



REPORT SAMPLE

ESS Supply, Technology, and Policy Report

Q1 2024



ESS Supply, Technology, and Policy Report

The CEA Energy Storage Systems (ESS) Supply, Technology, and Policy Report (STPR) is published on a quarterly basis and covers global and regional supply chain analysis, technology trends, and regional policy analysis. Given the breadth of technological developments in energy storage, there will be a new technology focus each quarter; this quarter, the focus is on **emerging battery technologies**, including LMFP cathodes, sodium-ion batteries, and solid-state batteries.

The strategic value of the STPR lies in its ability to enhance project profitability by leveraging industry incentives. It establishes security of supply through a thorough understanding of trade policy and aids stakeholders in understanding the project performance implications of new technology adoption.

Deliverables of the STPR include a quarterly report and full analyst support for any questions pertaining to its coverage. With the STPR, stakeholders gain a detailed view of the supply landscape, technology trends, and policy impacts, empowering them to make informed decisions and optimize their strategies in the PV and energy storage sectors.

In this report you will find:

- Global and regional supply chain analysis
- Technology trends
- Regional policy analysis

Executive summary

Trade policy and localization drive uncertainty, despite supply growth and low prices

Supply and policy trends

- Battery manufacturing capacity mismatch continues, with supply outstripping demand.
- Most significant development in US policy is Section 301 tariff hikes implemented in early May.
- European policy implementation continues, though still without a strong incentive framework.

Technology trends

- Low raw materials prices put pressure on continued development of battery recycling infrastructure.
- The current low-price environment gives system integrators more leeway to differentiate with their software and controls.

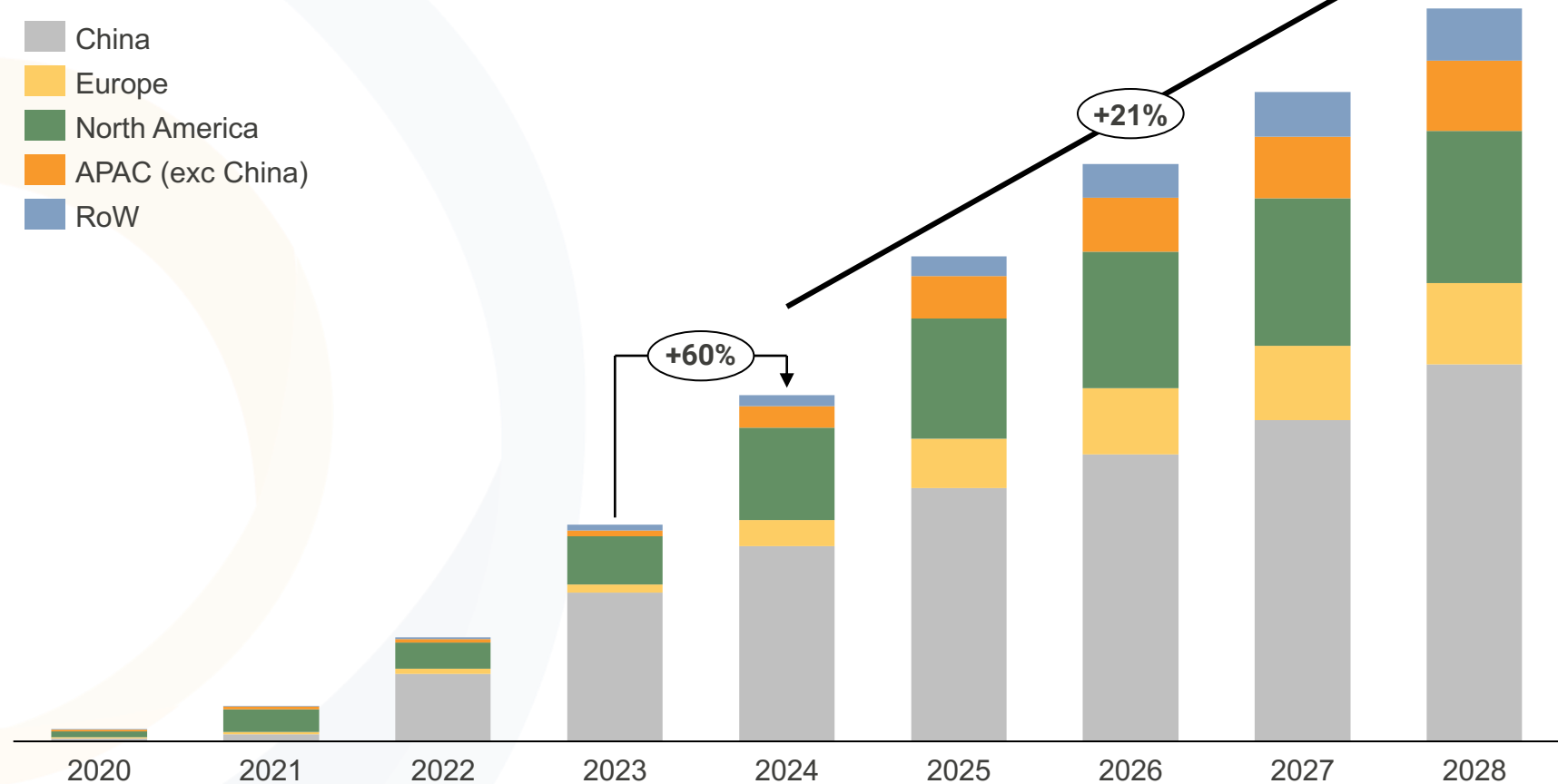
ESS demand growth rate at +20% despite slowing after record 2023

