



## Maricunga ready to go

Share Price: A\$0.26

### Environmental Impact Assessment approved

#### The Project

Lithium Power International (LPI) owns 51% of the Maricunga Lithium Project in Chile, a lithium brine play where the Definitive Feasibility Study (DFS) has been completed. LPI also owns a range of other lithium projects at earlier stages of development. In August 2019 LPI announced that Codelco, Chile's state-owned copper miner, had signed a non-binding Memorandum of Understanding for the joint development of Maricunga while in February 2020 LPI was able to announce that the Environmental Impact Assessment for Maricunga had been approved.

#### Investment case

Maricunga's 2019 DFS envisaged production of 20,000 tpa of LCE over a 20-year mine life at a production cost of US\$3,772/t LCE without potassium chloride credits. Total capex of US\$563m led to a pre-tax NPV of US\$1.3bn at an 8% discount rate. Following on from the Codelco MoU, LPI aims to close financing and initiate project construction for Maricunga this year. Maricunga's mine life is arguably longer than 20 years – the January 2019 only estimated the Measured and Inferred categories from surface to 200m depth, leaving room to expand down to 400 metres.

#### Valuation range of A\$0.72–0.83 per share

We value LPI at A\$0.72–0.83 per share using a DCF-based approach where the assumption is that LPI self-funds its share of Maricunga using equity. We see LPI being re-rated by the market once a project financing is in place and lithium prices, under pressure in 2018 and 2019, noticeably recover.

Year to June (AUD)	2019A	2020F	2021F	2022F	2023F
Sales (mn)	0.0	0.0	0.0	0.0	14.7
EBITDA (mn)	-10.0	-5.4	-17.9	-23.0	10.3
Net Profit (mn)	-10.2	-5.4	-18.0	-23.0	7.5
Adj. EBITDA Margin (%)	nm	nm	nm	nm	69.9%
RoA (%)	nm	nm	nm	nm	5.6%
EPS before extr. & amort.	-3.9	-1.9	-4.0	-3.5	1.0
EPS	-3.9	-1.9	-4.0	-3.5	1.0
DPS	na	na	na	na	na
EV/Sales	nm	nm	nm	nm	12.0x
EV/EBITDA	nm	nm	nm	nm	17.2x
P/E	nm	nm	nm	nm	25.9x

Source: Company, Pitt Street Research

ASX: LPI

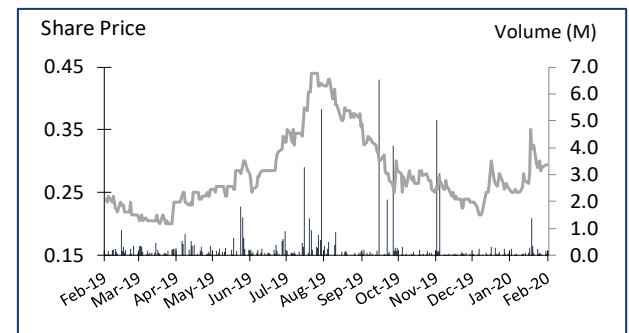
Sector: Metals & Mining

25 February 2020

Market Cap. (A\$ m)	68.3
# shares outstanding (m)	262.5
# share fully diluted	307.5
Market Cap Ful. Dil. (A\$ m)	80.0
Free Float	100%
12 months high/low	0.44 / 0.2
Avg. 12M daily volume ('1000)	354
Website	<a href="http://lithiumpowerinternational.com">lithiumpowerinternational.com</a>

Source: Company, Pitt Street Research

#### Share price (A\$) and avg. daily volume (k, r.h.s.)



Source: Thomson Reuters, Pitt Street Research

Valuation metrics	
Fair valuation range (A\$)	0.72-0.83
WACC	10.8%
Assumed terminal growth rate	None
Stock class	Speculative

Source: Pitt Street Research

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Analyst: Stuart Roberts

Tel: +61 (0)447 247 909

[Stuart.roberts@pittstreetresearch.com](mailto:Stuart.roberts@pittstreetresearch.com)



# Lithium Power International

Profit & Loss (A\$m) - LPI	2019A	2020F	2021F	2022F	2023F	2024F	2025F
<b>Sales Revenue</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>14.7</b>	<b>46.4</b>	<b>91.7</b>
Operating expenses	-10.0	-5.4	-17.9	-23.0	-4.4	-4.4	-4.4
<b>Adjusted EBITDA</b>	<b>-10.0</b>	<b>-5.4</b>	<b>-17.9</b>	<b>-23.0</b>	<b>10.3</b>	<b>41.9</b>	<b>87.2</b>
Depn & Amort	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Adjusted EBIT</b>	<b>-10.0</b>	<b>-5.4</b>	<b>-17.9</b>	<b>-23.0</b>	<b>10.3</b>	<b>41.9</b>	<b>87.2</b>
Net Interest	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Profit before tax (before exceptional)</b>	<b>-10.1</b>	<b>-5.4</b>	<b>-18.0</b>	<b>-23.0</b>	<b>10.3</b>	<b>41.9</b>	<b>87.2</b>
Tax expense	-0.1	0.0	0.0	0.0	-2.8	-11.3	-23.5
<b>NPAT</b>	<b>-10.2</b>	<b>-5.4</b>	<b>-18.0</b>	<b>-23.0</b>	<b>7.5</b>	<b>30.6</b>	<b>63.7</b>
Cash Flow (A\$m) - LPI	2019A	2020F	2021F	2022F	2023F	2024F	2025F
Profit after tax	0.0	-5.4	-18.0	-23.0	7.5	30.6	63.7
Depreciation	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Share of profit (loss) joint venture	0.0	2.5	15.0	20.1	-13.2	-44.8	-90.1
Changes in working capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other operating activities	-1.6	0.0	0.0	0.0	0.0	0.0	0.0
<b>Operating cashflow</b>	<b>-1.6</b>	<b>-2.9</b>	<b>-2.9</b>	<b>-2.9</b>	<b>-5.7</b>	<b>-14.2</b>	<b>-26.5</b>
Additional investment in MSB	-5.3	-15.1	-76.9	-31.2	0.0	0.0	0.0
Other investing activities	-1.1	0.0	0.0	0.0	0.0	0.0	0.0
<b>Investing cashflow</b>	<b>-6.4</b>	<b>-15.1</b>	<b>-76.9</b>	<b>-31.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
Dividend received from MSB	0.0	0.0	0.0	0.0	10.6	35.9	72.1
Equity raised (repurchased)	0.0	15.1	76.9	37.4	0.0	0.0	0.0
Other financing activities	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net change in cash	-8.0	-2.9	-2.9	3.3	4.9	21.6	45.6
Cash at End Period	15.3	12.4	9.5	12.8	17.6	39.3	84.9
Balance Sheet (A\$m) - LPI	2019A	2020F	2021F	2022F	2023F	2024F	2025F
Cash	15.3	12.4	9.5	12.8	17.6	39.3	84.9
Total Assets	48.8	58.6	117.6	131.9	139.4	170.0	233.7
Total Liabilities	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Shareholders' Funds	48.5	58.2	117.2	131.6	139.1	169.7	233.3
Ratios - LPI	2019A	2020F	2021F	2022F	2023F	2024F	2025F
EBITDA margin	nm	nm	nm	nm	69.9%	90.4%	95.2%
Total Cash / Total Assets	31.4%	21.2%	8.1%	9.7%	12.7%	23.1%	36.3%
Return on Equity (%)	nm	nm	nm	nm	5.6%	19.8%	31.6%

Profit & Loss (U\$m) - Maricunga	2019A	2020F	2021F	2022F	2023F	2024F	2025F
<b>Sales Revenue</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>89.0</b>	<b>181.9</b>	<b>309.6</b>
Operating expenses	0.0	0.0	0.0	0.0	-25.8	-50.2	-81.3
<b>Adjusted EBITDA</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>63.1</b>	<b>131.6</b>	<b>228.2</b>
Depn & Amort	0.0	0.0	0.0	0.0	-10.7	-19.8	-31.3
<b>Adjusted EBIT</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>52.4</b>	<b>111.8</b>	<b>196.9</b>
Net Interest	0.0	-3.4	-20.6	-27.6	-27.6	-27.6	-27.6
<b>Profit before tax (before exceptional)</b>	<b>0.0</b>	<b>-3.4</b>	<b>-20.6</b>	<b>-27.6</b>	<b>24.8</b>	<b>84.2</b>	<b>169.3</b>
Tax expense	0.0	0.0	0.0	0.0	-6.7	-22.7	-45.7
<b>NPAT</b>	<b>0.0</b>	<b>-3.4</b>	<b>-20.6</b>	<b>-27.6</b>	<b>18.1</b>	<b>61.5</b>	<b>123.6</b>



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## Introducing Lithium Power International: ASX: LPI

**Lithium Power International is a Sydney-based lithium mine developer.** The company's flagship project is the 51%-owned Maricunga Lithium Project in Chile, a lithium brine play where Definitive Feasibility Study (DFS) has been completed and financing options for the project are being considered. The company also owns 70% of another brine project, the Centenario Lithium Project in northwestern Argentina, as well as lithium hard rock projects in Western Australia – three in the Pilbara region of that state, another at Greenbushes, in the southwest. In August 2019 LPI announced that Codelco, Chile's state-owned copper miner and the world's No. 1 copper-producing enterprise, had signed a non-binding Memorandum of Understanding for the joint development of Maricunga.

