

Has the demand for lithium in electric vehicles peaked?

Dr Jason Tang

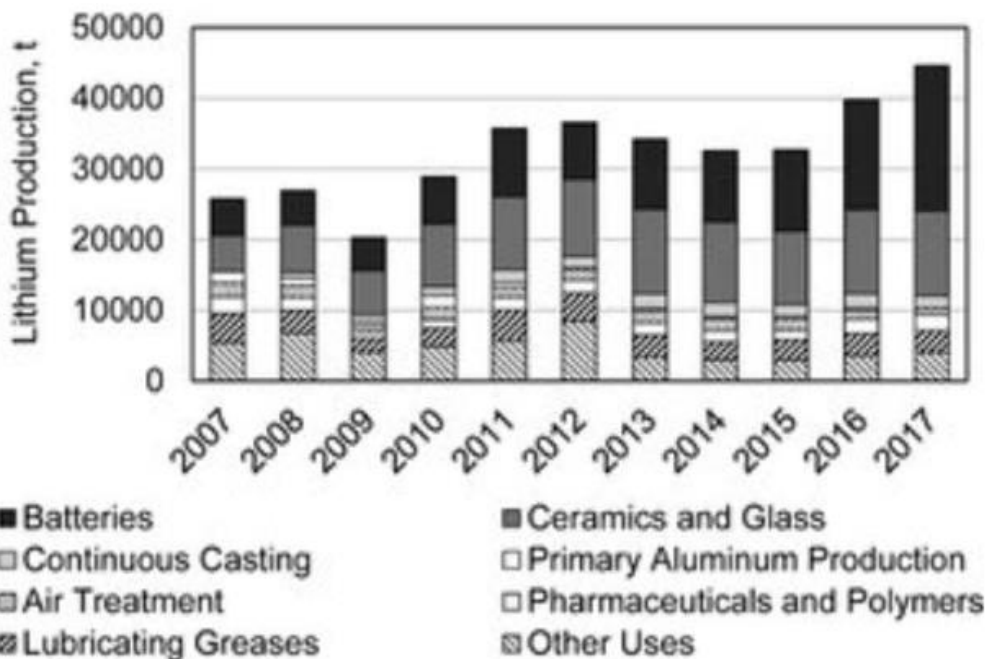
06 October 2023

Jason is a Research Analyst at Antares Equities. He is responsible for researching stocks in the Energy and Mining sectors. Jason has four years industry experience and previously worked as a research analyst at a global hedge fund focusing on the renewable energy sector. Jason holds a Ph.D. and a masters degree in Electrical Engineering and a Bachelor in Telecommunication Engineering.

Has the demand for lithium in electric vehicles reached its peak?

The year of 2017 marked a pivotal juncture in the trajectory of lithium demand. In 2017, Tesla launched the first generation of its Model 3, signalling the company's official entry into the affordable electric vehicle (EV) market. Concurrently, in the latter half of 2017, China sold 377,000 new EVs, a figure surpassing the combined sales of the rest of the world. Furthermore, the demand for lithium in battery applications in 2017 reached 30 thousand tonnes (kT) in lithium carbonate equivalent (LCE), which for the first time in history, constituted a remarkable 50% of the total lithium end market (Chart 1).

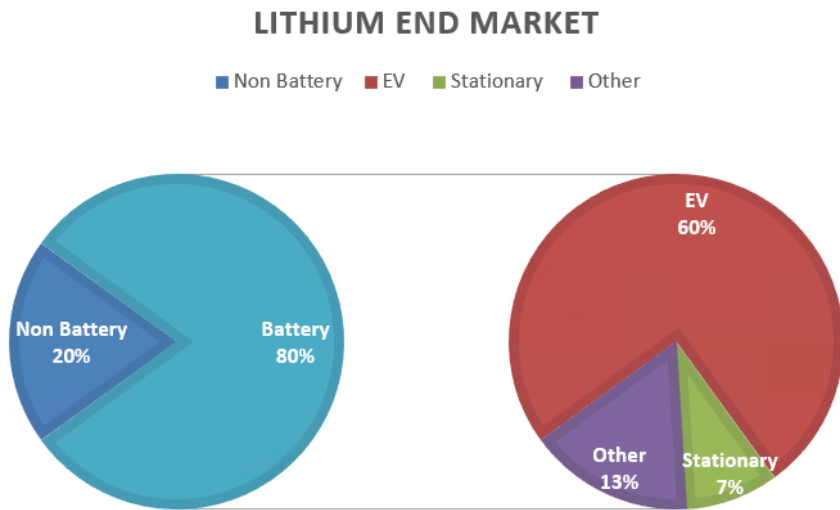
Chart 1: Global Lithium Demand and End Market 2007 – 2017



