

Alliance Mineral Assets Ltd

(AMS SP/ALLI.SI)

Australia site visit to Alliance and Pilbara Minerals; industry weakness an opportunity

Joel Ng / 62 6202 1192 / joel.ng@kgi.com

- We visited Alliance's Bald Hill mine in Australia and met up with the management of ASX-listed Pilbara Minerals (PLS). These companies have huge potential as key lithium suppliers.
- Share prices of lithium companies have declined 35-50% after peaking in Jan-2018 due to weak lithium prices in China. However, long-term demand remains stable, and the current downturn offers an opportunity for investors to position for the industry recovery.
- Alliance is set to join as one of the top 3 pure-play lithium producers in Australia, after Galaxy Resources (GXY ASX) and PLS.
- Valuations are attractive. Alliance is trading at only 5.8/4.4x FY2019/20F EV/EBITDA against peers' 5-13x. However, we would wait for the merger to complete in December 2018 before assigning a target price and recommendation on the stock.

Visit down under – Lithium is the new gold. We visited Western Australia recently and were pleasantly surprised by the positive sentiment from all the companies we met. All the nine mining and engineering companies we talked to were expanding operations and cited the recovery in key sectors such as O&G, mining and infrastructure. Perth, Australia is an important operating base for many global resource companies including BHP Billiton, Rio Tinto, ConocoPhillips, Newmont Mining and Barrick Gold.

Accidental lithium producer. Alliance initially listed on the SGX in July 2014 as a pure-play tantalum producer but transformed into a lithium producer through its JV with ASX-listed Tawana Resources in 2016 after the lithium minerals found on Alliance's Bald Hill mine were of high-quality spodumene concentrates that were economically viable to mine and export.

Merger and dual listing. Alliance would be acquiring 100% of the shares of Tawana, with the post-merger company 50.1% owned by Alliance shareholders and 49.9% by Tawana shareholders. The group expects the merger to be completed by 4 December 2018 and for trading on both ASX and SGX to commence trading on a normal settlement basis on 17 December 2018.

Bald Hill tantalum and lithium overview. The mine is located around 600km from Perth, Australia and is currently operated as part of the JV with Tawana. The Bald Hill mine had a total of 11.3mt of lithium reserves, which would support a mine life of 9 years at a processing rate of 1.2mtpa. There is still upside potential from the large quantity of

Not Rated		Performance (Absolute)	
Price as of 13 Nov 18 (SGX)	0.25	- 1 Month (%)	-7.5
12M TP (\$)		- 3 Month (%)	-24.2
Previous TP (\$)		- 12 Month (%)	-34.7
Trading data		Perf. vs STI Index (Red)	
Mkt Cap (\$mn)	162		
Issued Shares (mn)	659		
Vol - 3M Daily avg (mn)	1.9		
Val - 3M Daily avg (\$mn)	0.5		
Free Float (%)	60.6%		
Major Shareholders		Previous Recommendations	
Burwill Holdings	14.2%		
Grande Pacific	11.0%		
Regal Funds Mgt	10.0%		

inferred resources waiting exploration. Total production has been committed to a 5-year offtake agreement with HK-listed Burwill Holdings (24 HK) for a minimum price of US\$880/t FOB for 2018 and 2019.

Above and beyond. Alliance's processing plant was designed for 160 tonnes of ore per hour (tph) but has been processing an average throughput rate of 202tph in 3Q18, which is 17% higher QoQ and 25% above the original capacity. When it installs the fine circuit by the middle of 2019 with a minimal capex of A\$10mn (+/- 20% estimates), total production could potentially reach 300 tonnes per hour.

Valuation & Action: Based on a conservative set of assumptions, Alliance compares favourably against its peers, trading at only 5.8/4.4x FY2019/20F EV/EBITDA, vs peers at 5-13x. There is significant upside opportunities in 2019F to increase its lithium reserves from further exploration, all funded by operational cash flows. As a potential major lithium producer in Australia, the current downturn offers an attractive opportunity for investors to position for the industry recovery.

Risks: Lithium prices after 2019 and execution risks are key risks. Alliance has a fixed price of US\$880/t with offtake partner Burwill until 2019 but prices after that will be based on market conditions. Lithium prices, especially in China, are heavily influenced by government policies on Electric Vehicles (EV).

Contents

Site visit.....	2
Valuations.....	4
Peer comparison.....	5
Bald Hill Tantalum and Lithium mine.....	6
Lithium industry.....	7
Long-term lithium prices	7
Global demand	7
Key industry driver: Electric Vehicles (EV)	8
Car OEM EV plans	8
Chinese EV demand	9
Appendix.....	10
Industry cost structure	10
Lithium industry supply chain.....	10
Appendix: Glossary	10

Site visit

We visited Alliance's mine in Perth, Australia last month. The whole journey required a one-hour flight from Perth to the mining town of Kalgoorlie, and then by a two hours' drive to the mine site.

Figure 2: The site visit to Alliance's Bald Hill mine in Western Australia



Source: Google Maps, KGI Research

Figure 3: Arriving at the mine site with Alliance's workers who flew in from Perth with us.



Source: KGI Research

Figure 1: Pegmatites (left photo) are mined and goes through the plant facility to be processed into lithium concentrate. On the right photo are samples of pegmatite (bottom rock-like sample), spodumene, lithium and tantalum from the Bald Hill mine.



