



REPORT SAMPLE

ESS Price Forecasting Report

Q2 2024



ESS Price Forecasting Report

Ongoing supply chain issues, changing global market dynamics, and the rising demand for energy storage solutions are leading to challenges for buyers of energy storage system (ESS) equipment. To navigate this complex landscape, companies need a reliable tool to predict future cost and pricing trends. This is the driving force behind Clean Energy Associates' ESS Price Forecasting Report (PFR).

Released quarterly, the ESS PFR offers a comprehensive four-year cost and pricing outlook for Lithium Iron Phosphate (LFP) and Nickel Manganese Cobalt (NMC) battery containerized systems. This report is grounded in leading technology and material platforms, and it incorporates vital data on input material price and supply outlooks, market bottlenecks, and demand analysis to support its cost and price forecasts.

The ESS PFR is a crucial resource for decision-makers aiming to make well-informed choices in the ever-evolving energy storage industry. With detailed insights into containerized system price stacks, including forecasted "all-in" pricing and baseline price outlooks tailored to specific markets, subscribers are equipped with the knowledge they need to stay ahead.

In this report you will find:

- **Cost & Pricing Outlook:** Four-year forecast for battery cell, DC container, and lithium pricing
- **Market Analysis:** Insights into supply, demand, and market bottlenecks.
- **Cost and Price Stacks:** Detailed "all-in" cost and pricing breakdowns.
- **Data-Driven Accuracy:** Proprietary methodologies backed by CEA expertise.

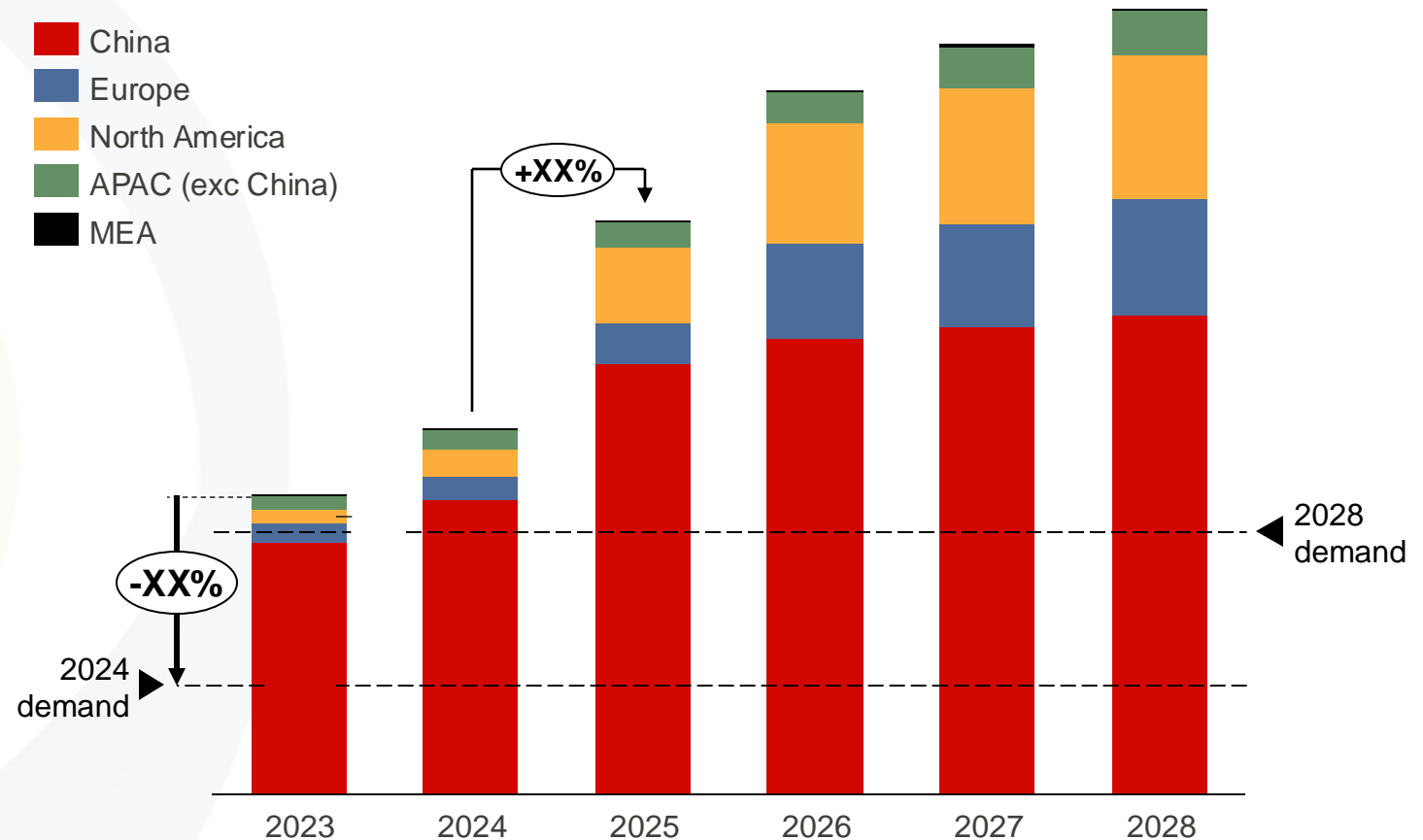
Global lithium-ion battery supply/demand remains out of balance

