

Battery Raw Materials – The Fundamentals



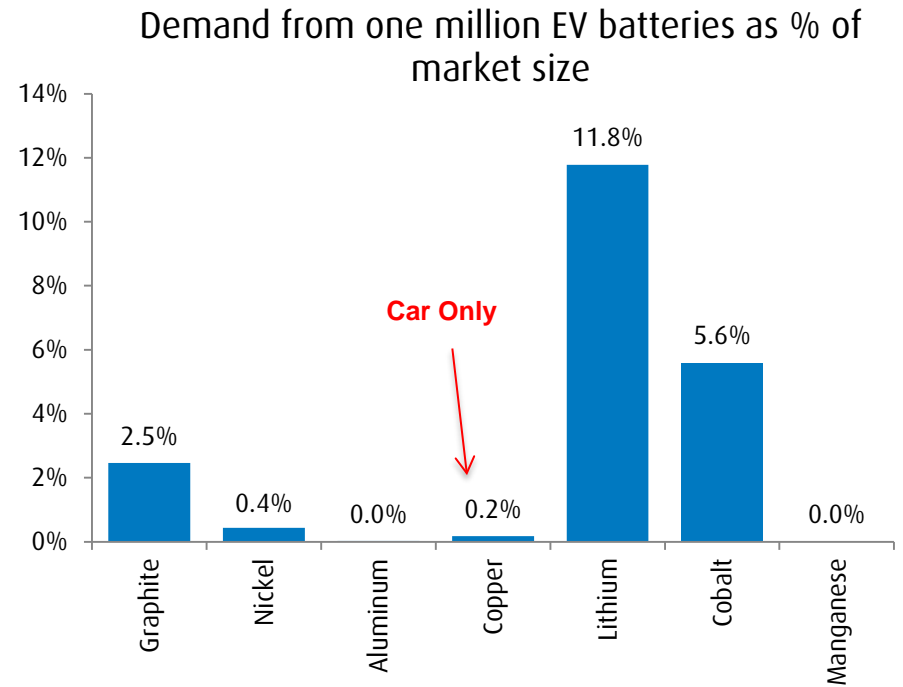
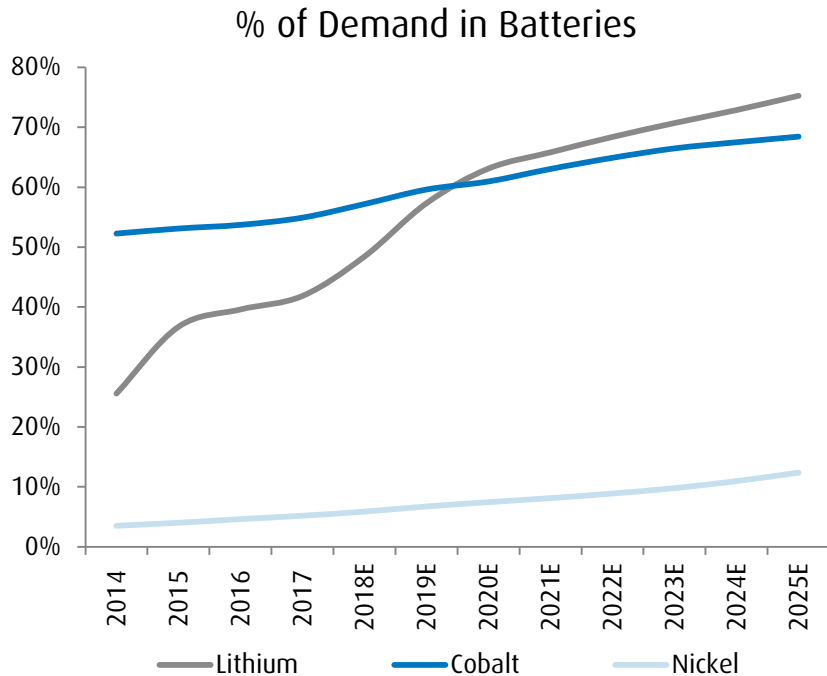
Colin Hamilton
Global Commodities Analyst
BMO Capital Markets Limited
(44) 20 7 664 8172
Colin.Hamilton@bmo.com



This report was prepared in part by analysts employed by a UK affiliate, BMO Capital Markets Limited, authorised and regulated by the Financial Conduct Authority in the UK, and who is not registered as research analysts under FINRA rules. For disclosure statements, including the Analyst's Certification, please refer to pages 18 to 21.

~11:50 ET

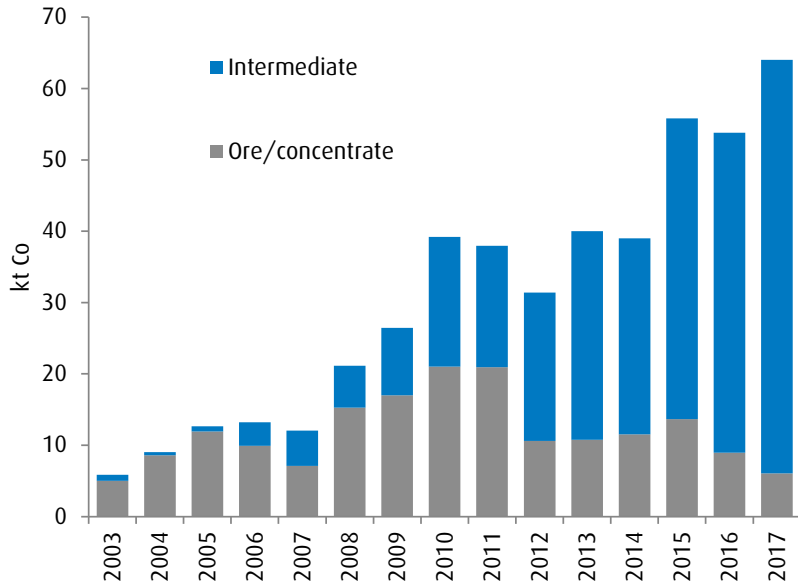
The EV Battery Story Has Many Important Sub-Plots



Source: Bloomberg, BMO Capital Markets

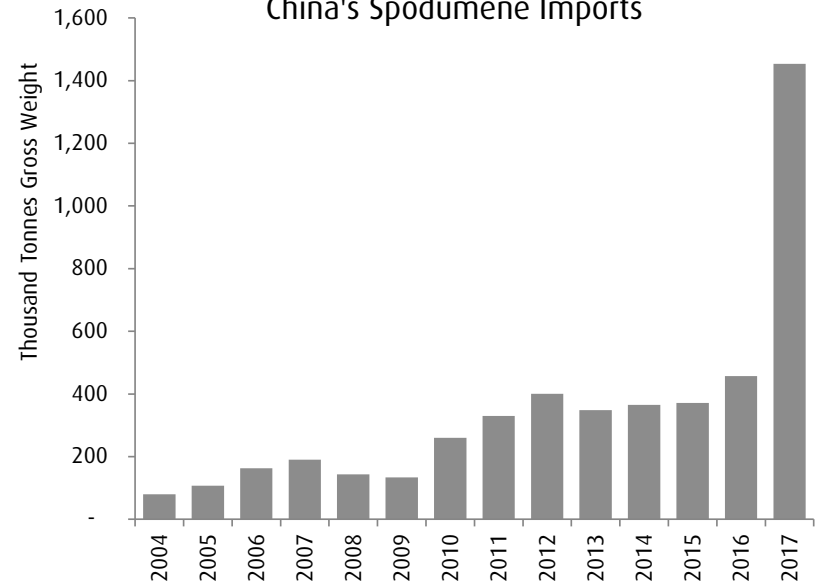
China Is the Dominant Import Destination for Raw Materials