Source: KGI Research

Access. The Bald Hill Lithium and Tantalum Mine (Bald Hill Mine) is located in the southeast of the Goldfields-Esperance region of WA, which is around 105km from Kalgoorlie. Kalgoorlie is the main hub in the region which can be accessed from Perth via air, rail and road. Access to the site is via a gravel road for 65km from the Coolgardie-Esperance Highway, which is accessible all year around.

Overview. The mine site consists of an open pit mine (Figure 4), a Dense Media Separation (DMS) and spiral circuits (Figure 5), waste rock dumps, and a camp containing admin and living quarters.

Open pit mine. The mine site was developed in stages 1 and 2, with the current ore feed from stage 1. The spodumene and tantalite ore is being mined by open pit mining using conventional truck/excavators. The current strip ratio is around 15, which has resulted in production cash costs of around US\$660/t in the most recent quarter. Strip ratio is expected to average at 10 for the life of the mine, which should result in costs stabilising at US\$430/t (when including tantalite credits), according to the IQPR.

2018 target. Alliance will be targeting to produce 60k-75k tonnes of lithium concentrate in 2H18, lower than the earlier guidance of 55k-60k tonnes due to mining delays and throughput limitations during construction.

Figure 4: Bald Hill's spodumene ore is mined from here and sent to the processing facility



Source: KGI Research

Figure 5: The processing plant showing the dense media separation (DMS) plant on the right side to recover spodumene. The smaller plant on left was the old tantalite processing plant operated prior to change in business mix to lithium production.



Source: KGI Research

DMS plant. The DMS plant at the mine site was processing at throughputs of 250 tph, which was above the originally-designed feed rate of 161 tph. A fines circuit is being planned to increase throughout and recovery.

Figure 6: The DMS plant where pegmatites are crushed and filtered into the final shipped product, lithium concentrates and tantalum.



Source: KGI Research

Figure 7: The final product – lithium concentrate, which is then shipped via the Port of Esperance 350km by road from the mine site.



Source: KGI Research

Valuations

We have opted to use relative valuation to value Alliance to capture its strong growth profile and undervaluation compared to peers. We expect cash profit (equivalent to EBITDA) to improve significantly over the next two years, stabilising at around US\$60mn per annum from 2020 onwards.

Based on a conservative set of assumptions, Alliance compares favourably against its peers, trading at only 5.8/4.4x FY2019/20F EV/EBITDA, the lower range of its peers who are trading at 5-13x.

KGI Forecasts. We derive our forecasts based on information contained in the independent Qualified Person's Report IQPR (Figure 9) and from our discussions with management.

▪ Ore throughput, meaning the total spodumene that goes through its plants for processing, increases from 0.7mn t/a in 2018 to 1.2mn t/a in 2019 and stabilises at this level until the end of mine life.

▪ Yield, which is the amount of 6% Li₂O concentrates recovered by its processing facilities, increases from 10% in 2018, 15% in 2019 and stabilises at 20% from 2020 onwards.

▪ Sale prices. We estimate average selling price (ASP) to average US\$700/t for 6% Li₂O throughout our forecasts. This is conservatively at 20% discount to the US\$880/t price in the offtake agreement with Burwill for 2018 and 2019.

▪ Operating costs of US\$589 in 2018, which improves to US\$450/t in 2019 and remains at this level throughout the remainder of our forecast period. The processing cost includes tantalite credits i.e. tantalum sold that helps offsets operating costs. This is conservatively higher than the IQPR's average operating cost (after tantalite credits) of A\$568/t, or US\$427/t.

Figure 9: Key assumptions used in the IQPR

Life of reserve (LOR)	years	9
LOR ore mined (spodumene)	Mt	11.3
LOR ore mined (tantalite)	Mt	2
LOR waste mined	Mt	131.7
LOR strip ratio	waste:ore	9.9 : 1
Plant feed rate (spodumene stage 1)	t/a	1,200,000
Plant feed rate (tantalite)	t/a	320,000
Avg spodumene ore feed grade	% Li ₂ O	1.01
Avg spodumene recovery (stage 1)	%	65.8
Avg spodumene recovery (stage 2)	%	80.0
Avg spodumene concentrate production	6% Li ₂ O t/a	183,000
Avg tantalite production	Ibs Ta2O5 pa	270,000
SC6% sale price (after royalty)	US\$/t	788
Tantalite forecast price	US\$/lb FOB	70
Forecast FX rate	A\$/US\$	0.75
Avg LOR operating costs	A\$/t product	657
Avg operating costs (after tantalite credit)	A\$/t product	568
Avg annual EBITDA	A\$M	66

Source: IQPR, KGI Research

Latest updates. In the latest update released on 31 October, strip ratio for 3Q18 was at 14.7, which is approaching the Life of Reserve (LOR) average of 10. However, strip ratio is expected to remain at elevated levels in the short-term given that it is undergoing significant waste removal to prepare stage 3 pit for future ore supply. Current ore is from stage 1 and stage 2. This is in line with our forecasts where costs will only start to come down in FY2020 (Alliance's YE is June).