Source: Energy Storage Material, Elsevier; January 2017

Demand for lithium used in battery applications began to accelerate. Fast forward five years to the end of 2022 and 80% of lithium was used in batteries, with over 75% of this allocation earmarked specifically for EVs. I.e., EVs accounted for 60% of overall lithium usage (Chart 2).

Chart 2: Global Lithium Demand and End Market 2022



Source: Antares Research; Statista 2023

To gauge future global lithium demand, it is necessary to understand the demand for lithium within the EV industry. Antares has built a global EV database and analysed lithium usage within the EV sector. In this article, we present the key findings of our research and endeavour to address the central question highlighted in the title...Has demand for lithium in EVs peaked?

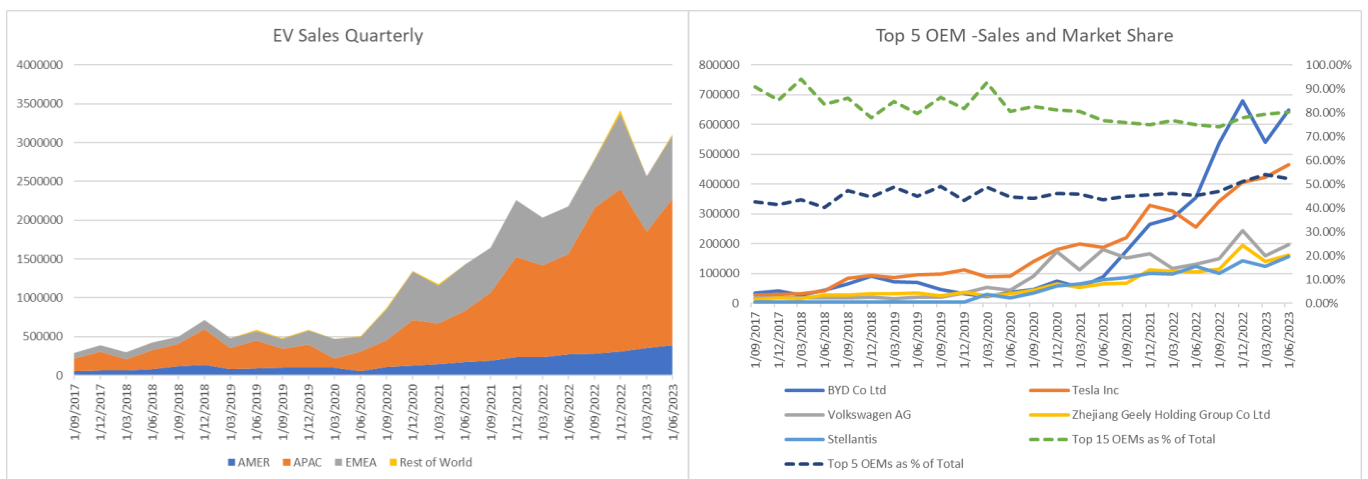
Growth in lithium demand for EVs

The EV market has been growing rapidly. More automakers are entering the market, but the top manufacturers are able to capture a larger share.

Between January 2017 and June 2023, the compound annual growth rate of the global EV market reached an astonishing 51%, with EV penetration in new car sales surging from less than 2% in 2017 to 18% in June 2023 (Chart 3, left). The rapidly expanding EV industry has attracted a greater number of players, including both traditional automakers and newcomers to the industry. Globally, 84 companies are now capable of producing and commercialising EVs, double the number of companies in 2017.