China's cobalt imports by type



93% originate from the DRC

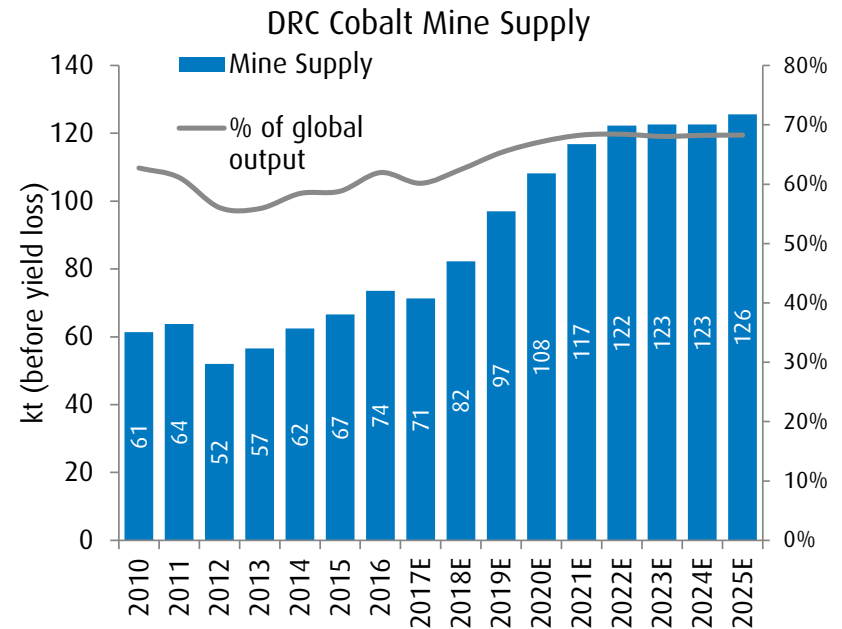
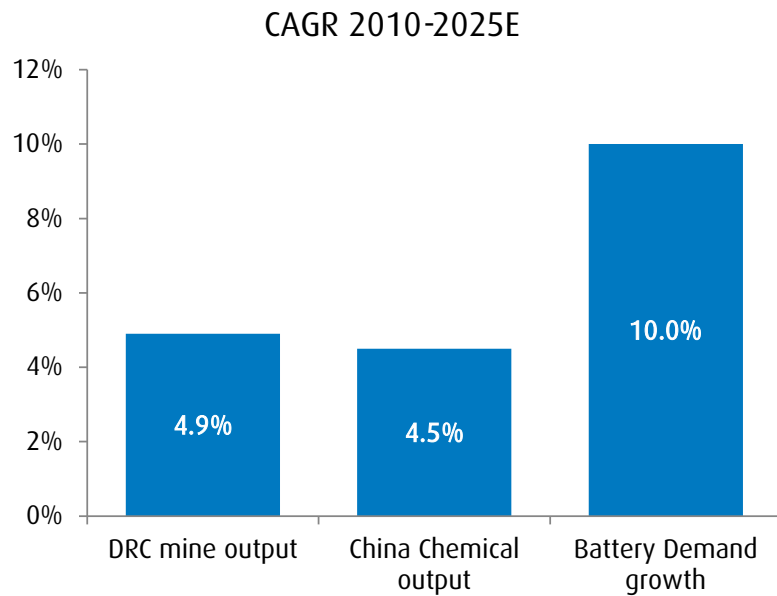
China's Spodumene Imports



Vast Majority from Australia

Source: CDI, CRU, BMO Capital Markets

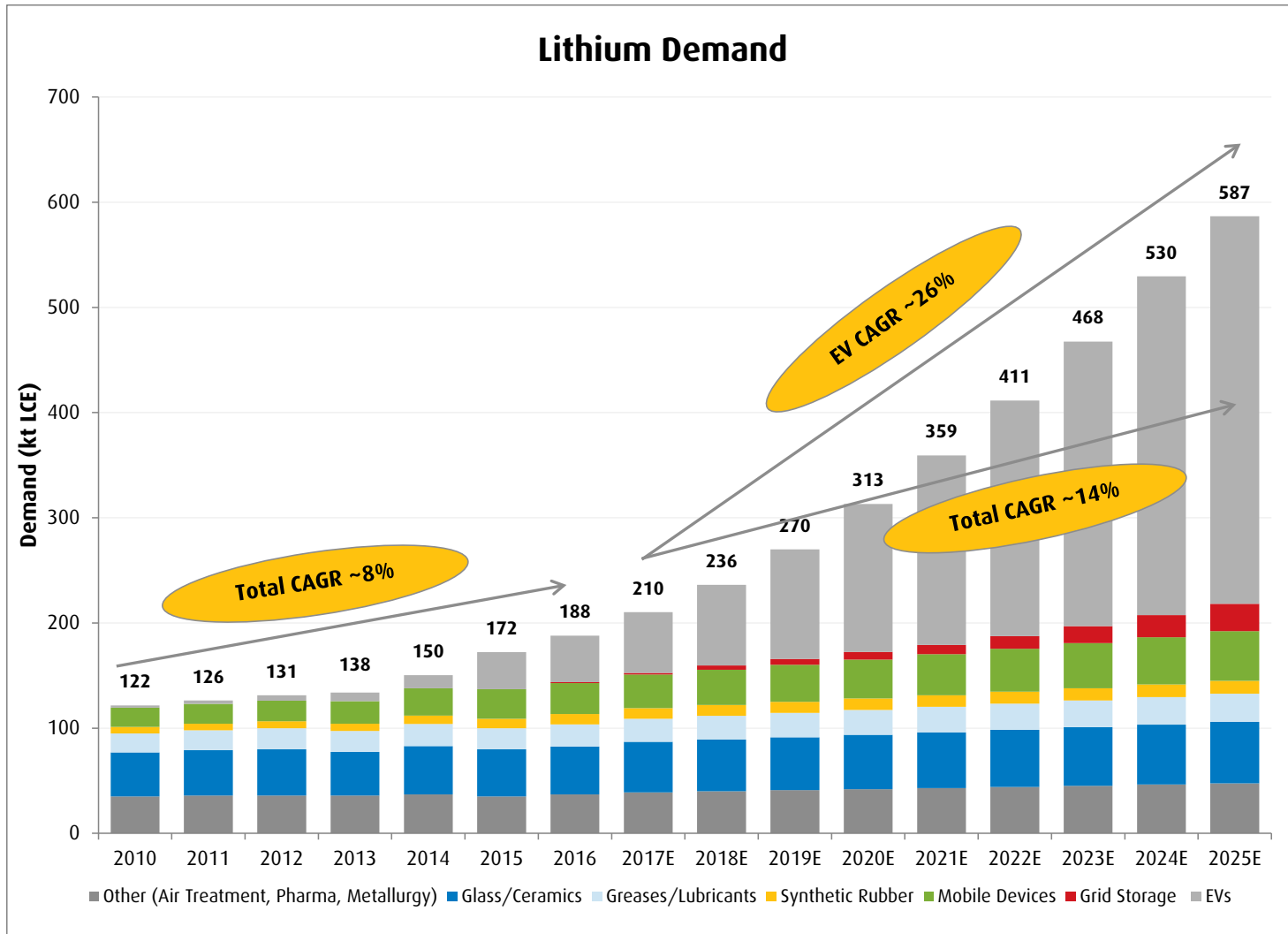
The DRC-China-Battery Power Axis Is Clear in Cobalt



