

# **Lithium 2024: Uncertain Times**

## **Where to from here?**

**Joe Lowry**

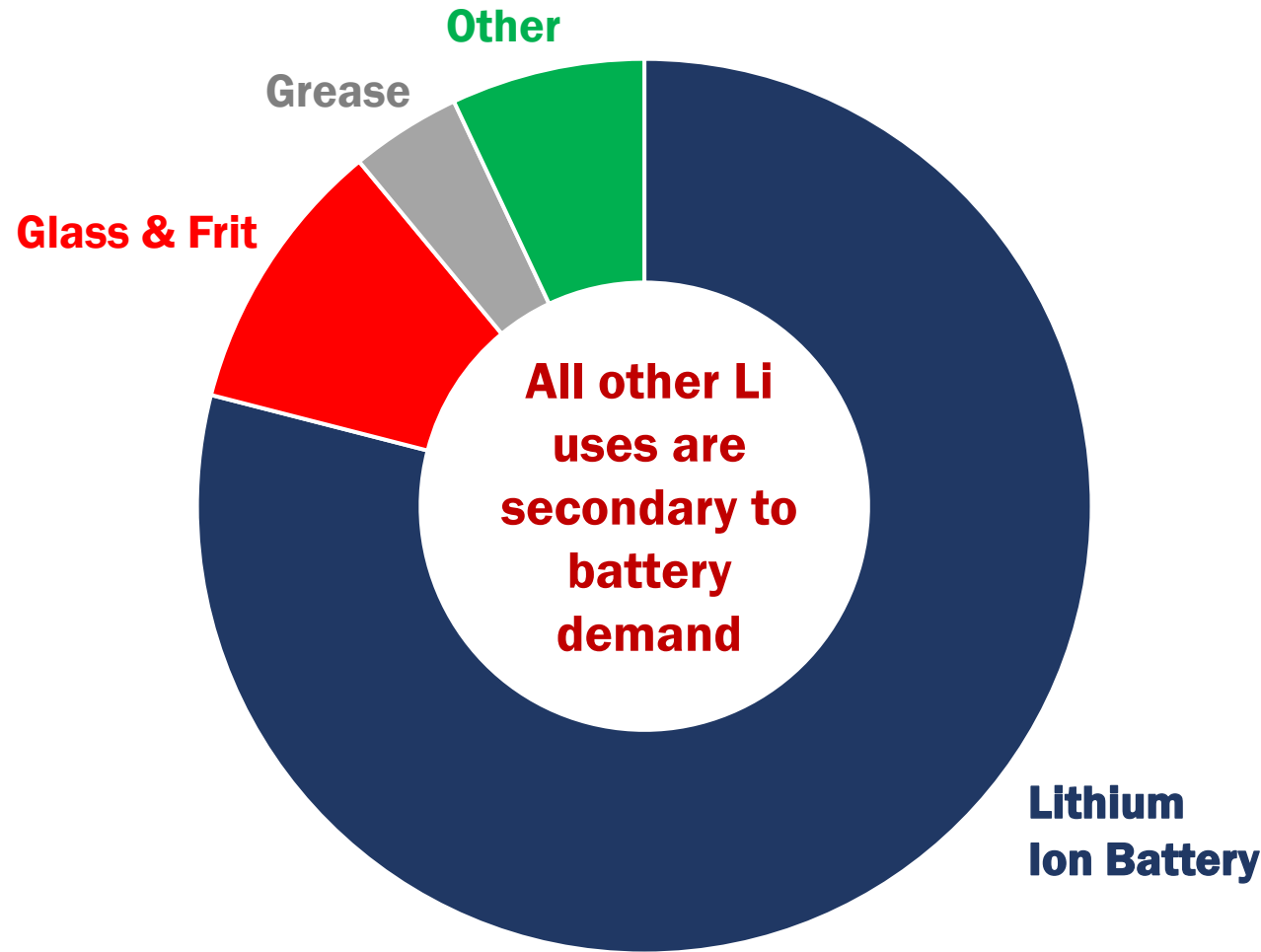
**March 2024**



- **What caused the bubble highs of 2022 and price drop in 2023?**
  - Panic buying beyond market demand led to both high prices and high SC inventory
  - The “draw down” of excess battery supply chain inventory impacted price more than new supply
  - High prices attracted unsustainable supply into the market
    - Low grade Chinese lepidolite and new supply from Africa
- **Has price bottomed?**
  - Did lower prices fix lower price?
- **Is the EV growth story still intact?**
  - Confusing a slowing growth rate with volume growth
- **What does the cost curve look like going forward?**
  - The debate over the “real” cost of low grade lepidolite & DSO
- **When does DLE make a meaningful contribution to supply?**
  - Will Exxon’s balance sheet accelerate progress?

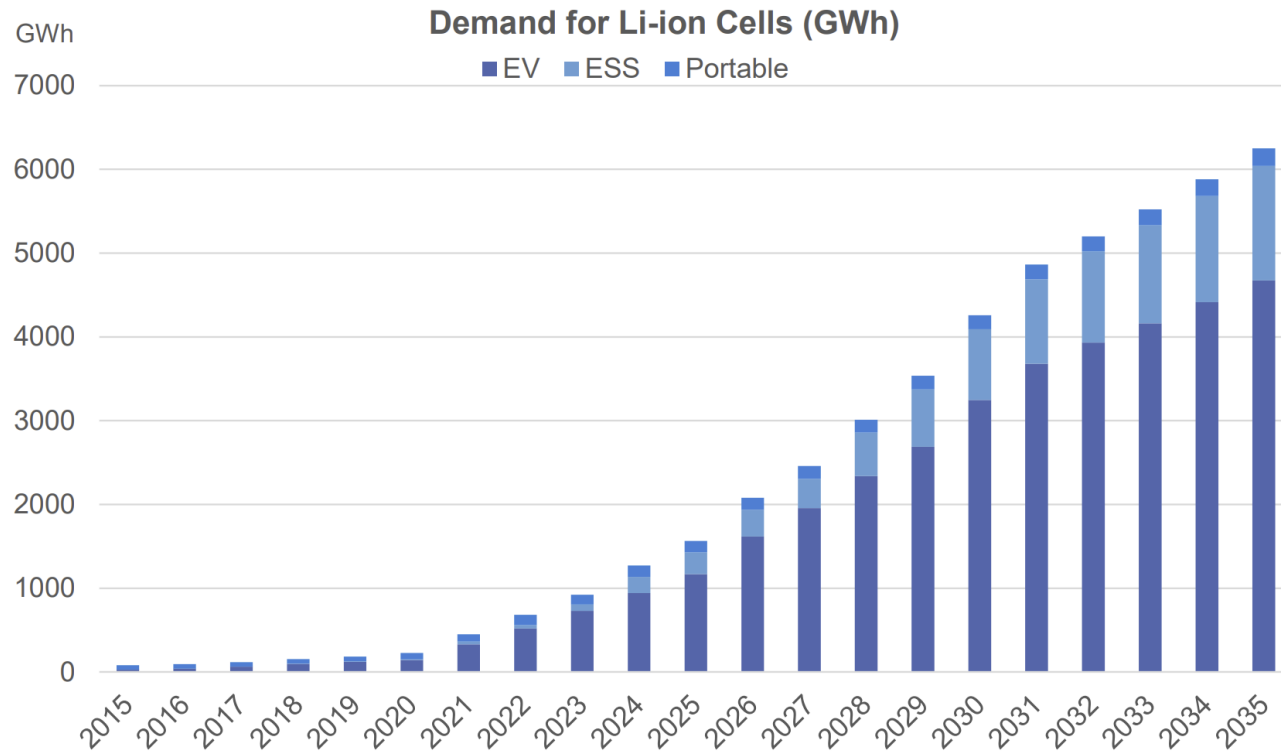
- **China will continue to dominate the battery market in the 2020s & drive volatility**
  - Too many suppliers across the battery supply chain / rapid changes in government incentives
  - Battery supply chain destocking / restocking cycle impacts lithium purchasing
  - Chinese battery suppliers greatly influence the lithium price narrative
- **The decline of EV demand is greatly exaggerated**
  - The growth rate has slowed but western press continues to misjudge the global EV story
- **Project capital cost (especially ex China) continues to rise**
  - Capital intensity of lithium projects up ~50% since 2019
  - Ex China projects average \$30K/MT LCE vs \$20K in 2019
- **The emerging cost curve will yield a long-term chemicals incentive price over \$20/kg**
  - Lepidolite & other low-quality production has created a steeper cost curve
  - New capacity will not be built if the price is based on the cost curve
  - Swing production should prevent a return to \$80/kg chemicals pricing
- **Unrealistic long term price forecasts will discourage investment in lithium projects**