Counterintuitively, an increased number of participants did not lead to market fragmentation. In fact, the top 5 manufacturers of new vehicles (OEMs) have continued to gain market share in this highly competitive market. As of 1H2023, these top 5 OEMs account for 53% of the global market. (Chart 3, right)

Chart 3: Global EV Sales and Market Share of Top OEMs



Source: Bloomberg NEF; September 2023

Chinese OEMs and non-Chinese OEMs have historically pursued different approaches to battery technology and pack size. Nevertheless, in recent years, there has been a noticeable trend toward convergence.

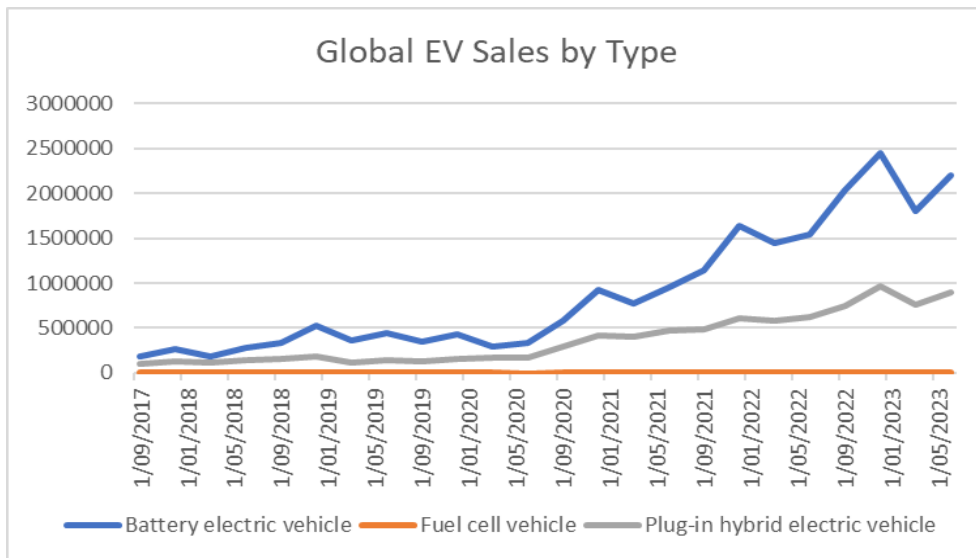
There is no doubt that Chinese OEMs are experiencing much faster growth than their Western peers. They are not only expanding within the domestic Chinese market but are also rapidly extending their footprint to Europe, Australia, the Middle East, and the United States. Post-COVID, BYD has overtaken Tesla to become the world's number one EV company in terms of sales volume.

EV battery preferences and growth

Our next step was to conduct a detailed analysis of individual EV models from the top 15 OEMs, which collectively represent 80% of the market. Our objective was to determine the battery pack size and identify their battery technology, primarily focusing on cathode materials. Here are our key findings:

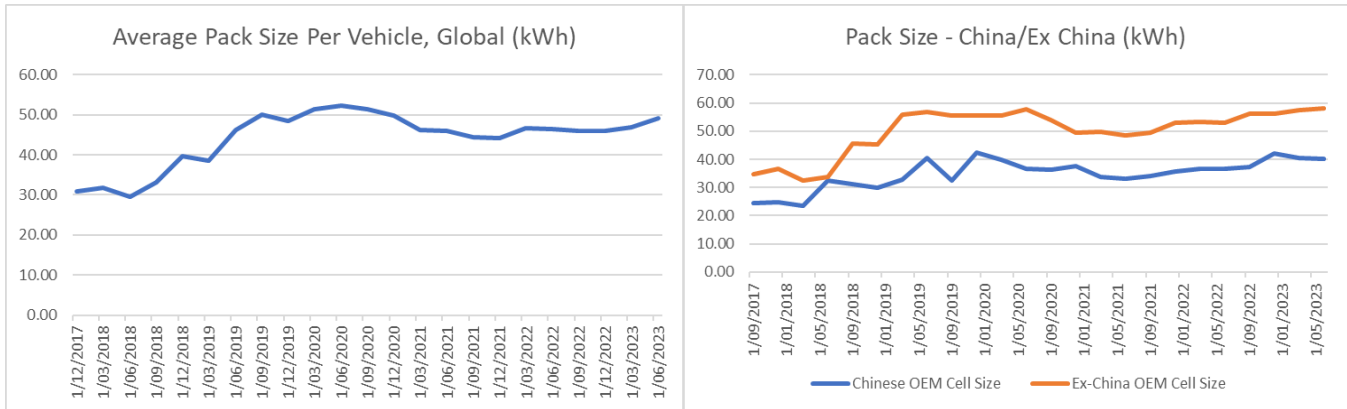
- Battery EVs are gaining market share over plug-in hybrid EVs, which is a net positive for lithium demand since Battery EVs typically require three times the amount of lithium compounds compared to plug-in EVs (Chart 4).
- On average, the size of the battery pack for Ex-China OEMs are 40% larger than the Chinese OEMs (Chart 5, right) and we attribute this to the following reasons.
 - Non-Chinese OEMs tend to concentrate on the premium end of the market, whereas Chinese OEMs target the entry-level EV market.
 - China is leading in the deployment of EV charging infrastructure compared to other markets. Consequently, domestic Chinese customers do not require a long mileage range to meet their travel needs
- The average size of battery pack across China and ex China OEMs reached a peak level in 2020 at 52 kWh per vehicle and moderated to the 46 kWh mark between 2021 – 2023 (Chart 5, left), which poses a challenge for lithium demand.
 - The decline in the global average pack size is not primarily due to individual OEMs adopting smaller battery packs but is mainly driven by Chinese OEMs gaining a larger market share.
- Cost-efficient cathode materials, such as lithium iron phosphate (LFP), are gaining popularity among global OEMs (Chart 6).

Chart 4: Global EV sales by type (Battery EV vs Plug-in Hybrid EV vs Hydrogen Fuel Cell EV)



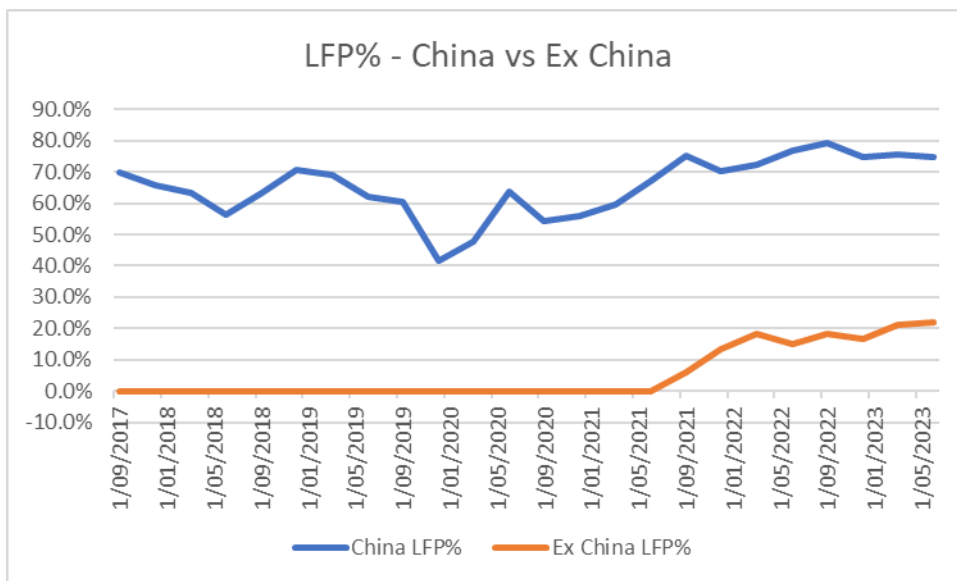
Source: Bloomberg NEF; September 2023

Chart 5: Average pack Size Per Vehicle, China vs Ex-China



Source: Antares Equities Research; September 2023

Chart 6: Percentage of LFP batteries, China vs Ex-China



Source: Antares Equities Research; September 2023

We believe that the incremental lithium demand in the EV industry may have already reached its peak level in 2022

Ramifications for lithium prices

Incremental lithium demand is the primary driver of the demand-supply balance in the lithium market and spot prices. Essentially, incremental lithium demand is what incentivises suppliers to adjust their production capacity, either increasing or decreasing it.