*Maricunga is a 'shovel-ready' lithium brine project*

**Maricunga is a 'shovel ready' lithium project.** Maricunga, 51% owned by Lithium Power International<sup>1</sup>, is a lithium brine project located in the Chilean sector of the Chile-Bolivia-Argentina Lithium Triangle, where much of the world's new lithium supply is expected to come from. Specifically, the project covers 45 sq km of the Maricunga salar in the Atacama Region of northern Chile<sup>2</sup>, around 170 km northeast of the regional capital of Copiapo and 250 km from the Chilean coastline. The district has all the relevant infrastructure, including Chile Highway 31, which runs close to the project area<sup>3</sup>, as does a 23 kV power line. After completion of a DFS earlier this year, LPI envisages start-up of construction in 2020 subject to completion of project financing for a US\$563m project. The first lithium carbonate production from a pilot plant was made in February 2018. An Environmental Impact Assessment (EIA) was submitted to the Chilean Environmental Review Agency<sup>4</sup> in September 2018 and a January 2019 DFS proposed production of 20,000 tpa of LCE over a 20-year mine life. The DFS valued the project at US\$1.3bn pre-tax. The project's Environmental Impact Assessment was approved in February 2020.

**Why is the Codelco relationship important for Maricunga's near-term development?** Codelco is not only a large and established mining company with US\$14.3bn in 2018 revenue but, more importantly, it is, in effect, an arm of the Chilean state with the potential to make investments in projects that are strategically important for Chile's economic future. Its willingness to work on the development of Maricunga therefore represents a vote of confidence in the project by high-level decision-makers in Chile, as well as bringing significant prestige to the project.

**What is Lithium Power International doing with its other lithium projects.** LPI has chosen to prioritise Maricunga at this stage because of the potential to unlock considerable shareholder value through a start-up of that mine. The company has considered selling the Centenario Lithium Project but remains optimistic on the Western Australian projects given the favourable geology. We believe that the market will start to attribute more value to these projects once they yield valuable drill results.

**If Lithium Power International is so good then why is it capitalized at only A\$70.9m/US\$48.5m?** LPI stock went as high as 44.5 cents in the wake of the Codelco announcement but it has since given back part of the re-rating. We believe the reason for the low share price is the fact that Maricunga has yet to be project-financed in an environment where the price of lithium has been in a bearish environment in 2018 and 2019, and there has been some recent

<sup>1</sup> The other 49% is held by a privately held Chilean company called Minera Salar Blanco with 31% (associated with the Chilean businessman Martin Borda), and a Canadian company called Bearing Lithium (Vancouver, BC, TSX-V: BRZ, bearingresources.ca) with 18%. LPI bought a 1.35% interest from MSB for A\$2m in June 2018.

<sup>2</sup> Called until 2018 'Region III' – until that year each of Chile's 16 regions was designated by a Roman numeral.

<sup>3</sup> Chile Highway 31 starts at Copiapó at Chile Route 5 (part of the Pan-American Highway) and ends at San Francisco on the Chile-Argentina border. The road continues as RN 60 in Argentina.

<sup>4</sup> The Servicio de Evaluación Ambiental (SEA).



unrest in Chile that has been widely reported internationally. We see LPI initially re-rating on the back of a project finance package and consolidating those early gains with the rise in lithium prices which are expected to kick in from 2021 once the marginal producers come off the market<sup>5</sup>.

## Ten reasons to look at Lithium Power International

- 1) **Maricunga's DFS has been completed and the Environmental Impact Assessment has been approved.** The project is now at the financing stage and represents good upside at the US\$1.3bn pre-tax DFS valuation assigned to it by the project investigators.
- 2) **Maricunga is a low-cost lithium brine project,** with the 2019 DFS suggesting 20,000 tpa of LCE could be produced at US\$3,772/t LCE without potassium chloride credits. This makes it potentially one of the lowest cost producers globally.
- 3) **The potassium credits from Maricunga could be valuable,** given rising demand for potash in fertilizers. Maricunga contains at least 5.4 million tonnes of potash.
- 4) **Maricunga does not have political risk,** with Chile a politically stable and economically free country with a long history of encouraging mining investment. Brine lithium in Argentina and elsewhere arguably comes with much more political risk.
- 5) **Maricunga's mine life is arguably longer than 20 years. There is potential to markedly expand mine life.** The January 2019 resource estimate of 2.07 million tonnes of Lithium Carbonate Equivalent (LCE) for just the Measured and Inferred categories only estimated from surface to 200m depth, leaving room to expand this respond down to 400 metres.
- 6) **LPI is collaborating with Codelco on financing of the Maricunga Project.** This large Chilean company brings the project considerable prestige given the long-standing importance of Codelco to Chile's economic direction, as well as the company's considerable balance sheet.
- 7) **There is strong potential for lithium prices to improve in the medium term,** mainly because of the long-term prospects for electric vehicles. In 2018 there was about 270,000 tonnes of lithium demand and some estimates that suggested this will rise to about 1 million tonnes in 2025<sup>6</sup>.
- 8) **LPI has other quality lithium projects in its portfolio.** The Tabba Tabba and Strelley Lithium Projects in the Pilbara region of WA lies near FMG's Tabba Tabba lithium discovery, while the Pilgangoora project lies near the Pilgangoora discoveries of Pilbara Minerals (ASX: PLS) and Altura Mining (ASX: AJM). Important, the Greenbushes Lithium Projects cover a large area of ground near the Greenbushes Lithium Mine. We see these projects ultimately delivering value to LPI given the favourable geology.
- 9) **LPI has a quality leadership team.** LPI's CEO, **Cristobal Garcia-Huidobro**, former ran CENTINELA, a Santiago-based investment company, before he started work on development of Maricunga. Chairman **David Hannon**, a Sydney-based investor, founded Atlas Iron. **Richard Crookes**, Executive Director, Corporate Finance, brings years of mining project finance experience including a 12-year stint at Macquarie Bank. CFO **Andrew Phillips** brings corporate governance skills. The LPI board, which includes Hannon, Garcia-Huidobro, Crookes and Phillips, also features former

*Maricunga does not have political risk*

<sup>5</sup> Generally from recyclers and hard rock lithium producers - see, for example *Morgan Stanley predicts a 45% fall in lithium prices by 2021* by Sam Jacobs, Business Insider, 27 February 2018.

<sup>6</sup> See *The lithium industry needs a \$17b injection to meet 2025 demand – here come the deals* by Angela East, MSN, 16 May 2019.



Newcrest CEO **Russell Barwick**, the Chilean businessman **Martin Borda** and the Sydney businessman **Ricky Fertig**.

- 10) LPI is undervalued on our numbers**, with the stock currently trading below our valuation range of A\$0.72-\$0.83 per share. We see LPI being re-rated by the market on the back of a project financing package for Maricunga as well as recoveries in lithium prices.

*Maricunga is a very high-grade lithium salar*

## Maricunga: A world-class lithium brine play

**Maricunga is one of the potentially more productive salars in the Lithium Triangle.** The Lithium Triangle features numerous salars that are already producing or in late stage development. What is notable about Maricunga is the high grade of the lithium as well as the availability of potassium credits.

- The lithium grade at the time of the January 2019 resource update was 1,167 mg/L, making it one of only about five salars in the world with grades above 1,000 mg/L, and comparable in potential productivity to the Atacama salar where SQM and Albemarle currently have producing lithium mines. Balanced against this is a high magnesium content, but LPI argues that Maricunga's magnesium/lithium ratio is comparable to Atacama's.
- Maricunga contains at least 5.4 million tonnes of potash as per the January 2019 resource update, which represents valuable project credits.

**A favourable DFS.** The 2019 DFS suggested that Maricunga's production cost for its 20,000 tpa of LCE would be a low US\$3,772/t LCE without potassium chloride credits. Total capex of US\$563m led to a pre-tax NPV of US\$1.3bn at an 8% discount rate. The operation will see brine pumped 5 km to evaporation ponds and from thence to a lithium carbonate plant.

**A large and growing lithium resource.** An important feature of the Maricunga story since 2016 has been the expansion of the resource:

- At the time the Maricunga deposit had 574,000 tonnes of lithium carbonate and 1.5 million tonnes of potash under an NI 43-101 estimate.
- In July 2017 an initial JORC 2012 resource was announced of 2.15 million tonnes LCE and 5.7 million tonnes potassium chloride. This was for the Measured, Indicated and Inferred categories.
- In January 2019 the resource was upgraded to 2.07 million tonnes of LCE and 5.38 million tonnes of potassium chloride for just the Measured and Inferred categories. This resource supported the 20-year mine of the DFS published at the same time.

**Potential to markedly expand mine life.** The January 2019 resource estimate only covered the region from surface to 200m depth, leaving room to expand this resource down to 400 metres. The 2016-2018 diamond drilling campaign showed the potential for continued increases in the resource.

- The pumping wells flowed as expected in 2016<sup>7</sup>.
- An 18-hole diamond drilling programme from late 2016, conducted in order to develop a JORC resource, generated many lithium intersections with higher than expected grades<sup>8</sup> and established that the deposit had high drainable porosity and permeability.

**Maricunga has had its Environmental Impact Assessment approved.** The most important permit needed for any development in Chile, is the

<sup>7</sup> See LPI's market release dated 13 September 2016 and headlined 'Maricunga lithium brine update'.

<sup>8</sup> The original resource was only defined to 150 metres. Brine may be available at 500 metres.





Environmental Impact Assessment (EIA). LPI submitted its Maricunga EIA to the Chilean authorities by September 2018 and this gained approval in February 2020. The Chilean government takes environmental protection seriously, and consequently EIAs need to be comprehensive -in Maricunga's case the document ran to 11,400 pages and was reviewed three times before gaining approval.

**Maricunga has its production permits.** An issue in recent years for Chile's mining industry is the unique permitting issues related to lithium. In 1979 Chile declared lithium as 'strategic' and therefore subject to state control because of its nuclear applications. A key strength of Maricunga is that almost half of the project mining concessions were registered under the pre-1979 mining code<sup>9</sup>, allowing immediate exploitation. Production permits for the exploitation and commercialisation of lithium products were granted by the CCHEN, Chile's Nuclear Energy Commission<sup>10</sup>, in March 2018.