Figure 8: Cash flow analysis – we expect EBITDA to stabilise at US\$60mn from 2020 onwards (100% consolidated basis)

Year (YE-June)	1 2019	2 2020	3 2021	4 2022	5 2023
Throughput Ore (t/a)	700,000	1,200,000	1,200,000	1,200,000	1,200,000
Yield (%)	10.0%	15.0%	20.0%	20.0%	20.0%
Spodumene 6% Li ₂ O production (t/a)	70,000	180,000	240,000	240,000	240,000
Product sale price (US\$/t)	\$700.0	\$700.0	\$700.0	\$700.0	\$700.0
Sales US\$	\$49,000,000	\$126,000,000	\$168,000,000	\$168,000,000	\$168,000,000
Cost (A\$/t) - includes tantalite credits	\$860.0	\$600.0	\$600.0	\$600.0	\$600.0
Cost (US\$/t) - convert to US\$	\$645	\$450	\$450	\$450	\$450
Cost (US\$)	\$45,150,000	\$81,000,000	\$108,000,000	\$108,000,000	\$108,000,000
Cash profit US\$ (EBITDA)	\$3,850,000	\$45,000,000	\$60,000,000	\$60,000,000	\$60,000,000
EV (\$\$)	\$340,000,000				
EV (US\$)	\$261,538,462				
EV/EBITDA	67.9x	5.8x	4.4x	4.4x	4.4x
EBITDA margins	7.9%	35.7%	35.7%	35.7%	35.7%
Key Assumptions					
AUD/USD	\$1.33				
SGD/USD	\$1.30				

Source: KGI Research

Peer comparison

Alliance compares favourably against its peers, trading at only 6.8/5.1x FY2019/20F EV/EBITDA, the lower range of its peers who are trading at 5-13x. We cite two possible reasons for its undervaluation against peers.

1. Lower lithium resources/reserves against ASX-listed peers like Pilbara Minerals (PLS) and Galaxy Resources (GXY), who have 20-40 years Life of Mine (LOF), which is 5-10x that of Alliance's 9 years LOF. However, this is mainly due to Alliance's decision to focus on generating cash flows from production early in the project cycle to fund future exploration costs, as opposed to PLS which spent 4 years building up its reserve base before its first lithium shipment.

As Alliance continues to fund exploration from its cash flows, its reserves & resources base should incrementally increase over time based on the large quantity of inferred resources awaiting infill drilling.

2. Alliance only has one offtake partner with HK-listed Burwill Holdings, while peers such as PLS has four offtake agreements with established companies like Ganfeng Lithium (CN's largest fully integrated lithium company), Posco (South Korea's biggest steel producer) and Great Wall (CN's largest SUV manufacturer). Meanwhile, GXY, its closest peer in terms of 2019F spodumene production, has offtake agreements with Panasonic, BMW and Mitsubishi.

The eight lithium operations scheduled that came online last year in Western Australia, or will come online by late 2019, have attracted a collective total of 15 offtake partners. Just five of those partners – Panasonic, BMW, Mitsubishi, POSCO and SQM – are not based in China.

Alliance set to be top three pure-play Australian lithium miners. If excluding those companies with overseas mines or downstream operations (e.g., Tianqi, Mineral Resources), Alliance would be the third largest pure-play Australian lithium miner by lithium production in 2019, after PLS and GXY.

Figure 11: Australia spodumene production ('000 tonnes lithium concentrate)

Owner	Asset	Production (2017)	Production (2018F)
Tianqi/Albermarle	Greenbushes	644	700-750
MIN/NMT/Ganfeng	Mt Marion	309	350-400
GXY	Mt Cattlin	142	150-200
PLS	Pilgangoora		40-50
AJM	Pilgangoora		40-50
MIN	Wodgina		30-35
ALLIANCE	Bald Hill		65-70

Source: Company data, KGI Research

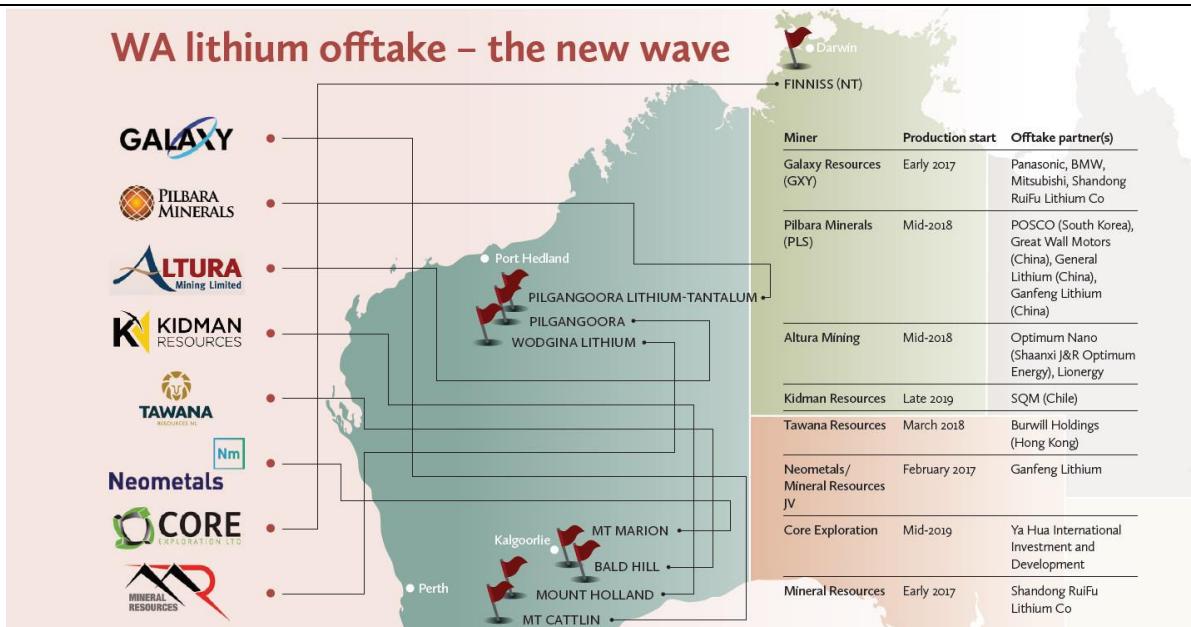
Peer valuations. Valuations of lithium companies have been declining in 2018 due to the weak lithium prices. EV/EBITDA ratios for FMC, Tianqi and Albermarle have dropped 50% YTD but are still well above Alliance's valuations.