Reliance on the DRC is increasing – this is a major cobalt-specific risk

Source: CDI, CRU, BMO Capital Markets

Lithium Demand Growth by Sector



Source: BMO Capital Markets, Company Reports, Industry Reports

Changing Scenarios Can Have a Major Impact on Demand

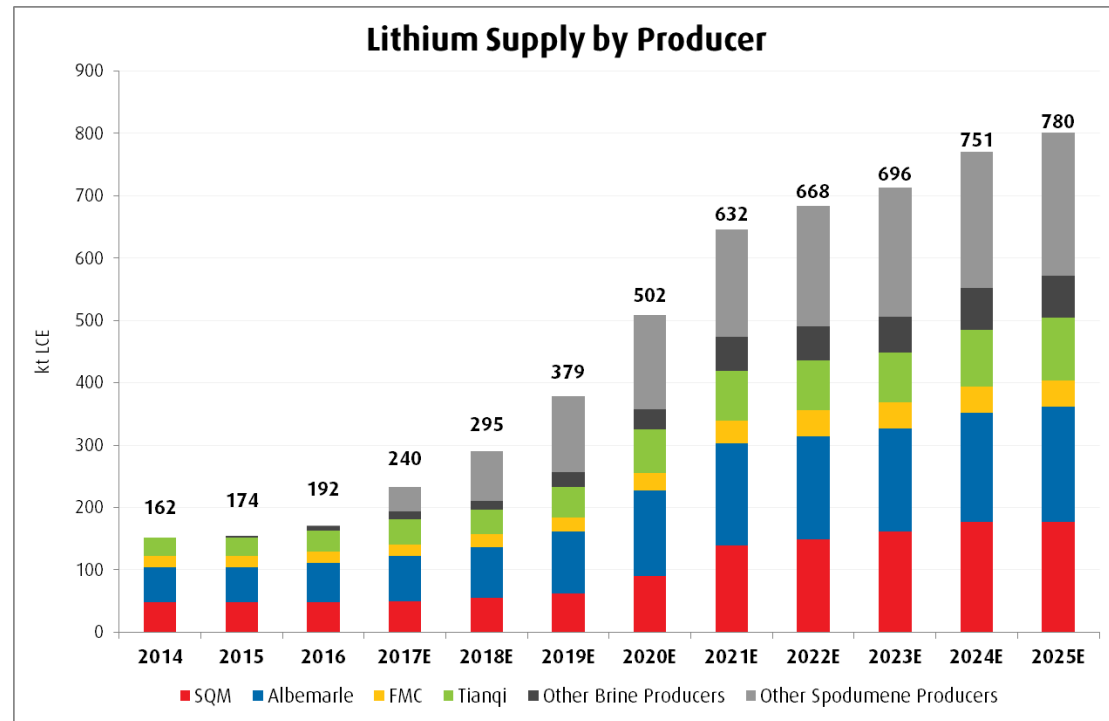
	2025 EV Sensitivity Scenarios												BMO Base Case	2017F
EV Market Penetration Rate	10%				12%				14%				10%	1.2%
<i>EV Car Sales (millions)</i>	11.0				13.2				15.4				11.0	1.2
EV Car Mix:														
BEV Market Share (%)	50%	60%	70%	80%	50%	60%	70%	80%	50%	60%	70%	80%	60%	60%
PHEV (Plug-In Hybrid) Market Share (%)	50%	40%	30%	20%	50%	40%	30%	20%	50%	40%	30%	20%	40%	40%
Blended Average Battery Pack Size (kWh)	28	38	50	59	28	38	50	59	28	38	50	59	31	29
Average BEV Battery Pack Size (kWh)	45	55	65	70	45	55	65	70	45	55	65	70	45	41
Average PHEV Battery Pack Size (kWh)	11	13	15	17	11	13	15	17	11	13	15	17	11	10
EV Car LCE Content (kg/kWh)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lithium Demand (kt LCE):														
EV (BEV+PHEV)	278	379	496	589	332	454	594	705	388	529	693	823	311	30
E-Buses ¹	57	57	57	57	57	57	57	57	57	57	57	57	57	28
Glass/Ceramics	58	58	58	58	58	58	58	58	58	58	58	58	58	48
Greases/Lubricants	27	27	27	27	27	27	27	27	27	27	27	27	27	22
Synthetic Rubber	12	12	12	12	12	12	12	12	12	12	12	12	12	10
Mobile Devices	47	47	47	47	47	47	47	47	47	47	47	47	47	32
Grid Storage	26	26	26	26	26	26	26	26	26	26	26	26	26	2
Other (Air Treatment, Pharma, Metallurgy)	48	48	48	48	48	48	48	48	48	48	48	48	48	39
Total 2025 Lithium Demand (kt LCE)	553	654	771	864	608	729	869	980	663	804	968	1098	587	210

¹2025 E-Buses demand assumes ~300K sales, 0.6kg of LCE per kWh, and 300kWh average battery pack size

Source: BMO Capital Markets, Company Reports, Industry Reports

See Sizable Lithium Supply Response Coming (~16% LCE CAGR Through 2025)

- Major incumbents roughly doubling capacity
- New Australia/Brazil spodumene mines
 - Conversion capacity becomes bottleneck?
 - DSO likely only stop-gap
- Also new brine producers in Argentina
- Forecast only assumes incumbents, funded projects in construction, and projects with incumbent partners

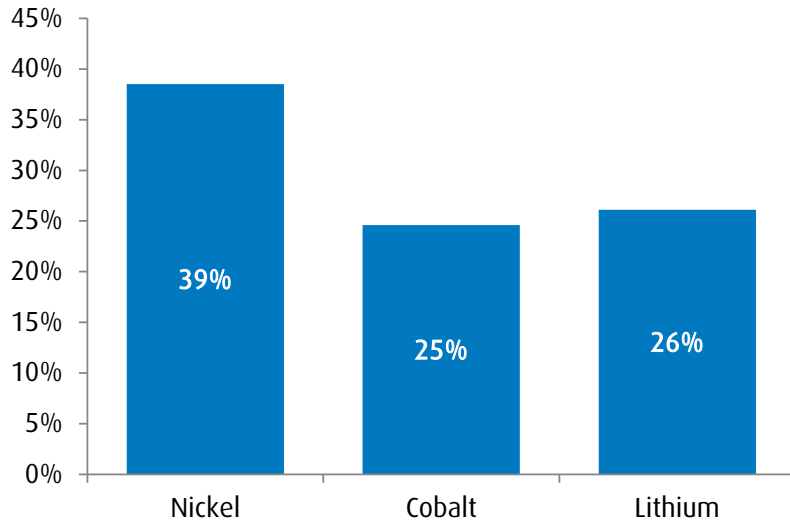


Source: BMO Capital Markets, Company Reports

Supplementary Slides

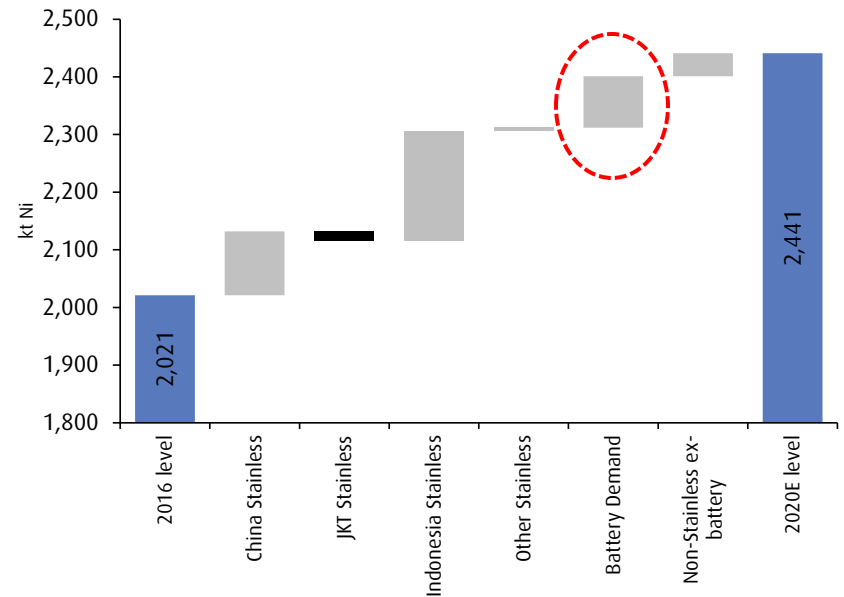
Nickel – Strong Battery Growth ... From a Low Base

EV Demand CAGR 2017-2025E



Nickel has faster EV demand growth than cobalt or lithium...