- **Price bottoms & starts to rise**
  - China spot and ex-China pricing will bottom at different levels
  - Average Japan lithium carbonate price in 2023 was ~\$56/kg with a Y/E price of \$40/kg
- **Majors show lithium chemical supply discipline**
  - ALB, SQM, ALTM & other have taken actions to curtail 2024 supply or slow projects
  - Both hard rock & brine supply impacted: ~ 250K MT from 2024 – 2027
  - Current prices make much of the “swing supply” uneconomic
- **EV growth continues – higher volumes despite a lower growth rate**
  - Rho Motion believes global EV growth goes from 13.8M vehicles in 2023 to 18.0 in 2024
- **ESS growth becomes more significant with almost 200 GWH in 2024**
- **Geopolitics continue to be an important influence on lithium sentiment**
  - Elections around the world – a wildcard
  - China, Korea and Japan seek to IRA compliance



**Lithium Chemicals Market 2023 = ~ 925K MT LCE**

Total Lithium-ion (Li-ion) battery cell demand is forecast to grow by 20.2% CAGR between 2024 and 2034 with more capacity set to be announced in both Europe and North America as supply chains regionalise to support established automotive industries.



**End Use Sectors**

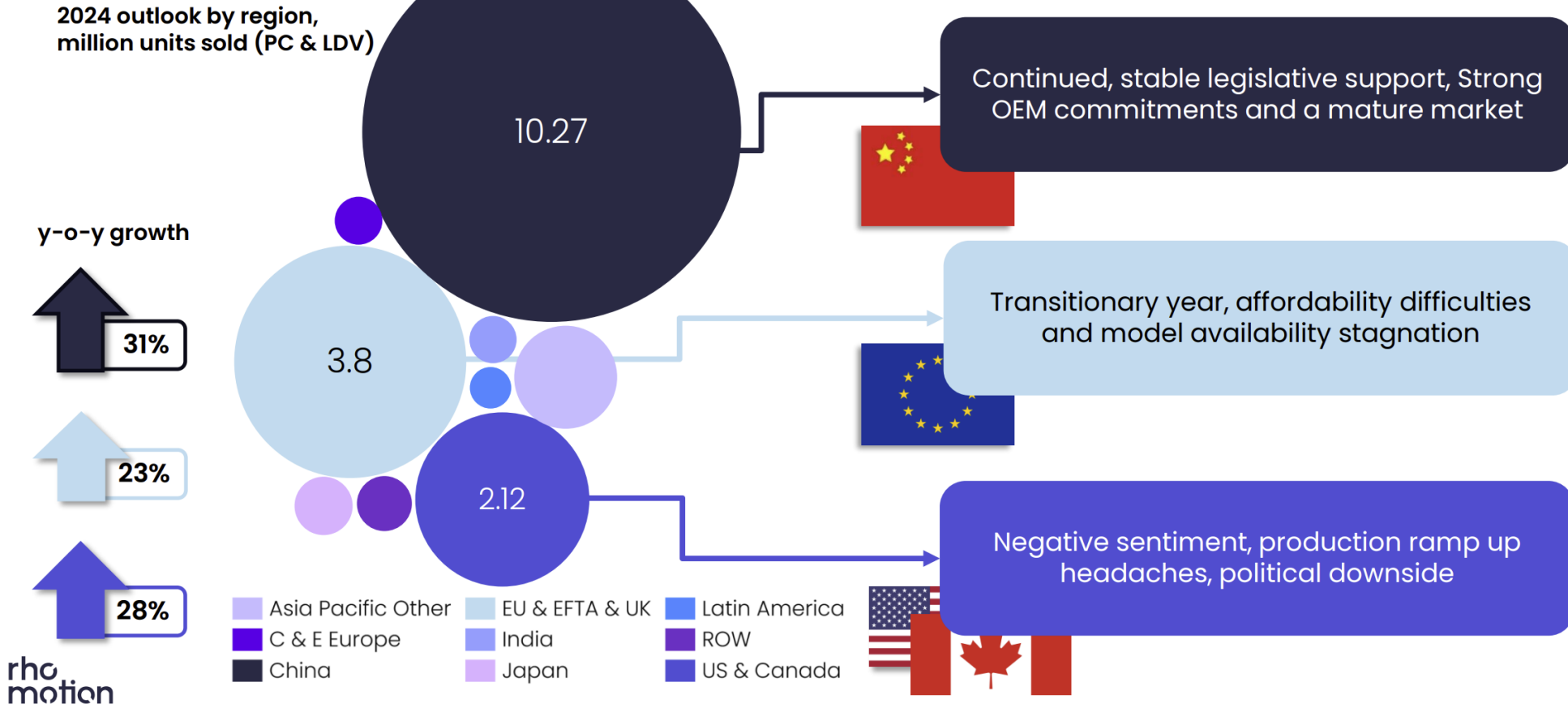
- Portable Electronics** continues to grow along with consumer spending levels
- Energy Storage Systems (ESS)** Strong growth trends from peak shifting, industrial consumers, renewables and decentralised grids. Overcapacity and falling cell costs are seeing demand shoot higher.
- Electric Vehicles (EVs)** continue to dominate the demand for Li-ion. Growth in demand not just as EV penetration increases, but also larger batteries for longer range vehicles and fewer plug-in hybrids and mild hybrids