Table 1: EV/EBITDA of the largest lithium companies (1 year)



Source: Bloomberg

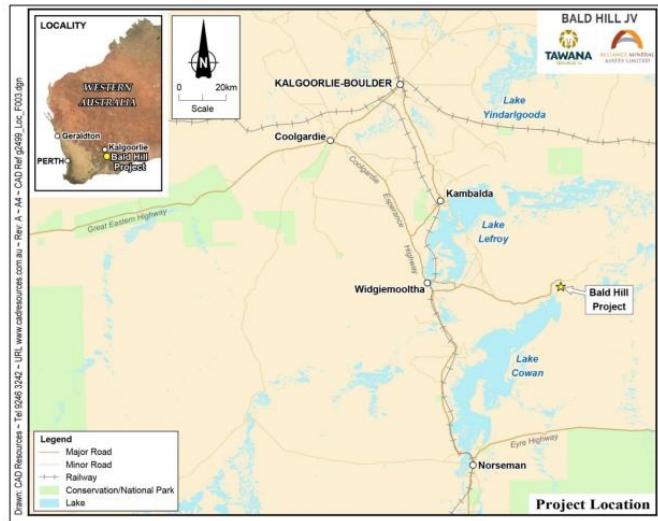
Figure 10: Australia lithium miners and offtake partners



Source: Australia Chinese Business Review (ACBR)

Bald Hill Tantalum and Lithium mine

The Bald Hill mine is located within the state of Western Australia and is around 580km from the state capital of Perth. Alliance has a portfolio covering around 79,400ha comprising mainly of mining, exploration and prospecting licenses. The project is a JV between ASX-listed Tawana Resources.



Source: Bald Hill Project Independent Qualified Persons Report, 9 August 2018

History. Alliance acquired the mine in 2009 and undertook work to re-commission the processing plant and site preparations for mining, as the mine site had put into care and maintenance since 2005. In 2016, Alliance started working with Tawana whereby the later would be granted 50% rights to the lithium minerals on the condition it undertook a minimum spend on exploration and feasibility studies.

Figure 12: Resource and Reserve Summary for Bald Hill outside mined pits as at 30 April 2018. The Resources are inclusive of Reserves.

JORC category	Mineral type	Gross attributable to licence			Net attributable to issuer			#Change from previous update (tonnes %)
		Tonnes (Mt)	Grade* Ta ₂ O ₅ (ppm)	Grade* Li ₂ O (%)	#Tonnes (Mt)	Grade* Ta ₂ O ₅ (ppm)	Grade* Li ₂ O (%)	
Reserves – Central (Tawana, 2017)								
Proved	Tantalum	0.0	0	0.00	0.0	0	0.00	No change
Probable	Tantalum	2.0	313	0.16	1.0	313	0.16	43%
	Subtotal	2.0	313	0.16	1.0	313	0.16	43%
Proved	Tantalum + Lithium	0.0	0	0.00	0	0	0.00	No change
Probable	Tantalum + Lithium	11.3	160	1.01	5.7	160	1.01	163%
	Subtotal	11.3	160	1.01	5.7	160	1.01	163%
TOTAL RESERVES		13.3	183	0.88	6.7	183	0.88	133%
Resources – Creekside (carried over from previous IQPR, by AMC 2014) and Central and Boreline (Tawana, June 2018)								
Measured	Tantalum	0.0	0	0.00	0.0	0	0.00	No change
Indicated	Tantalum	3.3	340		1.7	340		-14%
Inferred	Tantalum	1.4	340		0.7	340		-18%
Total		4.7	340		2.4	340		-15%
Resources – Central and Boreline (Tawana, June 2018)								
Measured	Tantalum + Lithium	0.0	0	0.00	0.0	0	0.00	No change
Indicated	Tantalum + Lithium	14.4	168	1.02	7.2	168	0.51	80%
Inferred	Tantalum + Lithium	12.1	123	0.90	6.1	126	0.46	11%
Total		26.5	149	0.96	13.3	149	0.49	40%

Source: IQPR

Resources and reserves. Alliance's ore reserves as of May 2018 underpins the next 9 years of production. The resources estimates as at 30 April 2018 for the Bald Hill deposits totalling 31.2mt of tantalite and spodumene resources are summarised in Figure 12. Production of spodumene concentrate commenced following

commissioning of the dense media separation (DMS) plant in 1Q18. The first shipment of spodumene concentrate was exported in May 2018.

Experienced personnel. The merged company will be managed by highly credentialed personnel with experience in Australia's mining industry. Mark Calderwood will be the MD of the merged entity. He has been the CEO and MD of Tawana since 2016. Prior to this, he was the MD of Perseus Mining Limited and was instrumental in bringing the company from an explorer to a producer, joining the ASX-100 club in the process. He is an authority on pegmatites and is a co-author of a publication "A Guidebook to the Pegmatites of Western Australia".