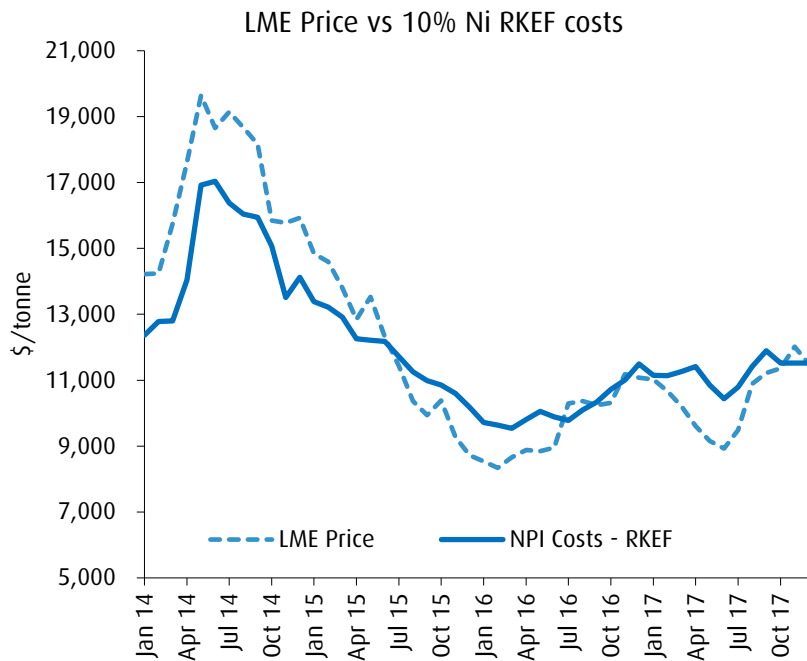
Changes in nickel demand, 2020E vs. 2016



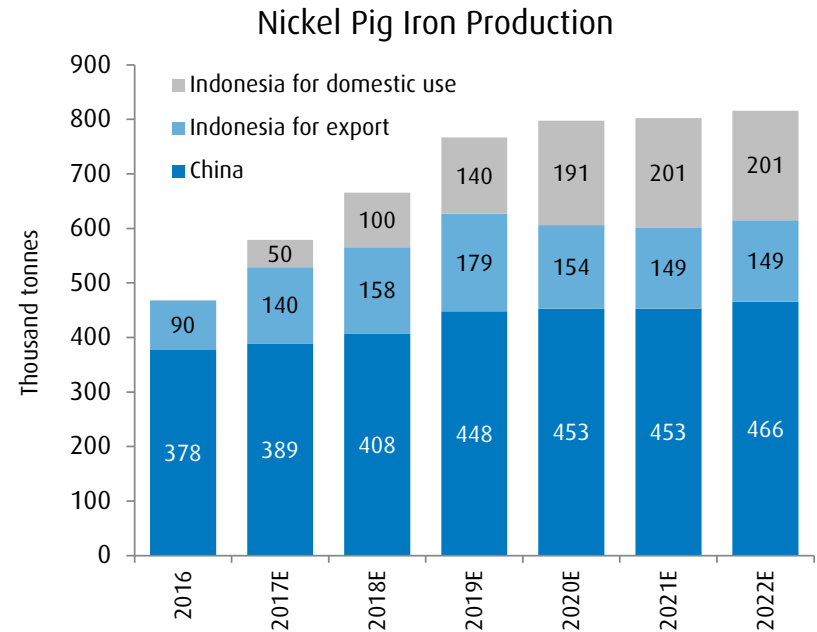
...but relative to stainless the impact is still low

Source: China Customs, BMO Capital Markets

Nickel Pig Iron Outweighs Batteries in 2018



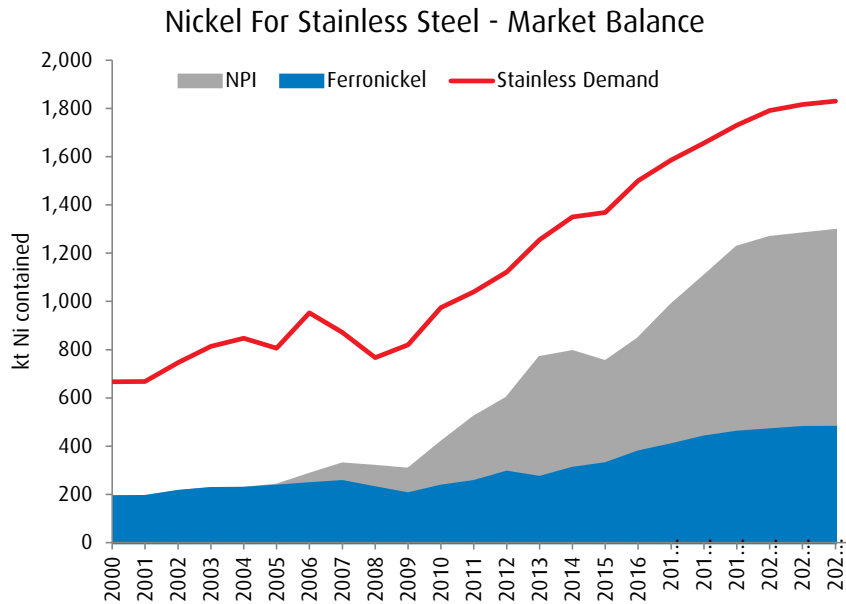
The LME price is anchored by the cost of making NPI in China...



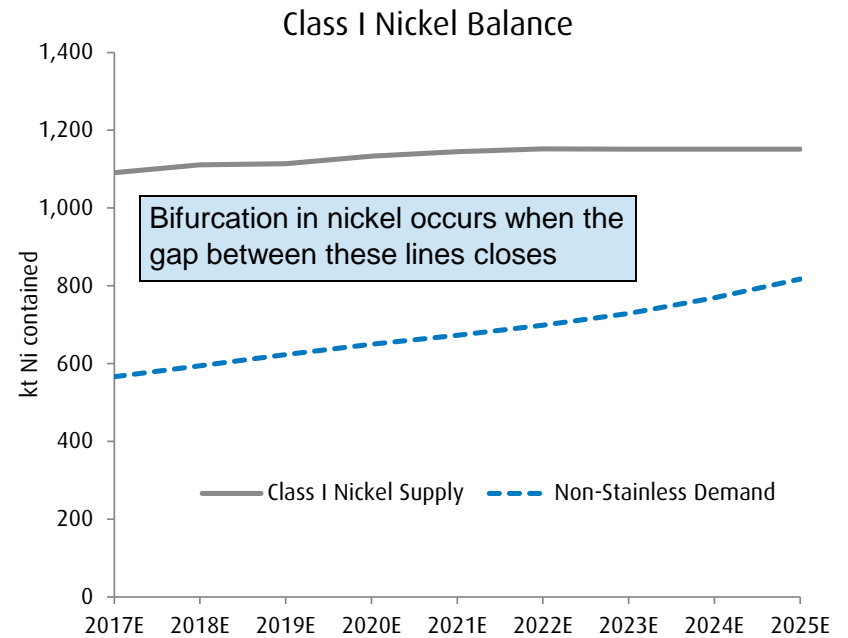
... and NPI output is accelerating once more

