Special Report

Where are the real opportunities in Battery Chemicals?

aranca

Confidential
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Falling Prices and Overcapacity are forcing a shift Toward Chemistry-Led Value Creation

A decade of EV-driven demand created an unprecedented investment surge across battery manufacturing. That phase is maturing and giving way to something more selective, more chemistry-driven and more defensible

2015 - 2022

Phase 1 - The Manufacturing Race

EV adoption accelerates. Gigafactories multiply. Capacity expands globally. Demand outpaces supply. Every player invests in cell manufacturing.

2023 - 2026

Inflection Point - Commoditization Sets In

Overcapacity emerges. Battery prices fall sharply. Chinese manufacturers dominate on cost. Manufacturing margins compress across the board.

2026 - 2030

Phase 2 - Chemistry & Materials Lead

Value creation shifts upstream. Specialty chemicals, advanced materials, and recycling emerge as the new profit pools.

9×

Battery demand growth expected by 2030 vs. 2020

−89%

Fall in battery cell prices over the last decade

4,700 GWh

Projected global Li-ion demand by 2030E

Global Li-ion Battery Price vs. Capacity Utilization

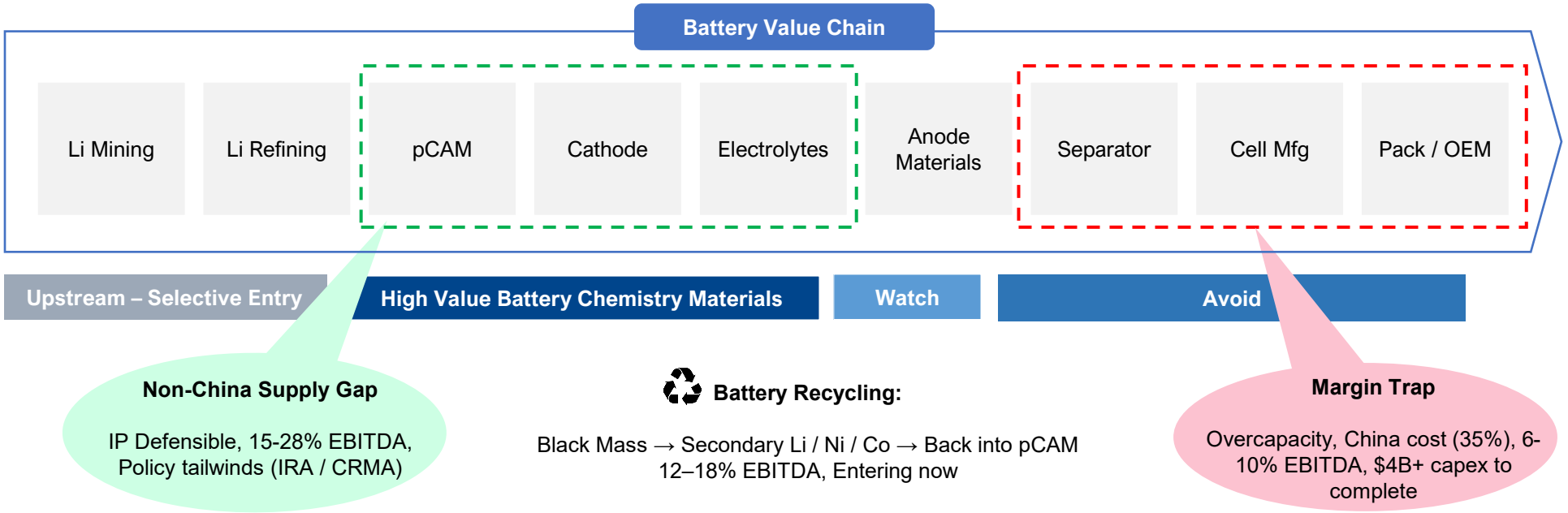
2015 – 26E. Price decline compressing margins as overcapacity builds

The question is no longer **"Should we invest in batteries?"** *- it is* **"Which part of the battery value chain can we actually win?"**

***Source**: Publication. Report/Press Release; Aranca Analysis; Aranca Estimates*

Margin Compression is redirecting Investment to Specialty Chemicals & Materials

Not all value chain positions are equal. Margins tell a clear story: chemistry and materials deliver 2–3× the returns of manufacturing - with a fraction of the capital.



