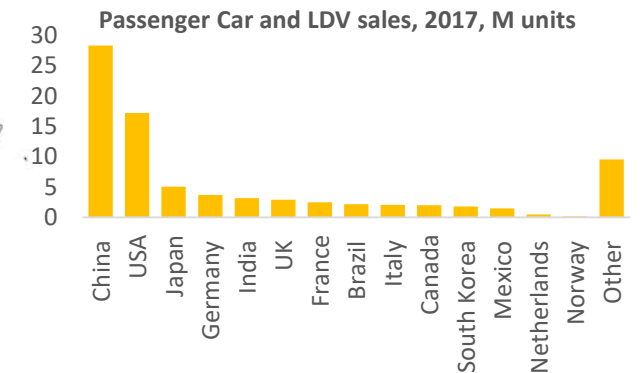
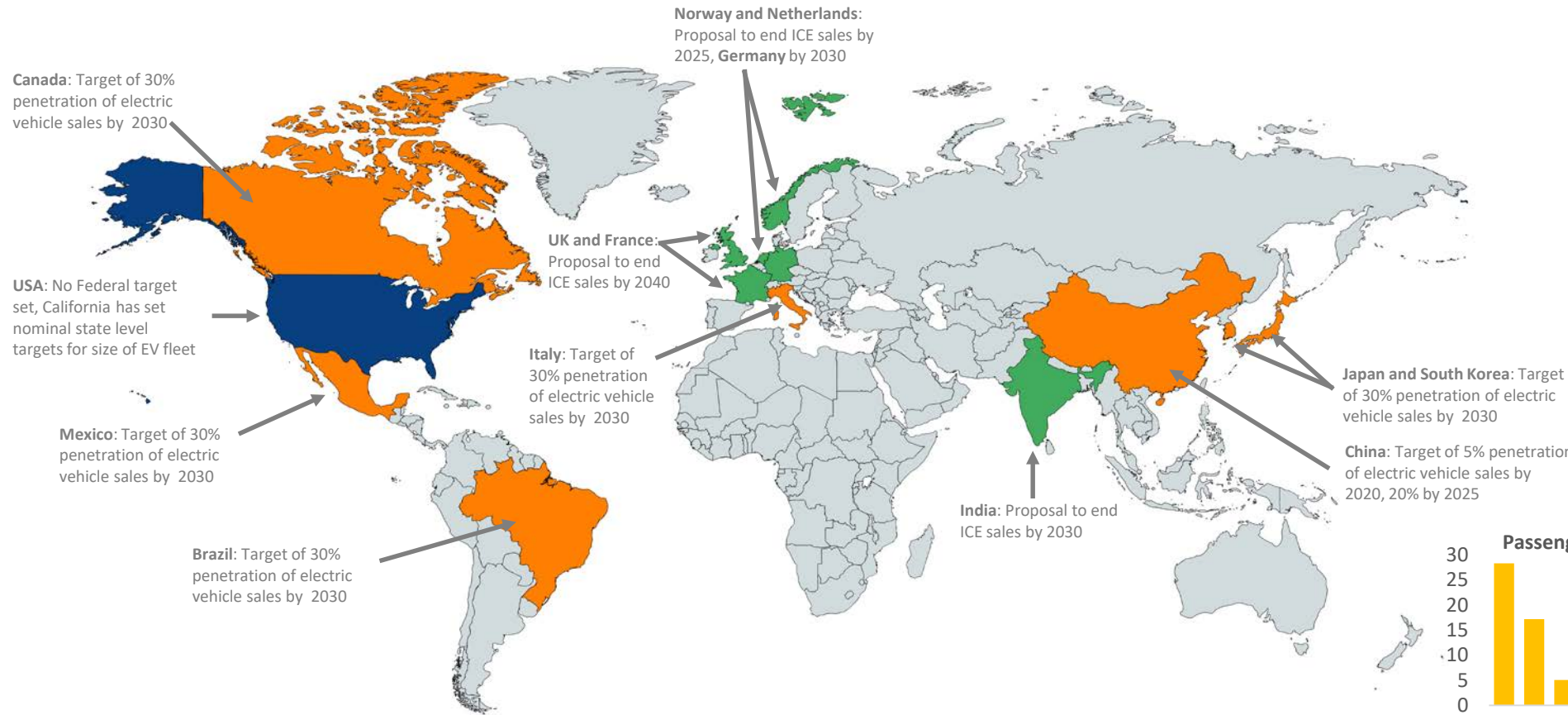