Source: China Customs, BMO Capital Markets

We View Nickel as Shifting to a Two-Tier Market



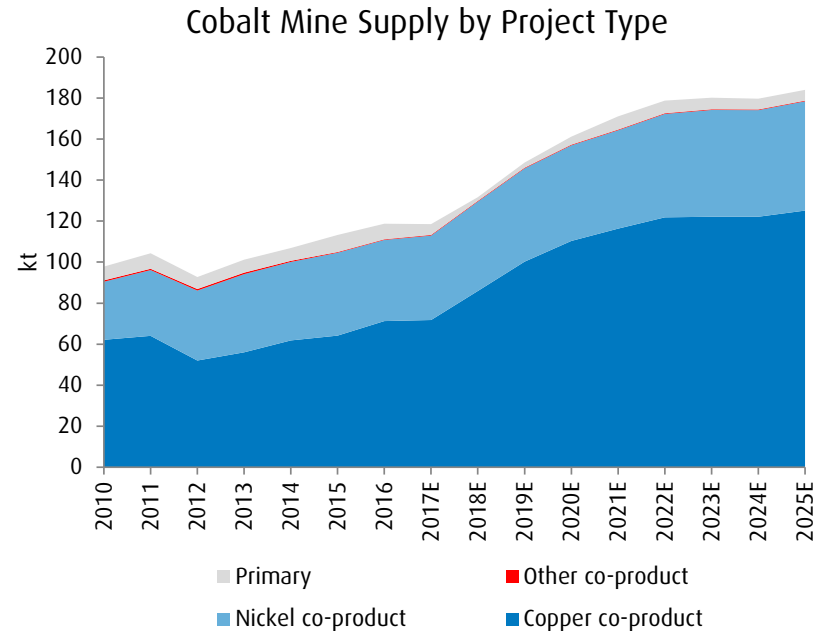
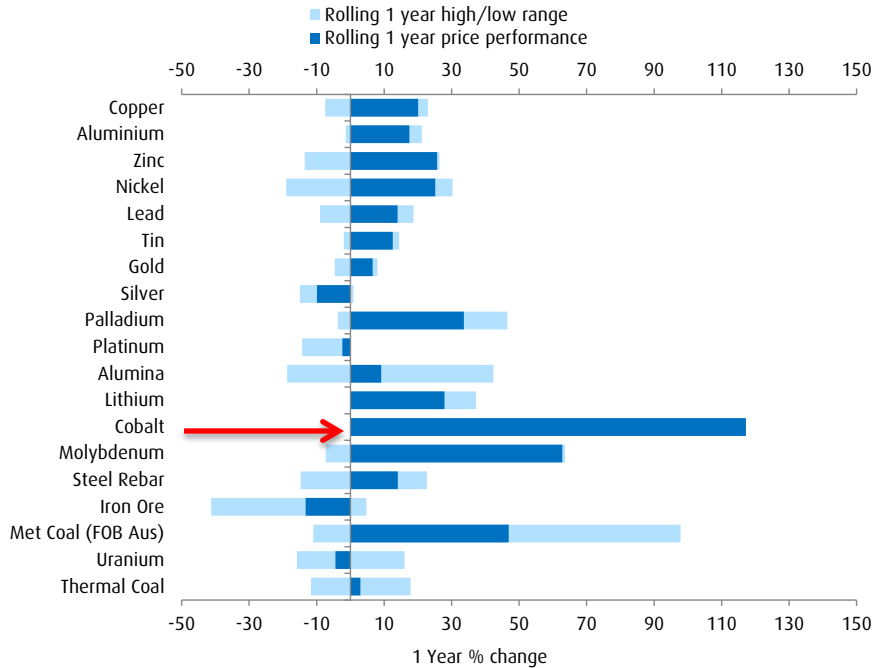
The stainless steel industry is short of the nickel units it prefers



Bifurcation in nickel occurs when the gap between these lines closes

Source: INSG, BMO Capital Markets

Cobalt Has Been the Best Performer Over the Past Year

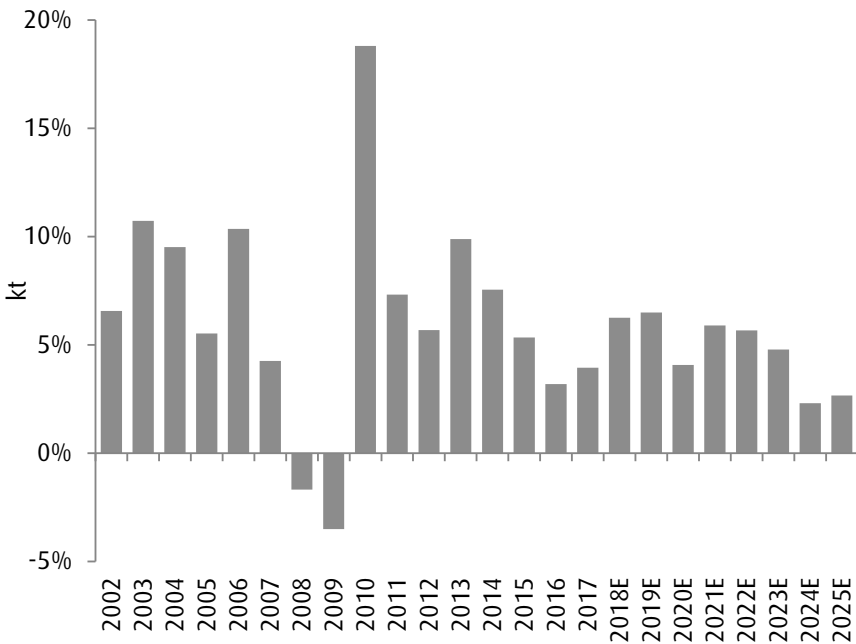


Cobalt struggles to justify project development on its own

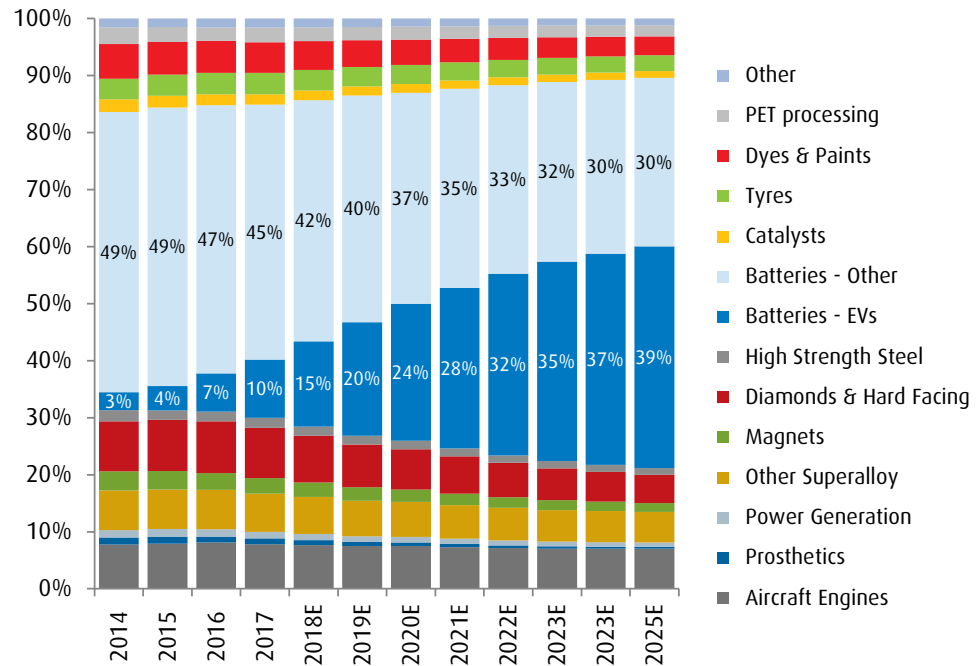
Source: Bloomberg, CDI, BMO Capital Markets

To Make Way for EV Demand Needs Aggressive Substitution

YoY cobalt demand growth



Cobalt End Use Demand

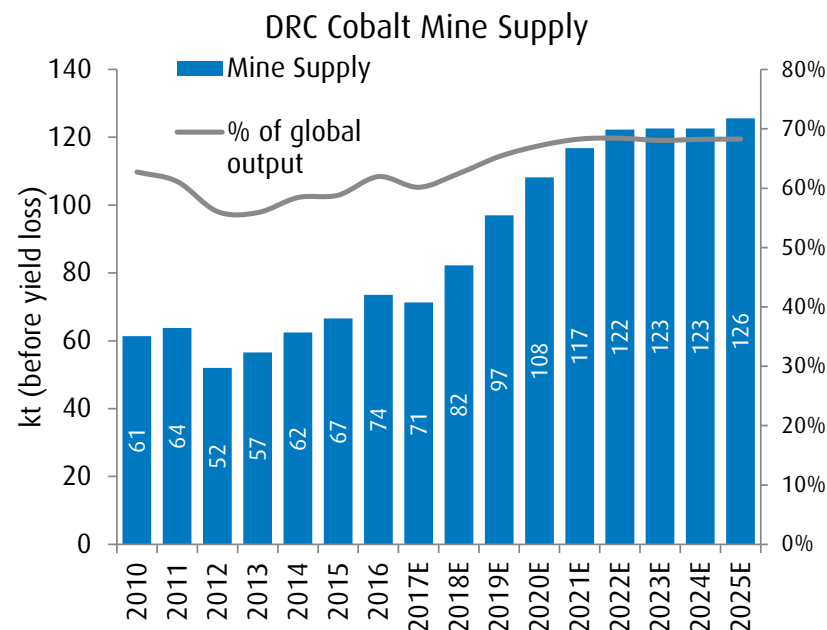
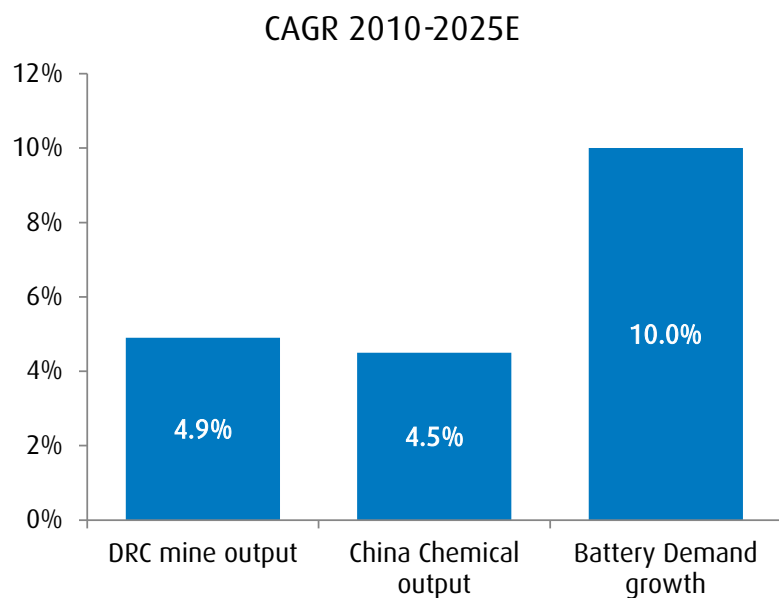