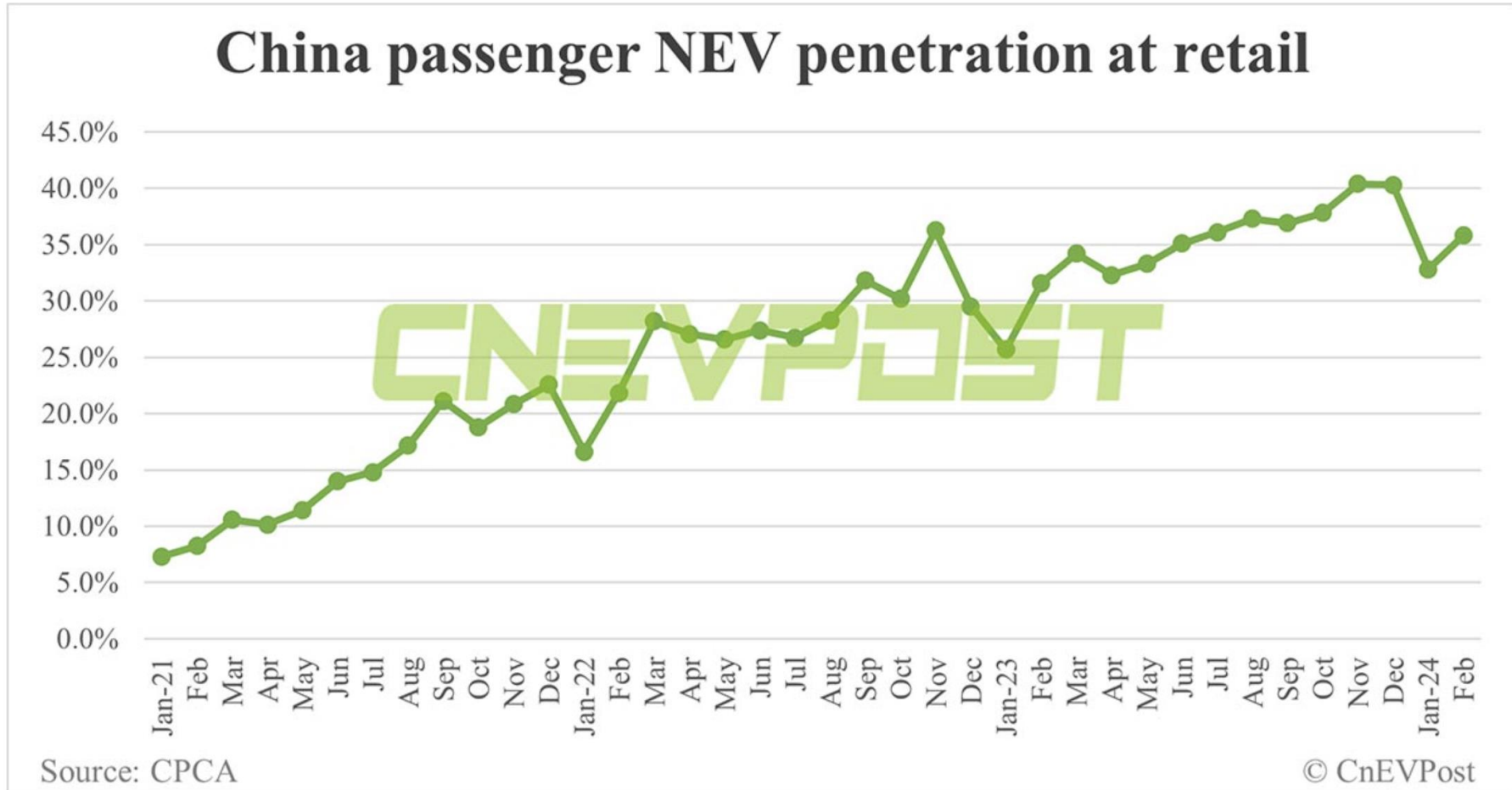


**GWh produced is the best single indicator of lithium demand**

## 2024 Outlook

Total global demand: **18 million units**



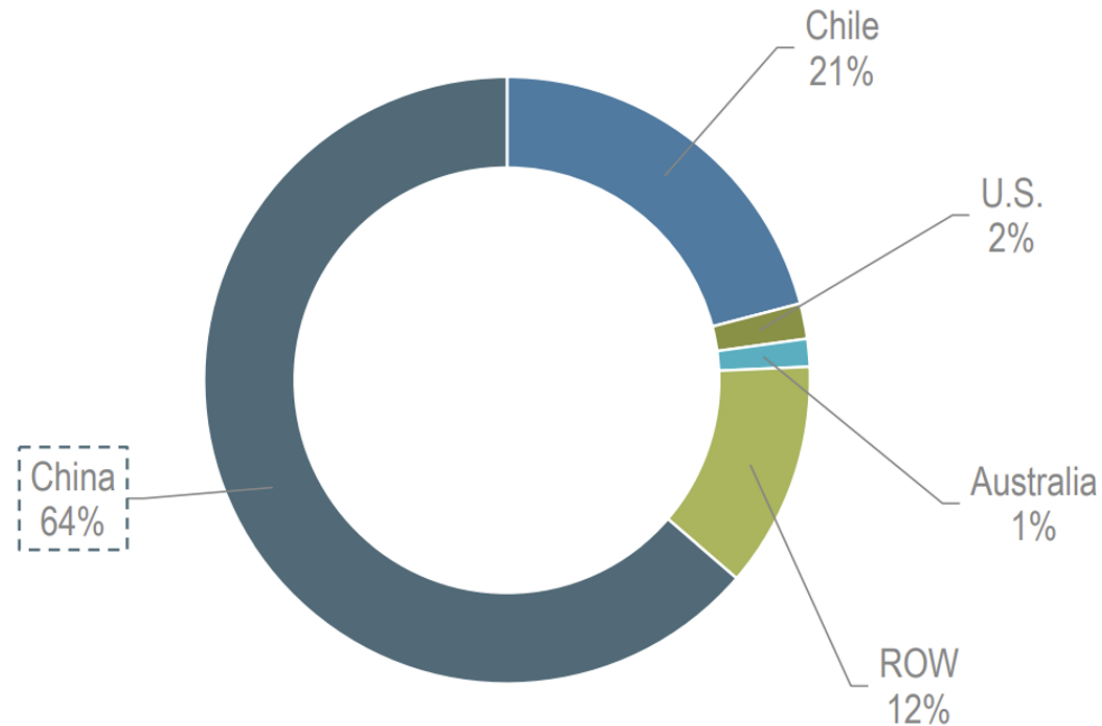


**Despite seasonality the upward trend is clear**

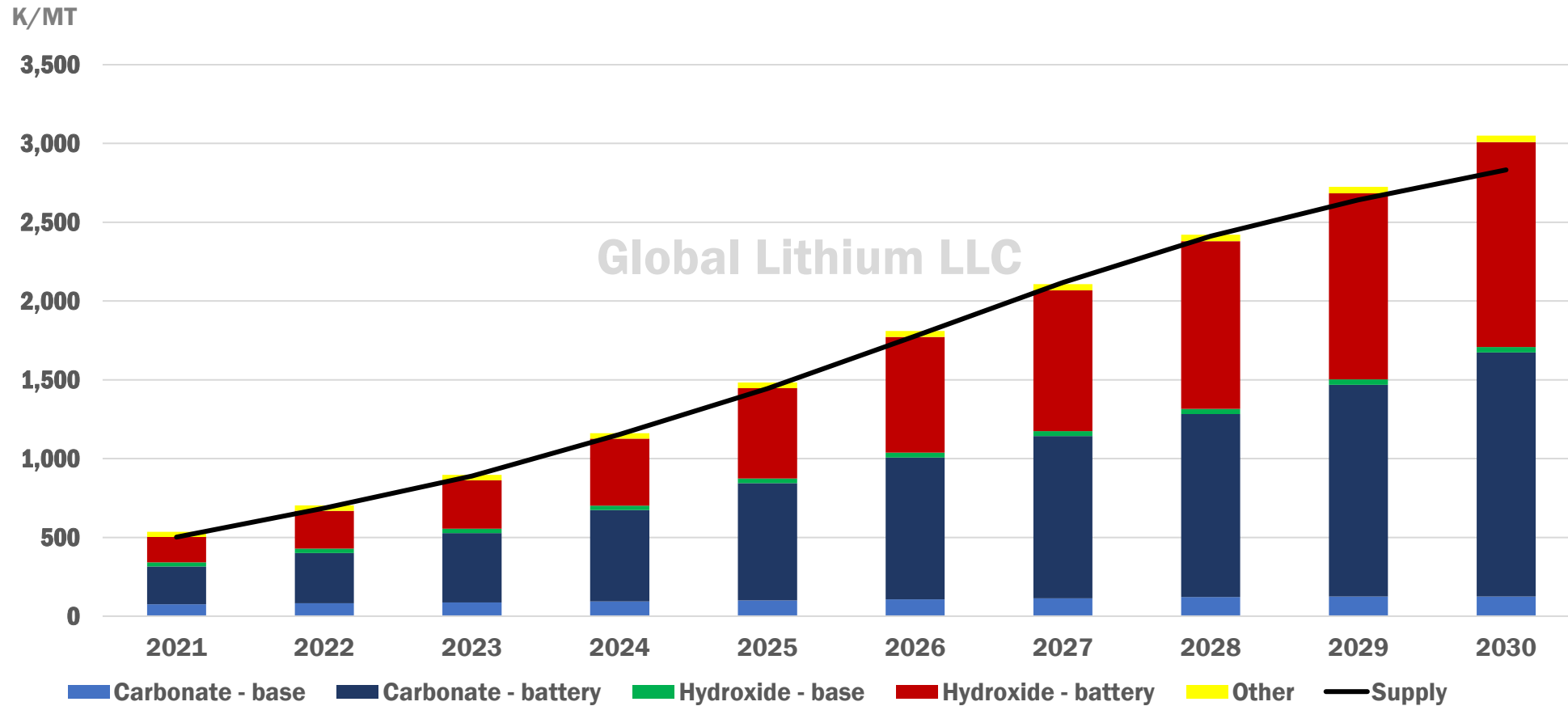


- **Many bank analysts accept PFS/DFS timelines at face value**
  - The person assigned to “determine supply” is usually the least experienced
  - Most greenfield projects are three years late from their original estimated start-up
  - Ramp-up to full production is an additional delay
- **Increasing capital costs & lower price expectations impacts financing**
  - Significant supply included in many long-term forecasts does not have financing
- **“China free” supply initiatives have not provided sufficient financing**
  - The IRA & DOE programs have focused on downstream projects
    - The recent \$2.26 billion loan for Thacker Pass is a notable exception
- **Uncertainty over the Chile’s new lithium policy may delay brine development**
  - DLE requirements & majority government ownership remain barriers