Benchmark Mineral Intelligence

Challenges Facing the Mining Industry

May 2018 – Andrew Leyland, Head of Forecasting

Global policy statements by governments supporting EV adoption



Major passenger car and light duty vehicle OEM EV strategy announcements

Total annual vehicle production

10-12M

5-9m

1-4M

Launching 12 EV models by 2022



GM planning to introduce at least 20 EVs by 2023



Ford is planning to invest \$11Bn in EVs by 2022, and will have 40 hybrid and full EV models

Chinese OEMs expected to comply with 20% EV penetration rate ruling by 2025



VW group plans to invest more than \$24bn in zero-emission vehicles by 2030. Will develop 80 EV models by 2025, wants to offer an electric version of each of its 300 models by 2030



Toyota has set a sales target of around 1m EVs and fuel-cell vehicles (FCVs) by 2030, investment \$13 billion to develop and make batteries

Aiming to develop 8 EV models by 2025, with 30 planned by 2030



Has set a target of two thirds of vehicle sales EV by 2030



BMW plans to deliver 12 pure EVs by 2025



PSA aims to develop at least 40 electric vehicles by 2025



Daimler will bring 10 pure EVs to the market by 2022

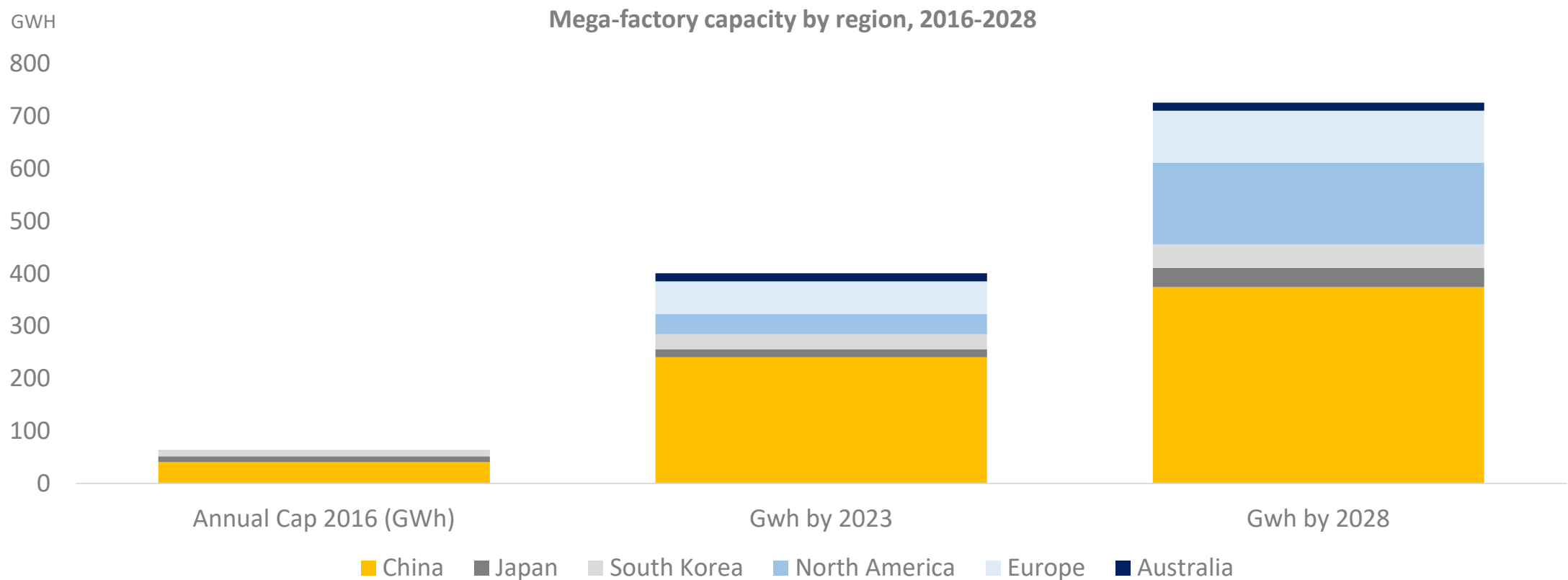
2022

2025
EV strategy timeline

2030

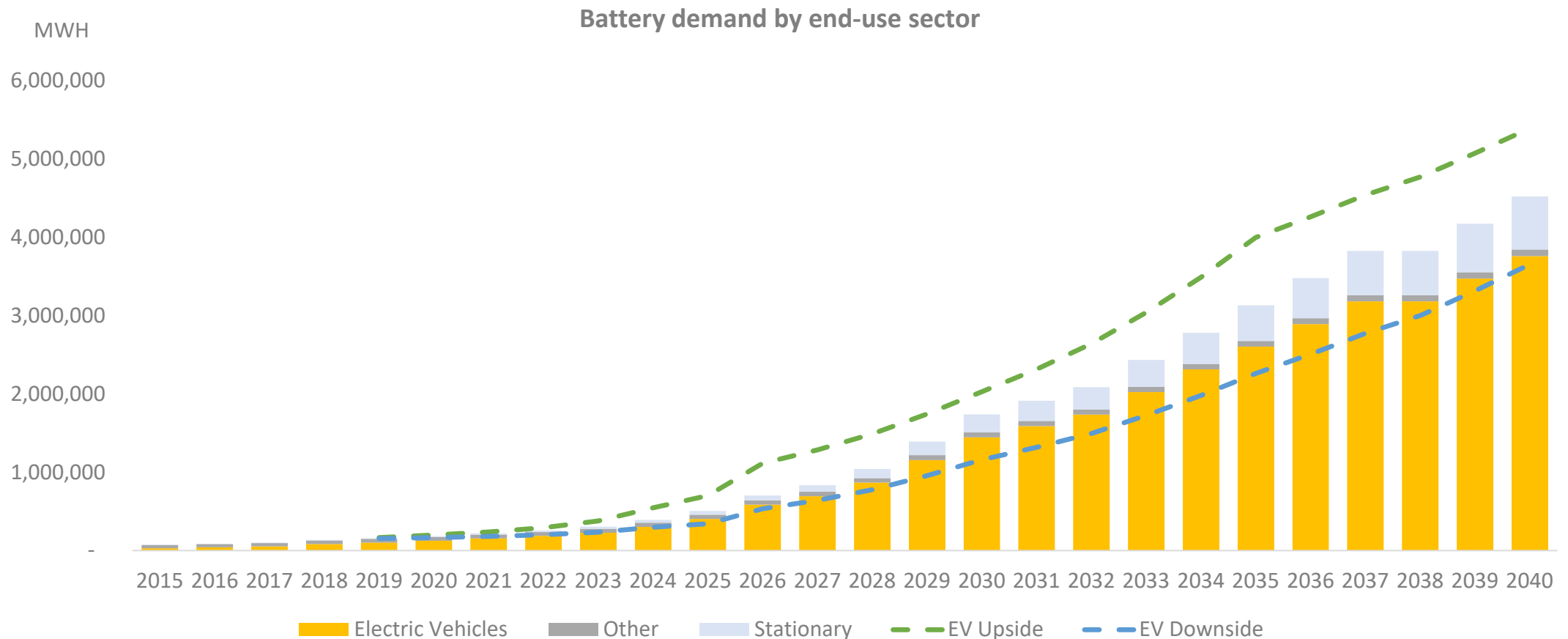
Major Giga-factory investments until 2028

In order to meet higher battery demand new Giga-factory capacity will need to be added. In this slide we summarise by country where new mega-factory supply is likely to be added, as we can see the majority of capacity will be added in China and North America.