Fundamentally the three key aspects driving the lithium demand in the EV industry are:

- Technology advancements
- EV penetration; i.e., new EV sales
- Average battery pack size

On the **technology** front, the difference in lithium demand per kWh between LFP and Lithium-Nickel-Manganese-Cobalt-Oxide (NMC) is negligible. As a rule of thumb, 160g of lithium metal is required for every kWh of energy storage capacity, or 580g of lithium carbonate equivalent (LCE) per kWh. Solid State Batteries and Fuel Cell EVs are likely to represent the next generation of technological advancements in the automotive industry. However, both technologies are still in the early research stage and are not expected to be commercialised within the next five years. In theory, Solid State Batteries are likely to consume more lithium compounds on a per EV basis, while

Fuel Cell EVs are likely to have smaller battery pack sizes. Therefore, we believe that overall, technological evolution is likely to have a neutral impact on lithium demand.

In relation to **EV market penetration**, Table 1 illustrates new EV sales as a percentage of the overall vehicle market in major markets. We have witnessed a rapid increase in most major markets, including China, Australia, and the United States. In more mature European markets, we have observed that EV penetration has stabilised at elevated levels. Conversely, we've noticed a significant slowdown in the growth rate of EV sales post-COVID. In 2021, EV sales were growing at over 100%, but in 2022, this figure decreased to 70%. In the first half of 2023, the growth rate further moderated to 50% due to a higher baseline and challenging macroeconomic conditions. Additionally, traditional internal combustion vehicle (ICE) OEMs intensified their price competition in 2023 and reclaimed some market share. Based on the current trend, we anticipate the growth rate of new EV sales to remain in the range of 50% to 60% in 2023, with potential upside risks in 2024 and 2025.