Massive market opportunity for western battery integrators

What changed?

- Growth remains exceptionally strong, even in the U.S., despite meaningful headwinds.
- Load growth, price reductions and technology improvements all improve demand opportunity.
- Conversely, U.S. interconnection queues continue to exhibit bloat, with over 700GW of active capacity requests.
- Transformer and HV circuit breaker lead times are now measured in years, even for largest IPPs, and may slow demand growth.
- **BUT... despite all of this, demand up +70% through 2028.**

Global ESS grid-scale battery demand by region (GWh)



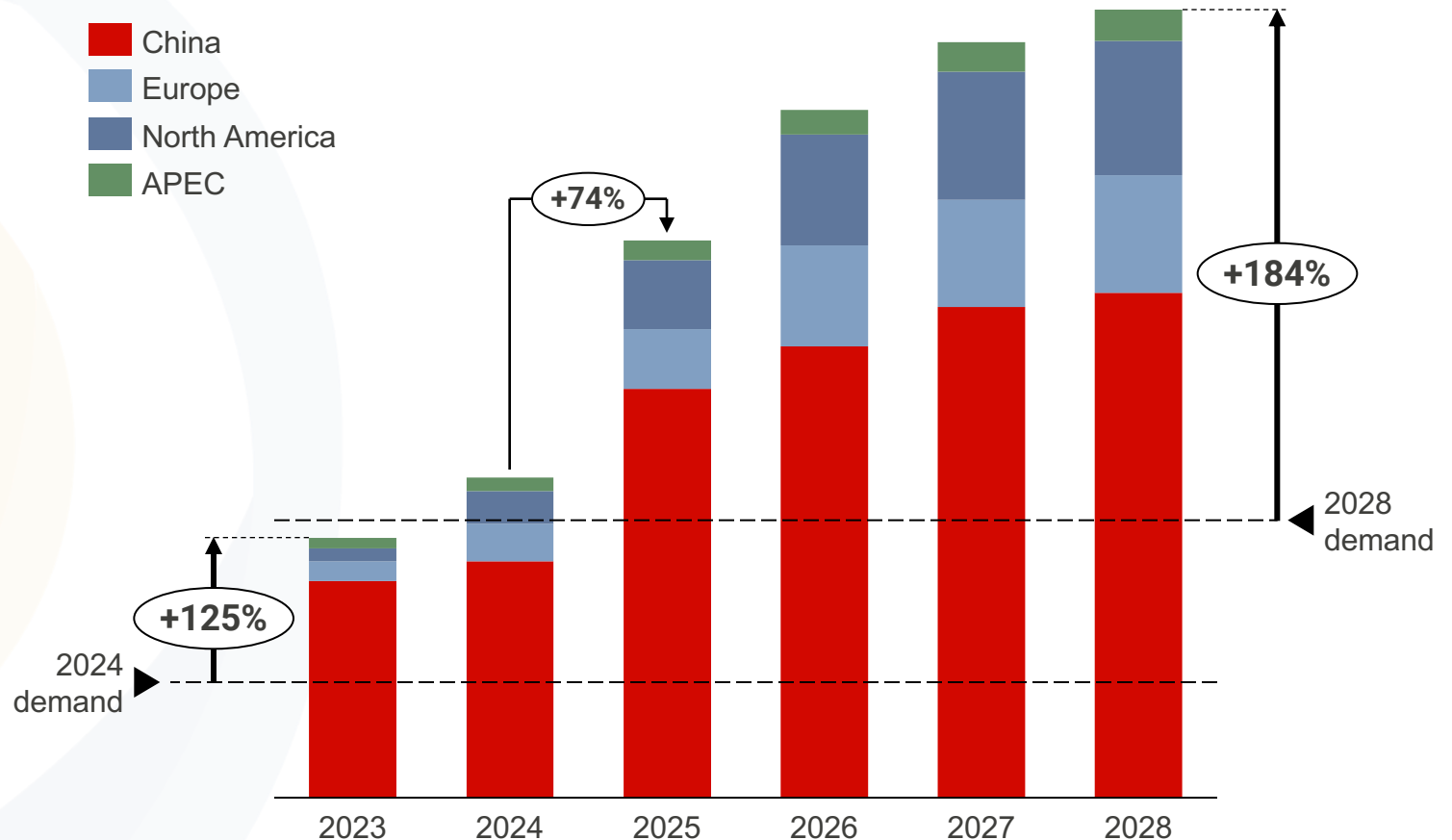
Global lithium-ion battery supply/demand remains out of balance