WHY IS MANUFACTURING BECOMING A TRAP?

- Global Li-ion capacity now far exceeds near-term demand — utilisation falling to 55–65% outside China
- CATL and BYD's fully-loaded cell cost is 20–35% below any Western or Indian producer - a gap scale alone cannot close
- A single 40 GWh gigafactory requires $3–5B capex and 5–7 years to breakeven — even at full utilization

WHY CHEMISTRY & MATERIALS IS THE BETTER BET?

- Electrolytes, pCAM, and specialty additives deliver 15 - 28% EBITDA: 2 -3× cell manufacturing margins
- Non-China supply of key chemicals (LiFSI, pCAM,) is near zero - policy mandates (IRA/FEOC) are forcing supply chain re-wiring
- OEM qualification creates sticky, long-term customer relationships once spec-locked, switching costs are extremely high

***Source**: Publication. Report/Press Release; Aranca Analysis; Aranca Estimates*

Supply Gaps and Chemistry shifts are opening entry windows across 9 priority chemicals

Nine chemicals across three priority tiers, each representing a distinct supply gap, margin opportunity, and entry window. Not all are equal. Sequence matters.

ACT NOW

2025 - 2027

LiFSI | **Electrolyte**

Lithium Bis-fluorosulfonyl Imide

Next-generation electrolyte salt

- Replacing LiPF6 in high voltage batteries
- 90% supply concentrated in China/Japan

FEC | **Electrolyte**

Fluoroethylene Carbonate

Critical electrolyte additive

- Silicon-anode adoption drives growth
- Replacing conventional carbonate additives that fail in silicon-anode cells

PVDF | **Cathode**

Polyvinylidene Fluoride

Cathode binder, every NMC cell needs it

- Required in every NMC cathode cell
- Replacing older polymer binders (PTFE) that cannot withstand high-nickel cathode chemistry

BUILD POSITION

2027 - 2029

$NaFSI / NaPF_6$ | **Electrolyte**

Sodium-Ion Electrolyte Salts

Na-ion battery electrolyte system

- Na-ion scaling has started in China
- Replacing lithium-ion electrolyte salts in sodium-ion battery systems

MHP | **pCAM**

Mixed Hydroxide Precipitate

Intermediate feedstock for PCAM production

- Key nickel-cobalt feedstock for high-nickel cathodes
- Replacing mixed sulphate as the preferred precursor for high-nickel pCAM

EC / DMC / EMC | **Electrolyte**

Electrolyte Organic Solvents

Base solvents in every Li-ion electrolyte

- Base solvent system in Li-ion electrolytes
- Derived from existing petrochemical value chains

MONITOR

2029 – 2032

Hard Carbon | **Anode**

Sodium-Ion Anode Material

Replaces graphite in Na-ion cells

- Na cell use hard carbon instead graphite
- Replacing graphite anodes, which do not work in sodium-ion cell chemistry

Si-C Composite | **Anode**

Silicon-Carbon Anode Material

Enables higher energy density cells

- Silicon expands ~300% during charging
- Composite structures improve cycle stability