Oversupply issues of today maintained throughout the outlook period

What changed?

- Near to mid-term EV outlook witnessed a decline as multiple OEMs have reduced their EV production targets with growing uncertainty regarding restrictive policies against China.
- Overcapacity in China remains, leading to declining battery prices, although no new capacity expansion plan was announced in Q2 2024.
- Chinese suppliers are expanding in overseas market, especially in SEA and MEA markets as U.S.-China EV trade war continues to intensify and countries like Morocco and Indonesia have free trade agreement with U.S. and Europe.
- ESS battery demand continues to grow as 32 GWh of BESS was installed globally in Q1 2024, representing a xx% Y-o-Y increase.
- Cell and system supply is strengthening owing to plummeting LFP cell prices and growing availability of Chinese ESS cell supply.

Global LiB nameplate cell production capacity (GWh)



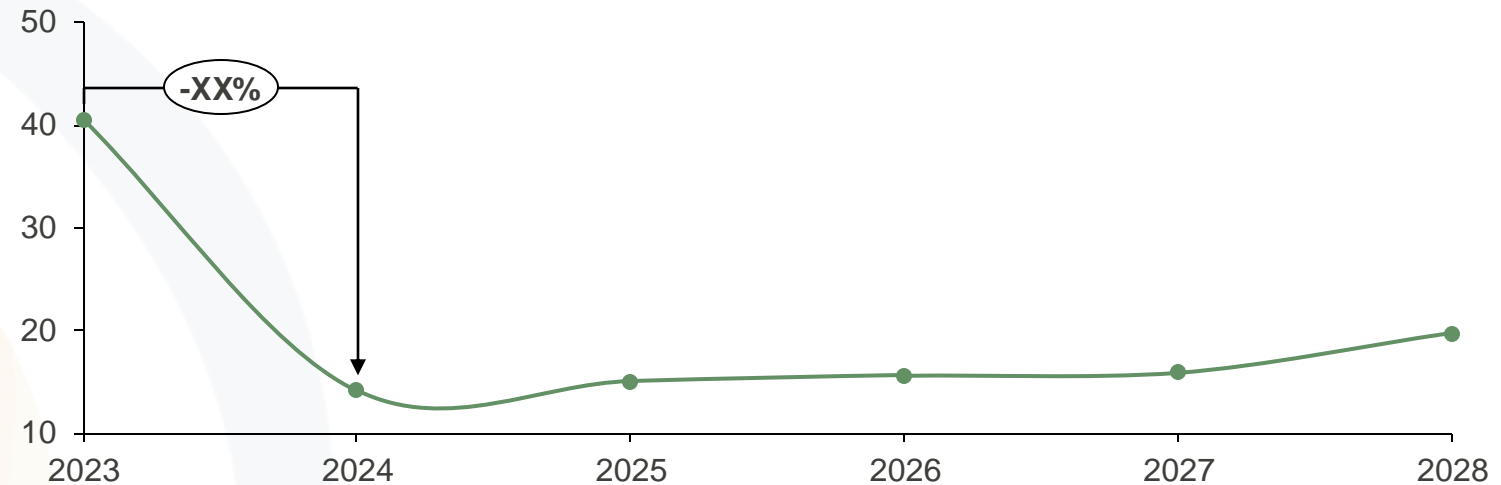
Lithium prices show no signs of a rebound during outlook period

Low pricing hinders new project development, increasing risk of shortage long-term