Lithium-ion battery demand by end use sector to 2040

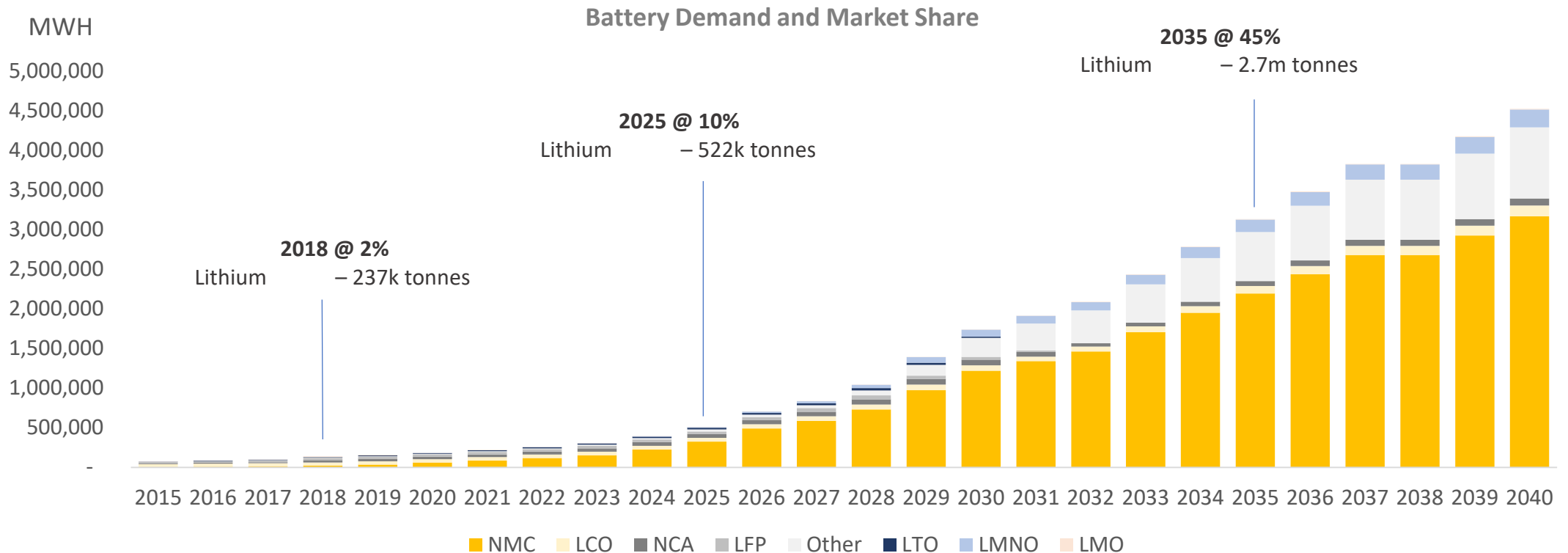
The chart below outlines the key drivers of demand for lithium ion batteries over the forecast period. As can be seen the major growth area is for electric vehicles (EVs), followed by stationary (grid) applications.