**A very well-placed potential partner in Codelco.** In August 2019 LPI announced that Codelco, Chile's state-owned copper miner<sup>11</sup>, had signed a non-binding Memorandum of Understanding for the joint development of Maricunga. The aim is to consolidate Maricunga into one big project using, as a starting point, the current project from LPI. It also aims to close the financing and initiate the project construction in the first half of 2020. Securing Codelco is a big deal for LPI. Among other things it would allow Maricunga to exploit also its 'new coded' concessions, the ones registered after 1979 mining code, using a CEOL, or Special Operation Lithium Contract, that Codelco already holds and that allows for the exploitation of lithium on any concession registered post-1979 in the Maricunga Salar. With LPI's EIA and CCHEN permits, plus this CEOL contributed by Codelco, LPI's project eliminates any uncertainty regarding the permitting of Maricunga.

**LPI benefits from the Chilean government's desire to catch up in the lithium race.** As we note below, Chile is one of the world's most attractive investment destinations for the global mining industry. The incumbent Piñera administration is now looking to catch up on the lithium industry and regain Chile's position as the main supplier for worldwide..

**LPI will potentially only be the third lithium producer in Chile.** We think the Codelco relationship bodes well for LPI. At the moment only the Chilean company SQM<sup>12</sup> and the American company Albemarle<sup>13</sup> operate mines in Chile. LPI once Maricunga gets up and running with Codelco can become the third.

## The Greenbushes Projects: Potential new lithium discovery

**LPI owns some potentially valuable leases near the Greenbushes Lithium Mine,** located 250 km south of Perth. The Greenbushes Mine is owned by Talison Lithium<sup>14</sup>, which is a joint venture company of Albemarle (49%) and China's Tianqi Lithium. Greenbushes is the world's largest hard rock lithium mine, with annual production in the order of 105,000 tonnes of LCE currently being expanded to 190,000 tpa<sup>15</sup>. LPI's two leases at Greenbushes – one that

*LPI benefits from the Chilean government's desire to catch up in the lithium race*

<sup>9</sup> Specifically, the Mining Code of 1932.

<sup>10</sup> Comisión Chilena de Energía Nuclear.

<sup>11</sup> The Corporación Nacional del Cobre (codelco.com) was established in the mid-1970s by Chile's military Junta from various copper assets that had been expropriated in 1971 by the Allende government.

<sup>12</sup> Santiago, Chile, NYSE: SQM, sqm.com. SQM is short for Short for Sociedad Química y Minera.

<sup>13</sup> Charlotte, NC, NYSE: ALB, albemarle.com.

<sup>14</sup> talisonlithium.com.

<sup>15</sup> Source: Albemarle 2018 10-K.



centres on the town of Balingup north and west of the mine<sup>16</sup>, and another that straddles the Brockman Highway south of the mine<sup>17</sup>. Together the two tenements cover 398 sq km.

**There is potential for spodumene resources in the Greenbushes pegmatites under LPI's tenements.** The Greenbushes pegmatite deposit, which hosts the lithium-bearing spodumene mined at Greenbushes, has a main zone that is 3 km long and 300 metres wide within a major regional fault zone. However, there are numerous smaller pegmatite dykes and pods flanking the main body. LPI believes that these subsidiary pegmatites may host valuable spodumene deposits that can be mined, and the concentrate fed into the Talison plants. LPI's tenements are largely unexplored for lithium in spite of their proximity to the mine. Gravity imagery suggest a feature worth exploring in the Brockman Highway tenement.

## The Pilbara opportunity: A second potential hard rock play

LPI is currently working on a number of hard rock lithium projects in the Pilbara region of Western Australia.

- **Pilgangoora-Houston Creek** – This project lies near the Pilgangoora discoveries of Pilbara Minerals (ASX: PLS) and Altura Mining (ASX: AJM). The tenements here cover 75 sq km. An aeromagnetic survey has identified greenstones which may be spodumene-hosting pegmatites and an initial RC drilling campaign was conducted in 2018.
- **Tabba Tabba and Strelley** – These projects cover 128 sq km of tenements which lie near to FMG's Tabba Tabba lithium discovery. Soil sampling has been conducted ahead of an RC drilling campaign.

**The Wodgina transactions of 2018 and 2019 point to the upside.** We believe that the sale by the Perth-based Mineral Resources (ASX: MIN) of a major stake in the Wodgina Lithium Project bodes well for LPI should its Pilbara projects move forward.

- Wodgina sits in the middle of this emerging Pilbara province. Mineral Resources had bought the project in 2016 and was originally selling Direct Shipping Ore before taking the strategic decision to move to production of higher value spodumene concentrate.
- In November 2018, Albemarle, the American specialty chemicals company, which is a major lithium producer, bought 50% of Wodgina in late 2018 for US\$1.15bn.
- In August 2019, the Albemarle/Mineral Resources relationship was revised. Albemarle moved to 60% of Wodgina for US\$820m plus 40% of two lithium hydroxide plants which the American company is establishing at Kemerton, near Bunbury in southwest WA. The much higher price for a Wodgina interest in this second agreement reflects, in our view, an improved long-term view of spodumene as well as lithium on the part of Albemarle, combined with the established nature of the Wodgina resource.

Even though the Wodgina Project has been placed on care and maintenance as of the start of this month, the transaction size points to the long-run value of hard rock lithium when the market environment turns positive again.

*LPI's tenements in the Pilbara lie near those of Pilbara Minerals*

<sup>16</sup> E 70/4763.

<sup>17</sup> E 70/4774.





## The Centenario opportunity: A second brine project

**LPI owns 70% of the Centenario Lithium brine project in Argentina.** This project covers seven tenements with a 69 sq km total area on the Centenario lithium brine salar in Salta Province of northwestern Argentina, the centre of Argentina's lithium brine industry. The project, easily accessible by road, lies around 165 km west of Salta City, the provincial capital. The Centenario salar, one of several on Argentina's Puna Plateau, hosts a number of developers including the French mining company Eramet<sup>18</sup>. LPI sold a 30% stake in the project to a private company called Centenario Lithium in June 2018.

**Eramet's Project suggests the upside for Centenario.** In February 2020 Eramet chose to postpone development of its project on the Centenario salar, citing economic and regulatory uncertainty in Argentina. Should this uncertainty be resolved, Eramet could be a heavy investor in the salar – the ~US\$600m project had been envisaged as a 24,000 p.a. tonne LCE producer in its first phase. Eramet had previously announced its decision to proceed at Centenario in June 2019 with the intention of proceeding to Final Investment Decision over the next six months or so.

**LPI envisages a drilling program.** A diamond drill hole into LPI's Centenario properties around 2012 indicated low to moderate lithium grades but with a favourable magnesium to lithium ratio. LPI envisages a further diamond drill programme once Maricunga is up and running.

**The political situation may still favour Argentina's lithium.** The area has some major players, including SQM, Orocobre, Livent and Lithium Americas. The general elections held in Argentina on 27 October 2019 facilitated a return to the left which greatly concerned investors in that country. However, LPI argues that any change at the Federal level is unlikely to impact the potential of Centenario due to the power of the provinces related to mining in Argentina, and the generally pro-mining nature of governments in Salta province.

## Chile: A great country in which to do business

*Chile has long been a leader in terms of the ease of doing business*

An attractive feature of the Lithium Power International story is the fact that the initial production operation is based in Chile. That South American nation may have been in the news lately for some domestic unrest<sup>19</sup>, but has long been a leader in terms of the ease of doing business, both for domestic companies as well as foreign, and we see Lithium Power International benefiting from this positive environment.

**A free market economy.** Chile has been a generally favourable place in which to do business ever since the advent of military rule under General Augusto Pinochet in 1973, which saw economic freedom established as a cornerstone of public policy<sup>20</sup>. This freedom has more or less continued after Chile's transition to a stable democracy<sup>21</sup> in 1990, which is remarkable given that the first 20 years after this transition saw centre-left governments consistently elected.

**A pro-business government since 2018.** Chile's November 2017 General Election witnessed strong gains in the Chilean legislature for the pro-business Chile Vamos<sup>22</sup> coalition while Chile Vamos' Presidential candidate, Sebastián

<sup>18</sup> Paris, France, Euronext Paris: ERA, eramet.com.

<sup>19</sup> There have been widespread protests, civil disobedience, rioting and property damage throughout the country since 18 October 2019, prompted initially by a fare increase on the Santiago metro but now encompassing wider public concerns about 'social equality'. See *Chile enters 26th day of protest with strike, huge marches* by Patricia Luna, Washington Post, 13 November 2019. The Chilean peso has been falling as a result.

<sup>20</sup> How *Chile successfully transformed its economy* by Hernán Büchi, heritage Foundation 18 September 2006.

<sup>21</sup> With a strong commitment to human rights - It's worth noting that Chile is a signatory, since 2008, to the United Nation's Convention 169, which is a 1989 Convention on Indigenous and Tribal Peoples.

<sup>22</sup> 'Let's Go, Chile'.



**Chile is highly attractive to resources sector players**

Piñera, won a run-off election the following month. Piñera, who previously served as President from 2010 until 2014, is a billionaire<sup>23</sup> who made his fortune from the credit card company Bancard<sup>24</sup>. Chile's next general election takes place in 2021<sup>25</sup>. In a country where trade unions have been politically powerful, Piñera is seeking to enact reforms to the labour code<sup>26</sup>. He is also pushing for legislation designed to speed up environmental approvals for new mines<sup>27</sup> - we noted above that Maricunga's EIA took 15 months to gain approval.

**Increasing Economic Freedom.** The US-based Heritage Foundation<sup>28</sup> ranked Chile as the world's 19<sup>th</sup> freest economy in its 2019 Index of Economic Freedom<sup>29</sup>, with strong scores on the size of government, business and monetary freedom, and open markets. The Piñera ascension stabilised Chile's Heritage Foundations scores after four years of modestly sliding under Piñera's predecessor, the left-leading Michelle Bachelet.

