.4	25.8	26.1	43.2
Share Prof/(loss) in Assoc.	**-0.2**	**-21.3**	**50.2**	**66.6**	**60.6**	**98.6**
Operating Costs	23.1	23.1	16.7	17.0	17.2	28.5
Royalties	1.2	2.1	2.0	2.1	2.1	3.5
Corporate & O'heads	14.7	16.9	9.8	10.0	10.2	10.4
Exploration (Expensed)	0.0	0.2	0.0	0.0	0.0	0.0
EBITDA	**-9.3**	**-33.0**	**49.1**	**65.5**	**59.4**	**102.9**
Dep'n	1.2	2.4	2.0	2.1	2.1	3.5
EBIT	**-10.6**	**-35.4**	**47.0**	**63.4**	**57.3**	**99.5**
Net Interest	-1.5	0.7	0.8	3.5	6.0	5.6
Tax	1.0	0.1	0.8	-0.1	-0.9	-2.3
NPAT	**-11.1**	**-34.6**	**48.7**	**66.8**	**62.3**	**102.8**
Abnormals	10.0	0.3	0.0	0.0	0.0	0.0
NPAT (reported)	**-1.1**	**-34.4**	**48.7**	**66.8**	**62.3**	**102.8**

Cash Flow (A$m)	**FY15a**	**FY16e**	**FY17e**	**FY18e**	**FY19e**	**FY20e**
Cash Receipts	19.3	23.6	25.4	25.8	26.1	43.2
Cash paid to supp's & emp'ees	-31.0	-37.7	-26.3	-26.6	-26.8	-38.1
Tax Paid	0.0	0.0	-0.1	-0.5	-1.2	-2.3
Net Interest paid	-1.3	-0.3	0.8	3.5	6.0	5.6
Other	3.6	1.7	0.0	0.0	0.0	0.0
Operating Cash Flow	**-9.4**	**-12.8**	**-0.1**	**2.2**	**4.1**	**8.5**
Exploration and Evaluation	-0.2	-1.4	-3.7	-3.5	-4.0	-4.0
Capex	-2.6	-3.6	-1.1	-1.1	-15.6	-14.3
JV Divs & Other	-55.9	-61.0	10.4	65.9	40.7	53.2
Investing Cash Flow	**-58.7**	**-66.1**	**5.7**	**61.3**	**21.1**	**34.9**
Debt Drawdown (repayment)	3.3	4.2	-10.2	0.0	0.0	0.0
Share capital	50.0	116.5	0.0	0.0	0.0	0.0
Dividends	0.0	0.0	0.0	0.0	0.0	-37.5
Financing Expenses	-4.2	-3.2	0.0	0.0	0.0	0.0
Financing Cash Flow	**49.1**	**117.4**	**-10.2**	**0.0**	**0.0**	**-37.5**
Opening Cash	25.7	7.4	46.9	42.2	105.7	130.9
Increase / (Decrease) in cash	-18.9	38.5	-4.7	63.5	25.2	5.9
FX Impact	0.7	1.0	0.0	0.0	0.0	0.0
Closing Cash	**7.4**	**46.9**	**42.2**	**105.7**	**130.9**	**136.9**

Balance Sheet (A$m)	**FY15a**	**FY16e**	**FY17e**	**FY18e**	**FY19e**	**FY20e**
Cash + S/Term Deposits	7.4	46.9	42.2	105.7	130.9	136.9
Other current assets	20.6	20.6	30.5	93.7	79.2	79.8
Current Assets	**28.0**	**67.4**	**72.7**	**199.5**	**210.1**	**216.7**
Property, Plant & Equip.	17.1	18.3	17.3	16.4	29.8	40.7
Exploration & Develop.	11.1	12.4	16.1	19.6	23.6	27.6
Other Non-current Assets	193.3	237.6	251.8	205.6	223.1	245.5
Payables	18.0	5.7	5.1	5.2	5.2	8.6
Short Term debt	2.7	10.2	0.0	0.0	0.0	0.0
Long Term Debt	0.8	0.2	0.0	0.0	0.0	0.0
Other Liabilities	13.2	24.9	9.5	25.7	25.6	12.5
Net Assets	**211.8**	**293.7**	**342.4**	**409.2**	**454.8**	**507.6**
Shareholders Funds	176.5	293.0	293.0	293.0	293.0	293.0
Reserves	-48.5	-41.7	-41.9	-41.9	-41.9	-41.9
Retained Earnings	78.1	43.7	92.4	159.2	204.8	257.6
Total Equity	**211.8**	**293.7**	**342.4**	**409.2**	**454.8**	**507.6**