Oversupply issues of today maintained throughout the outlook period

What changed?

- Latest EV forecasts call for continued growth in 2024 albeit at a lesser rate, ranging from 15-17 million units worldwide.
 - In battery capacity terms this equates to ~25% YoY growth.
- In terms of battery supply, PHEVs are proving popular with buyers with continuing range anxiety in 2024, which lowers total battery demand on a per EV basis.
 - PHEV = +20% YOY growth projection for 2024 v. 3% in 2023.
- China Automotive Battery Innovation Alliance estimates battery OEMs completed 2023 operating ~50% capacity utilization... China EV100 pegged that figure at 41%.
- In response, China's Ministry of Industry and Information Technology released a guideline this month for OEMs to reduce projects aimed solely at expanding production capacity. Instead, battery companies must spend at least 3 percent of the revenue on R&D and technological upgrades.
- ESS growth more robust at close to 50% YoY for 2024, leading some OEMs to consider shifting production capacity to ESS.
- **Supply/demand pressures are pushing down prices, with Chinese majors claiming battery prices at US\$60/kWh.**

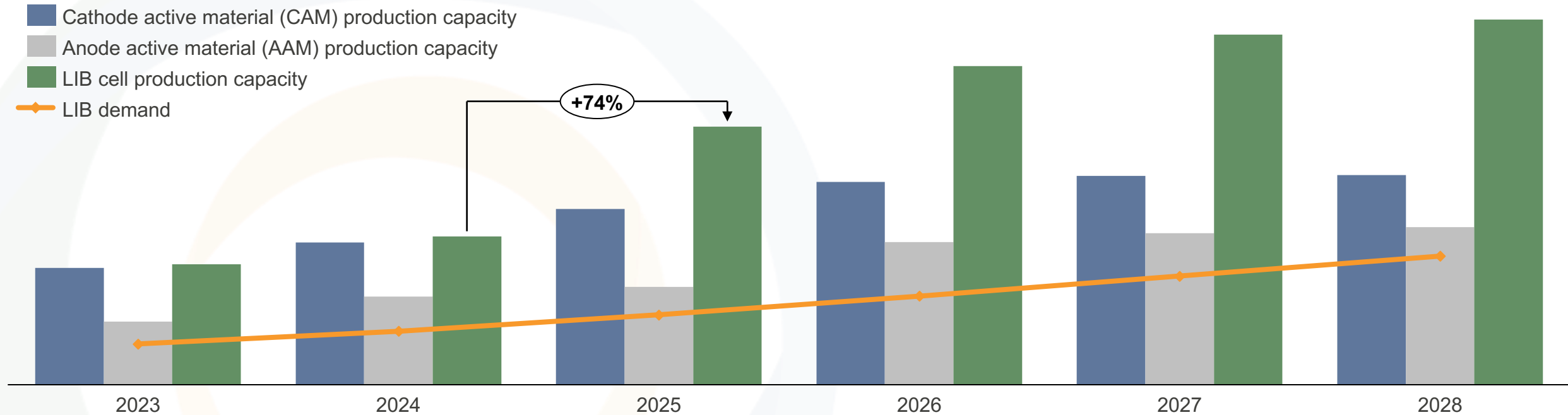
Global LIB nameplate cell production capacity (GWh)



Huge investments in capacity expansion resulted in oversupply

Raw material supply shortage is the major bottleneck for the global LiB market

Global LiB component nameplate manufacturing capacity vs. demand (GWh)



- 2025 increase in cell capacity is largely attributed to substantial capacity expansion plans in China coupled with a boom in the U.S. planned capacity in response to the IRA.
- Localization policies have been predominantly focused on downstream cell supply, though there have been some considerable investments in non-China midstream capacity, especially in North America, South Korea, and Japan in response to the IRA.
- While investments in non-China mining projects have ramped up in recent years, more investment in raw material refining and processing is still required to shift away from China for battery material supply.