**High attractiveness to global mining companies.** Canada's Fraser Institute<sup>30</sup>, in its 2018 Survey of Mining Companies<sup>31</sup>, ranked Chile as one of the world's ten most attractive mining jurisdictions and the leading country in this respect in Latin America. Its ratings were up markedly from 2014. Respondents to the 2018 survey cited decreased concerns regarding disputed land claims, environmental regulations and trade barriers under the Piñera administration. The Chilean government places no legal restrictions against foreign investment and foreign mining companies in the country.

**A favourable regulatory environment.** Unlike neighboring Argentina, which delegates much authority to the provinces, Chile regulates mining at a national level, with regional government having little or no authority over the sector. While that system may have adverse consequences should governments be elected that are not pro-mining, the mining sector in Chile is protected not only by the nation's Constitution, in place since 1980<sup>32</sup>, but also by its Mining Code, which dates from 1983<sup>33</sup>, and other legislation.

**A favourable tax and royalty regime.** Chile has a stable tax system. The top corporate tax rate in Chile is currently 25%, while Chilean mining operations pay royalties to the government on a sliding scale of 5% to 14%<sup>34</sup>. Imports of equipment are free of customs tariffs<sup>35</sup> if the source country has a free trade agreement with Chile, as many do<sup>36</sup>. Capital expenditures are effectively free of Chile's standard 19% Value Added Tax.

**Solid infrastructure.** Chile's roads are world class – indeed, on par with Canada's in terms of quality<sup>37</sup> – as are its water and power utilities which are world-class, allowing the country a competitive edge. Although the government controls electricity and water prices, these are low, driven in part

<sup>23</sup> As at 27 August 2019 Piñera was the world's 804 richest person, with an estimated net worth of US\$2.8bn (source: Forbes).

<sup>24</sup> Which he founded in the mid-1970s.

<sup>25</sup> See *LatAm presidential approval ratings: The good, the bad and the ugly*, BNamericas, 19 August 2019.

<sup>26</sup> See *Piñera's labor modernization: between flexibilization and precariousness* by Tomás Croquevielle, Chile Today, 13 May 2019

<sup>27</sup> See *Copper: solid project pipeline to drive global growth*, Mining Review, 26 June 2018.

<sup>28</sup> A conservative public policy think tank.

<sup>29</sup> See [heritage.org/index](http://heritage.org/index)

<sup>30</sup> A Canadian conservative public policy think tank based in Vancouver – see [fraserinstitute.org](http://fraserinstitute.org).

<sup>31</sup> Published late February 2019.

<sup>32</sup> See Article 19, No. 24. This Constitution was approved by Chileans in a plebiscite of all adult citizens, even though Chile was ruled by a military Junta at the time.

<sup>33</sup> Law No. 18.248.

<sup>34</sup> Prior to 2010 the royalty rate was 4-5% but the figure was raised in order to raise revenues to help the country rebuild after a devastating earthquake of February 2010.

<sup>35</sup> Ordinarily this is 6%.

<sup>36</sup> Chile's free trade agreement with the US has been in place since 2004. Australia's a free trade agreement with Chile went into effect in 2009. In all Chile has in excess of 35 free trade agreements that cover about 85% of global gross domestic product (see *Chile's economic freedom slumped under socialism - President Piñera's plan will revitalize it* by James Roberts, Heritage Foundation, 9 May 2018).

<sup>37</sup> Source: World Economic Forum Global Competitiveness Report 2018.



by low-cost renewables<sup>38</sup>. For electric power, the Chilean government completed the unification of the main SIC and SING grids, for the central and northern regions of the country respectively, in November 2017, thereby ensuring better power supply<sup>39</sup>.

**The guidance on lithium mining is coming.** Chile did not approve any new lithium mines during the Bachelet administration, in part because the regulatory environment was unclear. This is a long-standing issue that dates from 1979 when Chile altered its mining code so that the state retained all lithium deposits<sup>40</sup>. The Chilean government currently requires would-be lithium miners to partner with the state or obtain a special permit known as a 'Contrato Especial de Operación de Litio' or CEOL, that is, a 'Special Lithium Operation Contract' before they can develop their mine. However, the government has yet to provide guidelines as to how to be granted a CEOL, nor has there been guidance on lithium royalties or any tax schemes specific for the commodity. At the 11th Lithium Supply & Markets Conference in Santiago in June 2019, Chile's Mining Minister, Baldo Prokurica, committed to providing such guidelines in the near term<sup>41</sup>.

## Sizeable opportunity for lithium producers

Lithium has increasingly become important for the global economy. Today, it is used in almost every electronic device, from laptops and mobile phone batteries to EVs. It also features prominently in modern power tools and battery-operated material handling equipment. In the industrial space, it is widely used in the production of glass and glass ceramic products, such as fire viewing windows, cooktop panels, telescopic mirror substrates and fire-resistant glass due to its commendable heat absorption capability and zero thermal expansion quality.

An uncommon application of lithium is in the medical industry, where it is used as a mood stabiliser and supplement to boost mental fitness. Studies have shown that the calming properties of lithium carbonate assist in improving neurological health and mental well-being.

## Energy storage applications will continue to drive lithium demand

While the application of lithium is diverse, its usage as a battery mineral is expected to maintain the dominant position in driving demand. Consumption of Li-ion batteries has increased significantly because of rapid expansion in the portable consumer electronics sector through 2014 and a growing market for batteries for automotive electrification since then. Further technological advancement, together with the rise in installed renewable energy (wind and solar) capacity, extended the use of Li-ion batteries to grid/off-grid energy storage systems (ESS). According to Roskill, a leading market research company, consumption of lithium in volume terms will be driven by increasing Li-ion battery use for automotive purposes, with rechargeable batteries forecast to register 22.7% annual growth till 2032.

*Lithium has far-ranging applications across diverse end markets*

<sup>38</sup> Around a fifth of Chile's power generation comes from renewable sources at prices lower than coal-fired power generation (see *Chile: A country of opportunities in investment and development* by Daniel Brightmore, Mining Global, 25 July 2019). A new solar power plant in the Atacama Desert recently came on stream with the world's lowest production costs – see *Chile's cheap power - sign of a solar future?* by Felicia Jackson, Forbes, 5 June 2019.

<sup>39</sup> See *Chile completes interconnection of its two main power systems* by Emiliano Bellini, PV Magazine, 22 November 2017.

<sup>40</sup> This was because lithium is important in the nuclear power industry and Chile in the late 1970s was exploring the use of nuclear power.

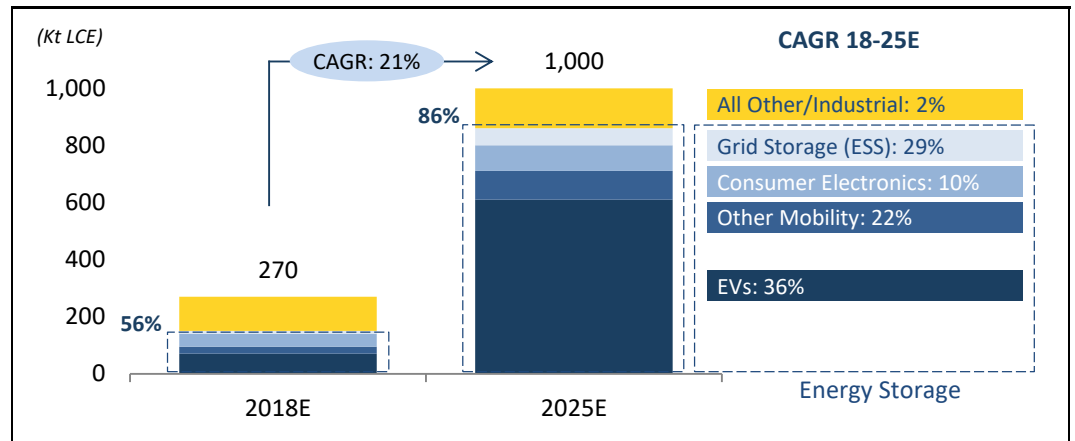
<sup>41</sup> See *Chile to clean up rules for lithium industry to boost production* by Dave Sherwood, Reuters, 12 June 2019.



**The use of lithium for energy storage devices is slated to increase to 86% by 2025**

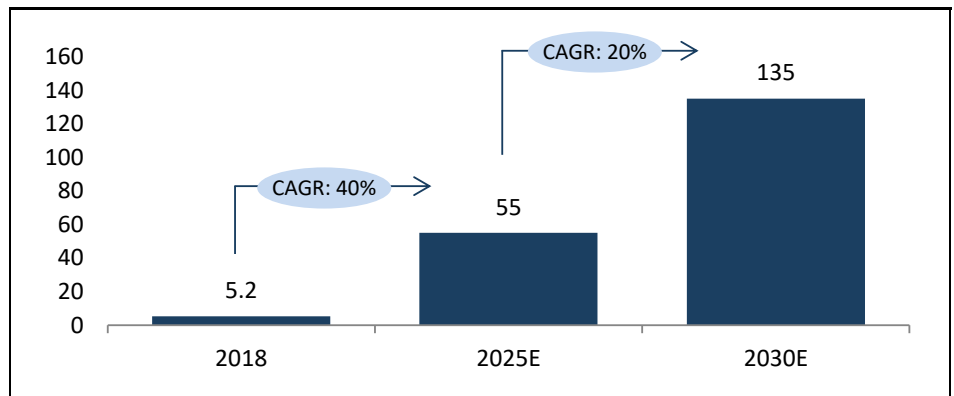
Their lighter weight (than nickel–cadmium and nickel metal-hydrate batteries), reliable cycle life, high energy and power density in terms of volume, high charge/discharge efficiency and low maintenance needs are the key features that have increased their adoption. It is estimated that the use of lithium in energy storage is expected to increase from 56% in 2018 to 86% in 2025 (Figure 1).