Ratios & Multiples	**FY15a**	**FY16e**	**FY17e**	**FY18e**	**FY19e**	**FY20e**
EBITDA Margin	nm	nm	nm	nm	nm	nm
EV/EBITDA	nm	nm	15.3x	10.5x	11.1x	6.4x
Op. Cashflow/Share	-$0.06	-$0.06	$0.00	$0.01	$0.02	$0.04
P/CF	nm	nm	nm	356.6x	192.6x	93.4x
EPS	-$0.01	-$0.18	$0.23	$0.32	$0.30	$0.49
EPS Growth	nm	nm	-228%	37%	-7%	65%
PER	nm	nm	16.3x	11.8x	12.7x	7.7x
Dividend Per Share	$0.00	$0.00	$0.00	$0.00	$0.08	$0.24
Dividend Yield	0%	0%	0%	0%	2%	6%
ROE	0%	-12%	14%	16%	14%	20%
ROIC	-5%	-12%	16%	22%	19%	20%
Debt/Equity	0%	0%	0%	0%	0%	0%
Net Interest Cover	-3.8x	-55.4x	46.9x	nm	nm	nm
Book Value/share	$1.40	$1.41	$1.64	$1.96	$2.18	$2.44
Price/Book Value	2.7x	2.7x	2.3x	1.9x	1.7x	1.6x

Appendix: Important Disclosures

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Target Price / Valuation Methodology:

General Mining Corporation Limited - GMM

We value GMM on a NAV basis, comprising an estimated $NPV_{10\%}$ for Mt Cattlin, net of corporate and other adjustments. While our LT spodumene concentrate pricing assumptions have increased, medium term forecasts (2018-2019) have decreased by 20% and 10% respectively. As a result, our valuation/target price moves from A$0.95 to A$0.85.

Galaxy Resources Limited - GXY

To reach our target price, we value GXY on a NAV basis comprising our NPV10% for Mt. Cattlin, our blended DCF/market-based value for Sal de Vida, and exploration, net of corporate and other adjustments.

Orocobre Limited - ORE

Our target price is derived from a NAV comprising $NPV_{10\%}$ of future dividends from the Olaroz JV, $NPV_{10\%}$ for the Borax operations, net of corporate and other adjustments.

Risks to achieving Target Price / Valuation:

General Mining Corporation Limited - GMM

The key investment risks for GMM include:

Funding risk

As a pre-production company with no material income, GMM is reliant on equity and debt markets to fund feasibility studies and development of various projects. We can make no assurances that accessing these markets will be done without further dilution to shareholders.

Exploration risks

Exploration is subject to a number of risks and can require a high rate of capital expenditure. Risks can also be associated with conversion of inferred resources and lack of accuracy in the interpretation of geochemical, geophysical, drilling and other data. No assurances can be given that exploration will delineate further minable reserves.

Operating risks

Once in production, the company will be subject to risks such as plant/equipment breakdowns, metallurgical (meeting design recoveries within a complex flowsheet), materials handling and other technical issues. An increase in operating costs could reduce the profitability and free cash generation from the operating assets considerably and negatively impact valuation. Further, the actual characteristics of an ore deposit may differ significantly from initial interpretations which can also materially impact forecast production from original expectations.

Commodity price and currency fluctuations

As with any mining company, GMM is directly exposed to commodity price and currency fluctuations. Commodity price fluctuations are driven by many macroeconomic forces including inflationary pressures, interest rates and supply and demand factors. These factors could reduce the profitability, costing and prospective outlook for the business.

Galaxy Resources Limited - GXY

The key investment risks for GXY include:

Funding risk

As a pre-production company with no material income, GXY is reliant on equity and debt markets to fund feasibility studies and development of various projects. We can make no assurances that accessing these markets will be done without further dilution to shareholders.

Exploration risks

Exploration is subject to a number of risks and can require a high rate of capital expenditure. Risks can also be associated with conversion of inferred resources and lack of accuracy in the interpretation of geochemical, geophysical, drilling and other data. No assurances can be given that exploration will delineate further minable reserves.

Operating risks

Once in production, the company will be subject to risks such as plant/equipment breakdowns, metallurgical (meeting design recoveries within a complex flowsheet), materials handling and other technical issues. An increase in operating costs could reduce the profitability and free cash generation from the operating assets considerably and negatively impact valuation. Further, the actual characteristics of an ore deposit may differ significantly from initial interpretations which can also materially impact forecast production from original expectations.