Li_6PS_5Cl | **Electrolyte**

Sulfide Solid Electrolytes

Key material for solid-state batteries

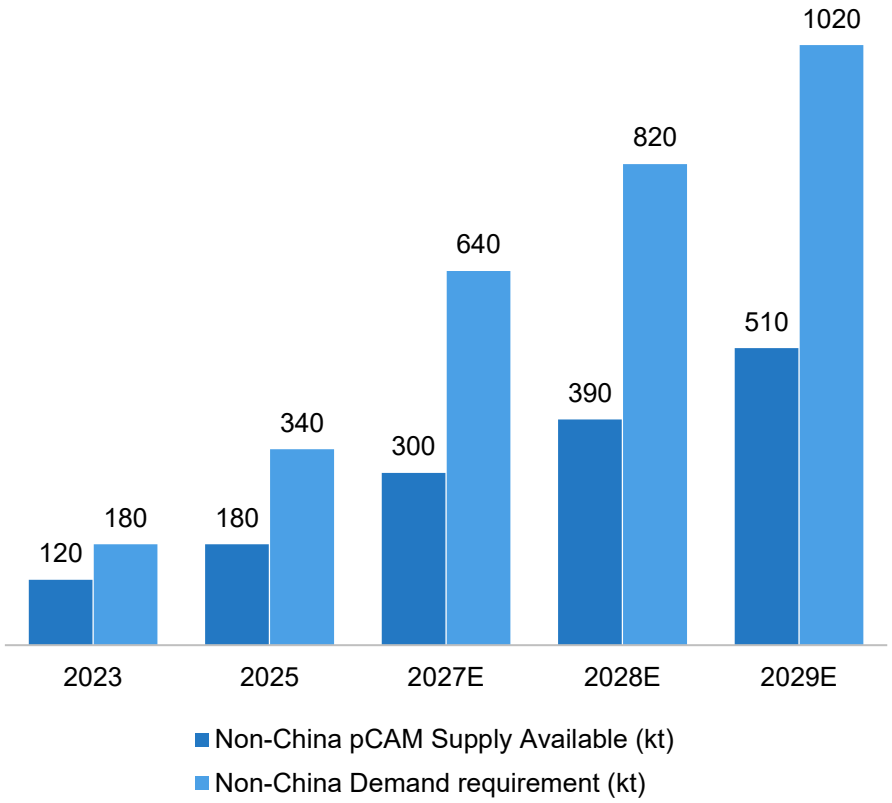
- Key material for sulfide solid-state battery
- Replacing graphite anodes, which do not work in sodium-ion cell chemistry

***Source**: Publication. Report/Press Release; Aranca Analysis; Aranca Estimates*

pCAM Supply Deficits Are Accelerating Localized Cathode Ecosystem Development

Western localization policies are accelerating non-China pCAM demand faster than supply capacity additions.

Projected Non-China pCAM Supply Gap (kt)



72% Global pCAM capacity controlled by China today

~22% EBITDA margin for qualified pCAM producers vs 6% for cell makers

410 kt Estimated non-China pCAM supply gap by 2028

Why the Cathode Ecosystem Is Attractive?

Localization policies are reshaping sourcing requirements

- IRA FEOC rules incentivize non-China pCAM sourcing from 2025
- Cathode localization depends heavily on upstream pCAM availability
- Current non-China supply additions remain insufficient

Chemistry shifts are creating new cathode supply chains

- LMFP combines LFP safety with higher energy density
- Commercial adoption is already emerging in China
- Early pCAM positioning may create long-term advantage

"pCAM is emerging as one of the most attractive near-term entry points due to structural non-China supply gaps and its critical role in localized cathode ecosystems"

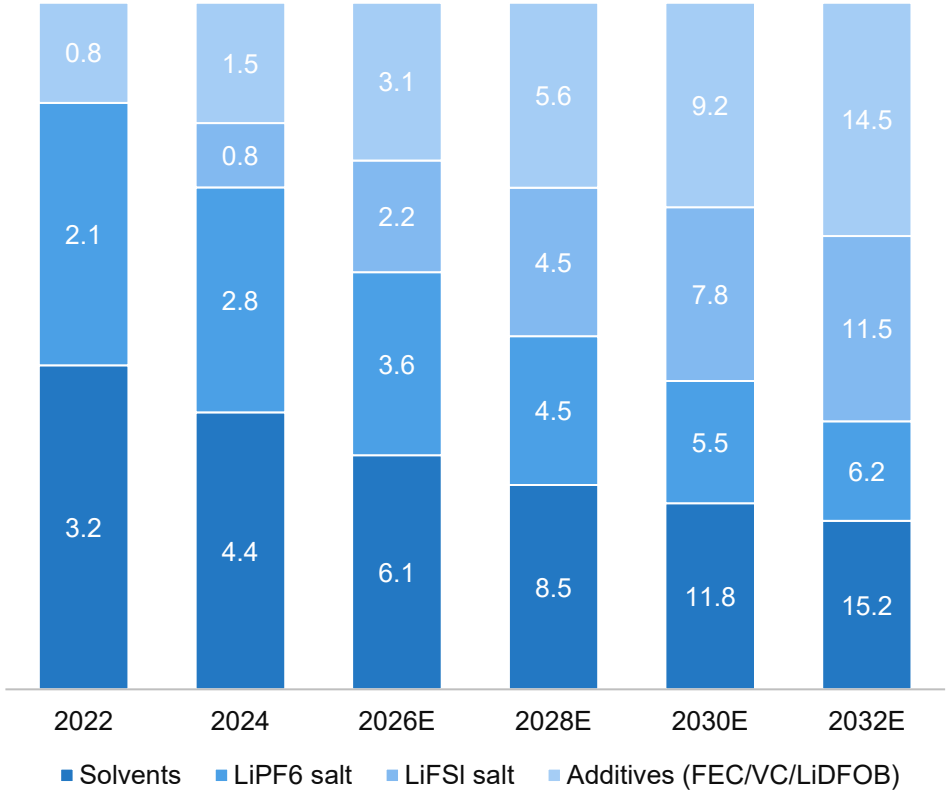
***Source**: Publication. Report/Press Release; Aranca Analysis; Aranca Estimates*