**Figure 1: Lithium demand by application**



Source: Roskill

**Figure 2: Global number of electric passenger cars (million)**



Source: IEA, OECD

## EVs will be the primary catalyst within energy storage applications

The lithium industry is experiencing rapid demand growth from EVs. Environmental concerns, volatile oil prices, governments’ incentive programmes and automakers’ efforts to reduce their carbon footprint are propelling the growth of EVs. The International Energy Agency (IEA) estimates the global stock of electric passenger cars to reach 55 million by 2025 and 135 million by 2030, growing 31% annually on average between 2018 and 2030 (Figure 2). The rapid growth and faster adoption of EVs bode well for lithium producers.

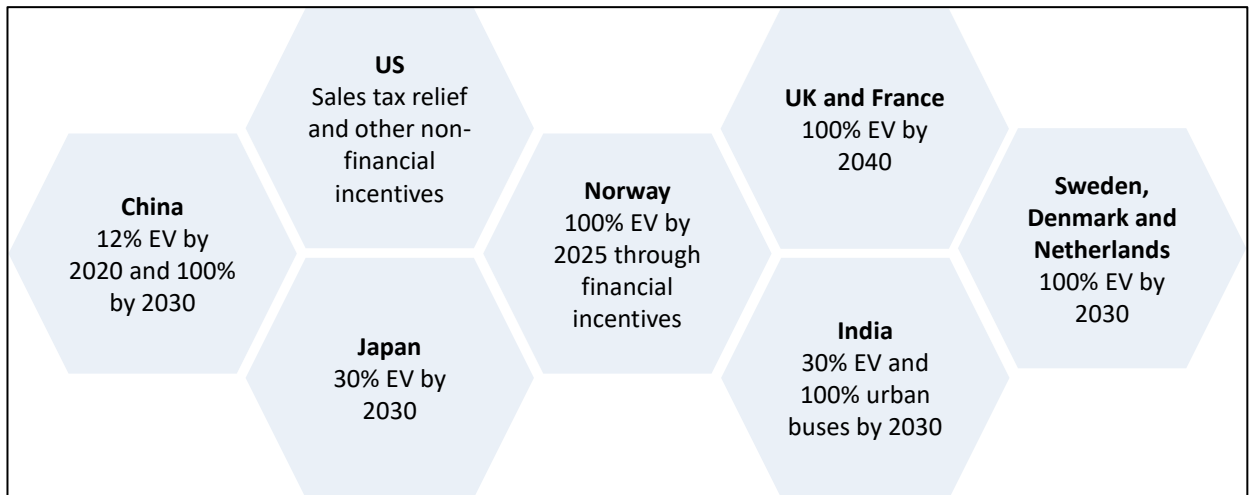
The automotive industry, including global road transport, contributes ~17% of the global greenhouse gases. Consequently, many countries have pledged to

**Robust growth in EVs will be the primary demand driver for lithium**



move away from the production of internal combustion engines (Figure 3). In order to encourage the use of cleaner mobility (such as EVs/HEVs), various governments are introducing favourable regulations such as tax rebates, access to priority lanes, free parking and free electricity. This will support the rapid expansion of the number of EVs.

Figure 3: Government targets for EVs sales



Source: Pitt Street Research

### Asia Pacific to post the fastest gains in demand

In 2018, the Asia Pacific region was the largest customer of lithium globally. China, Japan and Korea collectively catered to over 97% of the total global demand for EV batteries. The majority of the demand came from China due to its massive output of goods manufactured with lithium, including batteries. China is expected to post the strongest lithium demand in future due to the rising demand for Li-ion batteries, supported by a nearly threefold expansion in the country’s rechargeable battery segment. Other major suppliers of Li-ion batteries in the Asia Pacific region, including South Korea and Japan, are also expected to witness strong growth in lithium demand.

### Demand for lithium to outstrip supply in long term

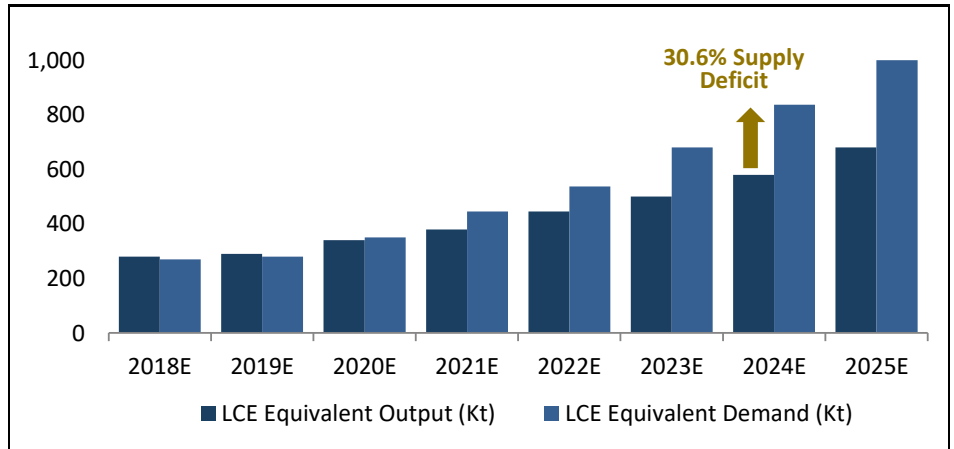
Lithium demand is expected to grow at a staggering rate of 21% between 2018 and 2025, driven by growing demand for Li-ion batteries and their application in EVs, high-drain portable electronics and other energy storage systems. In response to strong lithium demand, production has expanded and new mines in Australia have opened, which has resulted in a marginal oversupply. However, the supply is not expected to match the rapid growth in demand. Roskill estimates that there will be a supply deficit of 30.6% by 2024 (Figure 4), which is expected to grow further on the back of increasing demand. A widening demand–supply gap will turn out to be beneficial for lithium producers, such as LPI, in the medium–long term.

*Supply deficit is anticipated to increase steeply post 2020 due to the expected rapid increase in annual lithium consumption*



# Lithium Power International

Figure 4: Outlook for lithium demand and supply

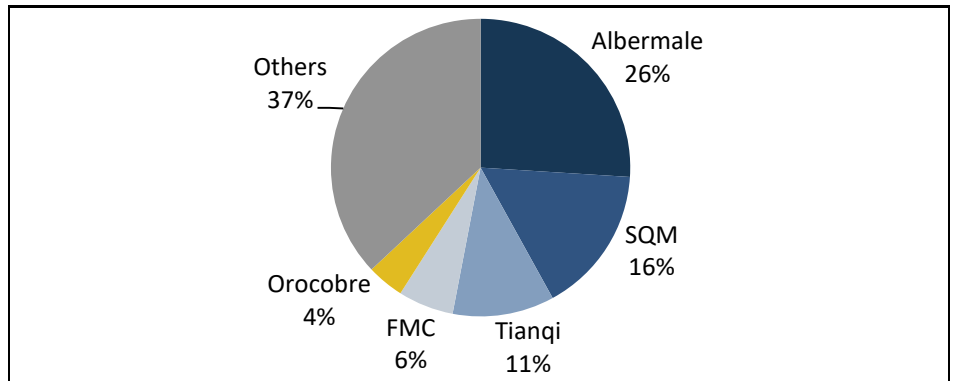


Source: Roskill Lithium report (2018), Pitt Street Research

### Lithium supply is oligopolistic in structure

The global lithium market is an oligopoly, with the top five players dominating the market with ~60% share in terms of production capacity (Figure 5), a scenario which is not likely to change any time soon. Most market leaders are forward-integrated players with a broad product portfolio of lithium products used in the manufacturing of batteries and other applications. The concentration of suppliers will enable control of supply, thereby providing bargaining power to influence global lithium prices.

Figure 5: Market share of mine production (2018E)



Source: Bloomberg NEF

### Chile expected to double its production by 2023

Chile, once the world’s top lithium producer, has seen its market share shrink (Figure 6) as miners in the South American nation face increasing regulatory hurdles and scrutiny from environmental and indigenous activists. Despite having over 50% of the world’s reserves (Figure 7), the country has not permitted operations on any new lithium mine since the boom began in 2014. However, Chile’s government has now stepped up and plans to clarify rules around its lithium industry to maintain its global share of output amid spiralling demand. The government plans to push both state and private investment to double the country’s production to 230,000 tonnes of lithium carbonate equivalent per year by 2023. This should assist Chilean mine operators to attract funds to further explore and produce lithium to cater to the sharp increase in global demand.





Figure 6: Lithium production by country

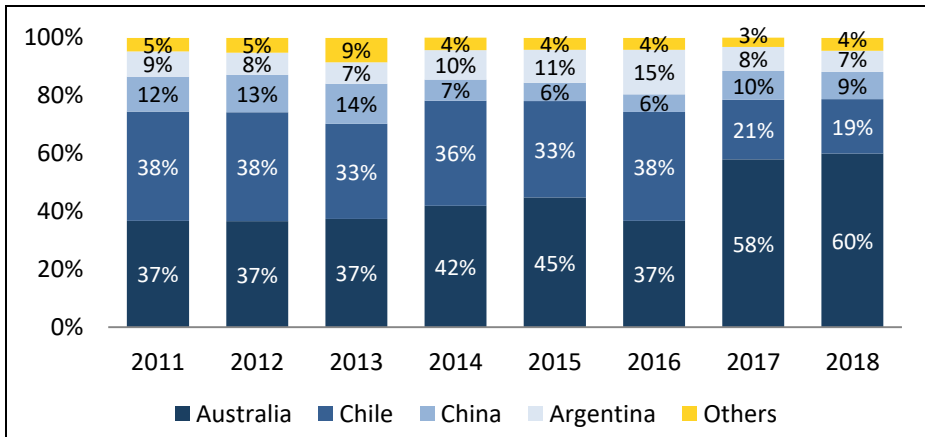
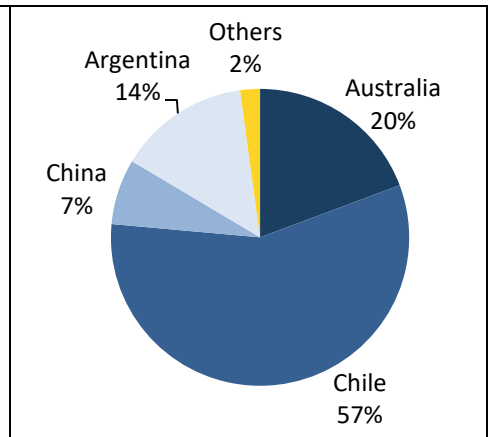


Figure 7: Lithium reserves (2018)



Source: US Geological Survey

### Medium and long-term outlook for lithium prices remains strong

The lithium boom began in 2014, with prices rising from less than US\$6k/t to over US\$16k by 2018. With demand soaring, billions were invested in new mines, with salt brine deposits in Chile and China receiving the most attention. However, the trend changed in Q1 2018. The aggressive supply anticipated from the expansion of brine operations in China, prediction of lithium oversupply by major investment banks and commissioning of lithium mineral operations in Australia pulled down lithium prices.