Table 2: Experienced management team

Management	Experience
Mark Turner Independent Non-Executive Chairman	<ul style="list-style-type: none"> Independent Non-Executive Director of Tawana since 2017 Mining Engineer with more than 30 years of experience in the resources sector Currently Chief Operating Officer of RTG Mining Inc
Mark Calderwood Managing Director	<ul style="list-style-type: none"> CEO and MD of Tawana since 2016 30 years mining exploration including over 5 years in pegmatite minerals Formerly MD of ASX-100 listed gold producer Perseus Mining Limited
Robert Vassie Independent Non-Executive Director	<ul style="list-style-type: none"> Non-Executive Director of Tawana since 2017 Mining Engineer with 30 years of international mining industry experience and 18 years experience in a range of senior management roles with Rio Tinto Currently Managing Director & CEO of St Barbara Limited
Vicki Xie Non-Executive Director	<ul style="list-style-type: none"> Non-Executive Director of Tawana since 2017 16 years experience in accounting and finance, fund raising, acquisition and private equity Formerly CFO, Accounting and Company Secretary in both China and Australia
Arnold Chan Ming Fai Non-Executive Director	<ul style="list-style-type: none"> Independent Non-Executive Director: Burwill Holdings Ltd and China Lotsynergy Holdings Former CEO of City Green Holdings Limited and Full Seas Technology Group 30 years investment banking and asset management experience
Joshua Ong Independent Non-Executive Director	<ul style="list-style-type: none"> Independent Director of Alliance since 2014 More than 20 years experience in audit, consultancy and commercial financial control, and accounting, including >10 years in international accounting firms and corporates
Geoffrey McNamara Independent Non-Executive Director	<ul style="list-style-type: none"> More than 23 years resources sector experience as geologist, project manager, corporate financier and fund manager Partner at Medea Capital Partners, Non-Executive Chairman of Cora Gold Limited

Source: Company data, KGI Research

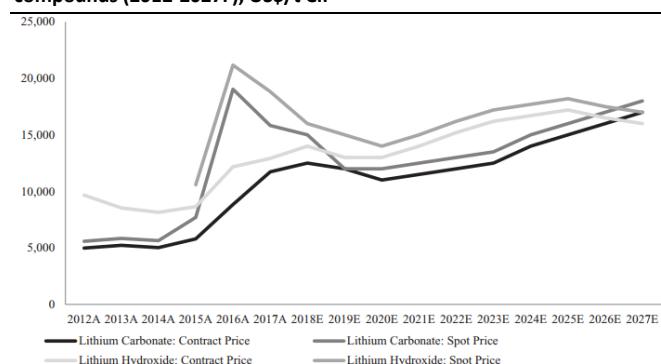
Lithium industry

Long-term lithium prices

Prices of battery-grade lithium carbonate have fluctuated from US\$5,700 in 2007 to US\$7,700 in 2015 and increased significantly to >US\$19,000 per ton in 2016. Prices of battery-grade lithium hydroxide has traded at a premium to prices of battery-grade lithium carbonate since the mid-2000s due to the limited suppliers, but the premium has narrowed as more suppliers entered the market.

Lithium hydroxide premium over carbonate prices are widely expected to remain given the downstream shift to Lithium nickel manganese cobalt (NMC) cathode technologies, which has become automotive OEM's preferred technology in recent years.

Figure 13: Avg yearly contract and spot prices of battery-grade lithium compounds (2012-2027F), US\$/t CIF

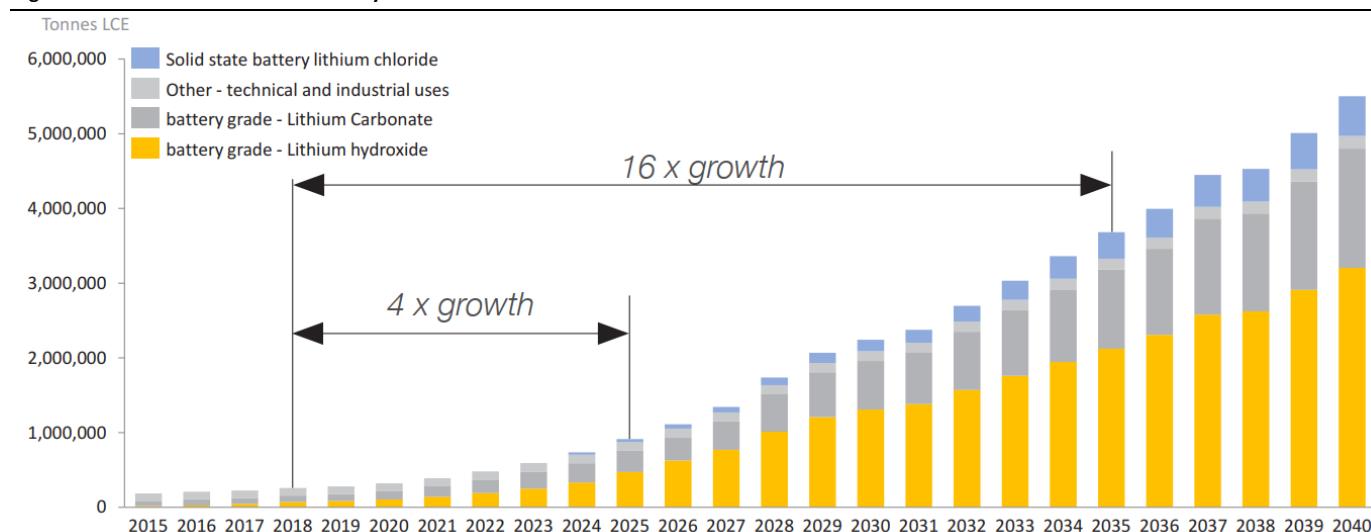


Source: Roskill, Tianqi Lithium Corp Prospectus

Global demand

Lithium demand is forecasted to increase 4x between 2018 and 2025 to meet the exponential rise in battery demand from the growing EV sector, according to Benchmark Mineral Intelligence. Lithium hydroxide is expected to become the predominant product in the lithium chemical supply chain which favours hard rock lithium supply, which is mainly from Australia.