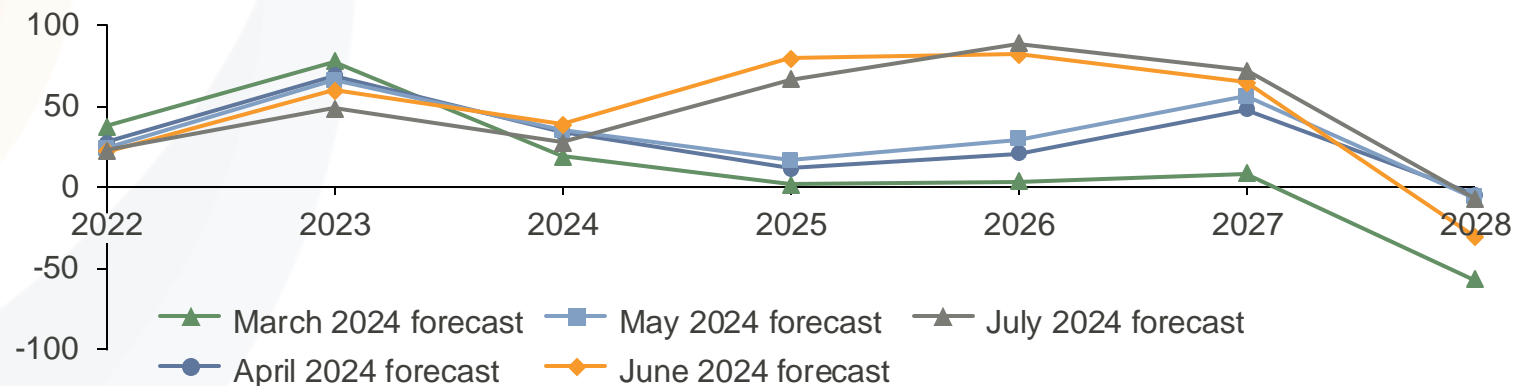
What changed?

- While lithium prices have remained relatively low since the beginning of 2024, the beginnings of a price recovery in Q2 were quashed by demand concerns stemming from trade actions by the US and EU.
- Continued demand growth means that prices must eventually rise to balance out supply and demand, but a combination of continued investment and changes in the lithium cost curve have made it less clear how low a price the market can sustain.
- Projected lithium balance over the next five years is projected to stay in surplus, pushing any likelihood of structural price increases out to 2028.
- While supply changes are slow due to lead times and large capital requirements, changes in EV uptake and storage demand are much more likely to occur within the forecast period, shifting price expectations.

Lithium carbonate price outlook (US\$/kg)



Lithium supply/demand balance: Outlook over time (,000 t LCE)



Biden increases Section 301 tariffs on Chinese batteries, solar

Total rate for non-EV lithium-ion batteries to increase to XX% in 2026

What changed?

- President Biden enacted a host of anti-China trade policies ahead of November elections to prove that his party will also be tough on China.
- Specifically, Section 301 tariffs have been elevated for lithium-ion batteries and associated components and materials.
- The increase in the total non-EV lithium-ion battery tariff from xx% to xx% will increase total costs for U.S. integrators from xx-xx%.
- Cost increases will be higher for those who add less value in the United States (i.e., procuring containers or racks v. modules and cells).
- The delay of the tariff rate change to 2026 gives the market time to adapt + for more non-China LFP facilities to come online to serve the U.S. market (including LG's Arizona LFP cell factory).
- Cost increases may affect some projects with marginal economics, but overall demand contraction will be limited.

Product	HTS codes	Prior 301 rate	New 301 rate	Other tariffs	Total tariff	Date effective
Lithium-ion EV batteries	8507.60.10	xx%	xx%	xx%	xx%	8/1/2024
Lithium-ion batteries (non-EV)	8507.60.20	xx%	xx%	xx%	xx%	1/1/2026
Battery parts	8507.90.80	xx%	xx%	xx%	xx%	8/1/2024
Natural graphite	2504.10.10 2504.10.50 2504.90	xx%	xx%	xx%	xx%	1/1/2026
Other critical minerals (manganese, cobalt, aluminum, zinc, others)	2602 2605 2606 2608 Others**	xx%	xx%	xx%	xx%	8/1/2024
Steel & aluminum products**	Multiple**	xx%	xx%	xx%	xx%	8/1/2024
Solar cells & modules	8541.42 8541.43	xx%	xx%	xx%	xx%	8/1/2024