Current Global Processing Capacity



**Western hemisphere chemical production & conversion changes the balance**



- Supply remains in relative near-term balance
- Shortages can occur when capacity utilization is > 90%

- Goldman's belief that even low grade lepidolite can be produced for < \$12/kg drives their marginal supply assumption
- The consensus is that low grade lepidolite costs are substantially higher
- Goldman predicts lithium carbonate will sell for \$10/kg in 2025 which would likely delay financing of many projects in their supply model
- Goldman's bullish view on DLE by 2028 also impacts their supply

Li ('000 tonnes LCE)	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
<b>Global demand</b>											
<b>Consumption - batteries</b>	<b>200</b>	<b>361</b>	<b>562</b>	<b>786</b>	<b>989</b>	<b>1261</b>	<b>1547</b>	<b>1796</b>	<b>2152</b>	<b>2575</b>	<b>3090</b>
% change y/y	42%	80%	56%	40%	26%	27%	23%	16%	20%	20%	20%
EV	113	247	398	557	704	923	1115	1308	1560	1912	2339
ESS	10	17	33	73	101	129	195	214	266	278	327
E-buses, two-wheeler EVs	20	33	48	64	84	102	120	146	187	235	263
Portable electronics	39	41	46	47	48	50	53	56	60	63	67
Other	18	24	37	46	51	57	64	73	79	87	95
<b>Consumption - ex batteries</b>	<b>130</b>	<b>137</b>	<b>141</b>	<b>144</b>	<b>148</b>	<b>151</b>	<b>155</b>	<b>158</b>	<b>162</b>	<b>165</b>	<b>169</b>
% change y/y	-2%	5%	3%	2%	3%	2%	2%	2%	2%	2%	2%
Ceramics	32	34	35	36	37	38	39	40	41	42	43
Glass-ceramics	27	28	29	30	31	31	32	33	34	35	36
Other	71	74	77	78	80	82	83	85	86	88	90
% of global demand		15%	18%	6%	3%	6%	6%	5%	4%	3%	2%
<b>Global demand (excl. restocking)</b>	<b>331</b>	<b>498</b>	<b>703</b>	<b>930</b>	<b>1137</b>	<b>1413</b>	<b>1702</b>	<b>1954</b>	<b>2314</b>	<b>2740</b>	<b>3259</b>
<b>Global demand (incl. restocking)</b>	<b>351</b>	<b>570</b>	<b>830</b>	<b>990</b>	<b>1169</b>	<b>1501</b>	<b>1796</b>	<b>2045</b>	<b>2404</b>	<b>2831</b>	<b>3339</b>
% change y/y	23%	63%	46%	19%	18%	28%	20%	14%	18%	18%	18%
<b>Global Refined Supply</b>											
<b>Brine</b>	<b>172</b>	<b>228</b>	<b>318</b>	<b>372</b>	<b>505</b>	<b>704</b>	<b>838</b>	<b>974</b>	<b>1057</b>	<b>1128</b>	<b>1152</b>
China	36	60	79	114	135	229	271	307	314	320	327
Ex-China	137	168	239	257	370	475	568	667	744	807	825
<b>Spodumene</b>	<b>189</b>	<b>236</b>	<b>342</b>	<b>534</b>	<b>747</b>	<b>1081</b>	<b>1322</b>	<b>1523</b>	<b>1633</b>	<b>1689</b>	<b>1706</b>
China	10	7	14	30	59	86	127	183	190	196	203
Ex-China	179	229	328	504	688	996	1195	1340	1444	1493	1503
<b>Other (Lepidolite or Clay)</b>	<b>13</b>	<b>45</b>	<b>83</b>	<b>140</b>	<b>190</b>	<b>339</b>	<b>363</b>	<b>382</b>	<b>410</b>	<b>439</b>	<b>467</b>
China	13	45	83	140	190	339	363	382	409	435	462
Ex-China	0	0	0	0	0	0	0	0	2	3	5
<b>World output</b>	<b>375</b>	<b>509</b>	<b>743</b>	<b>1045</b>	<b>1442</b>	<b>2125</b>	<b>2524</b>	<b>2879</b>	<b>3101</b>	<b>3255</b>	<b>3324</b>
% change y/y		36%	46%	41%	38%	47%	19%	14%	8%	5%	2%
<b>Total output (adj. for disruption)</b>	<b>375</b>	<b>504</b>	<b>721</b>	<b>967</b>	<b>1269</b>	<b>1764</b>	<b>2095</b>	<b>2389</b>	<b>2574</b>	<b>2702</b>	<b>2759</b>
% change y/y		35%	43%	34%	31%	39%	19%	14%	8%	5%	2%
<b>Battery Scrap Supply</b>	<b>5</b>	<b>10</b>	<b>17</b>	<b>33</b>	<b>50</b>	<b>73</b>	<b>91</b>	<b>93</b>	<b>121</b>	<b>219</b>	<b>336</b>
% change y/y		2%	2%	3%	4%	4%	4%	4%	5%	8%	12%
<b>Global Balance</b>	<b>29</b>	<b>-56</b>	<b>-93</b>	<b>10</b>	<b>150</b>	<b>336</b>	<b>390</b>	<b>438</b>	<b>290</b>	<b>90</b>	<b>-244</b>
as % of global supply	8%	-11%	-13%	1%	12%	19%	19%	18%	11%	3%	-9%

Source: Goldman Sachs Global Investment Research, Company data, BNEF, IEA, Woodmac

# Canaccord's View of Supply & Demand to 2030

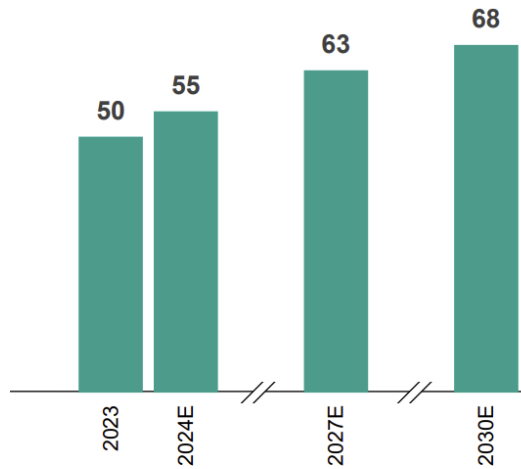
		2021a	2022a	2023a	2024e	2025e	2026e	2027e	2028e	2029e	2030e
<b>Supply</b>											
<b>Brines</b>	<b>kt LCE</b>	<b>207</b>	<b>271</b>	<b>399</b>	<b>484</b>	<b>585</b>	<b>683</b>	<b>737</b>	<b>818</b>	<b>870</b>	<b>911</b>
Existing brine supply	kt LCE	207	271	399	399	399	399	399	399	399	399
Brownfield expansions	kt LCE				70	122	195	217	237	247	247
Greenfield brine production	kt LCE				15	64	89	121	182	224	265
<b>Effective converter capacity</b>	<b>kt LCE</b>	<b>231</b>	<b>336</b>	<b>613</b>	<b>795</b>	<b>982</b>	<b>1,227</b>	<b>1,353</b>	<b>1,407</b>	<b>1,454</b>	<b>1,513</b>
China	kt LCE	245	310	523	685	851	999	1,063	1,094	1,103	1,103
Ex-China	kt LCE			50	66	106	229	290	314	352	411
<b>Total market supply</b>	<b>kt LCE</b>	<b>439</b>	<b>607</b>	<b>1,012</b>	<b>1,280</b>	<b>1,567</b>	<b>1,910</b>	<b>2,089</b>	<b>2,225</b>	<b>2,324</b>	<b>2,425</b>
YoY change	%	27%	38%	67%	26%	22%	22%	9%	7%	4%	4%
<b>Demand</b>											
Industrial use	kt LCE	107	109	111	113	115	118	120	122	125	127
Batteries - EV's	kt LCE	293	490	625	814	1,040	1,358	1,646	1,872	2,083	2,325
Batteries - other (inc WIP)	kt LCE	121	199	257	333	386	454	399	347	316	299
Total batteries	kt LCE	415	690	883	1,147	1,426	1,813	2,045	2,219	2,399	2,624
<b>Total demand</b>	<b>kt LCE</b>	<b>521</b>	<b>798</b>	<b>993</b>	<b>1,260</b>	<b>1,542</b>	<b>1,930</b>	<b>2,165</b>	<b>2,341</b>	<b>2,523</b>	<b>2,751</b>
YoY chance	%	67%	53%	24%	27%	22%	25%	12%	8%	8%	9%
<b>Market surplus/(deficit)</b>	<b>kt LCE</b>	<b>-82</b>	<b>-191</b>	<b>19</b>	<b>20</b>	<b>25</b>	<b>-20</b>	<b>-76</b>	<b>-116</b>	<b>-199</b>	<b>-326</b>
%		-16%	-24%	2%	2%	2%	-1%	-3%	-5%	-8%	-12%