Figure 14: forecast for lithium demand by lithium chemical

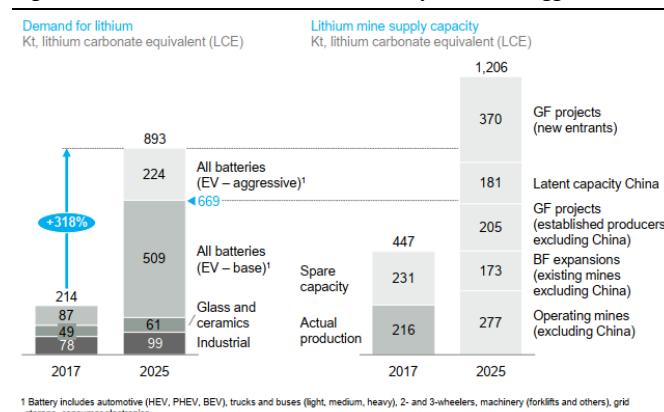


Source: Pilbara Minerals, Benchmark Mineral Intelligence, August 2018

McKinsey's forecasts. A report by McKinsey & Company titled "Lithium and cobalt – a tale of two commodities" published in June 2018 provides a very comprehensive overview and forecasts of the two key elements driving the EV revolution – lithium and cobalt.

According to McKinsey's analysis, total lithium demand will increase from 214 kt of LCE in 2017 to 669 kt of LCE in 2025 in McKinsey's base case, with battery uses representing 509 kt of total demand by 2025. McKinsey also estimates that demand can potentially increase to 893 kt of LCE by 2025 in its aggressive case, based on a faster adoption of EVs.

Figure 15: Lithium demand based on McKinsey's base and aggressive case



Source: McKinsey

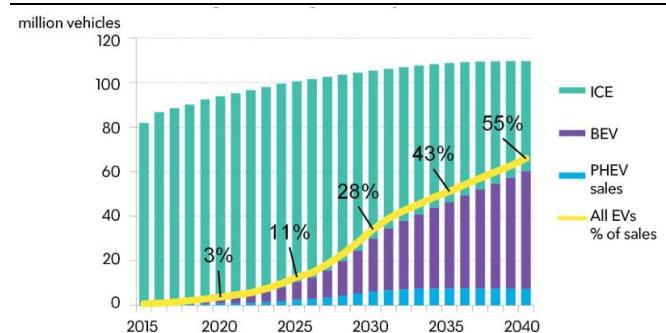
How the EV industry evolves will be impacted by government policies, battery technology innovations and industry economics. Any changes in these areas may result in vastly different outlook than forecasted by current analysis.

Key industry driver: Electric Vehicles (EV)

Tipping point by 2024. By 2024, the upfront cost of EVs will become competitive on an unsubsidised basis, and by 2029, most segments would reach parity as battery prices continue to fall, according to forecasts by Bloomberg New Energy Finance. This should help trigger a tectonic shift in car sales mix.

According to Bloomberg New Energy Finance, 55% of all new car sales and 33% of the global car fleet will be electric by 2040. China will continue to be the largest EV market in the world in its forecast period.

Figure 16: Annual global light duty vehicle sales forecast by Bloomberg New Energy Finance



Source: Bloomberg New Energy Finance

There are around 3mn EV globally, and about two-thirds of which are made and used in China. Production of EV and other non-petrol vehicles in China rose to 500,000 in 1H18. This is still a small number compared to the 1.1bn global market of cars and light vans.

Car OEM EV plans

Car OEMs are planning over 350 new EV models over the next several years. Figure 17 highlights most of the major OEMs EV plans over the next decade. This new race between automotive OEMs to provide the EV of the future will be a positive tailwind for lithium demand.

Ford Motor Company, the United States' second largest carmaker, is planning to spend \$US11 billion (\$14.3 billion) developing a range of 40 hybrid and fully electric vehicles by 2022.

Toyota has pledged to offer more than 10 new electric models to its line-up by the early 2020s, partnering with electronics giant Panasonic to develop batteries.

Nissan has also pledged to sell 1 million electric vehicles by 2022, while **Hyundai Motor Company** and its affiliate **Kia Motors** plan to release 38 green models by 2025, using a variety of new technologies, including battery power.

Among luxury manufacturers, **BMW** is not alone, with **Audi** planning to launch 20 electric vehicle models by 2025 in collaboration with **Porsche**, and **Daimler AG** investing €10 billion in electric and hybrid technology.

Volvo has said it will introduce five electric models between 2019 and 2021 and move away from building vehicles that only have an internal combustion engine.