Table 1: New EV Sales (units) as a % of overall vehicle market in major markets

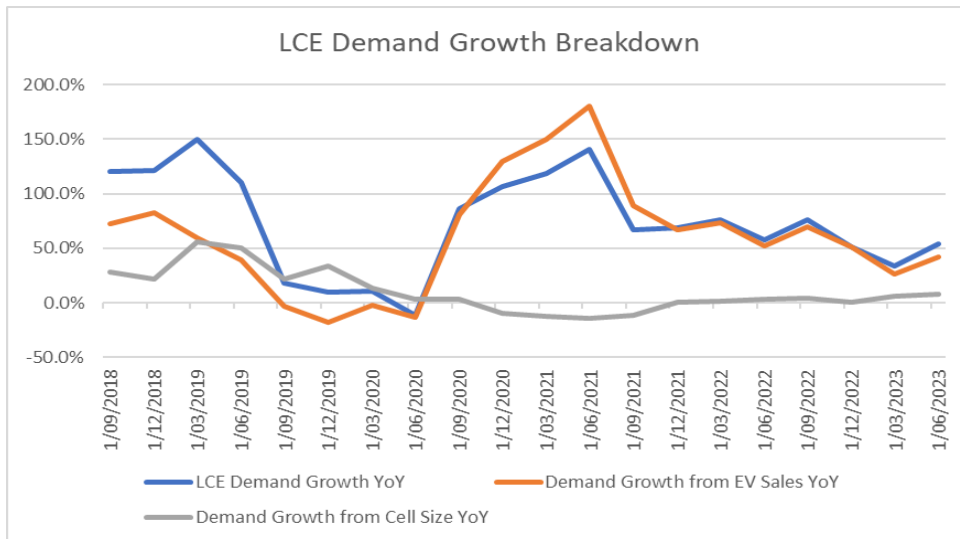
	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	Country or region	Cumulative sales	Annual sales 2022	Market share 2022	% of cars in use 2022
	87.80%	86.20%	74.70%	55.90%	49.10%	39.20%	29.10%	22.40%	13.80%	6.10%	China	14,100,000	5,924,421	30.00%	4.90%
	56.10%	54.70%	45.00%	22.60%	17.20%	11.70%	5.60%	3.60%	2.10%	1.30%	Europe	7,800,000	2,602,431	23.00%	2.40%
	56.10%	43.30%	32.20%	11.40%	8.20%	5.20%	3.50%	2.62%	1.53%	0.71%	United States	2,960,000	990,000	7.70%	1.30%
	38.60%	35.20%	16.40%	4.20%	2%	0.60%	0.60%	2.29%	0.88%	0.29%	Germany	1,877,721	832,652	31.40%	3.85%
	37.50%	30.80%	18.10%	6.90%	4.70%	2.57%	1.20%	—	—	—	California	1,385,383	343,244	18.70%	3.85% (2021)
	34.90%	29.80%	24.60%	14.90%	6.20%	2.20%	6.70%	9.90%	3.87%	5.55%	France	990,000	346,849	21.60%	2.70%
	31.40%	26.00%	13.50%	3.00%	1.90%	1.58%	1.10%	0.73%	0.43%	0.25%	United Kingdom	950,000	368,617	22.90%	2.80%
	30.00%	15.00%	5.40%	4.90%	4.20%	2.10%	1.31%	0.84%	0.23%	0.08%	Norway	817,471	153,144	87.80%	27.73%
	26.50%	18.40%	10.70%	3.20%	2.50%	2.70%	1.80%	—	—	—	Netherlands	515,838	106,854	34.90%	5.80%
	25.90%	22.50%	14.30%	5.50%	3.20%	2.55%	1.80%	1.98%	0.75%	0.44%	Sweden	440,000	161,649	56.10%	8.80%
	22.90%	18.60%	10.70%	2.90%	2.53%	1.86%	1.37%	1.07%	0.59%	0.16%	Japan	410,000	102,000	3.00%	0.60%
	22.20%	15.70%	7.40%	4.10%	1.57%	0.72%	0.48%	0.46%	0.27%	—	Canada	380,000	114,000	9.40%	1.60%
	22.00%	20.00%	9.50%	3.50%	2.60%	2.06%	1.60%	0.90%	—	—	Global total	25,900,000	10,200,000	14.00%	2.10%
	21.70%	20.00%	13.50%	5.70%	3.60%	1.90%	—	—	—	—					
	21.70%	15.50%	7.12%	4.18%	2.89%	2.11%	1.03%	0.50%	0.28%	0.34%					
	21.60%	18.30%	11.20%	2.80%	2.11%	1.98%	1.40%	1.19%	0.70%	0.83%					
	13.00%	3.60%	2.80%	2.80%	1.90%	1.20%	0.60%	0.20%	0.10%	—					
	9.60%	7.80%	4.80%	1.40%	0.90%	0.60%	0.32%	—	—	—					
	9.40%	6.60%	3.50%	3.00%	2.20%	0.92%	0.58%	0.35%	0.28%	0.18%					
	8.80%	9.30%	4.30%	0.60%	0.26%	0.10%	0.08%	0.09%	0.08%	0.07%					
	7.70%	4.00%	2.20%	1.90%	2.10%	1.10%	0.90%	0.66%	0.72%	0.60%					
	5.10%	2.40%	0.78%	0.60%	0.30%	0.19%	0.12%	0.15%	0.12%	0.03%					
	3.00%	1.00%	0.60%	0.90%	1.00%	1.10%	0.59%	0.68%	1.06%	0.91%					
Global	14.00%	8.60%	4.60%	2.50%	2.10%	1.30%	0.86%	0.70%	0.40%	0.30%					
California	18.70%	12.80%	8.10%	7.60%	7.60%	4.90%	3.60%	3.10%	3.20%	2.50%					
Europe	23.00%	19.00%	11.40%	3.60%	2.50%	1.74%	1.30%	1.41%	0.66%	0.49%					
Hong Kong		23.00%	14.00%	5.00%			5.00%	4.84%		0.39%					

Source: Bloomberg NEF, Wikipedia; September 2023

As for the average **size of the battery pack**, we believe the strategy of EV OEMs blindly increasing the size of battery packs has gradually become a thing of the past. Data suggests that EV OEMs are now more cautious about battery size after 2020. As indicated in Chart 5, the average size of battery packs reached its peak level in 2020. Statistically, EVs using LFP batteries typically have smaller pack sizes compared to EVs using NMC cathode material. With an increasing number of OEMs adopting LFP for their entry-level EVs, we believe this also presents a potential headwind for lithium demand.