US BESS market impacts: Section 301 tariff rate increases

Battery prices to increase marginally; overall demand contraction will be limited

Battery market impacts

- The increase in the total non-EV lithium-ion battery tariff from 10.9% to 28.4% will increase total costs for U.S. integrators from 11-16%. 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.

Battery manufacturing impacts

- Higher tariffs on Chinese battery products make non-China LFP cells more cost competitive; this could drive more domestic LFP factories to serve the BESS segment as well as other non-China factories.
- The impact of new tariffs on critical minerals is likely to be minimal given the lack of existing U.S. critical mineral processing capacity.
- Natural graphite tariffs are delayed until 2026, but the significant shortfall in domestic and ex-China AAM capacity is unlikely to be resolved in two years.

Cell manufacturing plans exceed U.S. LiB demand

Domestic upstream supplies inadequate to support excessive downstream capacities

U.S. LiB supply chain manufacturing capacity plans and installation summary (GWh)

Cathode Active Material (CAM)

- NMC
- LFP
- Others

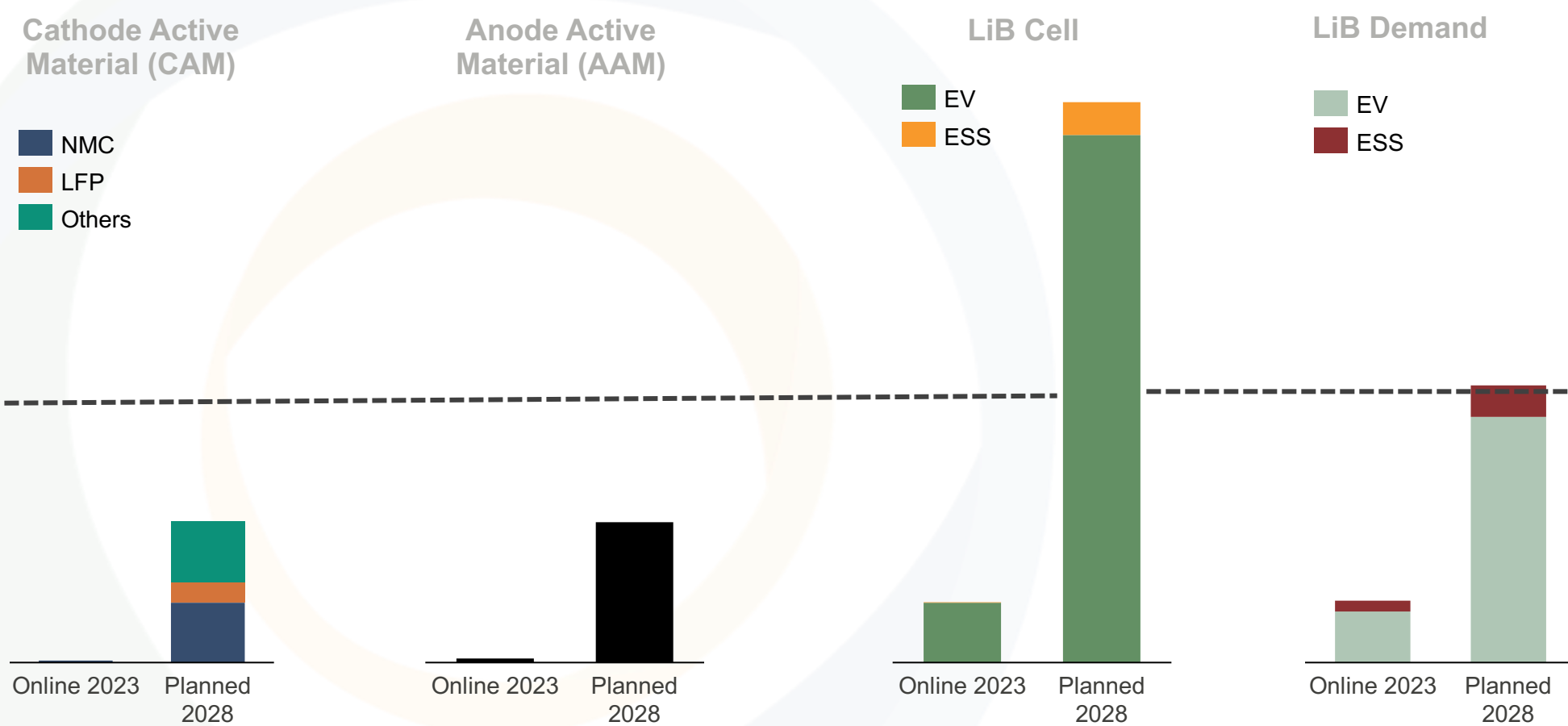
Anode Active Material (AAM)

LiB Cell

- EV
- ESS

LiB Demand

- EV
- ESS



- While planned domestic battery cell manufacturing capacity is 2X the projected demand, domestic midstream capacity (CAM and AAM) is not enough to support the LiB cell manufacturing capacity.
- U.S. cell makers have plans to tie up with midstream producers with plants set in FTA countries.