The long-term demand trend has been healthy

We anticipate EV demand surpassing portable electronics by 2023...even assuming less cobalt in cathodes

Source: CDI, CRU, BMO Capital Markets

The DRC-China-Battery Power Axis Is Clear

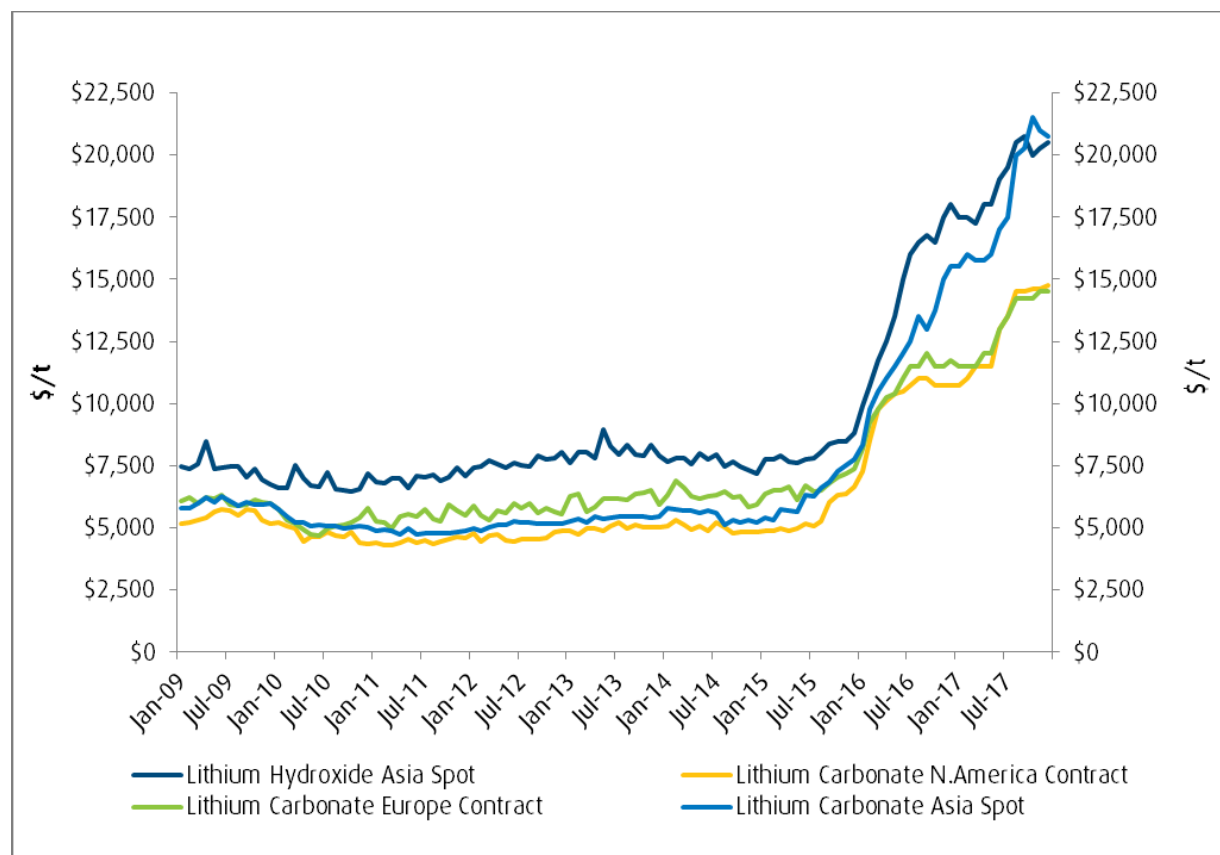


Reliance on the DRC is increasing – this is a major cobalt-specific risk

Source: CDI, CRU, BMO Capital Markets

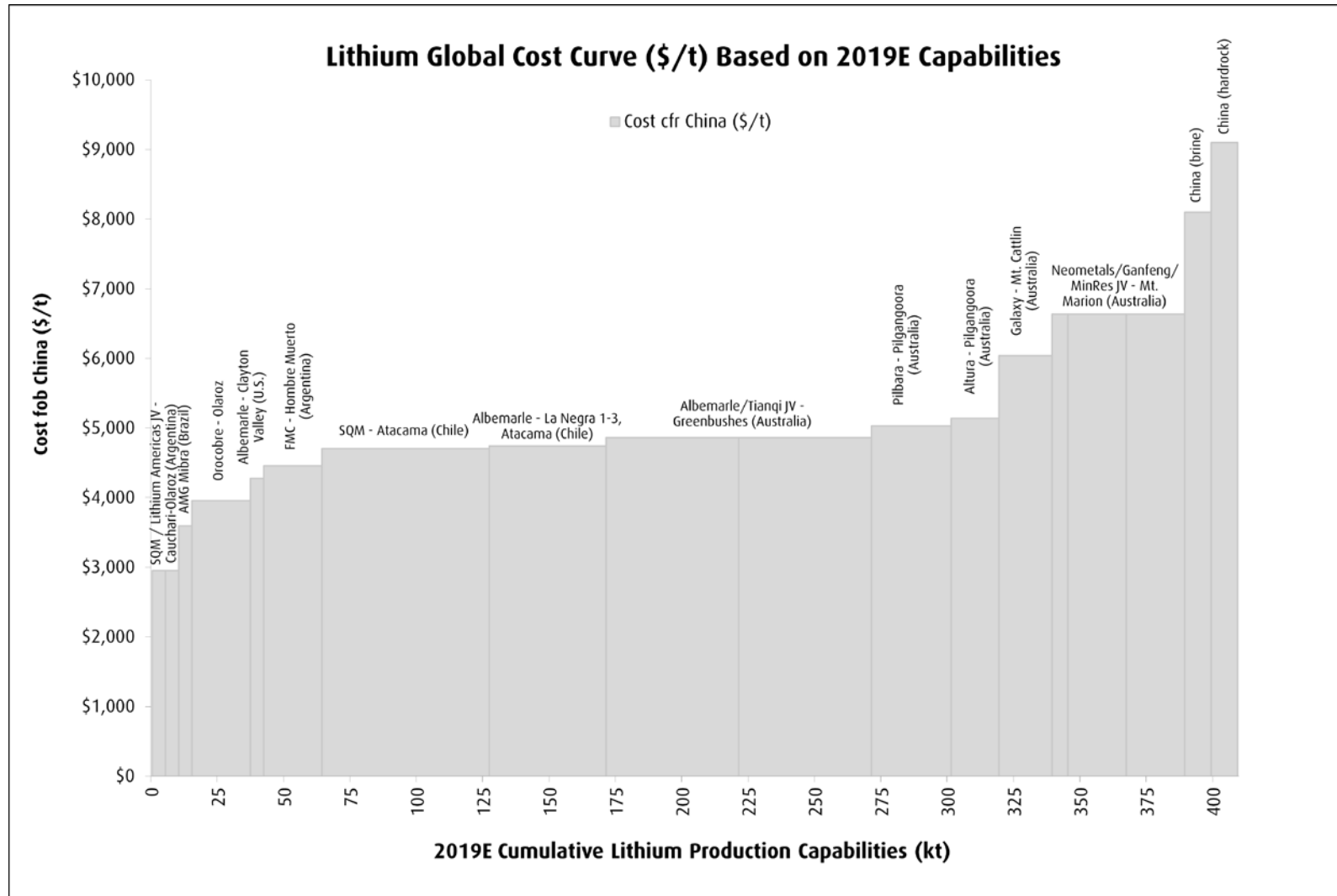
Lithium Prices Surged 2-3x Since 2015

- Demand skyrocketed on EV traction and prospects
- Supply lagged including complex constraints in Chile (recently lessened)