Chart 7 shows the contribution to (LCE demand from sales of EVs and from the size of battery pack.

Chart 7: LCE Demand Growth Breakdown

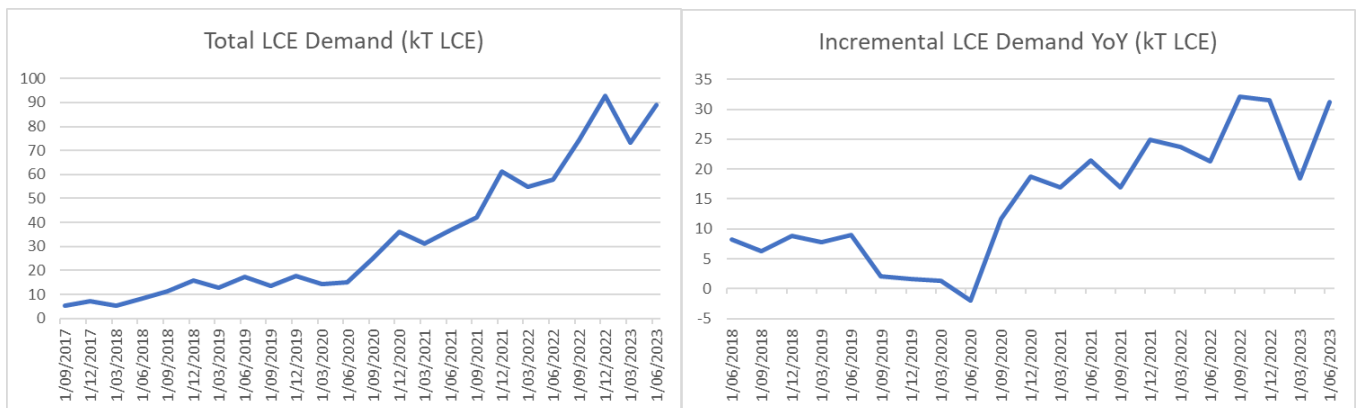


Source: Antares Equities Research; September 2023

We present our analysis of total LCE Demand between 2017 and 2023 and the incremental LCE demand on a rolling 12-month basis during the same period (Chart 8). We believe the growth in the EV market is likely to continue driving the growth in total LCE demand. However, we anticipate it's unlikely that the EV market can replicate the rapid growth rates of the past.

We expect the total LCE demand from the EV sector in the second half of 2023 to be slightly above the 200 kT, representing YoY incremental LCE demand growth of 25 kT for the 3rd and 4th quarters compared to the 2022 peak of 32 kT. Consequently, we believe that incremental lithium demand in the EV sector reached its peak level in 2022 and 2023. This suggests pressure on the lithium price has also peaked as EV related lithium has been a key driver for global lithium demand.

Chart 8: Total LCE Demand and Incremental LCE Demand in Electric Vehicles



Source: Antares Equities Research; September 2023

On the broader lithium market, we anticipate the share of lithium demand from EVs will moderate. This is mainly driven by the potential legislative tailwind in the European stationary battery space. Under a more favourable macro environment for stationary batteries, we expect the market share to increase from 7% to 10%, taking a 2% share from EVs and 1% share from other usage.

Where to for lithium?

With stationary batteries taking share from EV batteries for overall lithium demand, it's possible that incremental lithium demand will increase albeit not at the exponential rate of the past few years. What this means for lithium prices requires further analysis but our expectation is that there will be greater stability. This means there will be a greater need to be selective rather than buying anything with a whiff of lithium exposure. For Antares portfolios, we will continue to adhere to our fundamental research-based stock selection. Our current analysis favours lower cost producers, those which are more efficient in pipeline development and those whose strategy is most likely to capitalise on broader market trends. We have avoided (or shorted where possible) stocks that have higher costs and / or are more technically risky.