EU battery policy summary

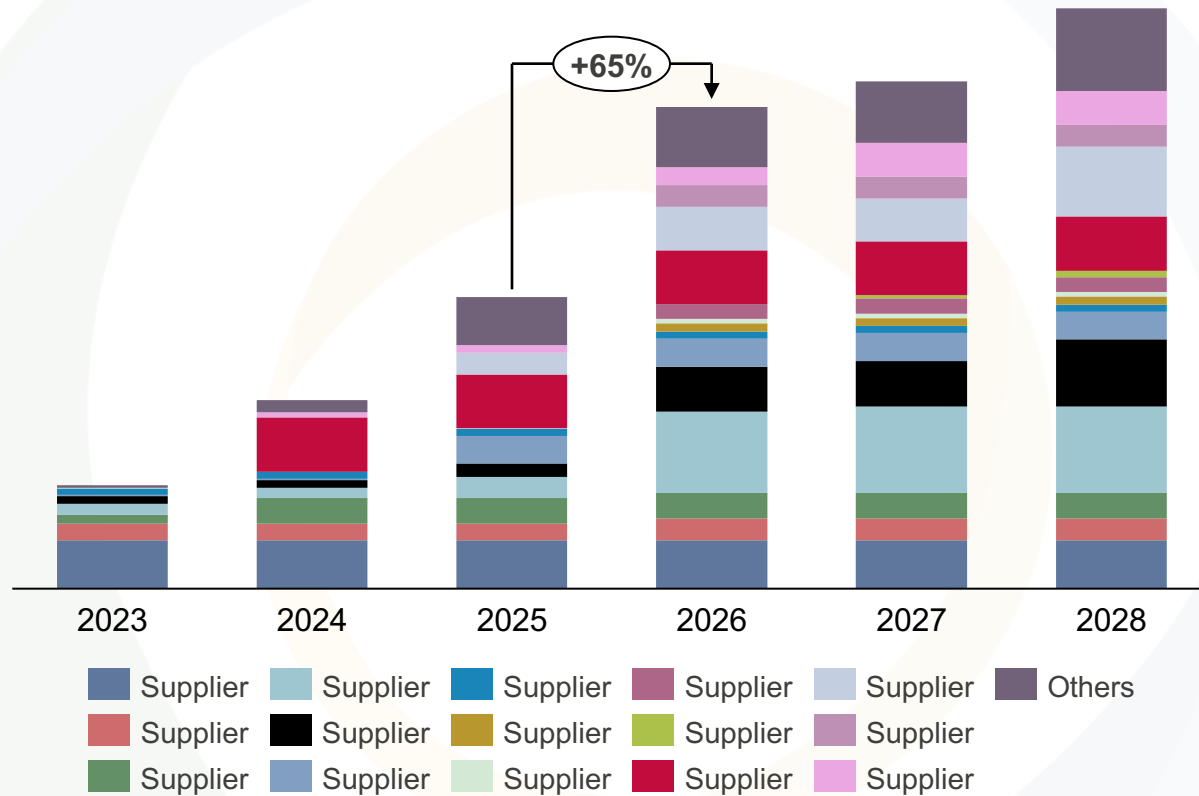
EU policy recap and progress in Q1 2024

	Recap	Updates	Progress & Next steps	Supply impact								
EU forced labor regulation	EU-wide ban on products made with forced labor.	<p>The final text mandates that the “burden of proof” will remain on the EU Commission, not importers</p> <p>Regulation is not applicable until 3 years after it enters into force (expected mid-2027)</p>	<table border="1"> <tr> <td>Final text agreed</td> <td>Final Parliament Vote</td> <td>Approved by EU Council</td> <td>Enters into force</td> </tr> <tr> <td>Mar 5, 2024</td> <td>April 24, 2024</td> <td>Expected : Unknown</td> <td>20 days following EU Council approval</td> </tr> </table>	Final text agreed	Final Parliament Vote	Approved by EU Council	Enters into force	Mar 5, 2024	April 24, 2024	Expected : Unknown	20 days following EU Council approval	No investigations or bans will take place until mid-2027, giving suppliers enough time to evaluate supply chains and ensure they are compliant with the future regulation.
Final text agreed	Final Parliament Vote	Approved by EU Council	Enters into force									
Mar 5, 2024	April 24, 2024	Expected : Unknown	20 days following EU Council approval									
Net Zero Industry Act	New EU-wide targets for manufacturing (40%) across all net zero technologies. Also includes faster permitting for manufacturing facilities and non-pricing criteria in public auctions to create market demand for EU-made products.	<p>The final text excludes any new or direct incentives for clean technology manufacturers</p> <p>In May 2024, new guidance was published to assist with the design and methodology of new non-price criteria in public auctions</p>	<table border="1"> <tr> <td>Final text adopted</td> <td>Final Parliament Vote</td> <td>Approved by EU Council</td> <td>Enters into force</td> </tr> <tr> <td>February 6, 2024</td> <td>April 24, 2024</td> <td>May 27, 2024</td> <td>20 days following EU Council approval</td> </tr> </table>	Final text adopted	Final Parliament Vote	Approved by EU Council	Enters into force	February 6, 2024	April 24, 2024	May 27, 2024	20 days following EU Council approval	This regulation will facilitate easier conditions for manufacturing development, however, without financial incentives for any industry, its overall impact is ultimate reduces the initial appeal of the EU as a manufacturing location when compared with other countries i.e., China or the US.
Final text adopted	Final Parliament Vote	Approved by EU Council	Enters into force									
February 6, 2024	April 24, 2024	May 27, 2024	20 days following EU Council approval									