Commodity price and currency fluctuations

As with any mining company, GXY is directly exposed to commodity price and currency fluctuations. Commodity price fluctuations are driven by many macroeconomic forces including inflationary pressures, interest rates and supply and demand factors. These factors could reduce the profitability, costing and prospective outlook for the business.

Orocobre Limited - ORE

The key investment risks for ORE include: Geological risk -- the actual characteristics of an ore deposit may differ significantly from initial interpretations and expectations. We note however the resource is extremely large relative to the forecast extraction rates and mine life, somewhat mitigating geological risk. Technical risk -- the construction and operation of brine based lithium carbonate projects although proven is still in its relative infancy and therefore construction and operating risks are inherently elevated. Mitigating this risk is a pilot plant has been operating on site for in excess of 18 months, producing battery grade lithium carbonate. Financing risk -- the ability of ORE to fund its portion of the development of the Olaroz project should also be considered a key investment risk. Equity and credit markets may not be conducive to securing the required funds to complete construction of the project although we consider with the Capital expenditure and operating risk -- the risk that capital and or operating costs exceed budget and/or exhaust available funding before project completion, and reduce the profitability and free cash generation of the project. Commodity price and exchange rate risk: As with all mining and mineral exploration companies, commodity price and exchange rate risk should also be considered. In particular lithium and lithium carbonate are not exchange-traded commodities and are relatively small markets. Small and illiquid markets can be more susceptible to wild fluctuations in prices.

Distribution of Ratings:

Global Stock Ratings (as of 05/17/16)

Rating	Coverage Universe		IB Clients
	#	%	%
Buy	526	59.30%	33.27%
Hold	275	31.00%	17.09%
Sell	28	3.16%	3.57%
Speculative Buy	58	6.54%	60.34%
	887*	100.0%	

*Total includes stocks that are Under Review

Canaccord Genuity Ratings System

BUY: The stock is expected to generate risk-adjusted returns of over 10% during the next 12 months.

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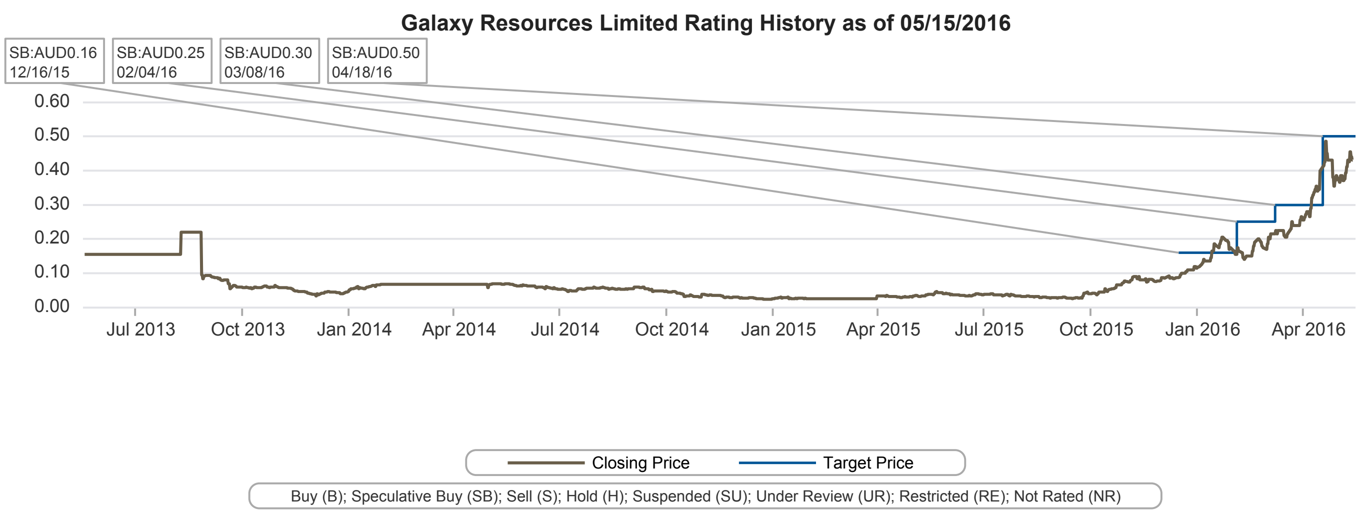
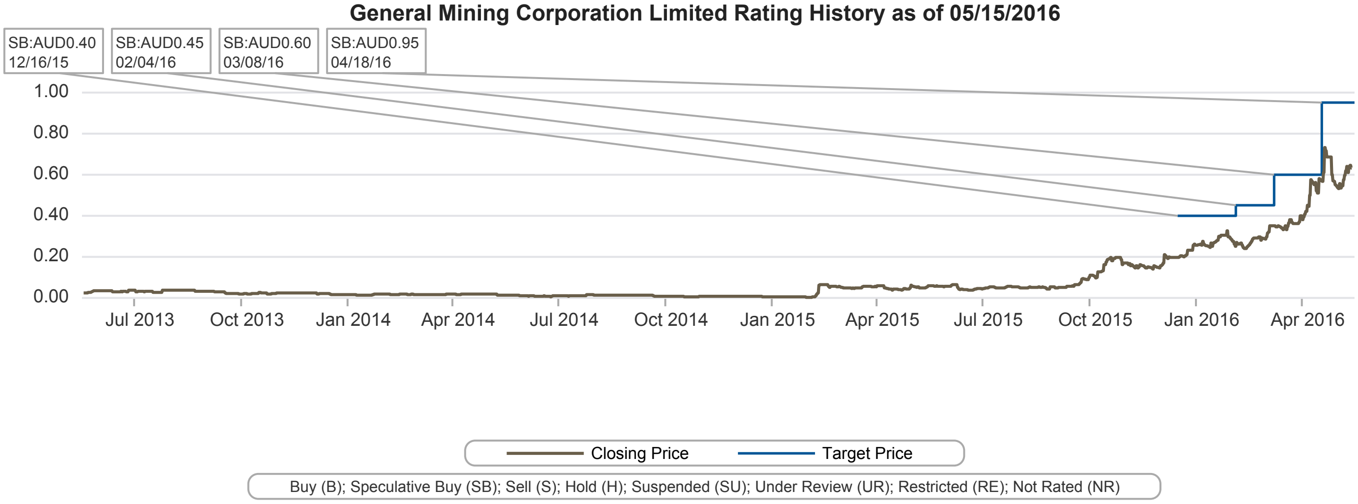