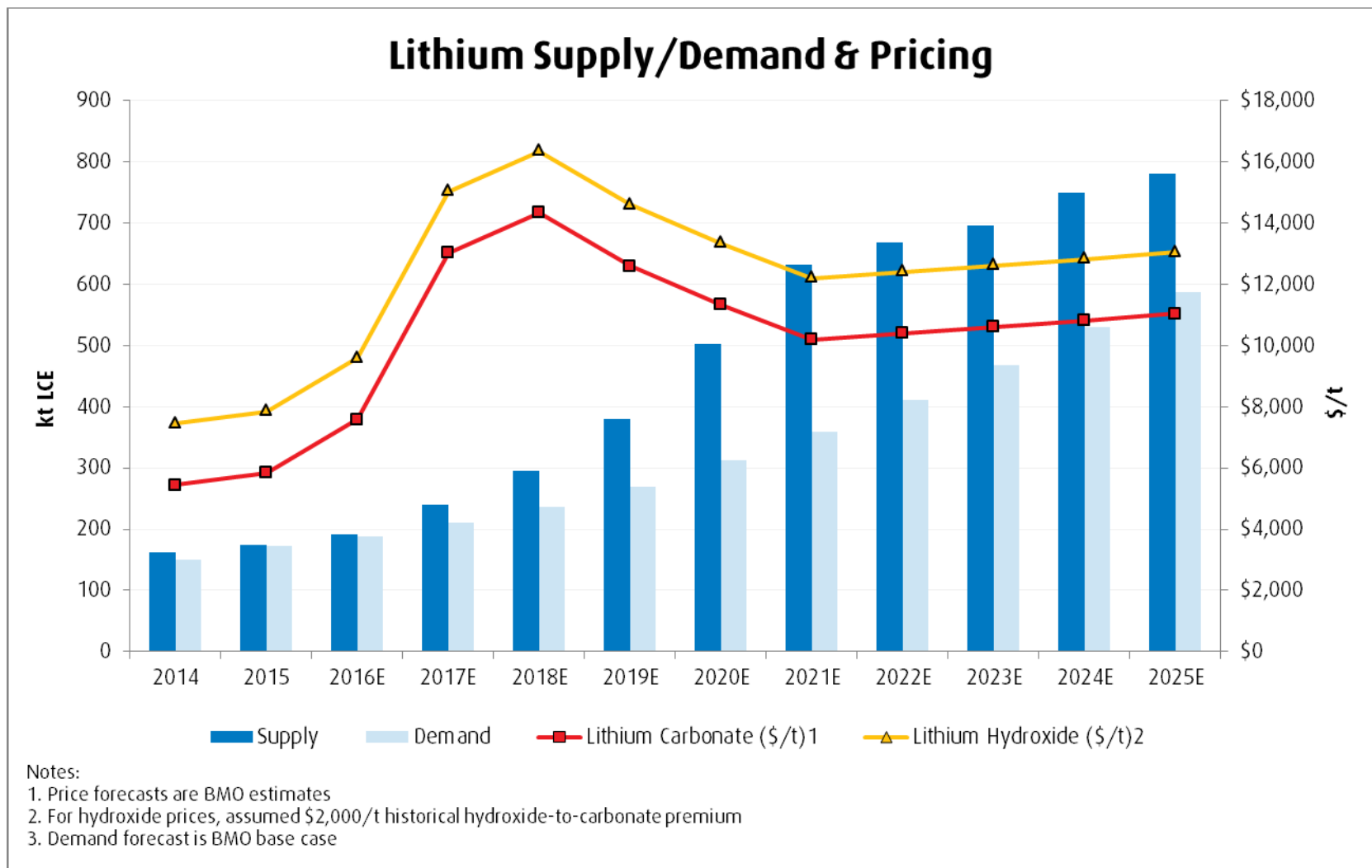
Source: Bloomberg

Expect Battery Industry Supply Chain Anxiety to Keep LCE Prices at High End of Cost Curve



Source: BMO Capital Markets, Industry Reports, Company Reports

Base Case: Expect Lithium (LCE) Prices to Rise Further, Peak in 2019, Stabilize ~\$10k/t



Source: BMO Capital Markets

Disclaimer

IMPORTANT DISCLOSURES

Analyst's Certification

I, Colin Hamilton, hereby certify that the views expressed in this report accurately reflect my personal views about the subject securities or issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Analysts who prepared this report are compensated based upon (among other factors) the overall profitability of BMO Capital Markets and their affiliates, which includes the overall profitability of investment banking services. Compensation for research is based on effectiveness in generating new ideas and in communication of ideas to clients, performance of recommendations, accuracy of earnings estimates, and service to clients.

Analysts employed by BMO Nesbitt Burns Inc. and/or BMO Capital Markets Limited are not registered as research analysts with FINRA. These analysts may not be associated persons of BMO Capital Markets Corp. and therefore may not be subject to the FINRA Rule 2241 and 2242 restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

Company Specific Disclosures

For Important Disclosures on the stocks discussed in this report, please go to http://researchglobal.bmocapitalmarkets.com/Public/Company_Disclosure_Public.aspx.

Distribution of Ratings (March 1, 2018)

Rating Category	BMO Rating	BMOCM US Universe*	BMOCM US IB Clients**	BMOCM US IB Clients***	BMOCM Universe****	BMOCM IB Clients*****	StarMine Universe
Buy	Outperform	47.3%	24.6%	55.6%	49.5%	56.6%	55.3%
Hold	Market Perform	49.4%	17.8%	42.1%	47.2%	41.6%	39.7%
Sell	Underperform	3.3%	15.0%	2.4%	3.3%	1.8%	5.0%

* Reflects rating distribution of all companies covered by BMO Capital Markets Corp. equity research analysts.

** Reflects rating distribution of all companies from which BMO Capital Markets Corp. has received compensation for Investment Banking services as percentage within ratings category.

*** Reflects rating distribution of all companies from which BMO Capital Markets Corp. has received compensation for Investment Banking services as percentage of Investment Banking clients.

**** Reflects rating distribution of all companies covered by BMO Capital Markets equity research analysts.

***** Reflects rating distribution of all companies from which BMO Capital Markets has received compensation for Investment Banking services as percentage of Investment Banking clients.

Ratings Key (as of October 2016)

We use the following ratings system definitions:

OP = Outperform - Forecast to outperform the analyst's coverage universe on a total return basis;

Mkt = Market Perform - Forecast to perform roughly in line with the analyst's coverage universe on a total return basis;

Und = Underperform - Forecast to underperform the analyst's coverage universe on a total return basis;

(S) = Speculative investment;

Spd = Suspended - Coverage and rating suspended until coverage is reinstated;

NR = No Rated - No rating at this time; and

R = Restricted - Dissemination of research is currently restricted.

BMO Capital Markets' seven Top 15 lists guide investors to our best ideas according to different objectives (CDN Large Cap, CDN Small Cap, US Large Cap, US Small Cap, Income, CDN Quant, and US Quant have replaced the Top Pick rating).

Prior BMO Capital Markets Rating System

(April 2013 – October 2016)

http://researchglobal.bmocapitalmarkets.com/documents/2013/rating_key_2013_to_2016.pdf

(January 2010 – April 2013)

http://researchglobal.bmocapitalmarkets.com/documents/2013/prior_rating_system.pdf

Other Important Disclosures

For Important Disclosures on the stocks discussed in this report, please go to http://researchglobal.bmocapitalmarkets.com/Public/Company_Disclosure_Public.aspx or write to Editorial Department, BMO Capital Markets, 3 Times Square, New York, NY 10036 or Editorial Department, BMO Capital Markets, 1 First Canadian Place, Toronto, Ontario, M5X 1H3.