Critical Raw Materials Act	EU-wide, non-binding targets for extraction (10%) processing and refining (40%) and recycling (25%). Mitigation against supply shocks through monitoring, stockpiling.	The Commission is expected to release a call for proposals for companies to apply for recognition as a “strategic project”, awarding them permitting and potential financial benefits	<table border="1"> <tr> <td>Final Parliament Vote</td> <td>Approved by EU Council</td> <td>Enters into force</td> </tr> <tr> <td>Dec 12, 2023</td> <td>Mar 18, 2024</td> <td>May 23, 2024</td> </tr> </table>	Final Parliament Vote	Approved by EU Council	Enters into force	Dec 12, 2023	Mar 18, 2024	May 23, 2024	<p>Targets for extraction, processing, refining, and recycling are non-binding, undermining the regulatory impact and likelihood of completion.</p> <p>Risk assessments, stockpiling and monitoring should help mitigate any market disruptions for battery manufacturers in the future .</p>		
Final Parliament Vote	Approved by EU Council	Enters into force										
Dec 12, 2023	Mar 18, 2024	May 23, 2024										
Critical Minerals Agreement	Ongoing negotiations between the EU and the U.S. on granting free trade agreement status so EU critical minerals can count toward Section 30D of IRA.	Trade and Technology Council (TTC) took place in April 2024, however, did not conclude on a final CMA	Next TTC meeting unknown	Together with the easier conditions of the CRMA and NZIA, this agreement could be another driving force on boosting domestic EU supply chains.								
EU anti-subsidies investigation against EV's	Oct, 2023 - EU Commission launch anti-subsidy investigation into electric vehicles coming from China.	June 12, 2024: Provisional tariff rates published for Chinese imports of EVs	Duties will apply from July 4, 2024. Final rates to be determined within 4 months	This imposition of tariffs may lead to a changing tide in EU trade policy, adopting more protectionist measures which could seep into other green technology sectors.								

Europe's 2025 domestic planned capacity declined by ~3% YoY

IRA is encouraging cell suppliers to focus on their U.S. expansion

Europe LIB cell manufacturing capacity, supplier (GWh)



FREYR

- FREYR's stocks dropped by nearly 39% due to the decelerating EV demand and increased interest rates.
- Due to increasing unprofitability, FREYR has put its European battery projects on hold to decrease cash burn.
- It will be fully investing in Giga America in Georgia, U.S. in response to the IRA to bring it online by 2025.

VW

- VW cancelled plans to set up its third battery plant in Europe and prioritizing a similar facility in North America (Canada) to receive generous IRA incentives.
- Europe makes up >60% of VW's global EV sales. VW's EV orders in Europe declined by 50% in 2023 Y-o-Y.

NORTHVOLT

- Northvolt chose Canada over Germany for its second Gigafactory in response to the IRA.

SVOLT

- SVOLT cancelled its battery plant project in Brandenburg, Germany. Meanwhile, its plans for cell production in Saarland, southwest Germany, continue to be delayed.