Figure 17: Major car manufacturers are committed to electric vehicles by 2030

Region	OEM	Year	Investment	Announcements	
					xEV Target
NAFTA	Ford	2022	\$11 billion		40 xEV including 16 BEV
	GM	2022			>20 BEV
	Tesla	2024			Sales of Model 3 around 274 kunits
EMEA	BMW	2025			xEVs to account for 15-25% of sales
	Daimler	2025	€12 billion		25 electrified models (12 BEV) xEVs for 15-25% of sales
	VW	2025			>10 BEV models 40 hybrid models
		2030	Over € 20 billion		50% of sales to be electric 80 xEV models
			\$40 billion		Electrified versions of all +300 global models
ASIA	Honda	2030			2/3 of total car sales to be electrified
	Toyota	2020			Launching 10 EVs
		2030			Selling 5.5 million electrified vehicles (including hybrids and hydrogen fuel cells)
	Nissan	2022			8 new EV models Sales of 1 million units
	Dongfeng	2022			xEV sales accounting for 30% of total sales
	BYD	2020			Sales of 600 kunits
	BAIC	2020			Production of 800 kunits

Source: SQM

Chinese EV demand

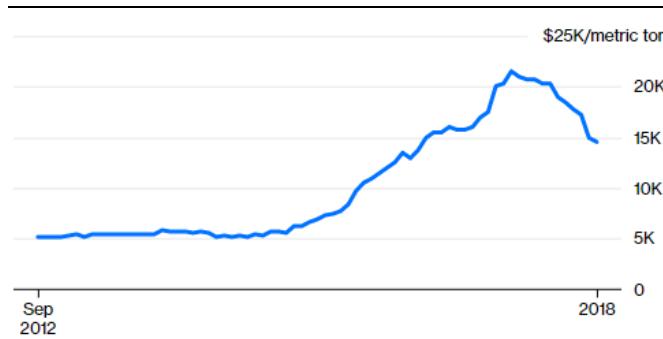
While North America and Europe are important markets, it is China that is leading the global EV industry. As such, an overview of China's EV policies is necessary to understand the industry dynamics which has resulted in the recent lithium price weakness.

Since 2016, there has been frequent shifts in China's EV policy. The Chinese government removed financial incentives in April 2016 when reports emerged that car manufacturers were fraudulently claiming EV subsidies. In the middle of 2017, the government then introduced a revised EV subsidy programme. In January 2018, the government then announced a change in policy where incentives were tilted towards higher range and energy density, and the minimum range to qualify for the subsidy was raised from 100km to 150km.

The new EV subsidies announced in January 2018 supported the change in battery technology toward higher range and energy density. As a result, there has been a misalignment between conversion capacity. Conversion plants required additional time to adjust operations, leading to demand disruption and pressure on lithium spot prices in China as the supply chain adopts to the new requirements.

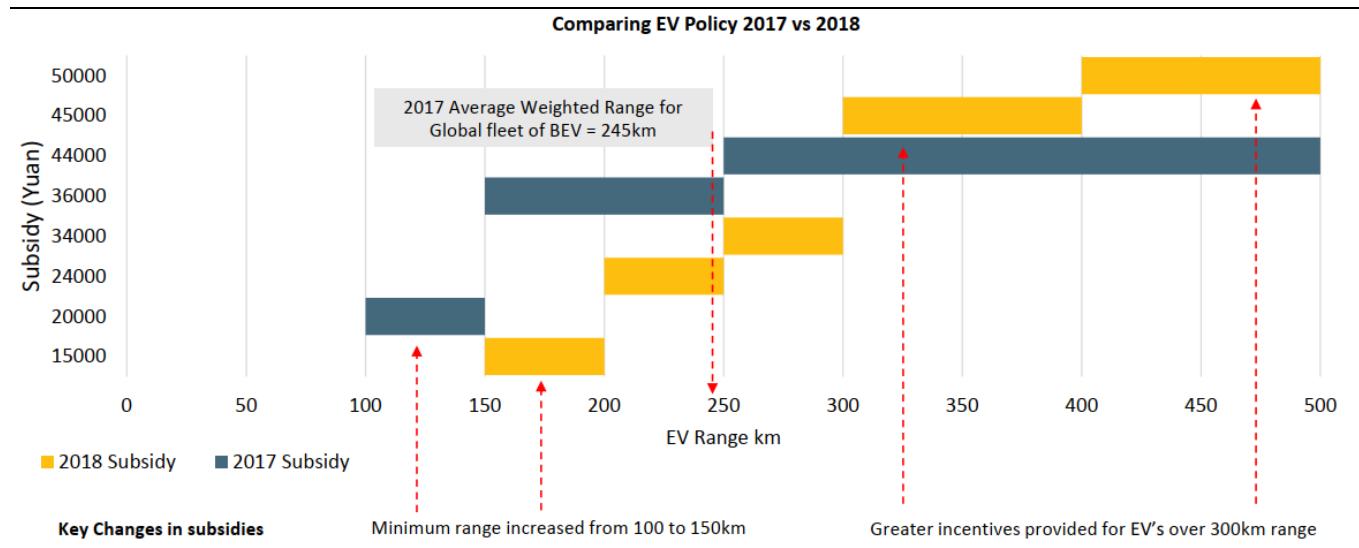
Prices are now at its lowest levels in two years, after doubling in 2016 and rising more than 30% in 2017, according to data by Benchmark Mineral Intelligence.

Table 3: Lithium carbonate prices



Source: Benchmark Mineral Intelligence, Bloomberg

Figure 18: China raised the bar for EV subsidies in 2018, favoring higher-energy and longer range EV



Source: Orocobre

Demand still healthy. It is important to distinguish between lithium spot prices and demand, where the >30% decline in lithium carbonate prices in 2018 does not mean a corresponding drop in demand. Given that 90-95% of the lithium supply is arranged through long-term contracts between producers and customers, the 5-10% of market supply on spot pricing is expected to be volatile, driven mainly by China's EV policies as mentioned earlier.