**Concerns of oversupply raised in 2018 appear to be unfounded**

However, the threatening supply that was anticipated from the expansion of brine operations in China did not turn out to be a risk. The 10 producers in the Qinghai region of China that were set to turn the tide could only add 5,000–10,000t of material to the market, crippled as they were by technical challenges relating to high magnesium concentration in the region. Moreover, ‘a tsunami of oversupply’ of lithium predicted by major banks in early 2018 turned out to be unfounded. The estimates failed to take into account the long conversion time, evidenced by the delays experienced in the Chilean projects of SQM and Albemarle – Albemarle spent a majority part of 2018 laying the foundation to expand to full capacity of its La Negra II project, and SQM ran into technical hurdles at its new conversion facilities towards the end of 2018.

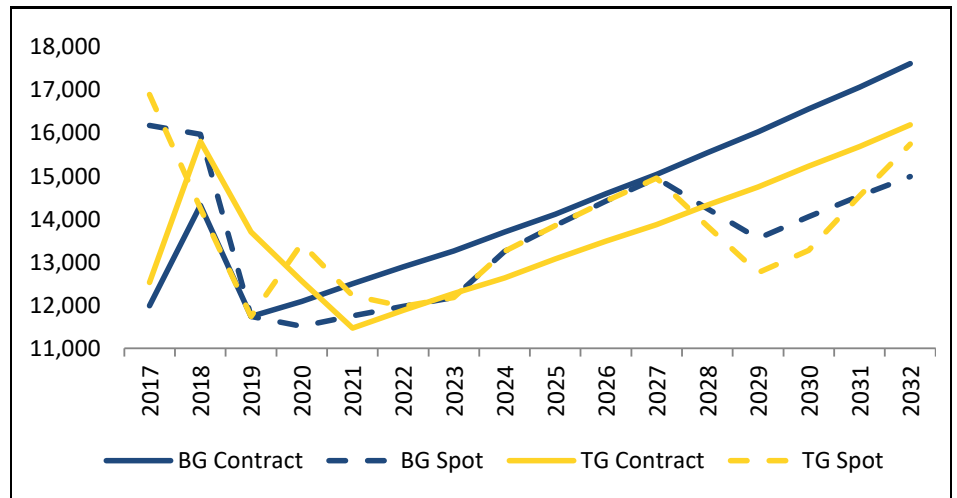
**Supply deficit due to the rapid increase in demand for lithium will likely support prices in the long term**

The dynamic of the industry is now changing, and producers are returning to being ‘demand responsive’ as compared with the current ‘demand anticipation’ state of play. Australian upstream lithium players have also pulled back on concentrate shipments and/or production schedules. Aspiring developers’ access to capital could also be impacted as suppressed prices will drive down feasibility study economics. The current trend is expected to support lithium prices in the medium–long term, especially post 2020, when the annual consumption of lithium is expected to rise rapidly, and demand growth will again stretch capacity. Roskill forecasts average annual prices of lithium carbonate to remain above US\$10,000/t in the long term on both nominal and real (inflation adjusted) basis, and rise to US\$20,000–22,000/t (US\$16,000–18,000/t adjusting for inflation) by 2032 (Figure 8).



# Lithium Power International

Figure 8: Average annual real (inflation-adj.) price forecast for LCE (US\$/t CIF)



Note: BG: Battery-grade; TG: Technical-grade

Source: Roskill

## Valuing Lithium Power International

We value LPI at A\$0.72 per share base case, and A\$0.85 per share optimistic case using a DCF-based approach. Our valuation approach is as follows:

- We assumed that LPI retains 51% of MSB.
- Our DCF of MSB is broadly based on the assumptions outlined in the January 2019 DFS and its Preliminary Assessment Report of December 2017.
- We have assumed commencement of operations at the mine in 2020, with commercial production beginning three years hence.
- A 22-year mine life excluding a three-year construction period has been used.
- We have assumed a WACC of 7.8% which factors in the country risk as well as operational risk and a 70/30 debt for equity split for the project (9.7% cost of equity, 5.1% after tax cost of debt).
- The government of Chile will collect a 1.3% royalty on sales per year in the first 12 years of operations, and 9.6% of sales thereafter.
- We have assumed 0.6% of the sales as contribution to local and indigenous communities.
- Other assumptions included a 27% corporate tax rate and a long run USD/AUD exchange rate of 1.43.

**WACC.** We estimated our WACC as follows:

- **Risk-Free rate**, 3.27% (Average Australian ten-year bond rate 2010-2019).
- **Market risk premium**, 8% (suitable in our view for projects where a DFS has been prepared but where there is no project financing announced).
- **Country risk premium**, 4.5% (suitable for jurisdictions generally considered 'safe'<sup>42</sup>).

<sup>42</sup> We use country risk premia from 4% to 10.5% depending on perceived risk. On our methodology Australia, Canada, Ireland, New Zealand and the United States have a moderate country risk premium of 4% while Chile, Finland, Norway and Sweden have a 4.5% premium.



- **Beta, 1.3** (appropriate for mining and metal companies<sup>43</sup>).

**Project capital expenditure  
estimated to be ~A\$805m  
(US\$563m)**

**Capital costs and project funding.** We have broadly used the estimates outlined in Maricunga’s DFS which details the breakdown of the capital cost during the construction phase of the project (initial three years). It estimates a total capital expenditure of ~A\$805m, with ~62% needed in the second year. The project also assumes an annual sustaining capital expenditure of ~A\$3m over the operational life of the project. We have currently assumed 70/30 debt/equity financing for the project, with 51% of the total capital expenditure to be funded by LPI. Purely for valuation purposes we assume LPI raises \$A86m at 28.5 cents, which is around the average close since the publication of the January 2019 DFS.

**Lithium and potash pricing.** In our base case, we have used an average battery-grade lithium price of ~US\$20,300/t and technical-grade lithium price of US\$16,800/t, whereas in the optimistic case it is US\$22,900/t and US\$21,400/t, respectively. For potash we have assumed average pricing of US\$213/tonne base case and US\$220/tonne optimistic case. We have assumed no price increment for lithium and potash after 2033 and 2029, respectively in the base case, in line with projections provided by leading market research firms such as Roskill. However, in our optimistic case, we have assumed an average annual price growth of 3% and 0.5%, for lithium (2023-2047) and potash (2029-2047), respectively.

**Initial operating costs.** We have assumed mining costs of US\$3,772/t for lithium and US\$145/t for potash and have assumed it will remain constant over the life of the project.

Our valuations have been summarised below (Figure 9) with our base case and optimistic scenario, yielding a value per share of A\$0.72 and A\$0.83, respectively.

**Figure 9: NAV based valuation for LPI**

<b>LPI Valuation (AUD million)</b>	<b>Base</b>	<b>Bull</b>
Net Asset Value of MSB	554.7	635.7
Net cash (debt) (m)	15.3	15.3
NPV of corporate overhead	-30.1	-30.1
<b>Equity value (m)</b>	<b>539.9</b>	<b>621.0</b>
Share outstanding (Diluted)	747.6	747.6
Implied price (AUD cents)	72.2	83.1
Current price (AUD cents)	26.0	26.0
Upside (%)	178%	219%

Source: Pitt Street Research

<sup>43</sup> Source: NYU Stern School datasets.



# Lithium Power International

**Sensitivity.** On our analysis each US\$2,000 per tonne in the lithium price changes the DCF of LPI by around A\$106m (see Figure 10).

Figure 10: Sensitivity analysis for LPI

Lithium Price/t	NAV (A\$m)	NAV/share (A\$)
10,000	(20.5)	(0.85)
12,000	85.2	3.55
14,000	190.8	7.95
16,000	296.5	12.35
18,000	402.1	16.75
20,000	507.8	21.16
22,000	613.4	25.56
24,000	719.1	29.96

Source: Pitt Street Research

## Re-rating LPI

LPI's stock is currently trading below our base case valuation. The primary factors that will help re-rate the stock into our valuation range are as follows:

- Sustained increases in lithium prices driven by the widening demand-supply gap for this metal will result in significant upside potential for LPI.
- Significant capital is required to fund the development activities of the Maricunga project and if LPI or its partner is able to complete the project financing, it will be a major positive milestone.
- Encouraging results from further feasibility studies of the Maricunga Lithium project.
- Binding offtake agreements signed in future will provide much needed capital and revenue visibility. MSB had preliminary discussions with a Chinese company, Fulin Group, in 2017, where under a non-binding Memorandum of Understanding (MoU), Fulin had the option to purchase 20–50% of MSB. The MoU also included a funding component where Fulin would finance the development costs.
- Exploration results in the Pilbara Land Greenbushes projects although we have not factored these in our current valuation.

## Risks

We see four main risks related to LPI's investment thesis.