** Critical minerals and steel and aluminum products subject to Section 301 span many HTS codes.

*** Other tariffs are provided for the HTS codes listed; there may be additional tariffs on HTS codes not listed

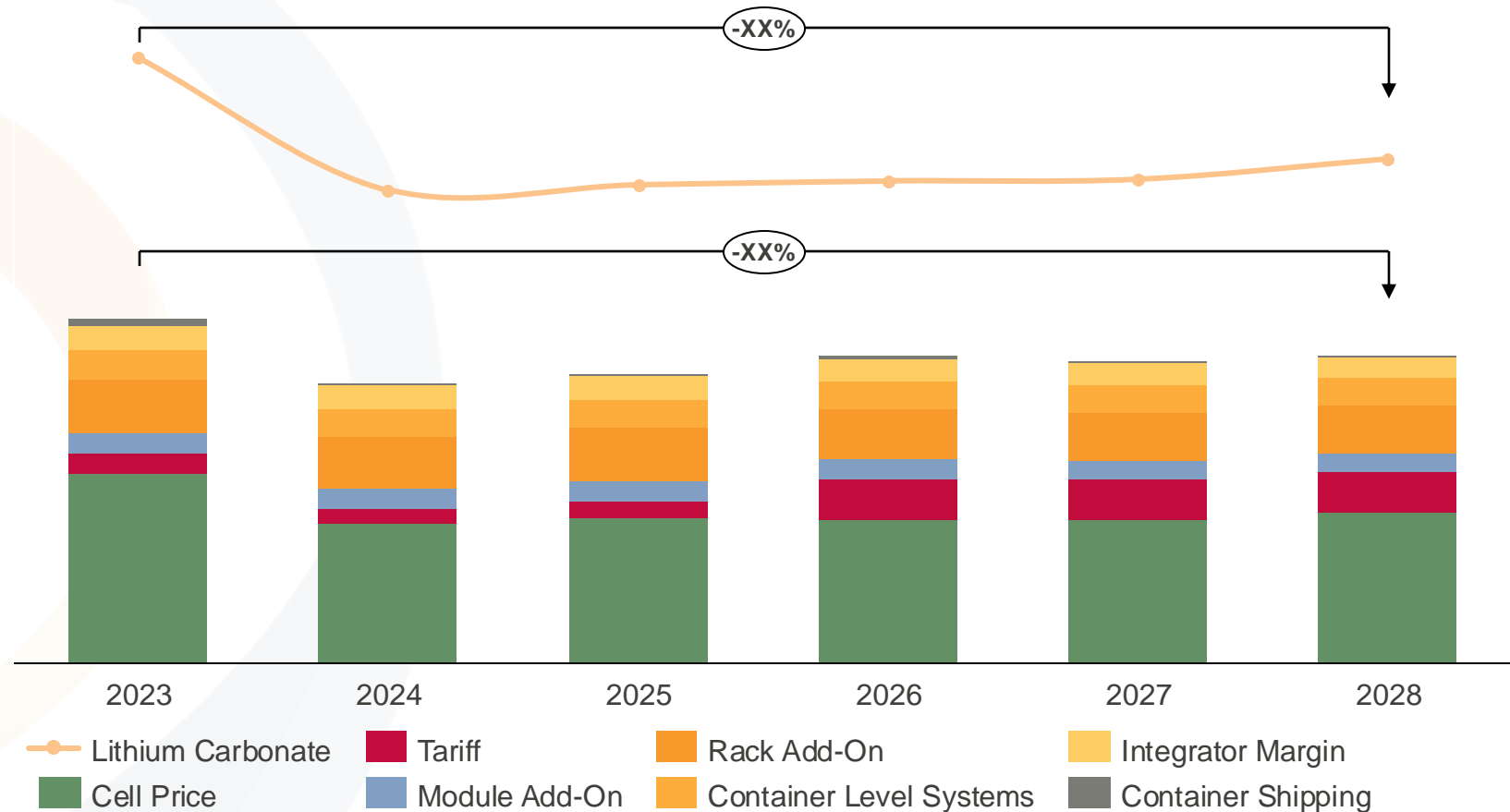
Price forecast exhibiting increased policy derived volatility

U.S. tariffs increase cost, but move to +300Ah cells keeps pricing below \$xx/kWh

What changed?

- U.S. Section 301 tariffs will increase to xx% in 2026, elevating the net tariff on imported BESS enclosures to xx%.
- The market is migrating to +300Ah cells more quickly than previously modelled, due in large part to increased competition in the market.
- ESS hardware suppliers are leveraging larger cell production and delivering upscaled 20ft containers delivering 5-6MWh capacities.
- Following dramatic declines from 2023 levels lithium carbonate prices remain relatively stable at lower levels as EV penetration in western markets continues to slow with China unable to make up the difference.
- Lithium carbonate prices are not expected to move appreciably during the current outlook period given the mining market's willingness to push ahead on development projects in hopes that EV markets will recover long-term.