Recycling technologies and processes

Pyro-, hydro-metallurgical, and direct recycling

Pyrometallurgical extraction

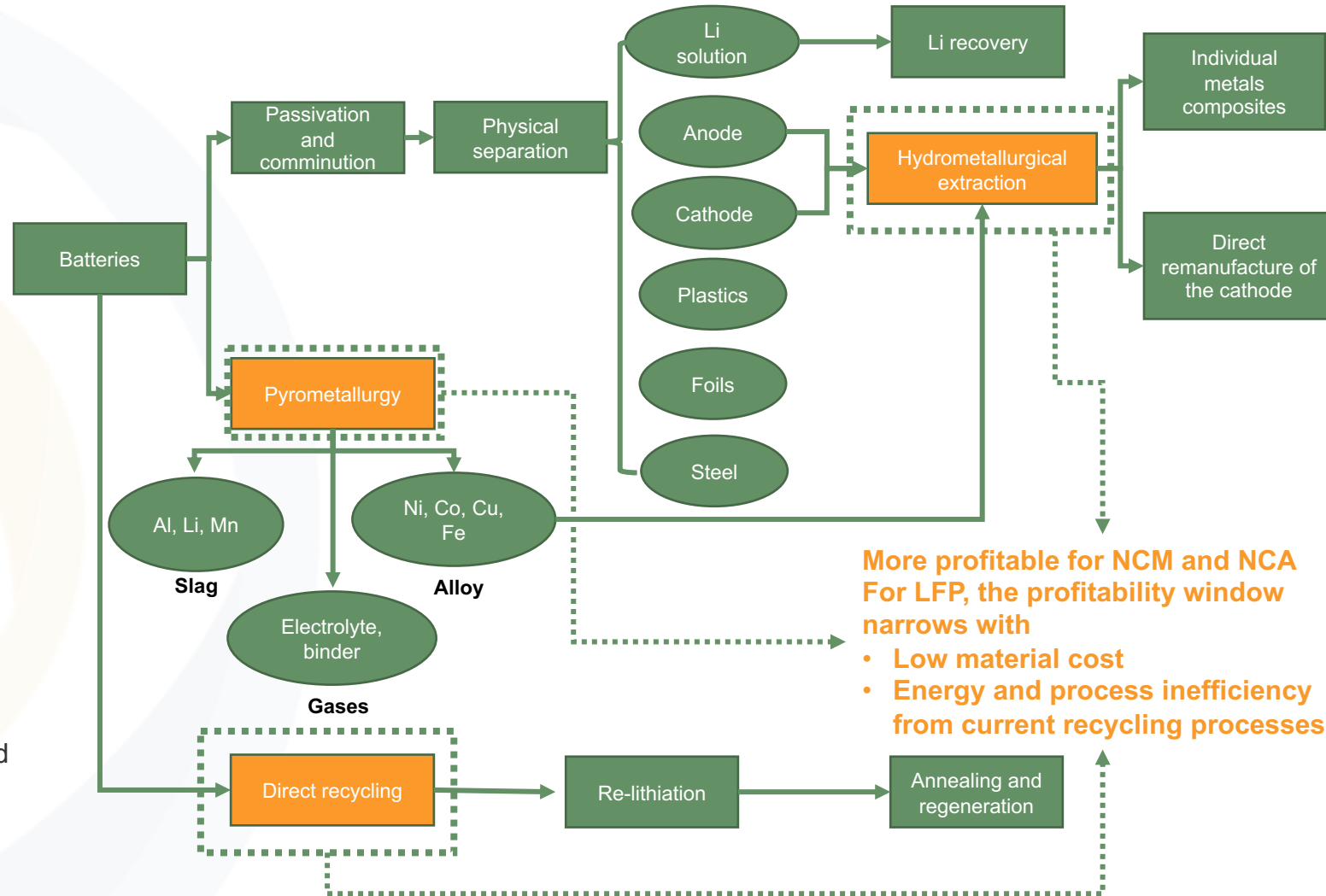
- Batteries are directly smelted in a furnace to recover cobalt, nickel, and copper, in the form of an alloy.
- Other components mostly end up as slag (such as lithium, aluminum, and Manganese).
- Energy intensive (for binder decomposition), emits toxic gases.

Hydrometallurgical extraction

- The screened black mass is extensively treated with acids where the metals are dissolved.
- A series of “solvent extraction,” “crystallization,” and “precipitation” steps separates the different metal ions.