Glossary

Electric Vehicle (**EV**) – Four main types:

- Battery EV (**BEV**) – Purely battery powered, no fuel component.
- Plug-in Hybrid EV (**PHEV**) – The battery pack can be recharged by plugging a charging cable into an external electric power source or internally recharged by its on-board internal combustion engine-powered generator.
- Hybrid EV (**HEV**) – The battery pack can only be recharged by its internal combustion engine-powered generator. In some jurisdictions (and in this article), HEVs are not considered new energy vehicles.
- Fuel Cell EV (**FCEV**) – Next generation hydrogen EV. Battery pack can be charged by its hydrogen powered generator.

Fuel Cell (**FC**) - A fuel cell is an electrochemical cell that converts the chemical energy of a fuel (often hydrogen) and an oxidizing agent (often oxygen) into electricity.

Kilowatt Hour (**kWh**) – Unit of energy, equivalent to the energy consumption of a one kilowatt device running for one hour.

Lithium Carbonate Equivalent (**LCE**) – Industrial standard terminology to standardise the lithium compound usage.

Lithium Iron Phosphate (**LFP**) – A type of cathode material used in battery. LFP battery has the advantage of low cost, excellent cycle life, better safety performance.

Lithium-Nickel-Manganese-Cobalt-Oxide (**NMC**) – A type of cathode material used in battery. NMC battery has the advantage of higher energy density and thus better peak performance. NMC also performed better in extreme weather conditions.

Original Equipment Manufacturer (**OEM**) - a company that makes a product to be sold by another company under its own name. In the car industry, OEM generally means car manufacturer.

Solid-State Battery (**SSB**) – Next-generation battery technology that uses solid electrodes and a solid electrolyte instead of the liquid or polymer gel electrolytes. Research indicates that SSB has higher energy density than most current battery technology.

Important information and disclaimer

This communication has been prepared by Antares Capital Partners Ltd ABN 85 066 081 114 AFSL 234483 (ACP). ACP is the investment manager appointed to the Antares Equities suite of funds (Funds) by MLC Investments Limited ABN 30 002 641 661 AFSL 230705 (MLCI), the issuer of the Funds. ACP and MLCI are part of the Insignia Financial Group of companies, comprising Insignia Financial Ltd ABN 49 100 103 722 and its related bodies corporate (Insignia Financial Group).

The information provided is of a general nature only and does not take into account any particular investor's personal circumstances. Accordingly, reliance should not be placed by anyone on the information in this communication as the basis for making any investment decision. Before acting on the information, you should consider the appropriateness of it having regard to your personal objectives, financial situation and needs. You should also consider the relevant Product Disclosure Statement (PDS) and Target Market Determination (TMD) before deciding to acquire or hold an interest in a Fund. The PDS and TMD for the Funds are available from www.antarescapital.com.au.

Past performance is not a reliable indicator of future performance. The value of an investment may rise or fall with the changes in the market. Actual returns may vary from any target return described and there is a risk that the investment may achieve lower than expected returns. No company in the Insignia Financial Group guarantees the repayment of capital, the performance of, or any rate of return of an investment. Any investment is subject to investment risk, including possible delays in repayment and loss of income and principal invested.

Any opinions expressed constitute our judgement at the time this communication is issued and are subject to change. We believe that the information contained in this communication is correct and that any estimates, opinions, conclusions or recommendations are reasonably held or made at the time of compilation. However, to the extent permitted by law, no representation or warranty is made in relation to the accuracy, timeliness, reliability, adequacy, fitness for purpose or completeness of the information. Any projection or forward-looking statement (Projection) in this communication is provided for information purposes only. No representation or warranty is made as to the accuracy or reasonableness of any such Projection or that it will be met. Actual events may vary materially.

This communication is directed to and prepared for Australian residents only.