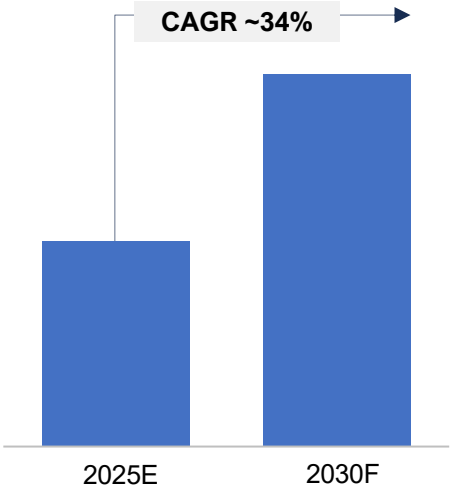
Electrolyte Con. and Complexity Are Locking In the Highest Margins in Battery Chemistry

Small volumes. Extraordinary margins. Formulation IP so sticky that switching costs make customers effectively permanent. The most defensible chemistry position in batteries

Electrolyte Market Growth - Segment by Segment

USD Billions | 2022–2032E | LiFSI and additives growing fastest as cell chemistry advances





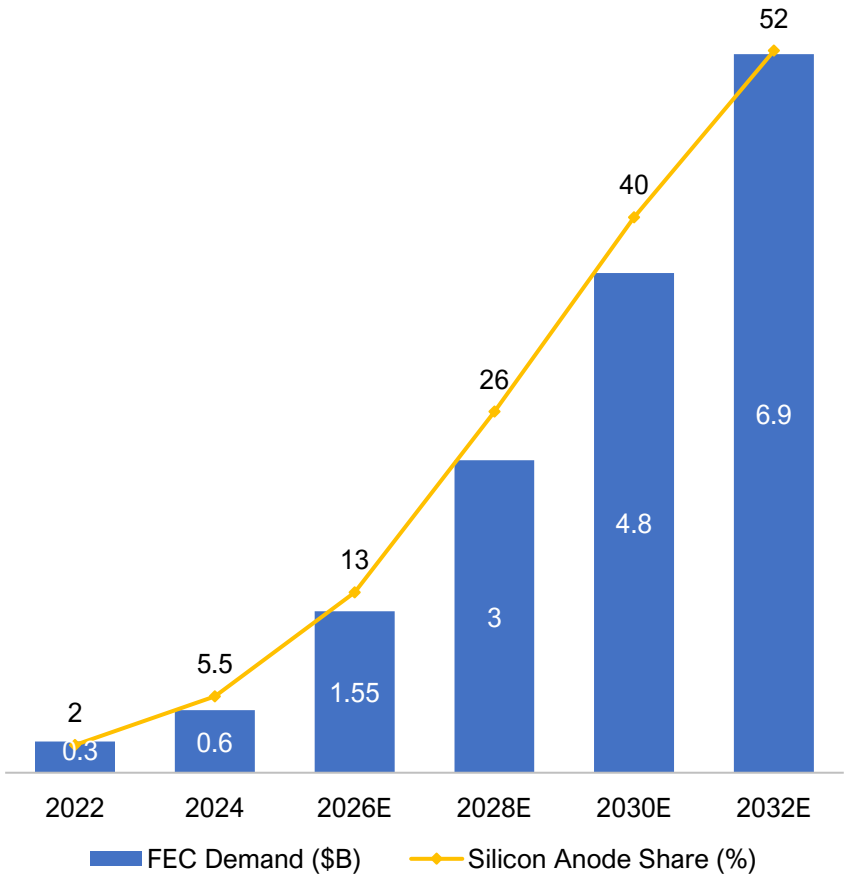
- Additives are 2% of electrolyte by weight, but 40% of its total value
- Qualified non-China LiFSI production capacity remains extremely limited today
- FEC demand could increase **~8x by 2032** as silicon-anode adoption scales
- Solid-state batteries are shifting electrolyte demand toward next-generation specialty chemistries
- Electrolyte producers - particularly LiFSI and additive manufacturers earn **25–35% EBITDA margins**, the highest in the battery value chain; 3–5x that of cell manufacturers