U.S. DC container price, 320Ah cells, 1 MW/5MWh, DDP from China (US\$/kWh) and lithium carbonate price (US\$/kg) outlook

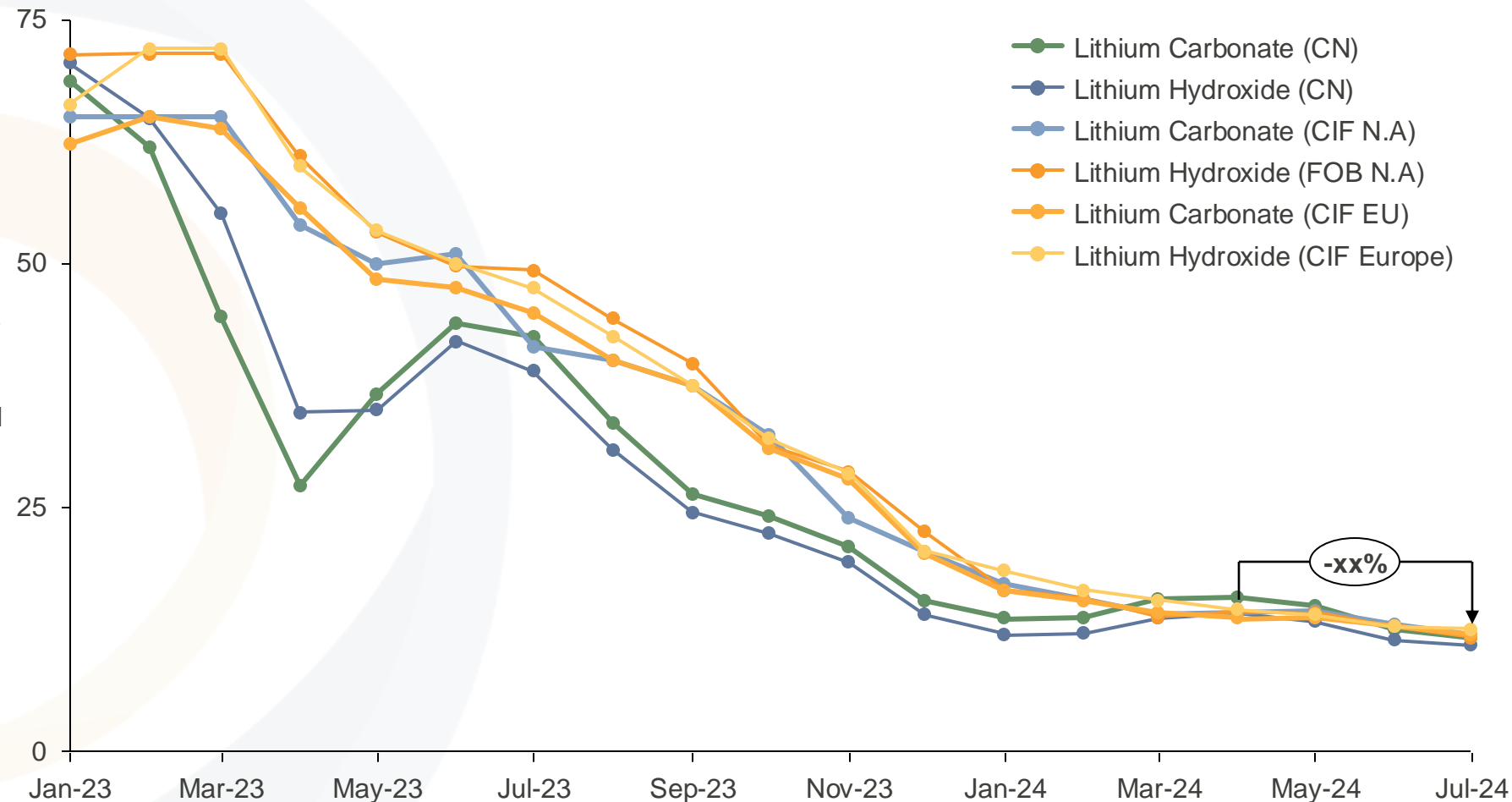


Lithium price convergence continues

Chinese prices have shifted back below E.U. and U.S., but differential remains small

- Battery-grade lithium carbonate prices in China declined from their April high of \$xx/kg to less than \$xx/kg by the end of July. It is unclear what the price floor for the current decline will be, though analysts have speculated that the price will be unable to go much lower than \$xx/kg.
- E.U. lithium carbonate prices have moved from a nearly \$xx/kg price premium in January of this year to a premium of only \$xx/kg in July. Prices in Europe were briefly cheaper than in China, though the size of the divergence has continued to decline throughout the entire time period.
- Geographic price divergence will depend on the buildup of localized supply chains; as long as the Chinese battery materials supply chain remains in oversupply and the E.U. market remains dependent on imports, the price differentials will stay fairly small.

Lithium Price (\$/kg) Trends in China, Europe, and the U.S.