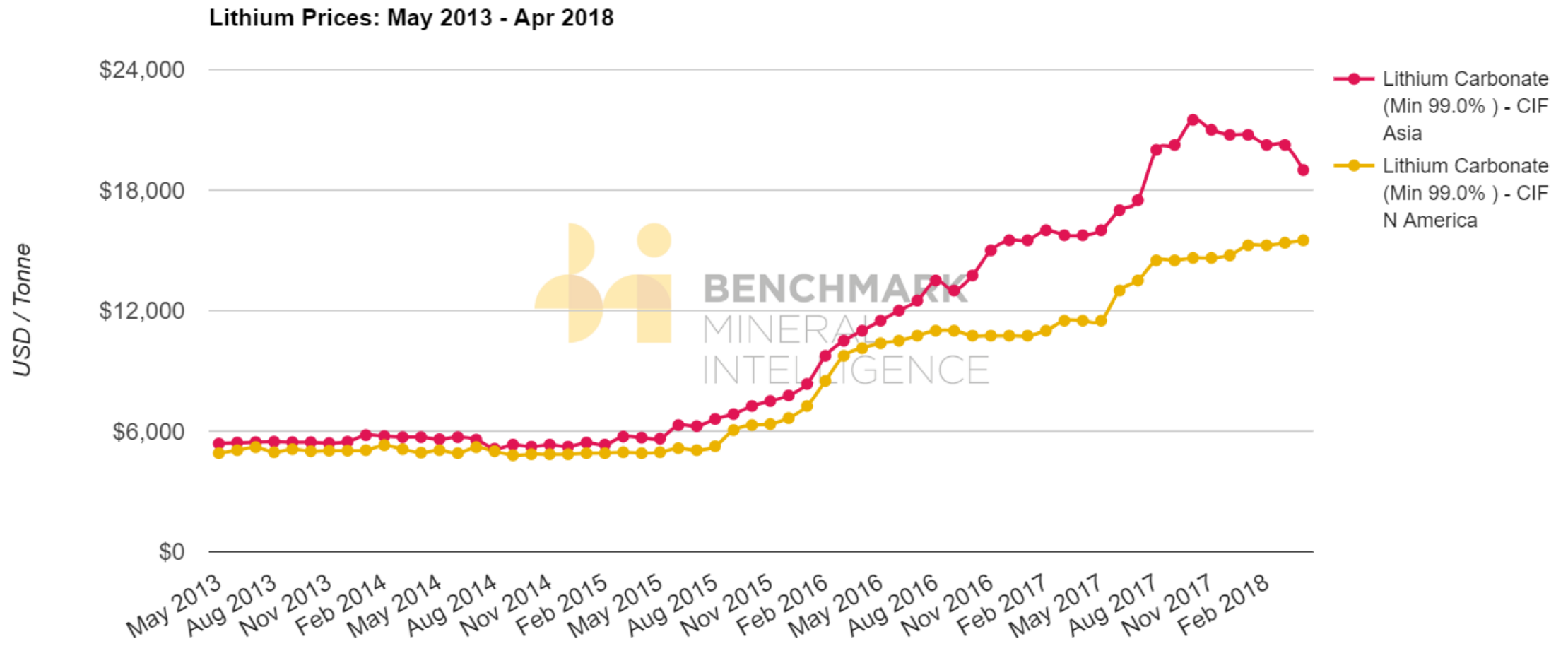
Lithium Forecasts and Challenges

Oversupply isn't as bad as many make out

- Battery grade lithium shortages, growth in pipeline inventory and chemical production capacities still create bottlenecks
- Unlike EVs, Batteries or Cathodes the mining industry is currently failing to finance this part of the supply chain
- This could lead to more investment from downstream companies, and ultimately, lower margins



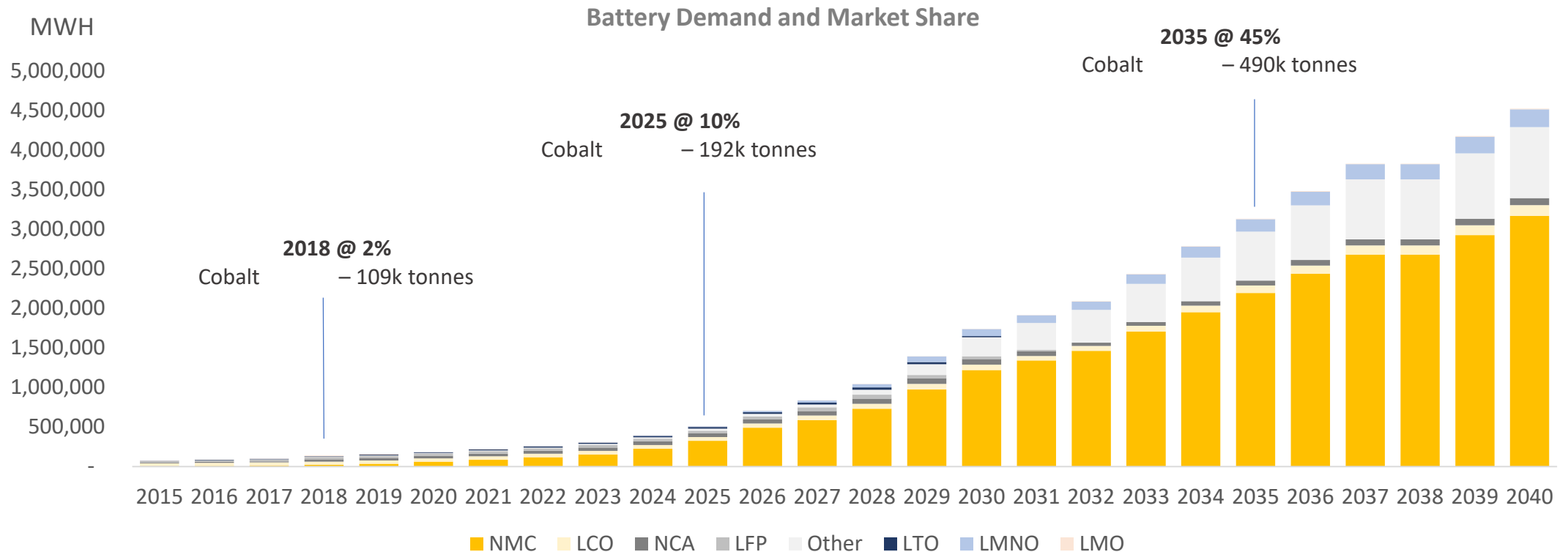
Lithium Prices Need to Incentivise Future Production