Source: Canaccord Genuity estimates

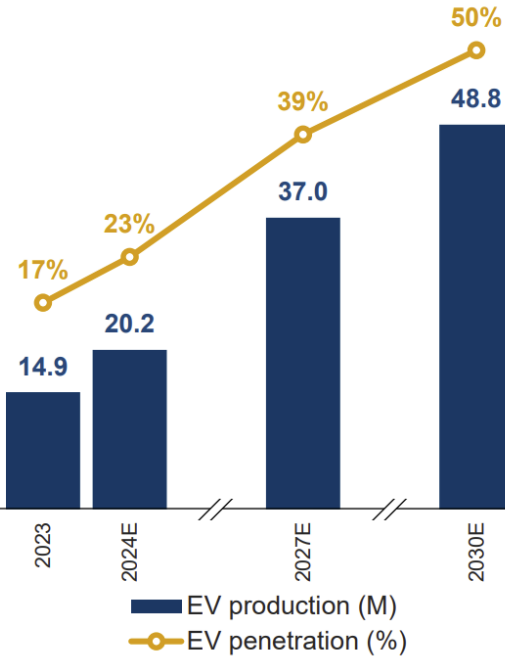
**Less bullish on supply & demand to 2030 but show a similar market tightness**

## Global EV Outlook

**Battery Size (Global EV Average)<sup>1</sup>**  
(kWh per EV)

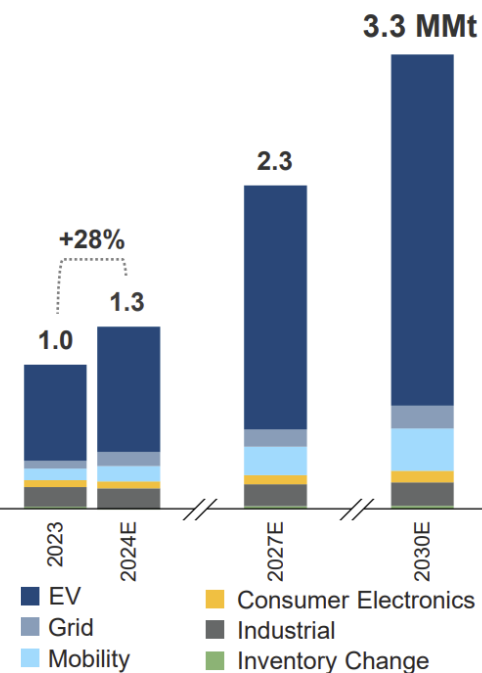


**Production / Market Penetration<sup>1</sup>**  
2024-2030  
CAGR: 15-20%



## Lithium Demand

**by Application<sup>2</sup>**  
(MMt LCE)  
2024-2030  
CAGR: 15-20%



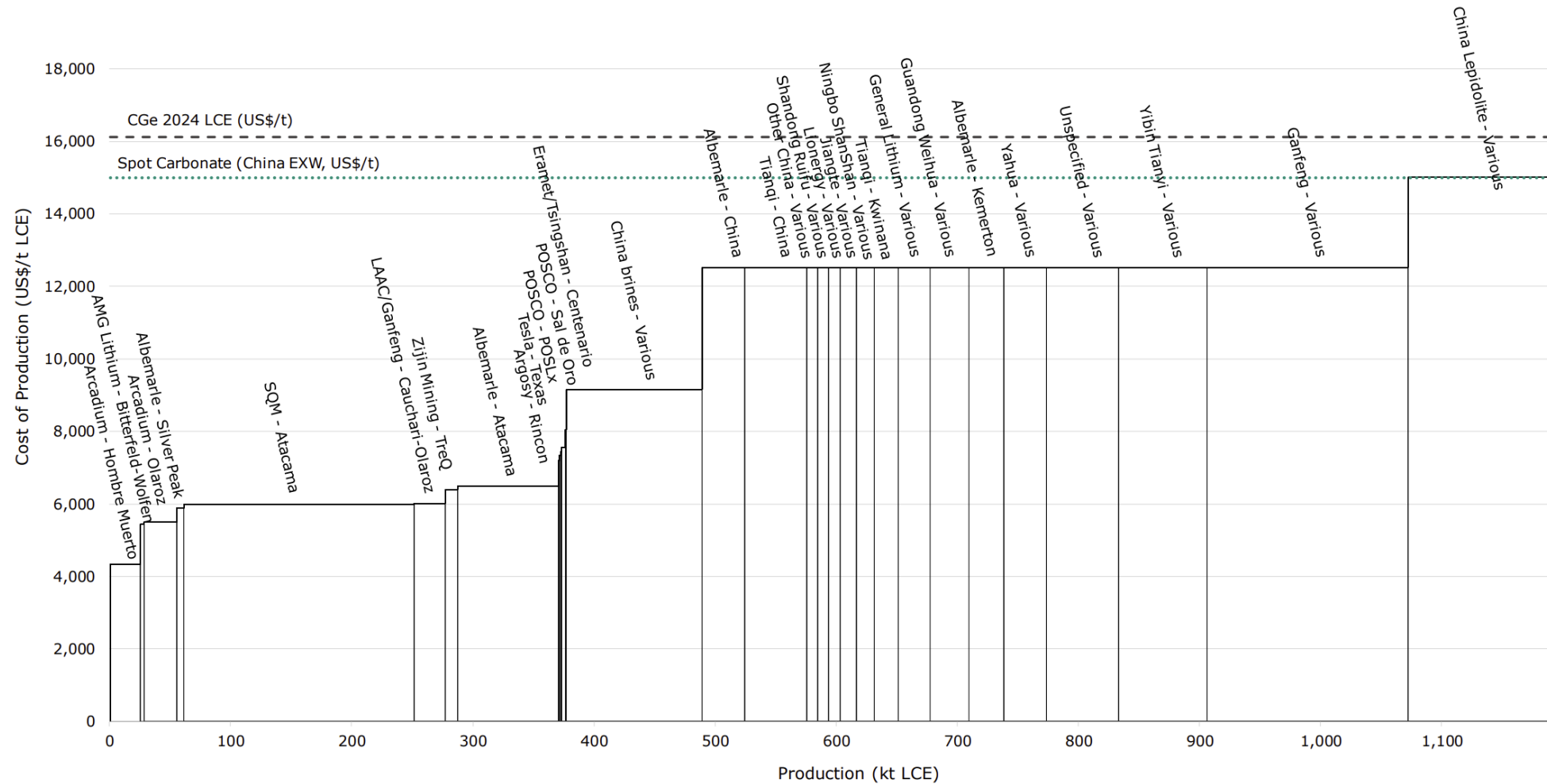
2030E lithium demand down ~10% vs previous forecast due to:

- OEM announcements
- Moderated battery size growth
- Reductions in downstream Li salt inventory

Supply expected to remain in balance given recently announced and on-going curtailments, start-up delays, and expansion delays

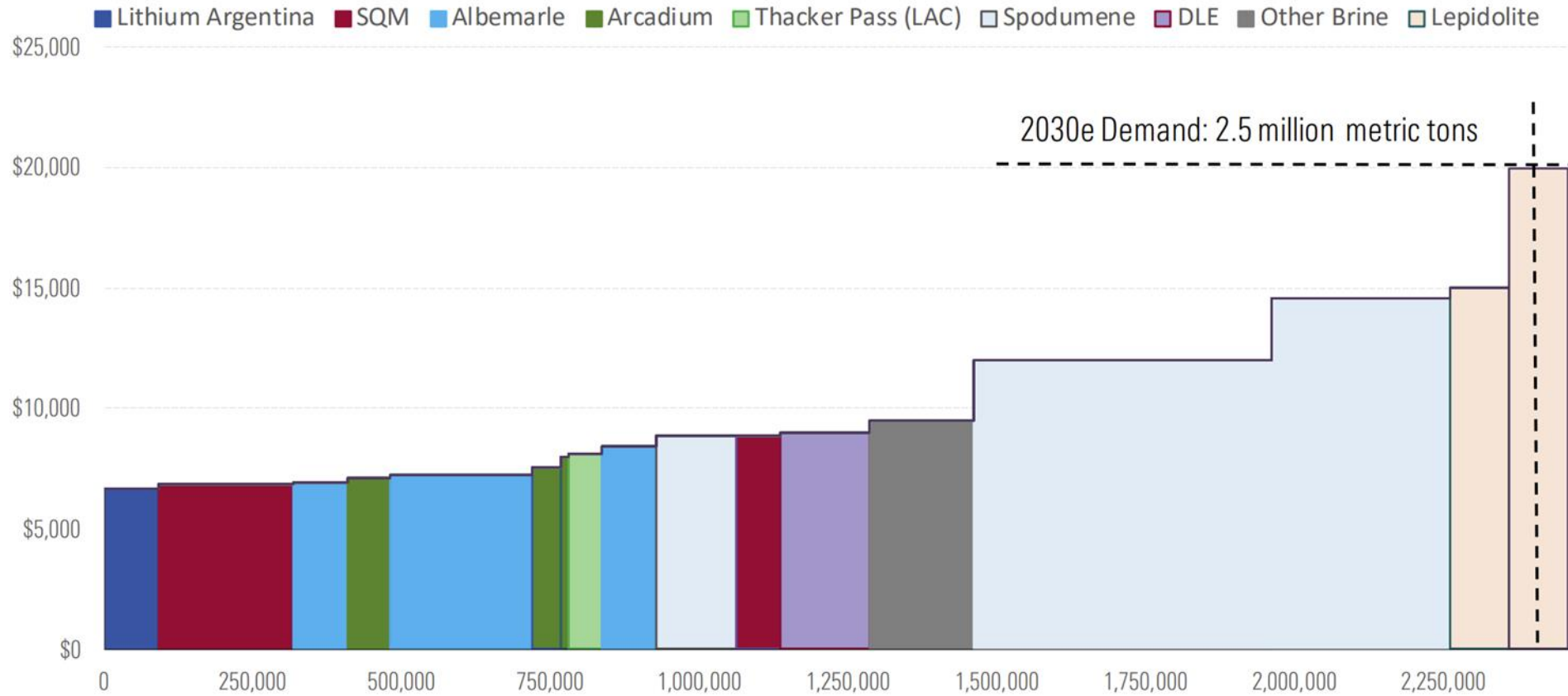
Incentivizing growth to meet demand requires long-term prices at or above re-investment economics

**Even after a downward adjustment to 2030 demand, ALB remains bullish**



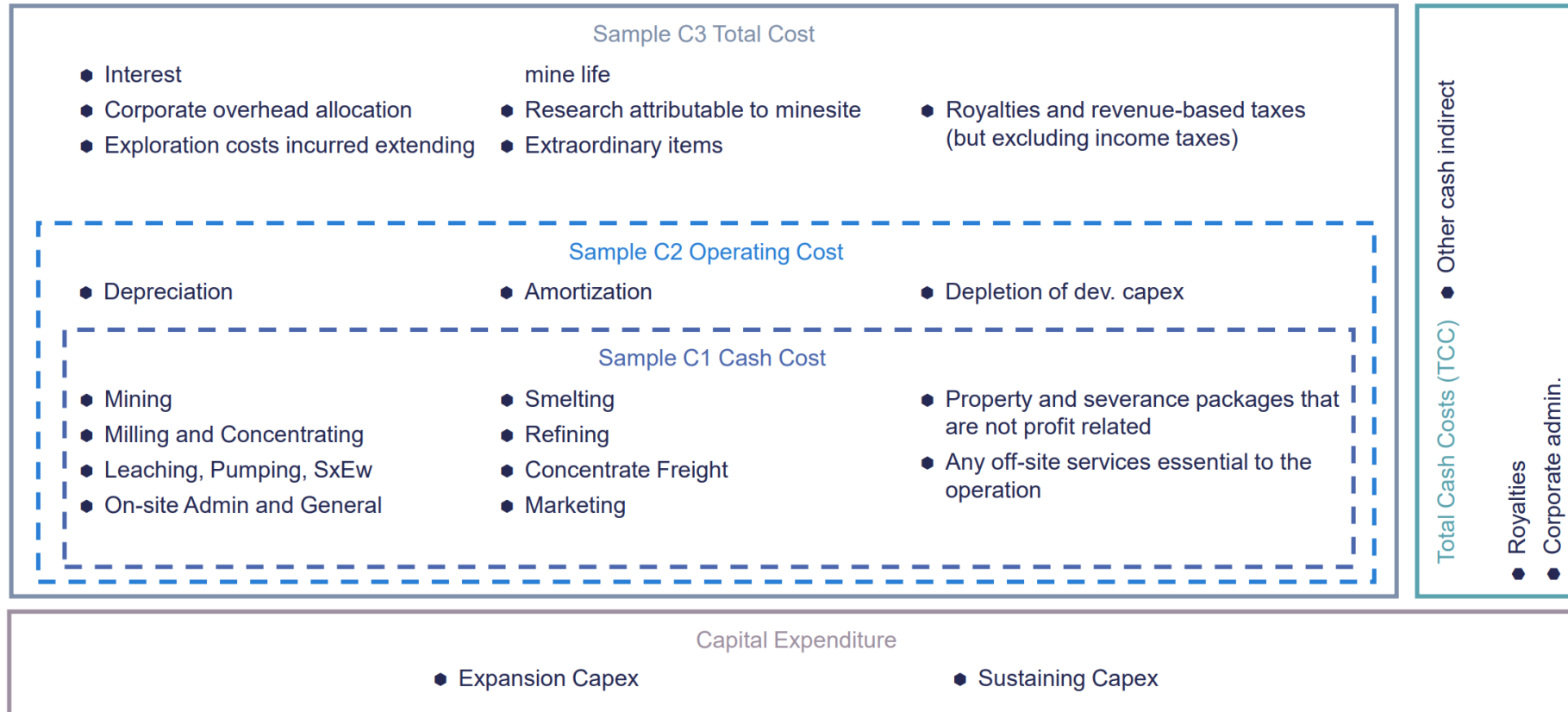
Source: Canaccord Genuity estimates; \*assumes US\$1170/t SC6 for non-integrated mineral conversion





Source: Morningstar, company filings. Note: Joint venture projects are counted as one entity, e.g., all of Cauchari-Olaroz is attributed to Lithium Argentina even though the project is a JV with Ganfeng.