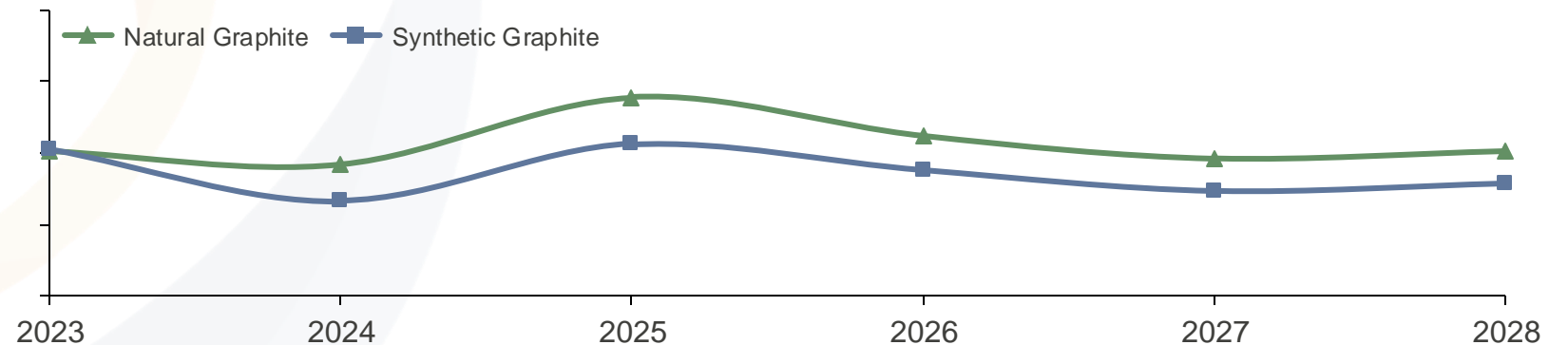
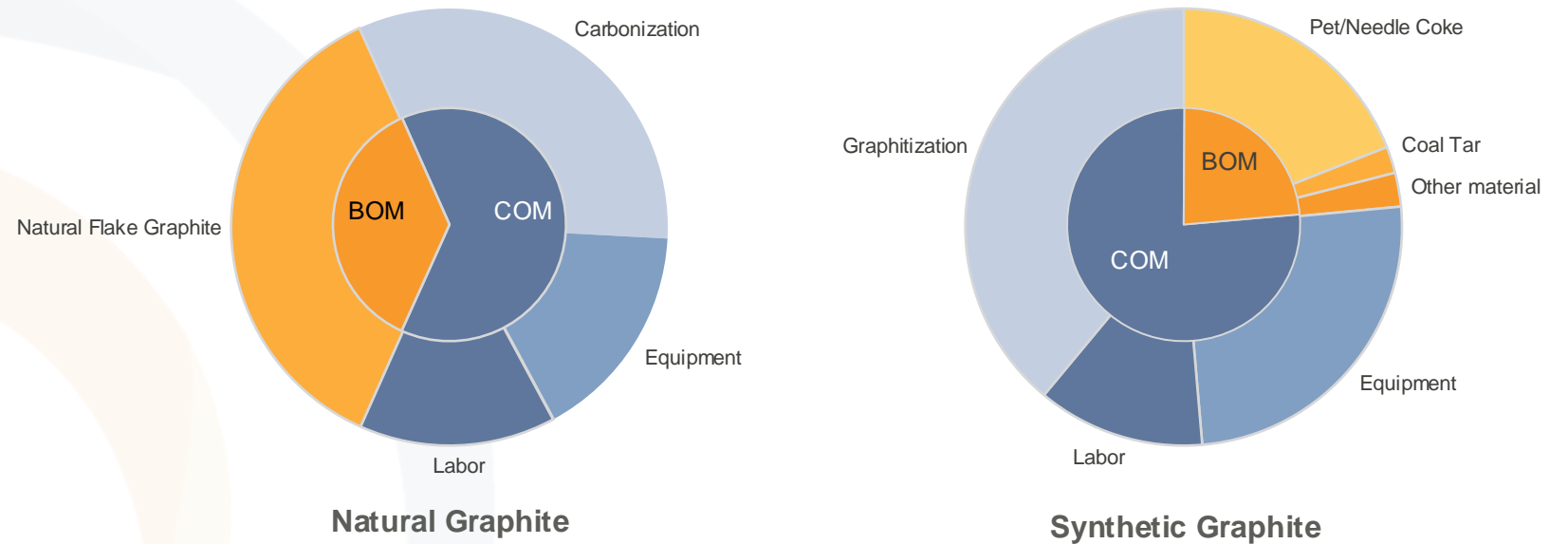


Graphite prices have been subject to price volatility

Graphite costs impacted strongly by labor and energy, prices by inventory

- Graphite is essential for EVs and ESS, China dominates global graphite supply, accounting for approximately 80% of production. This concentration leaves the E.U. and the U.S. vulnerable to supply chain disruptions.
- While production costs for synthetic graphite are typically higher than those of natural graphite, oversupply of synthetic graphite has driven prices down below natural graphite. This varies by graphite grade, but mid-range graphite spot prices are as much as xx% higher for natural graphite than artificial graphite.
- Graphite has not been a primary focus in the past due to its low cost in batteries and abundance of raw materials. However, both announced Chinese export controls as well as evolving trade policy has increased interest in ex-China graphite.
- Over 250 GWh of graphite projects have been announced in the U.S. and Canada with start dates of 2026 or earlier; it is likely only a portion of these projects will come online by their projected start date.