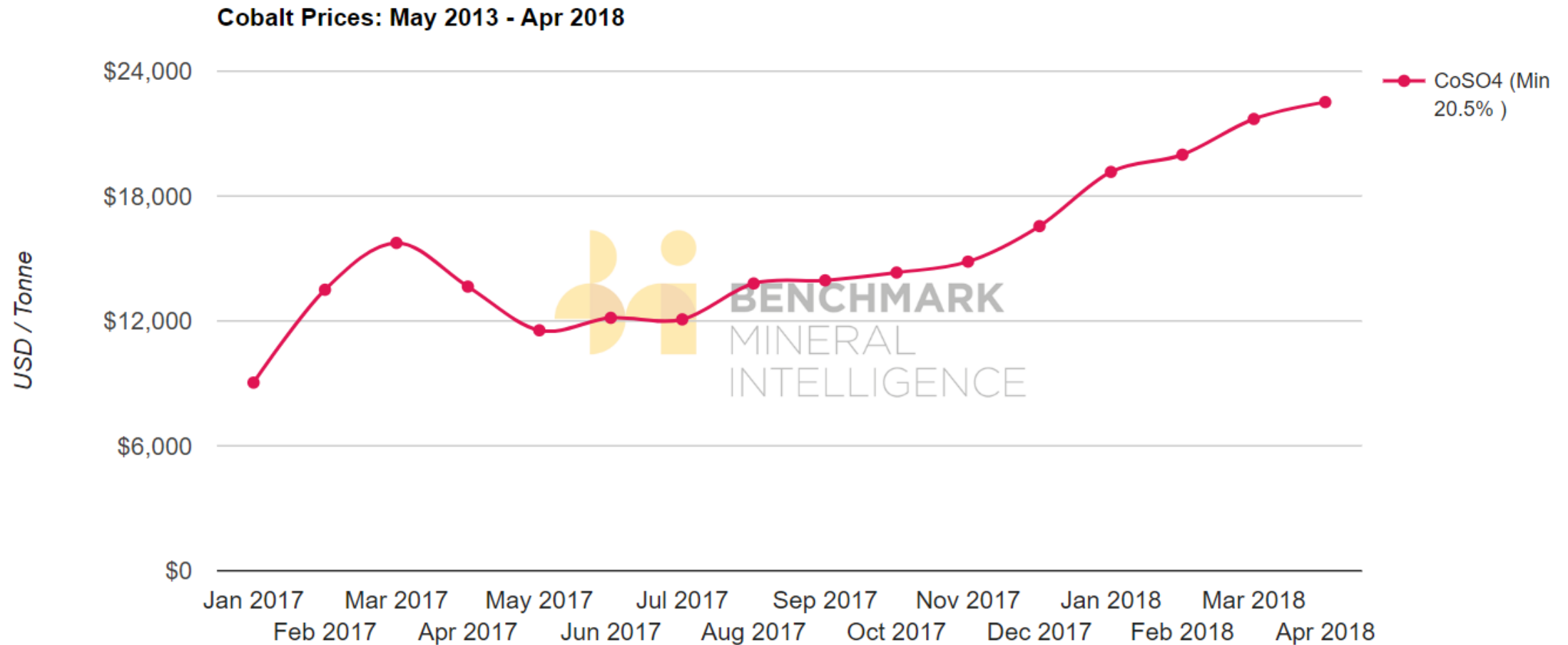
Cobalt Forecasts and Challenges

Could cobalt derail the EV revolution – and impact lithium demand?

- Even with all announced new supply the market reaches a structural deficit in 2024
- Substitution to low cobalt grades isn't enough to keep the market in balance
- Where are all the junior miners!!