Dissemination of Research

BMO Capital Markets Equity Research is available via our website <https://research-ca.bmocapitalmarkets.com/Public/Secure/Login.aspx?ReturnUrl=/Member/Home/ResearchHome.aspx>. Institutional clients may also receive our research via Thomson Reuters, Bloomberg, FactSet, and Capital IQ. Research reports and other commentary are required to be simultaneously disseminated internally and externally to our clients.

~ Research distribution and approval times are provided on the cover of each report. Times are approximations as system and distribution processes are not exact and can vary based on the sender and recipients' services. Unless otherwise noted, times are Eastern Standard and when two times are provided, the approval time precedes the distribution time.

BMO Capital Markets may use proprietary models in the preparation of reports. Material information about such models may be obtained by contacting the research analyst directly. There is no planned frequency of updates to this report.

For recommendations disseminated during the preceding 12-month period, please visit: http://researchglobal.bmocapitalmarkets.com/Public/Company_Disclosure_Public.aspx.

General Disclaimer

"BMO Capital Markets" is a trade name used by the BMO Investment Banking Group, which includes the wholesale arm of Bank of Montreal and its subsidiaries BMO Nesbitt Burns Inc., BMO Capital Markets Limited in the U.K. and BMO Capital Markets Corp. in the U.S. BMO Nesbitt Burns Inc., BMO Capital Markets Limited and BMO Capital Markets Corp are affiliates. Bank of Montreal or its subsidiaries ("BMO Financial Group") has lending arrangements with, or provide other remunerated services to, many issuers covered by BMO Capital Markets. The opinions, estimates and projections contained in this report are those of BMO Capital Markets as of the date of this report and are subject to change without notice. BMO Capital Markets endeavours to ensure that the contents have been compiled or derived from sources that we believe are reliable and contain information and opinions that are accurate and complete. However, BMO Capital Markets makes no representation or warranty, express or implied, in respect thereof, takes no responsibility for any errors and omissions contained herein and accepts no liability whatsoever for any loss arising from any use of, or reliance on, this report or its contents. Information may be available to BMO Capital Markets or its affiliates that is not reflected in this report. The information in this report is not intended to be used as the primary basis of investment decisions, and because of individual client objectives, should not be construed as advice designed to meet the particular investment needs of any investor. Nothing herein constitutes any investment, legal, tax or other advice nor is it to be relied on in any investment or decision. If you are in doubt about any of the contents of this document, the reader should obtain independent professional advice. This material is for information purposes only and is not an offer to sell or the solicitation of an offer to buy any security. BMO Capital Markets or its affiliates will buy from or sell to customers the securities of issuers mentioned in this report on a principal basis. BMO Capital Markets or its affiliates, officers, directors or employees have a long or short position in many of the securities discussed herein, related securities or in options, futures or other derivative instruments based thereon. The reader should assume that BMO Capital Markets or its affiliates may have a conflict of interest and should not rely solely on this report in evaluating whether or not to buy or sell securities of issuers discussed herein.

Additional Matters

To Canadian Residents: BMO Nesbitt Burns Inc. furnishes this report to Canadian residents and accepts responsibility for the contents herein subject to the terms set out above. Any Canadian person wishing to effect transactions in any of the securities included in this report should do so through BMO Nesbitt Burns Inc.

The following applies if this research was prepared in whole or in part by Andrew Breichmanas, Colin Hamilton, Sanam Nourbakhsh, Alexander Pearce, David Round, Edward Sterck or Brendan Warn: This research is not prepared subject to Canadian disclosure requirements. This research is prepared by BMO Capital Markets Limited and subject to the regulations of the Financial Conduct Authority (FCA) in the United Kingdom. FCA regulations require that a firm providing research disclose its ownership interest in the issuer that is the subject of the research if it and its affiliates own 5% or more of the equity of the issuer. Canadian regulations require that a firm providing research disclose its ownership interest in the issuer that is the subject of the research if it and its affiliates own 1% or more of the equity of the issuer that is the subject of the research. Therefore BMO Capital Markets Limited will disclose its and its affiliates' ownership interest in the subject issuer only if such ownership exceeds 5% of the equity of the issuer.

To E.U. Residents: In an E.U. Member State this document is issued and distributed by BMO Capital Markets Limited which is authorised and regulated in the UK and operates in the E.U. on a passported basis. This document is only intended for Eligible Counterparties or Professional Clients, as defined in Annex II to "Markets in Financial Instruments Directive" 2014/65/EU ("MiFID II").

Singapore: This disclaimer applies to research reports distributed by the Private Banking unit of Bank of Montreal, Singapore Branch ("BMO SG"), an exempt financial adviser under the Financial Advisers Act (Cap. 110) of Singapore ("FAA") only. This research report is prepared by BMO Capital Markets and distributed by BMO SG pursuant to an arrangement under regulation 32C of the Financial Advisers Regulations of Singapore. This research report is distributed by BMO SG solely to persons who qualify as accredited investors as defined in the FAA only, and is not intended for and may not be circulated to the general public. This report and any information contained in this report shall not be disclosed to any other person. If you are not an accredited investor, please disregard this report. BMO SG does not accept legal responsibility for the contents of the report. Recipients should contact BMO SG at 65-6535 2323 for matters arising from, or in connection with the report.

To U.S. Residents: BMO Capital Markets Corp. furnishes this report to U.S. residents and accepts responsibility for the contents herein, except to the extent that it refers to securities of Bank of Montreal. Any U.S. person wishing to effect transactions in any security discussed herein should do so through BMO Capital Markets Corp.

To U.K. Residents: In the UK this document is published by BMO Capital Markets Limited which is authorised and regulated by the Financial Conduct Authority. The contents hereof are intended solely for the use of, and may only be issued or passed on to, (I) persons who have professional experience in matters relating to investments falling within Article 19(5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (the "Order") or (II) high net worth entities falling within Article 49(2)(a) to (d) of the Order (all such persons together referred to as "relevant persons"). The contents hereof are not intended for the use of and may not be issued or passed on to retail clients.

These documents are provided to you on the express understanding that they must be held in complete confidence and not republished, retransmitted, distributed, disclosed, or otherwise made available, in whole or in part, directly or indirectly, in hard or soft copy, through any means, to any person, except with the prior written consent of BMO Capital Markets.

[Click here](#) for data vendor disclosures when referenced within a BMO Capital Markets research document.

ADDITIONAL INFORMATION IS AVAILABLE UPON REQUEST

BMO Financial Group (NYSE, TSX: BMO) is an integrated financial services provider offering a range of retail banking, wealth management, and investment and corporate banking products. BMO serves Canadian retail clients through BMO Bank of Montreal and BMO Nesbitt Burns. In the United States, personal and commercial banking clients are served by BMO Harris Bank N.A., (Member FDIC). Investment and corporate banking services are provided in Canada and the US through BMO Capital Markets.

BMO Capital Markets is a trade name used by BMO Financial Group for the wholesale banking businesses of Bank of Montreal, BMO Harris Bank N.A, (Member FDIC), BMO Ireland Plc, and Bank of Montreal (China) Co. Ltd. and the institutional broker dealer businesses of BMO Capital Markets Corp. (Member SIPC) in the U.S., BMO Nesbitt Burns Inc. (Member Canadian Investor Protection Fund) in Canada, Europe and Asia, BMO Capital Markets Limited in Europe and Australia and BMO Advisors Private Limited in India.

"Nesbitt Burns" is a registered trademark of BMO Nesbitt Burns Corporation Limited, used under license. "BMO Capital Markets" is a trademark of Bank of Montreal, used under license. "BMO (M-Bar roundel symbol)" is a registered trademark of Bank of Montreal, used under license.

© Registered trademark of Bank of Montreal in the United States, Canada and elsewhere.
TM Trademark Bank of Montreal

©COPYRIGHT 2018 BMO CAPITAL MARKETS CORP.

A member of BMO  Financial Group