Natural and synthetic (Med) graphite cost composition, price outlook (US\$/kg)

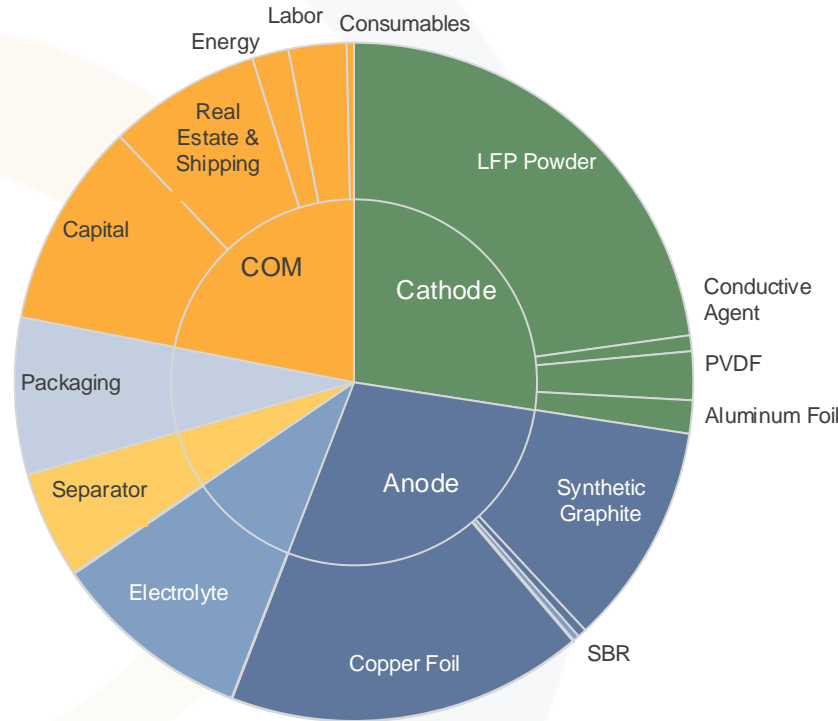


LFP and NMC pricing converging following lithium price collapse

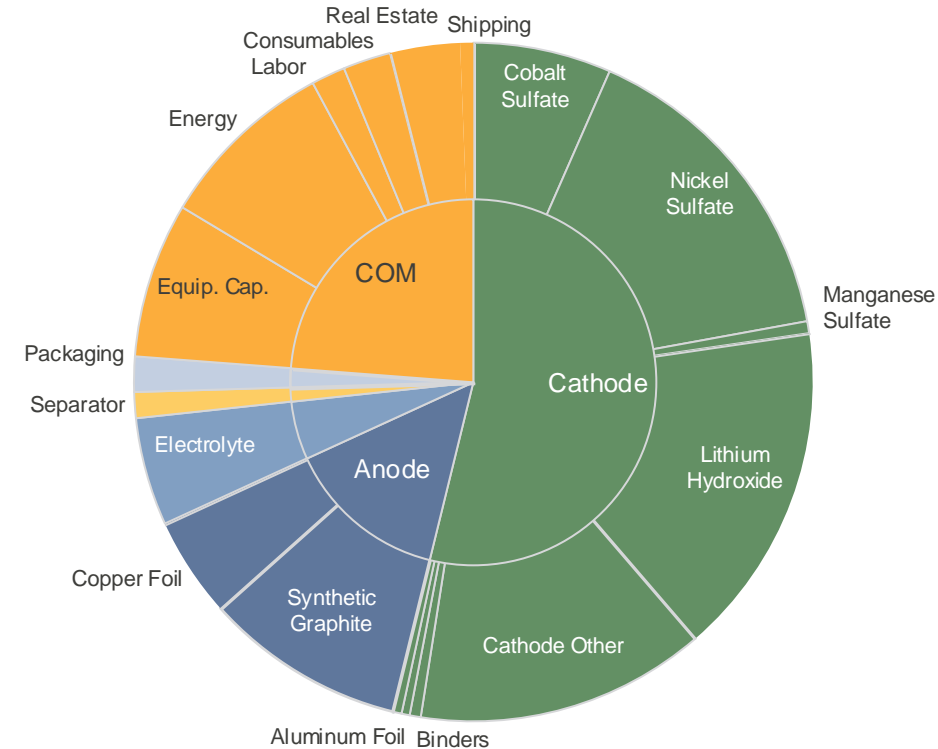
Cobalt markets have also weakened, contributing to lower NMC prices