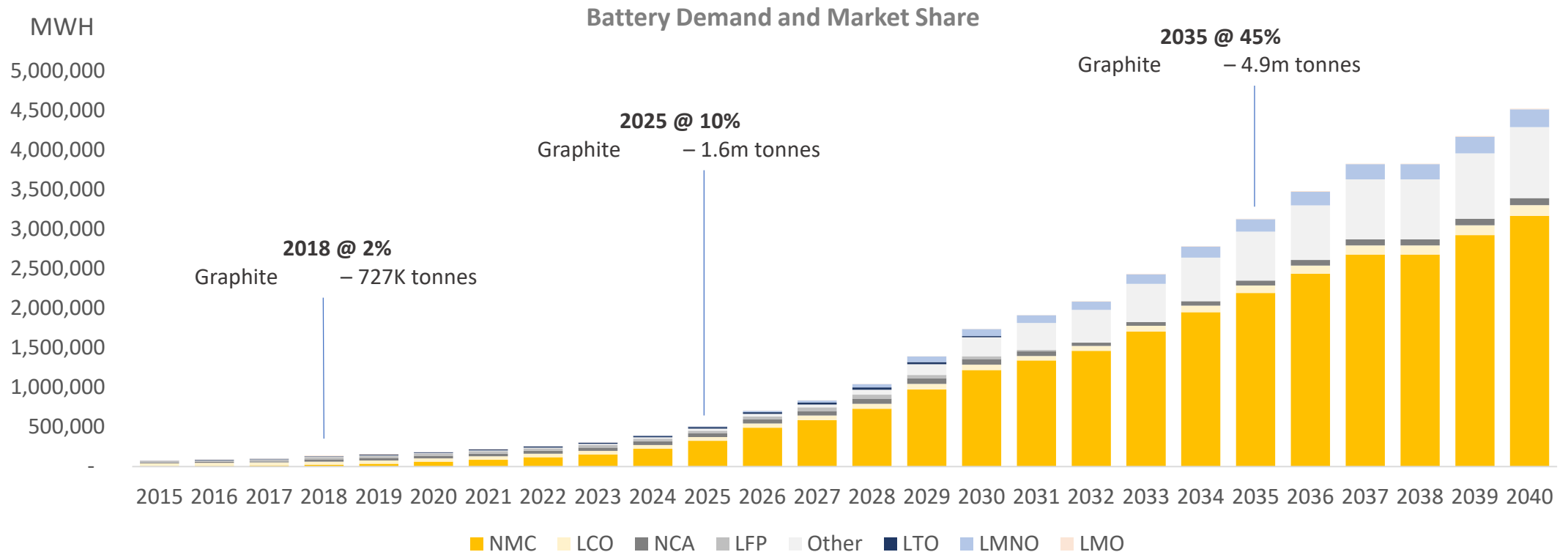
Cobalt Prices – Threatening Demand Destruction?



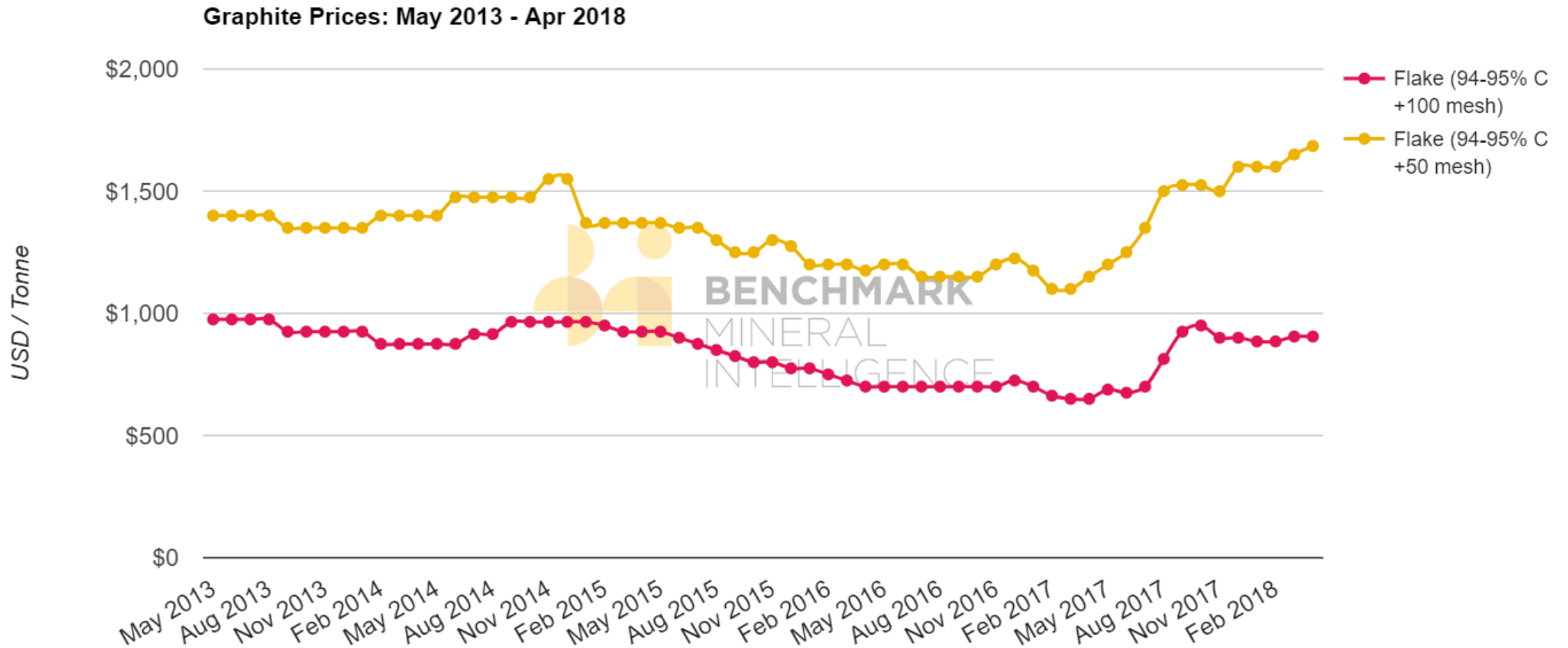
Graphite Forecasts and Challenges

Can the mining industry keep up?