Direct recycling: defect-targeted healing

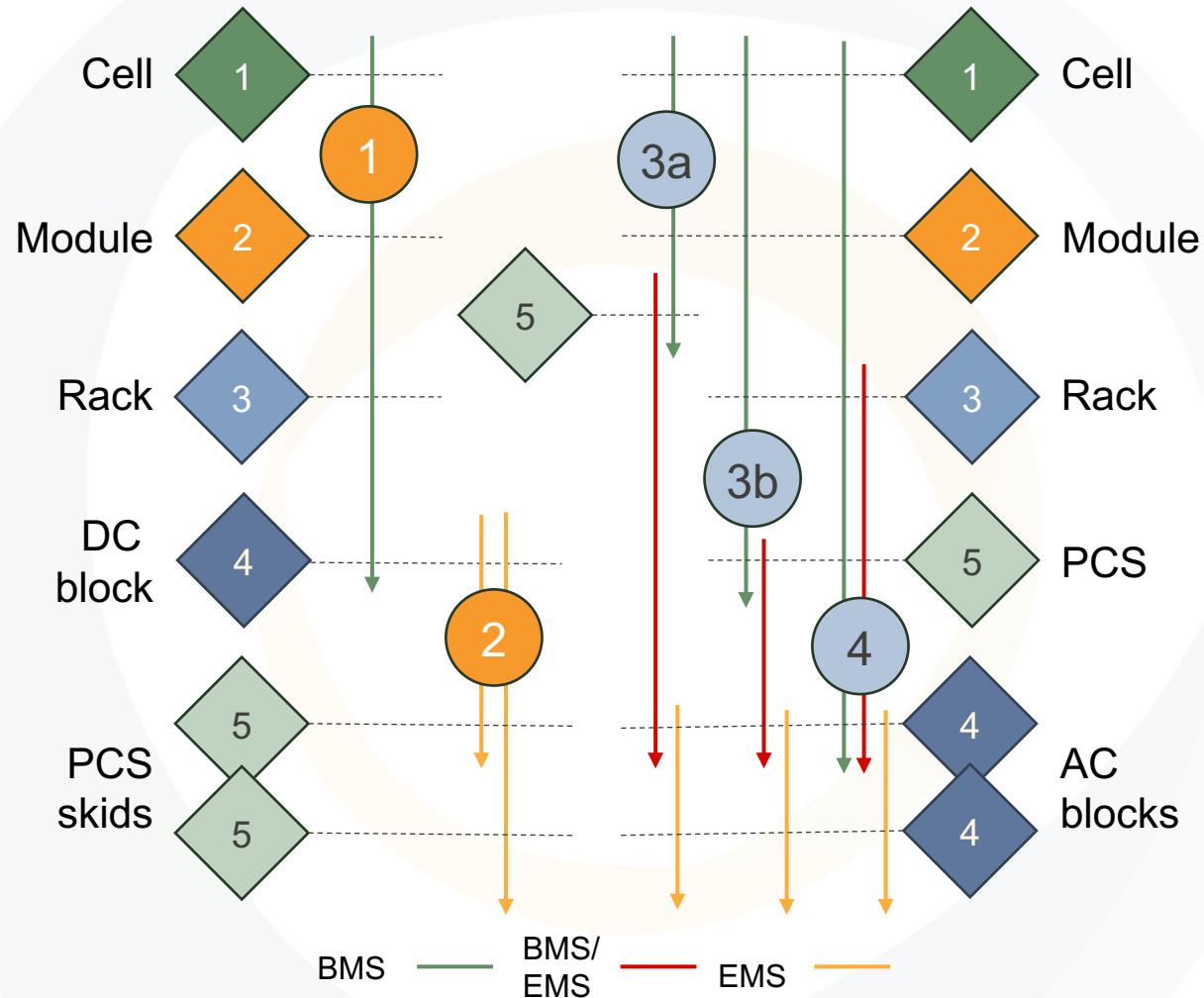
- Non-destructive process to directly regenerate degraded cathode particles to obtain new active particles.
- Can potentially make recycling LFP profitable from its simplified process and improved energy efficiency.



BESS controls stack nomenclature is complicated

Name confusion issues come from companies pushing their own value proposition

BESS controls stack, DC and AC solutions



EMS defined as follows:

- Controls for DC block + PCS unit
- Site level controls over multiple DC/PCS units or AC blocks
- Communication link to the PPC

- 1 DC block OEMs** - generally do not offer an EMS solution, but will sometimes refer to their internal battery management units as EMS, especially for containerized systems.
- 2 EMS software providers** – differences focused on hardware inclusion, as software generally focused on unit level control over AC blocks or DC block/PCS systems, and site level control over those units.
- 3a AC integrated solutions** – AC container with integrated BMS software and associated site level EMS software.
- 3b AC integrated solutions** – AC container with integrated BMS software and no site level EMS software.
- 4 AC/DC modular solutions** – DC building blocks for scalability controlled by separate AC control block with PCS.

Report Contents: 74 Pages of In-Depth Reporting

CEA's **Supply, Technology, and Policy Report** applies a systems level thinking approach to provide comprehensive industry analysis. We report on current trends and have a pulse on the latest solar, energy storage and green hydrogen technologies set to disrupt the clean energy landscape.

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www.cea3.com

info@cea3.com

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