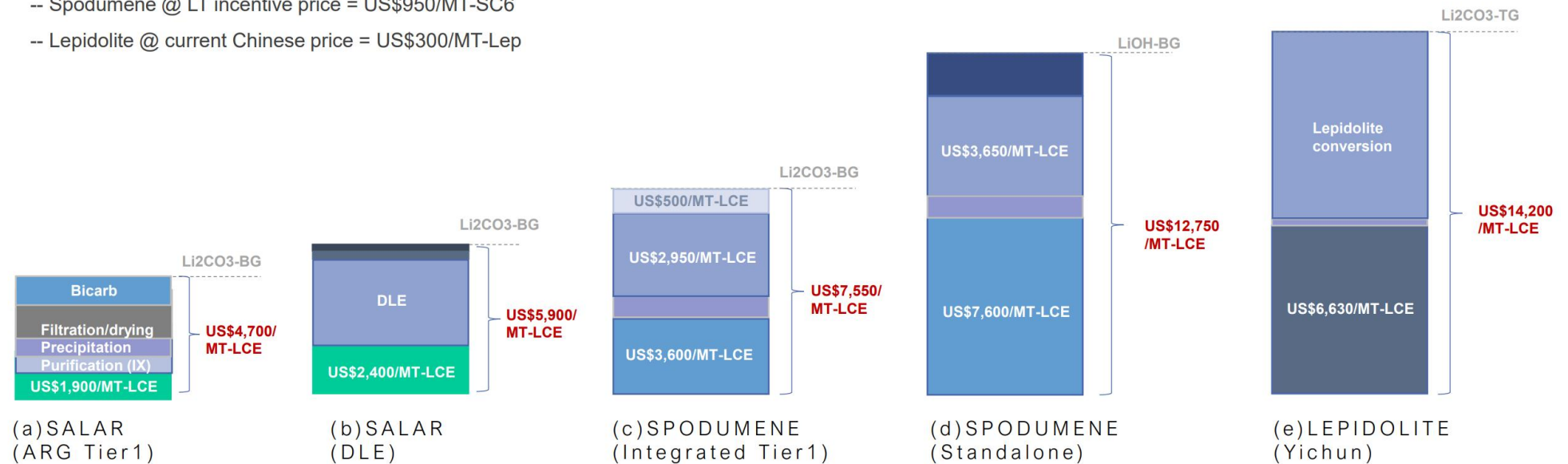


Source: Wood Mackenzie

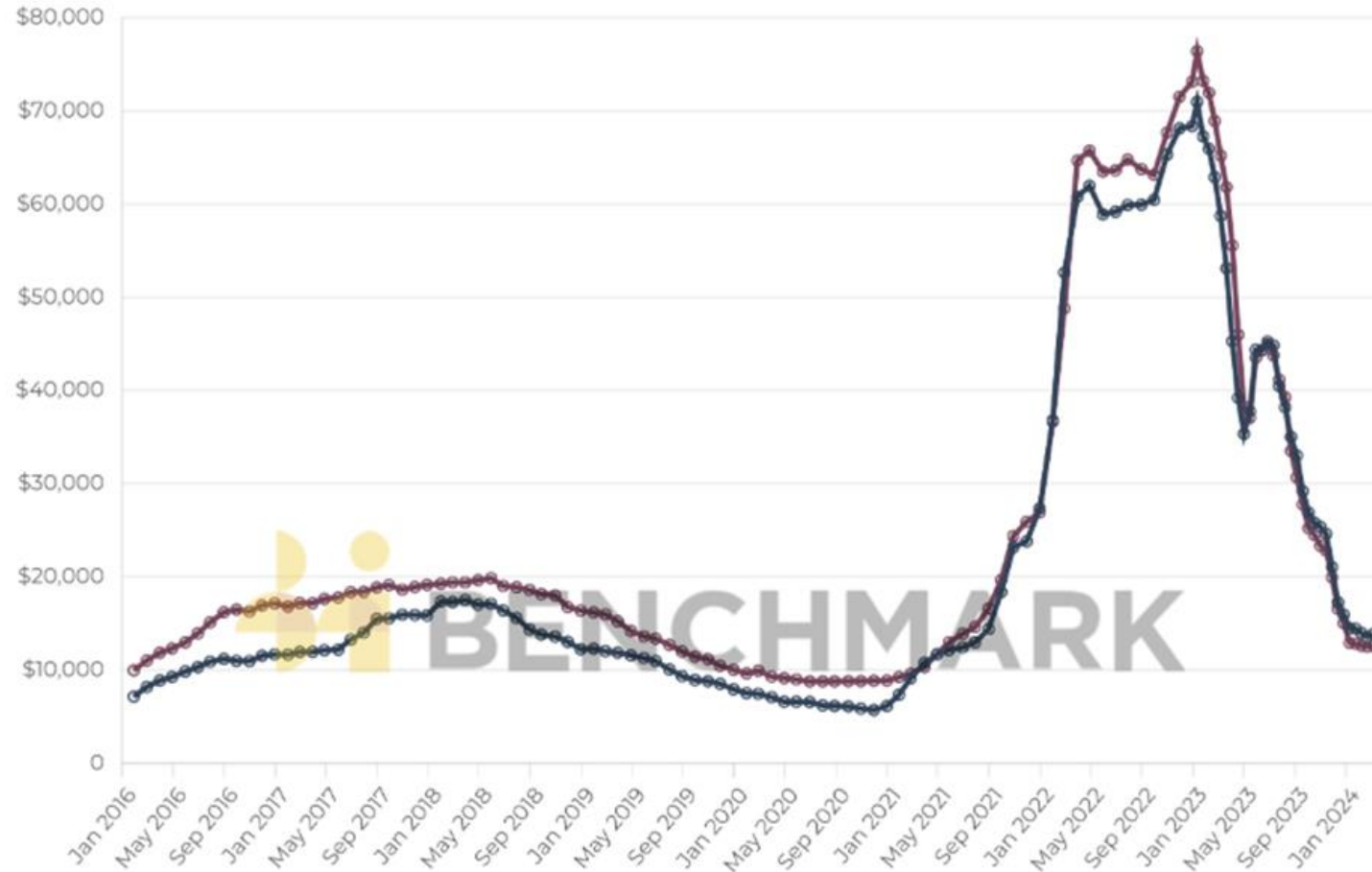
## C1 COST COMPARISON BETWEEN LITHIUM PROJECTS

Charts include a variety of different feedstocks and technologies. Hard rock projects tend to be more expensive than salars. Assumptions are:

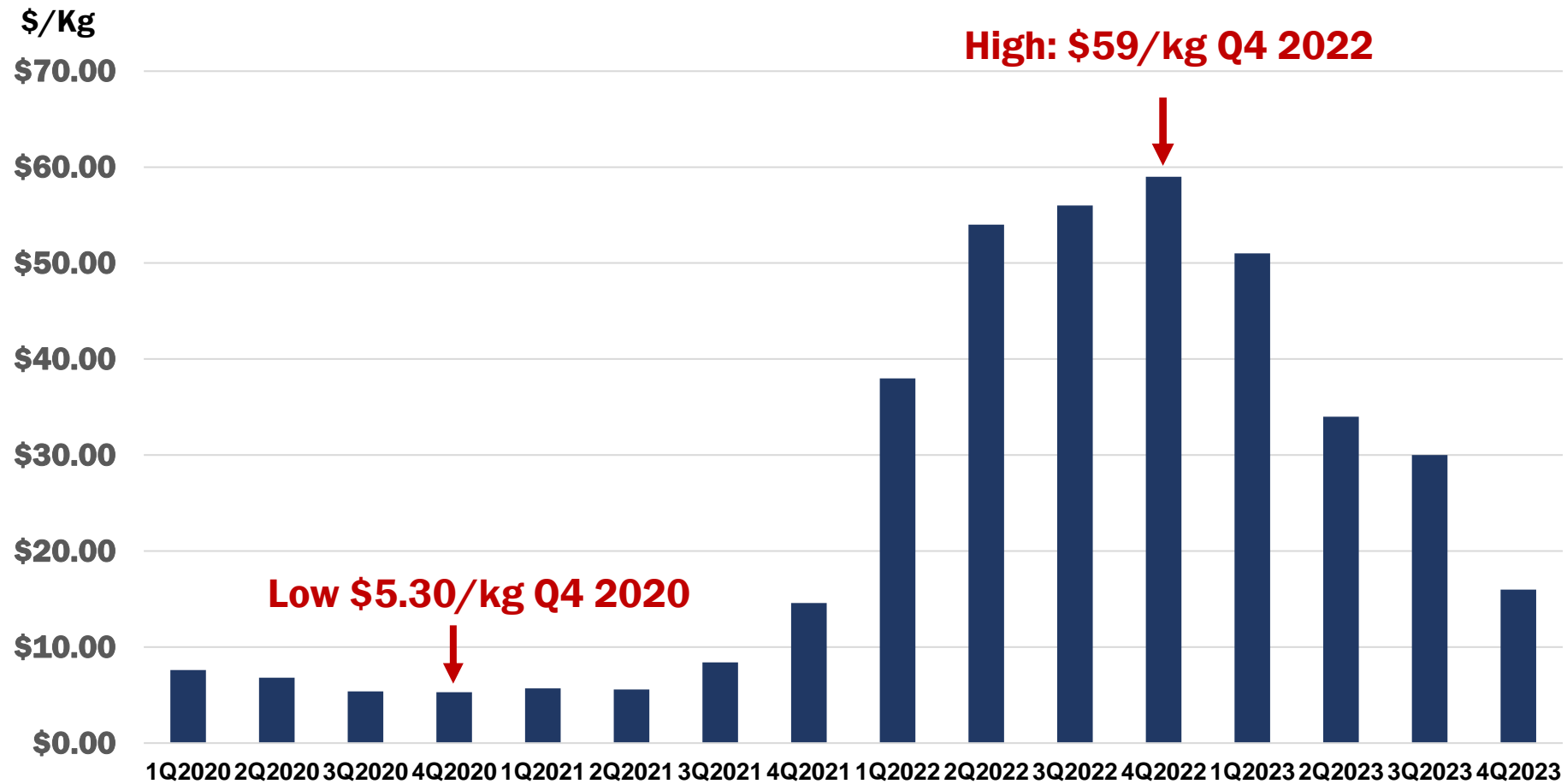
- Spodumene @ LT incentive price = US\$950/MT-SC6
- Lepidolite @ current Chinese price = US\$300/MT-Lep



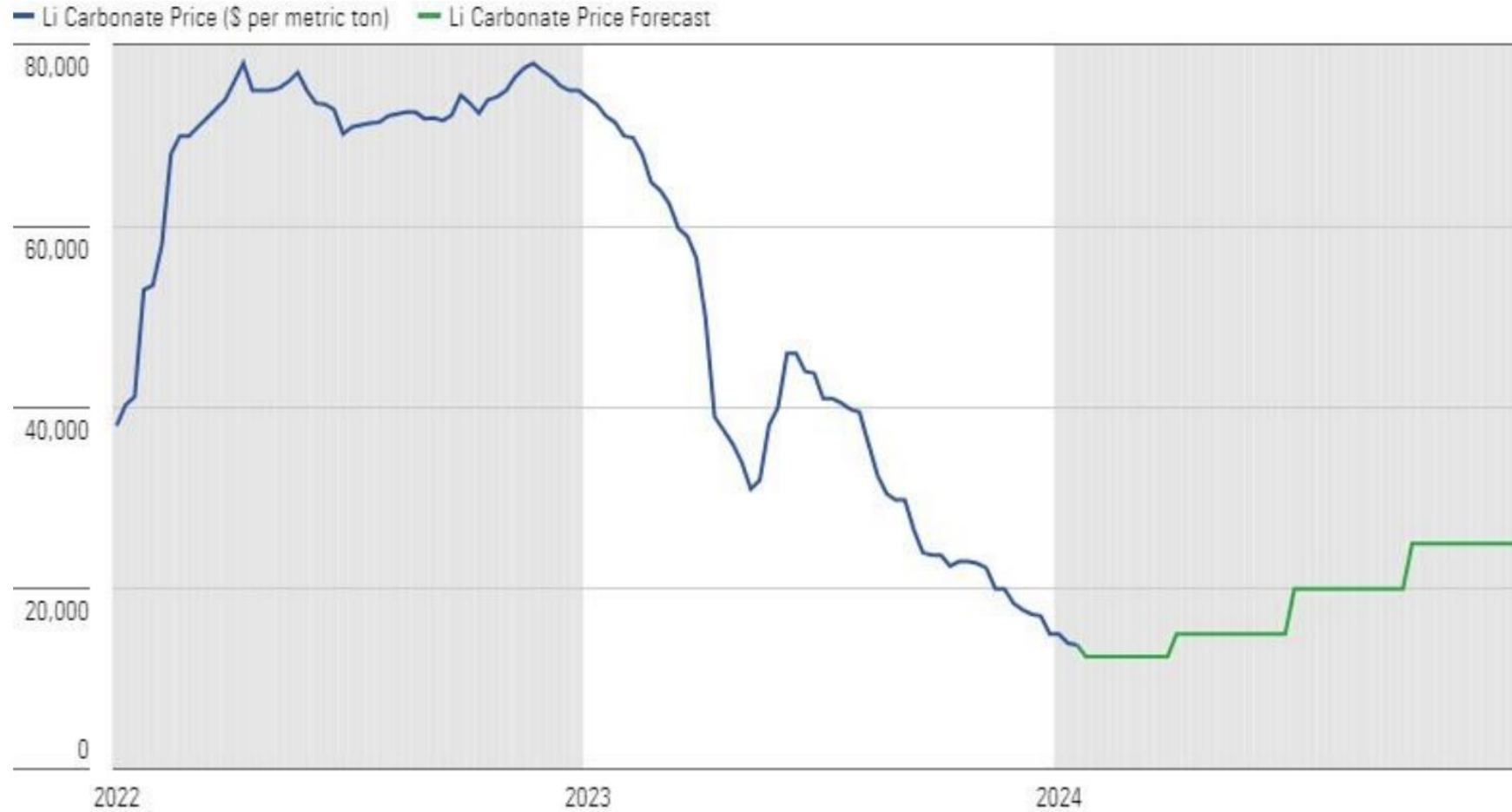
**Non - integrated spodumene and lepidolite C1 costs show the need for a long – term incentive price > \$20/kg**



**Anyone following the lithium market is familiar with this curve**



**SQM's price is a better reflection of global pricing than China spot**



Source: Morningstar, LME, Platts, Fastmarkets, Benchmark Minerals.

- **Did lower prices fix lower prices?**

- Recent evidence suggests both chemicals & spodumene prices have bottomed
- Much of the capacity that drove the 2023 oversupply is currently not economic
- Lower prices also increased demand in the battery sector and limited substitution (sodium ion)

- **How high will price go in this cycle?**

- Prices above \$25/kg will re-enable lower grade lepidolite, ore, etc to restart
  - Yet, market panics could spike price in the short term
- My prediction is global average carbonate pricing moves into the low to mid \$20s/kg by Dec.

- **What do the banks think about China spot carbonate pricing? (rounded to nearest \$)**

	<b>2024</b>	<b>2025</b>	<b>Long term</b>
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- **Lithium is still a very misunderstood market**
  - Banks continue to try to force feed investors the standard commodity narrative
    - Lithium is a **chemical business** that may or may not have a mining component
  - Excess in China capacity across the lithium-ion battery supply chain will drive volatility
  - China currently dominates lithium processing but is dependent for raw material
- **There is no shortage of lithium resources**
  - There will continue to be a shortage of developed lithium projects in this decade
  - Improved extraction technology and recycling will happen but are a 2030's story
- **There is no single “lithium price”**
  - The China spot price is currently important but only one of many prices
  - Despite the price crash narrative – ex China pricing was higher in 2023 than 2022
- **If you invest in lithium – “do the work”**



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