- Structural deficit reached in 2026, assuming most current projects are funded
- Some substitution risk from silicon, solid state and manufacturing advances
- Graphite offers a number of opportunities for private equity and junior miners seeking limited financing



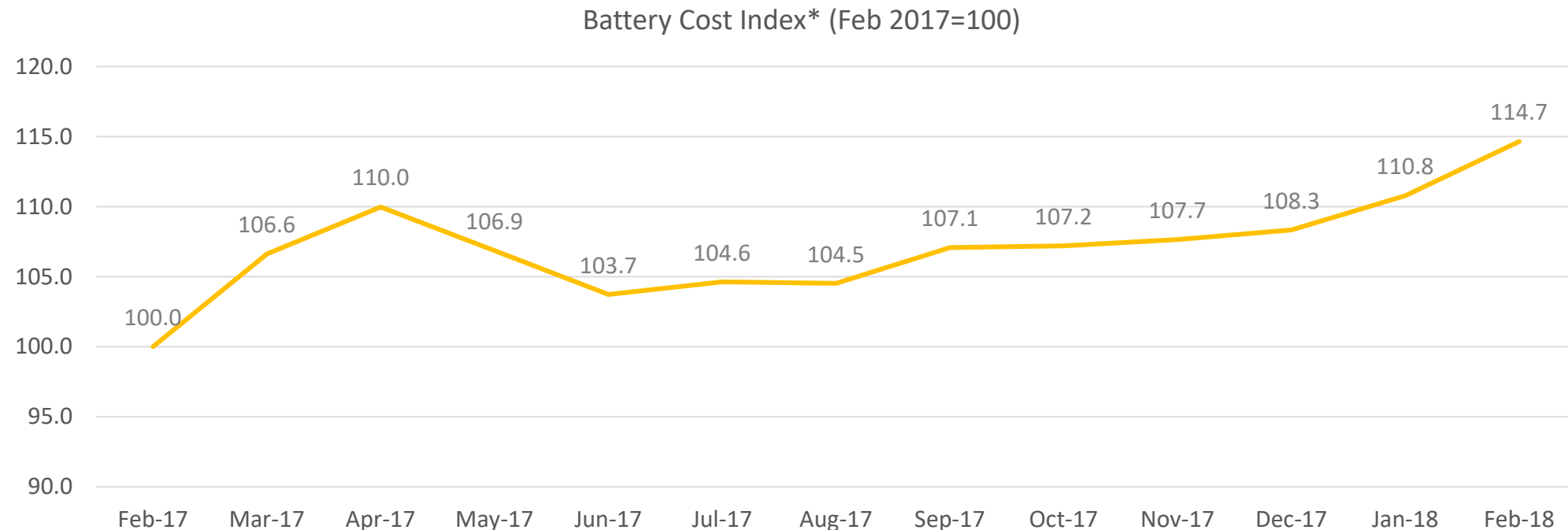
Graphite Prices Near All Time Highs



Can Battery Costs Continue to Fall?

Benchmark Mineral's Battery Cost Index

- A base case cell with an NMC 111 cathode was modeled to reflect the price changes of cobalt, lithium, and graphite from February 2017 to February 2018
- Battery costs have risen up to 14% from material price swings in high cobalt content chemistries
- As economies of scale diminish raw material costs and cathode chemistries will drive battery prices, and could ultimately impact on EV penetration levels



*Source: Benchmark Mineral's Li-ion Battery Cost Model

2040 Forecast Reports

Leading analysis from the most connected supplier

Our innovative Forecast Reports provide a clear picture of the current supply landscape and a flexible demand model to enable you to see the impact of changing battery technologies and electric vehicle adoption rates

The Quarterly Report Includes:

- Full Supply and Demand Balances, inclusive of Stock Changes
- Cost Curves for 2018, 2025, 2030 and 2035
- Incentive Price Forecasts
- Supply Chain Updates on Mega Factories and Conversion Capacity
- Access to our Global Analyst Team