***Source**: Publication. Report/Press Release; Aranca Analysis; Aranca Estimates*

Silicon Anode Commercialization Is Outpacing Non-China FEC and Hard Carbon Supply

The anode shift from graphite to silicon is already commercial across Tier-1 cell makers. Every percentage point of silicon added drives a disproportionate increase in FEC additive demand

Silicon Anode Adoption vs. FEC Additive Demand)



Silicon Anodes Are Already Commercial

Panasonic's 4680 cylindrical cell, Samsung SDI's Gen 5, and BMW's Neue Klasse platform (launching 2025) all include silicon-enhanced anodes, not as a future roadmap item but as shipping production cells. Silicon anode adoption is a 2024–2026 event, not a 2030 projection.

Non-China FEC Production at Commercial Scale

FEC (Fluoroethylene Carbonate) — the critical additive that stabilizes silicon anodes — has no qualified commercial producer outside China and Japan. As Western gigafactories adopt silicon-enhanced cells under IRA/FEOC requirements, they will need FEC from a non - Chinese source.

Serious Global Hard Carbon Producer for Na-ion

Na-ion cells do not use graphite — they use hard carbon derived from resin or biomass precursors. Kuraray (Japan) is the only commercially serious hard carbon producer globally. CATL began shipping Na-ion cells commercially in 2023. That is an invitation, not a risk.

***Source**: Publication. Report/Press Release; Aranca Analysis; Aranca Estimates*

Conclusion: The Next Winners won't be the Battery Manufacturers, who enable the chemistry.

Different industries, one shared opportunity. Whether in fluorochemicals, petrochemicals, metals, or refining. The path into battery-grade chemistry runs directly through capabilities these players already own

Recommended Strategic Entry Pathways	Key Companies to Watch
Specialty & Fluorochemical Companies ▪ LiFSI and PVDF scale-up represents a natural adjacency given existing fluorine chemistry capabilities. The primary gaps - battery-grade specification and OEM qualification appear bridgeable. Initiating a technical feasibility assessment would be a logical near-term step	Navin Fluorine International Limited; SRF; GFL Gujarat Fluorochemicals
Large Chemical Conglomerates ▪ Electrolyte solvents EC, DMC, and EMC align well with existing petrochemical value chains. The higher-margin opportunity likely lies in the additive package, where acquiring a qualified specialty firm at current valuations could offer an attractive entry point	Reliance Industries Limited; TATA CHEMICALS; BASF We create chemistry
Mining & Metals Companies ▪ Downstream integration into pCAM could meaningfully enhance margin capture: MHP and Ni/Mn sulphates offer substantially higher realizations than commodity metal sales. The structural FEOC supply gap presents a well-timed entry opportunity worth evaluating.	vedanta; HINDALCO; GLENCORE
Refineries and Process Industries ▪ EC, DMC and EMC are direct petrochemical derivatives, suggesting a relatively low-friction transition pathway. Closing the battery-grade purity specification gap may represent the most actionable near-term lever for entering the electrolyte solvent market	sabic; Shell; NAYARA ENERGY

***Source**: Publication. Report/Press Release; Aranca Analysis; Aranca Estimates*

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