Comments from the largest lithium producers (right table) indicates that spot prices are not reflective of global lithium demand.

Table 4: Comments on lithium prices and global demand

Albemarle, Luke Kissim, Q2'18 results: 'because of our long-term contract strategy, Chinese spot pricing has no impact on our pricing and you shouldn't see a correlation. I think this quarter, really, you begin to see that as the Chinese spot pricing is down and our pricing is up year-over-year. So we think that's a validation and we will continue to see that.'

FMC, Paul W.Graves, Q2'18 results: 'I'll keep making the point until I maybe go blue in the face that the Chinese spot market for carbonate is not a really very useful market. Even if it is a market to look at, it carries very little informational content for the overall state of the market or what customers are looking for with their own contracting strategies. So while I recognize that people pick up on that data, it's leading everybody down the wrong path as to what the true fundamentals of the market are."

Source: Orocobre, Albemarle, FMC

Appendix

Industry cost structure

Figure 19: Costs to convert 3rd party lithium concentrate - 1H18 Chinese Import

Cost to Convert 3 rd Party Concentrate – H1'18 Chinese import	per t
CIF Purchase Price for Spodumene Concentrate 5.5% grade	US\$1,045
Input Cost of Concentrate	US\$8,362
Cost to Convert	US\$3,000
<u>Cost of Production to LCE per t (Converter Gate)</u>	<u>US\$12,407</u>

Source: Orocobre

Lithium industry supply chain

Lithium does not occur naturally in its pure metallic form, and instead, occurs within minerals and salts. After being extracted from minerals or brines, lithium can be converted into various compounds which are ready for commercial applications, such as lithium carbonate lithium hydroxide, the two key ingredients of EV batteries.

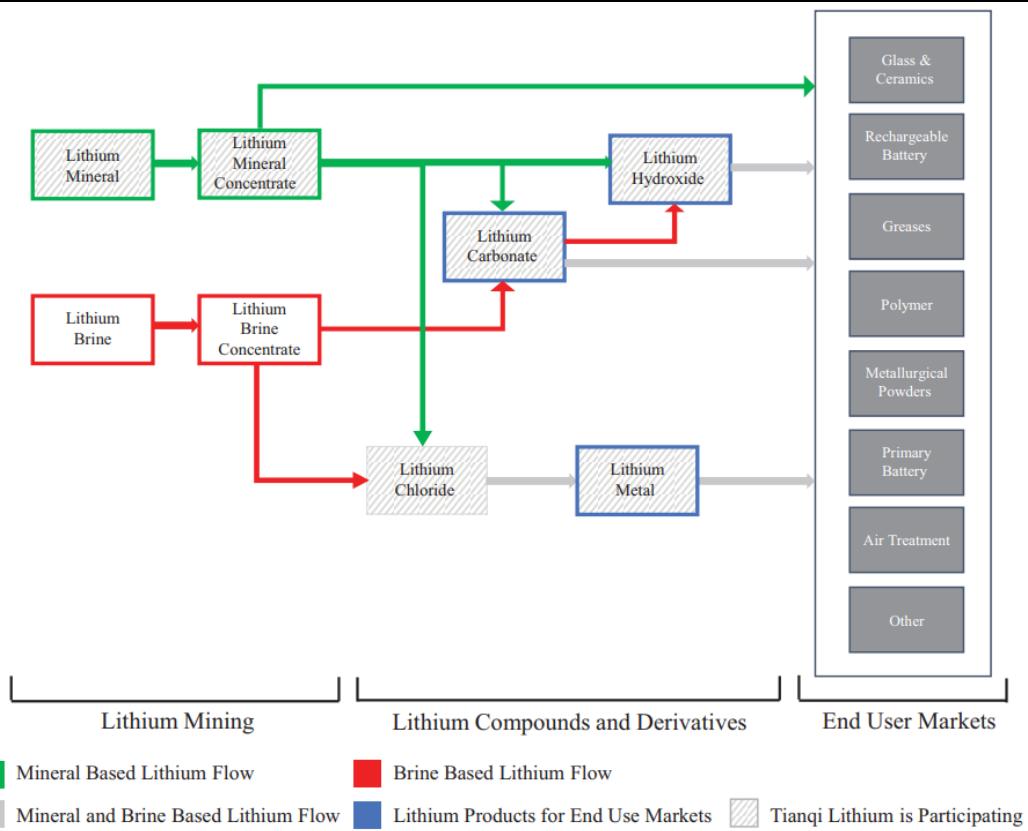
Appendix: Glossary

Lithium carbonate (Li₂CO₃) – a fine white powder that can be produced directly from brines and minerals. The main applications are for rechargeable batteries, ceramics, glass and metallurgy.

Lithium hydroxide (LiOH) – a fine white powder that may be directly recovered from spodumene concentrate or through conversion from lithium carbonate. It is used increasingly used in lithium-ion battery cathodes.

Tantalum – a chemical element with symbol Ta. A rare, hard, blue-grey, lustrous transition metal that is highly corrosion-resistant. The chemical inertness of tantalum makes it a valuable substance for laboratory equipment and substitute for platinum. Tantalum is also used for medical implants and bone repair. Its main use today is in tantalum capacitors in electronic equipment such as mobile phones, video game systems and computers.

Table 5: Lithium supply chain



Source: Tianqi Lithium Corp

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