General Mining Corporation Limited Rating History as of 05/15/2016



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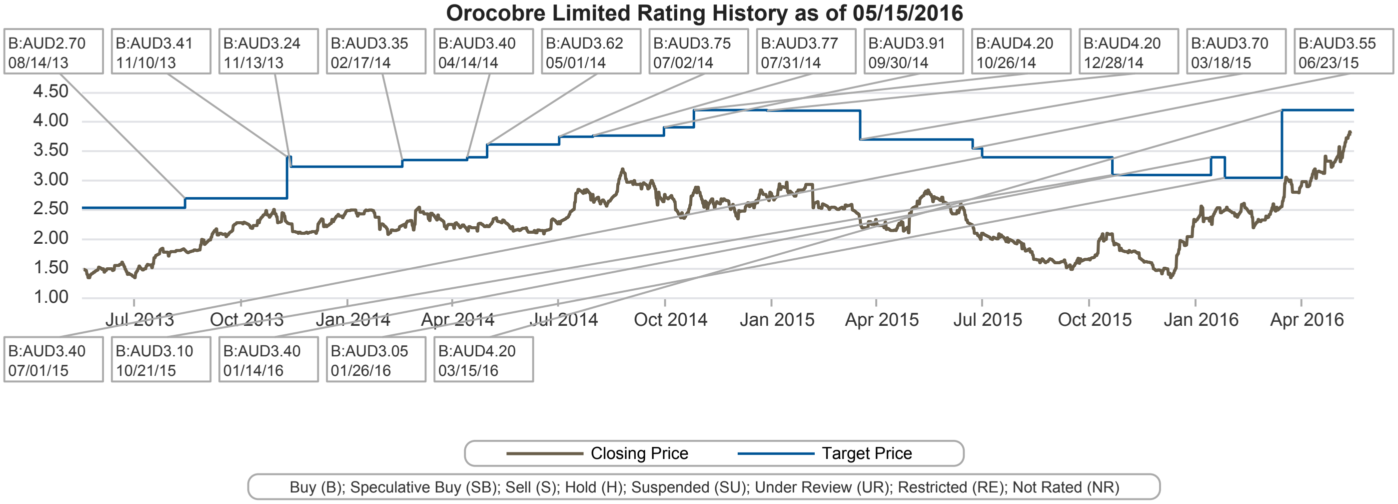

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