- 1) **Funding risk:** LPI is expected to fund its pro-rata share of development costs for MSB. As a pre-cash flow company, it may have to rely heavily on equity financing, which could lead to dilution for shareholders.
- 2) **Geological risk:** The reserves and resources figures for the Maricunga mine are estimates, and it is possible that their characteristics may differ. There could be a downside risk if a portion of reserves is re-categorised as resources at a later stage.
- 3) **Commodity risk:** LPI is exposed to commodity price risk, which will depend on macroeconomic factors, and demand and supply dynamics of lithium. Significant volatility in lithium prices will impact the predictability of cash flows for the project as well as LPI.



- 4) **Sovereign risk.** There is the risk that the current unrest in Chile escalates further and leads to a swing to the left in the 2021 general elections.

### Comparable companies in the lithium space

The Maricunga Salar project is second in deposit grade to one of the world's largest lithium mines, Salar de Atacama. However, it is relatively small in size, accounting for ~5% of the size of the Atacama mine which has an LCE reserve of 40 million tonnes. Consequently, for relative analysis, we have considered publicly-listed lithium producers with mines in Latin America with LCE reserves below 10 million tonne (Figure 11).

Figure 11: Key lithium mines comparable to the Maricunga mine

Company	Market Cap (US\$m)	Key Project Details				
		Project Name	Country	LCE (MT)	Li Grade (mg/l)	% Owned
Orocobre	576.8	Salar de Olaroz	Argentina	6.40	690	67%
Millennial Lithium	87.3	Pastos Grandes	Argentina	4.12	445	100%
Neo Lithium	71.4	Tres Quebrados	Argentina	4.01	400	100%
Advantage Lithium	17.2	Cauchari	Argentina	4.80	380	75%
Pure Energy	5.8	Clayton Valley	US	0.22	123	100%
<b>Lithium Power</b>	<b>51.9</b>	<b>Salar de Maricunga</b>	<b>Chile</b>	<b>2.07</b>	<b>1,167</b>	<b>51%</b>

Note: LCE MT includes measured and indicated reserves

Source: Pitt Street Research

**Orocobre (ASX:ORE).** Orocobre is a global lithium carbonate supplier, and a boron mineral and chemical producer. In 2018, the company announced the stage two expansion of its flagship Olaroz lithium facility in Argentina. The expansion will add 25,000 tpa of lithium carbonate production capacity, taking full production and capacity to 42,500 tpa of lithium carbonate. Additionally, Orocobre and Toyota Tsusho Corporation have commenced construction of a 10,000 tpa lithium hydroxide plant in Naraha, Japan.

**Millennial Lithium (TSXV:ML).** Millennial is a Canada-based lithium exploration and development company. It owns 100% interest in Pastos Grandes, the company's flagship project in Argentina, and Cauchari East. In July 2019, the company announced feasibility study results for its Pastos Grandes project.

**Neo Lithium (TSXV:NLC).** Neo Lithium engages in the exploration and development of lithium brine resource properties in Argentina. Its flagship project, Tres Quebradas, is 100% owned, making it one of the few players that independently own an entire lithium mine of this size. In March 2019, the company announced results from its pre-feasibility study.

**Advantage Lithium (TSXV:AAL).** It manages a portfolio of high-quality assets in Argentina, including its flagship asset, the Cauchari JV (25% held by Orocobre). The company also owns 100% interest in three additional lithium exploration properties in Argentina - Antofalla, Incahuasi and Guayatayoc. Its Cauchari JV, which has a production rate of 20,000 tpa of LCE, is expected to complete its pre-feasibility study by September 2019.

**Pure Energy Minerals (TSXV:PE).** Pure Energy engages in the acquisition, exploration and development of mineral properties, mainly lithium. The company's primary project is the Clayton Valley lithium brine project located in Clayton Valley, Nevada. It also holds interest in the Terra Cotta Project in Argentina.



Although Salar de Maricunga is relatively small in size in terms of Measured and Indicated LCE reserve, it tops the peer list with its highest-grade lithium deposits. The mine also has a relatively good location within South America, with access to infrastructure such as power grid and roadways on an undeveloped site. Through its JV, MSB, it outrightly owns the concessions to the mines, releasing it from any production quotas or royalties that are applicable to leased mines. Thus, the favourable mineralogy, proximity to infrastructure and strategic nature of concessions make the Maricunga Salar project one of the highest-quality brine projects in development.

## Experienced and seasoned management and board

The current management and board members of LPI have considerable breadth of experience, with expertise across mining, finance and geology, as well as a track record of enhancing shareholder value (Figure 12).

Figure 12: LPI's management and board members

Name and Designation	Profile
David R Hannon <b>Founder and Non-Executive Chairman</b>	<ul style="list-style-type: none"> <li>• He is the founding shareholder of LPI and has over 30 years of experience in the finance industry with focus on property, mining and international investing.</li> <li>• David was the Founding Director and former Chairman of Atlas Iron Ltd, which grew to over A\$3bn in market capitalisation.</li> <li>• He has operated a private investment group, Chifley Investor Group Pty Ltd, for over 15 years.</li> </ul>
Cristobal Garcia-Huidobro R <b>CEO, Managing Director, Board Member of LPI; CEO, MSB</b>	<ul style="list-style-type: none"> <li>• Cristobal is a civil engineer with over 18 years of experience in developing and financing mining, energy, infrastructure and property projects.</li> <li>• He led MSB's exploration and development programme for the Maricunga Salar project.</li> <li>• He previously served as the CIO of CENTINELA, an investment company, and as a Board and Committee Member on a number of mining, property and agricultural funds in North and South America.</li> </ul>
Richard A Crookes <b>Executive Director – Corporate Finance and Board Member</b>	<ul style="list-style-type: none"> <li>• Richard is a geologist with more than 30 years of experience in the mining and finance sectors.</li> <li>• He is also an investment professional deeply involved in all aspects of mining projects, including exploration, mineral resource development, environmental management, project finance and project management.</li> <li>• He currently serves as the Chairman of Highfield Resources Ltd and Black Rock Mining Ltd.</li> <li>• He previously worked as Investment Director at EMR Capital; Executive Director in the Metals Energy Capital division at Macquarie Group; and Chief Geologist and Mining Manager of Ernest Henry Cu-Au Mine in Australia (now Glencore).</li> </ul>
Andrew G Phillips	<ul style="list-style-type: none"> <li>• Andrew has over 25 years of international experience in commercial, financial and corporate governance.</li> </ul>





# Lithium Power International

<p><b>Executive Director, CFO, Company Secretary and Board Member</b></p>	<ul style="list-style-type: none"> <li>• He previously held senior management and board positions in several public and multinational companies, including Aristocrat, Allianz, Hoya Lens and Sequoia Financial Group.</li> <li>• He has additional board experience in the small cap resources sector.</li> </ul>
<p>Russell C Barwick <b>Non-Executive Director</b></p>	<ul style="list-style-type: none"> <li>• Russell is a mining executive and engineer with over 43 years of technical, managerial and corporate experience in various commodities.</li> <li>• He previously served as CEO of Newcrest Mining, and COO of Wheaton River Minerals and Goldcorp Inc.</li> <li>• He also worked for Bougainville Copper Ltd, Pancontinental Mining Ltd, CSR Ltd and Placer Nuigini Ltd.</li> </ul>
<p>Reccared (Ricky) P Fertig <b>Non-Executive Director</b></p>	<ul style="list-style-type: none"> <li>• Ricky is a senior executive with over 30 years of international commercial experience across the property, healthcare and mining services sectors.</li> <li>• He is currently the CEO of Adrenna Property Group Limited, a Johannesburg-based property fund.</li> <li>• He previously served as the Chairman of Quyn International Outsource, RMS Corporate Solutions and East Sydney Private Hospital, which he co-founded.</li> </ul>
<p>Martin Borda M <b>Non-Executive Director</b></p>	<ul style="list-style-type: none"> <li>• Martin is an economist with over 40 years of experience in a range of industries in Chile and internationally.</li> <li>• He was the major stakeholder in the early development stages of the Maricunga Lithium Brine project, which included the establishment of the JV, MSB, of which he owns 30.98% through a private investment entity.</li> <li>• He currently serves as the Executive Director and Founding Partner of Multiexport Foods, Chairman of Multiexport Pacific Farms, and Director of Cia Molinera San Cristobal and Alimentos Multiexport.</li> </ul>

Source: Company

## Major shareholders

The top six shareholders of LPI constitute around half the total outstanding shares. Chairman Dave Hannon holds 6.0% via Chifley Portfolios, and Non-Executive Directors Ricky Fertig and Martin Borda hold 5.4% (via Great Southern Holdings) and 6.1% (via Minera Salar Blanco SpA), respectively.



## Appendix I – Capital structure

Class	% of fully diluted		Note
Ordinary shares, ASX Code LPI (million)	262.5	85.4%	Exercise price 32.9 cents, average expiry date 26-May-2021
Unlisted options (million)	45.0	14.6%	
Fully diluted shares	307.5		
Current market cap:	A\$68.3 million (US\$45.6 million)		
Current share price	\$0.260		
Share price range (last twelve months)	\$0.44 - \$0.2		
Average turnover per day (last twelve months)	280,400		

## Appendix II - Lithium-ion batteries

One of the more important technological innovations of recent times, in terms of its potential to revolutionise the modern economy, is the low-cost rechargeable battery, generally in the form of the lithium-ion battery. Most of today's electric vehicles, whether hybrid or all-electric, use lithium-ion batteries, as do most portable consumer electronics such as mobile phones and laptop computers. The reason lithium-ion batteries are so commonplace today is that, pound for pound, these batteries are among the most energetic rechargeable batteries available.