- LFP batteries are safer, cheaper and boast a longer life span compared to NMC, making them ideal for ESS.
- NMC traditionally boasts a price premium on a US\$/kWh basis given its higher energy density and exposure to both lithium and cobalt markets.
- However, the convergence of lithium carbonate (LFP powder) and lithium hydroxide prices, along with a collapse in global cobalt prices has contributed to a price convergence among the two technologies.
- A lingering lithium surplus coupled with a desire to reduce/eliminate the use of cobalt in LiBs will likely maintain the limited price differential between LFP and NMC cells.

China LFP battery cell cost, 2024 (\$/kWh)



China NMC 622 prismatic battery cell cost, 2024 (\$/kWh)



Integrators coalesce around the twenty-foot equivalent unit

Holdouts like Fluence and Powin switch to TEUs for cost, density reasons

Overview of new TEU products from integrators

- The twenty-foot equivalent unit (TEU) has been cemented as the industry standard form-factor for BESS after several major integrators shifted to the design away from smaller, modular battery units. Both the Powin Centipede and Fluence Gridstack have recently been superseded by new TEU products.
- Two major advantages that TEU blocks have over other systems are energy density and ease of shipping. TEUs are significantly easier and cheaper to ship given their compatibility with essentially all multimodal infrastructure.
- Given the decline in lithium costs and resulting increase in balance of system cost share, the advantages of smaller modular blocks have been overshadowed by the lower cost of a TEU block.



	Fluence Gridstack Pro	Powin Pod
Dimensions	9.5 x 20 x 8 ft	9.6 x 19.8 x 8 ft
Total capacity	4.9 MWh	5 MWh
Cooling system	Liquid-cooled	Liquid-cooled
Previous product	Gridstack	Centipede
Previous product dimensions	8.4 x 8.5 x 7.1 ft	8.1 x 5.2 x 10.7 ft

Notes | All figures from spec sheets available from listed companies.

Report Contents: 39 Pages of In-Depth Reporting

CEA's **Price Forecasting Program** is the leading source of price data and analysis in the solar and storage industry. We leverage the expertise of our solar and storage industry experts and analysts, our network of lab partners, independent industry experts and raw material suppliers, and our access to proprietary, trade association and public databases to report on current trends and anticipate changes that will transform the renewable energy landscape.

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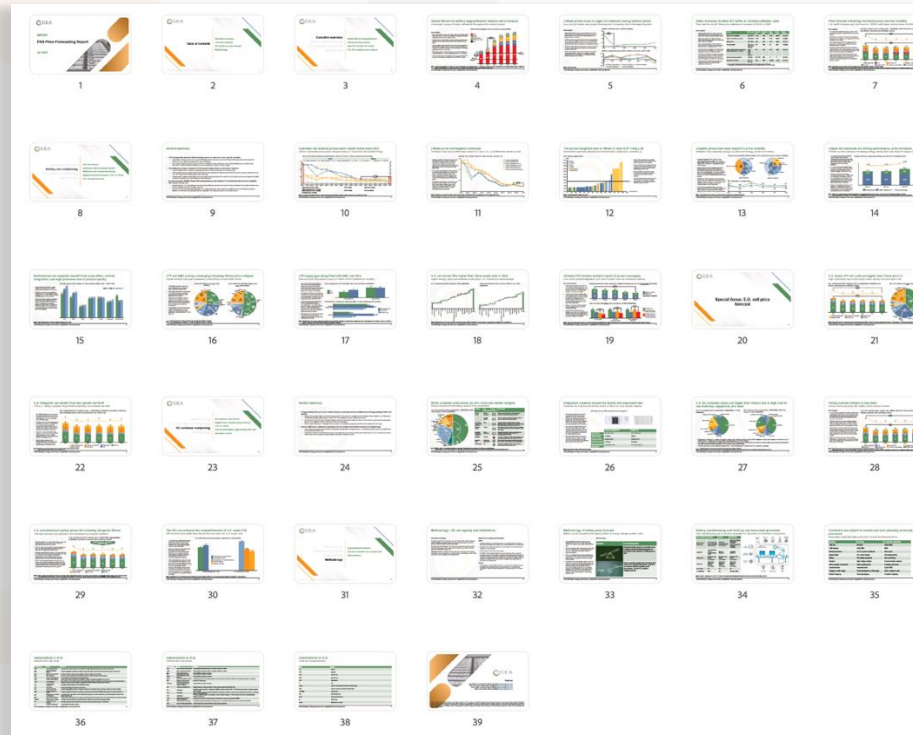


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Thank You

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