**What is a battery?** A battery is an 'electrochemical' cell made up of a positively charged terminal called a cathode, a negatively charged terminal called an anode, and a chemical called an electrolyte between the anode and the cathode. The anode and the cathode together are the battery's electrodes. Batteries are 'electrochemical' because they create electricity via chemical reactions. Batteries supply power to devices via an external electric circuit between the anode and the cathode to which the device is also connected. Electrons naturally flow along this circuit from the anode to the cathode. Those electrons come from a chemical reaction that takes place between the anode and the electrolyte. Once the electrons have flowed through the external electric circuit back into the cathode, another chemical reaction takes place at this terminal. These chemical reactions gradually change the material in both the cathode and the anode, to the point the material is, in effect, used up and the battery is 'flat'. With traditional alkaline batteries, the electrode materials are irreversibly changed during discharge and the battery can't be re-used. By contrast, with rechargeable batteries the original composition of the electrodes can be restored with a reverse electric current, allowing the battery to be used again and again.

**What kind of batteries are there?** Batteries have been made from a variety of materials over the years. The traditional non-rechargeable alkaline battery, which dates from the late 1950s, has a zinc anode and a manganese dioxide cathode. Nickel Metal Hydride (NiMH) batteries, which first came on the market in the late 1980s and these days represents the rechargeable battery



most commonly sold for consumer use, features nickel hydroxide at the cathode and a hydrogen-absorbing alloy at the anode. Rechargeable Lithium-ion batteries use a lithium metal at the cathode, often lithium cobalt oxide (LiCoO<sub>2</sub>) or lithium manganese oxide (LiMnO<sub>2</sub>), and carbon at the anode, usually graphite.

**Why is everyone so excited about lithium-ion batteries these days?** The reason the early 1990s introduction of the lithium-ion battery is widely regarded as a breakthrough<sup>44</sup> is threefold:

- Higher 'energy density' – the amount of power lithium-ion batteries can hold for their mass and volume is higher than for previous battery approaches<sup>45</sup>, since lithium and carbon are both lightweight materials and, being highly reactive, can store a lot of energy in their atomic bonds.
- Lower 'self-discharge' – lithium-ion batteries will retain their charge for a longer time than other types of rechargeable batteries.
- No 'memory effect' – Lithium-ion batteries are unaffected by repeated partial discharge/charge cycles, whereas other types of batteries will 'remember' a lower capacity.

**The lithium-ion battery has been mainstreaming since around 2007.** The lithium-ion battery was first invented in 1980<sup>46</sup> and while it took some ten years before Sony commercialised the first one<sup>47</sup>, the battery quickly found a market in portable electronic devices. By 2004 the world market was around 1.4 billion cells<sup>48</sup>. By 2007 it was more like 3 billion cells, and, fuelled by the rapid rise of the smart phone in the wake of the first Apple iPhone that year, it was 7 billion cells by 2017<sup>49</sup>.

**Why are lithium-ion batteries now going into electric vehicles in a serious way?** Demand for lithium-ion batteries in portable electronic devices helped manufacturers to gradually lower their cost, allowing them to be used in an increasing way in electric vehicles. One 2018 estimate has suggested that the volume-weighted cost of a lithium-ion battery pack fell 85% between 2010 and 2018<sup>50</sup>. This decline has allowed electric vehicle makers to start introducing products with a long range at reasonable prices. Tesla first unveiled its Tesla Roadster, with a range of 250 miles on a single charge, in July 2006 and the first one was sold in 2008. This prompted other electric vehicles such as the hybrids Chevrolet Volt and Nissan Leaf in 2010.

**What is the future of lithium-ion batteries?** Coming around the corner is lithium-ion batteries with less cobalt and graphite, higher energy density, faster charging speeds, lower cost of production and longer battery life spans.

## Appendix III – How lithium is mined

There are two principal sources of lithium – brine lithium and hard rock lithium. Brine lithium is the lower cost of the two in terms of extraction, but

<sup>44</sup> In spite of an occasional tendency for such batteries to catch fire, leading to such events as Sony's 2006 recall (see *Sony apologizes for defective batteries* by Kanako Takahara, Japan Times, 25 October 2006) and the famous Galaxy Note 7 Smartphone problems of Samsung in 2016.

<sup>45</sup> [cei.washington.edu/education/science-of-solar/battery-technology/](http://cei.washington.edu/education/science-of-solar/battery-technology/)

<sup>46</sup> Professor Stan Whittingham ((1922- ), an Englishman working at Exxon, developed a battery based on a titanium disulphide cathode and a lithium-aluminium anode in the mid-1970s (See Science. 1976 Jun 11;192(4244):1126-7). Professor John Goodenough (1922- ), an American physicist working at Oxford, built on this approach to create, in 1980, a lithium-ion battery with lithium cobalt oxide at the cathode (See Mizushima et. al., Materials Research Bulletin, 15(6), 783-789). It was this approach that ultimately went into the battery that was first brought to market in 1991 by Sony.

<sup>47</sup> After a development effort at Sony Eveready headed by Keizaburo Tozawa. Sony announced the battery in February 1990. The first product to be powered by a lithium-ion battery was the Sony CCD-TR1 8 mm camcorder – see Chapter 13 of Sony's corporate history at [sony.net/SonyInfo/CorporateInfo/History/SonyHistory](http://sony.net/SonyInfo/CorporateInfo/History/SonyHistory).

<sup>48</sup> See the Sony press release dated 9 December 2004 and headed '*Announcement of new lithium ion batteries, realizing industry's highest level of energy density*'.

<sup>49</sup> See *U.S. bars lithium batteries as cargo on passenger aircraft* by David Shepardson, Reuters, 28 February 2019.

<sup>50</sup> See *A Behind the scenes take on lithium-ion battery prices* by Logan Goldie-Scot, Bloomberg NEF, 5 March 2019.



the rise of lithium as a commodity over time is also widely expected to make room for higher-cost hard rock lithium, in order to keep up with demand.

**Brine lithium** is simply lithium from underground reservoirs of salt water.

- Typically, lithium brine deposits are found in arid climates where there are closed basins in which salt lakes can form. In the Andes these salt lake basins are known by the Spanish word 'salar'. Most lithium in salars comes from nearby volcanic rock of high-silica composition, commonly associated with hot springs. Over geological time the lithium has leached into the surface brine and been trapped and concentrated by evaporation, after which the brine has been buried by sediment.
- The reason such salars can provide a low-cost source of lithium is that the brine needs only to be pumped to the surface into a series of evaporation ponds, after which Mother Nature does most of the rest of the work in the form of sunlight so the water evaporates quickly, resulting in the crystallisation of other salts and leaving behind lithium-rich liquor. After this, only modest downstream processing for removal of impurities is required for this liquor to be converted to either lithium carbonate or lithium chloride for further upgrading to lithium hydroxide.
- The so-called Lithium Triangle that encompasses northern Chile, northwestern Argentina and southern Bolivia<sup>51</sup> is an ideal environment for brine lithium because in much of the Triangle there is plenty of intense sunlight, low humidity and steady, hot winds.
- A key consideration for the economics of lithium brine is obviously the lithium grade, measured in milligrams per litre. However, it is also important for there not to be too much magnesium or sulphate, while porosity and permeability are also of critical importance so that the brine can flow easily to the surface.
- A key risk for brine lithium is weather – if there are unusual levels of rains in the producing areas it can interfere with the evaporation rates.

**Hard rock lithium** is lithium hosted in pegmatites, that is, coarse-grained igneous rocks, in association with cesium and tantalum.

- Pegmatites form when mineral-rich magma intrudes into fissures in continental plates. As this magma cools water and other minerals become concentrated, with the metal-enriched fluids catalysing the rapid growth of the large crystals that distinguish pegmatites from other rocks. The lithium in pegmatites is generally contained in three minerals – spodumene, petalite, and lepidolite. Typically, lithium-rich pegmatites occur in dykes or veins.
- Hard rock lithium deposits are more evenly geographically distributed around the world and are less dependent on changed climatic conditions for production. Notable hard rock mines include the Tanco mine of Cabot<sup>52</sup>, located on Bernic Lake in the Canadian province of Manitoba, and the Greenbushes mine of Albemarle and Tianqi Lithium.
- Lithium ore is generally mined using traditional drill and blast methods and then concentrated using gravity, heavy media, flotation and magnetic processes, into a range of lithium concentrates.

<sup>51</sup> The northern apex of this triangle lies just to the north of Lake Poopó, a large saline lake located in the Altiplano Mountains in Oruro Department, Bolivia. The southern apex lies near Cafayate in the south of Salta Province in Argentina. The western apex is Chile's Pacific coast just north of Antofagasta.

<sup>52</sup> Boston, Ma., NYSE: CBT, cabotcorp.com.



## Appendix IV - Analyst qualifications

Stuart Roberts, lead analyst on this report, has been an equities analyst since 2002.

- Stuart obtained a Master of Applied Finance and Investment from the Securities Institute of Australia in 2002. Previously, from the Securities Institute of Australia, he obtained a Certificate of Financial Markets (1994) and a Graduate Diploma in Finance and Investment (1999).
- Stuart joined Southern Cross Equities as an equities analyst in April 2001. From February 2002 to July 2013, his research specialty at Southern Cross Equities and its acquirer, Bell Potter Securities, was Healthcare and Biotechnology. During this time, he covered a variety of established healthcare companies such as CSL, Cochlear and Resmed, as well as numerous emerging companies. Stuart was a Healthcare and Biotechnology analyst at Baillieu Holst from October 2013 to January 2015.
- After 15 months in 2015 and 2016 doing Investor Relations for two ASX-listed cancer drug developers, Stuart founded NDF Research in May 2016 to provide issuer-sponsored equity research on ASX-listed Life Science companies.
- In July 2016, with Marc Kennis, Stuart co-founded Pitt Street Research Pty Ltd, which provides issuer-sponsored research on ASX-listed companies across the entire market, including Life Science companies.
- Since 2018 Stuart has led Pitt Street Research's Resources Sector franchise, spearheading research on both mining and energy companies.

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