Article Review

Trends in the EV & Battery Industries That Matter for 2024

Frost & Sullivan's mobility analysts review 2023's biggest developments and the most important trends to be aware of in 2024.

SECOND LIFE: MAXIMIZING LIFECYCLE VALUE OF EV BATTERIES

Challenges & opportunities of repurposing

By Saverio Caldani, Irene Macchiarelli, Benedikt Unger, Victor Olsen

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January 2024

What Nobody Is Telling You About Solid-State Batteries

Solid-state batteries could offer massive advantages over current lithium-ion battery tech, but they're not quite ready yet.

BY BRUNO MAIA UPDATED FEB 17, 2024

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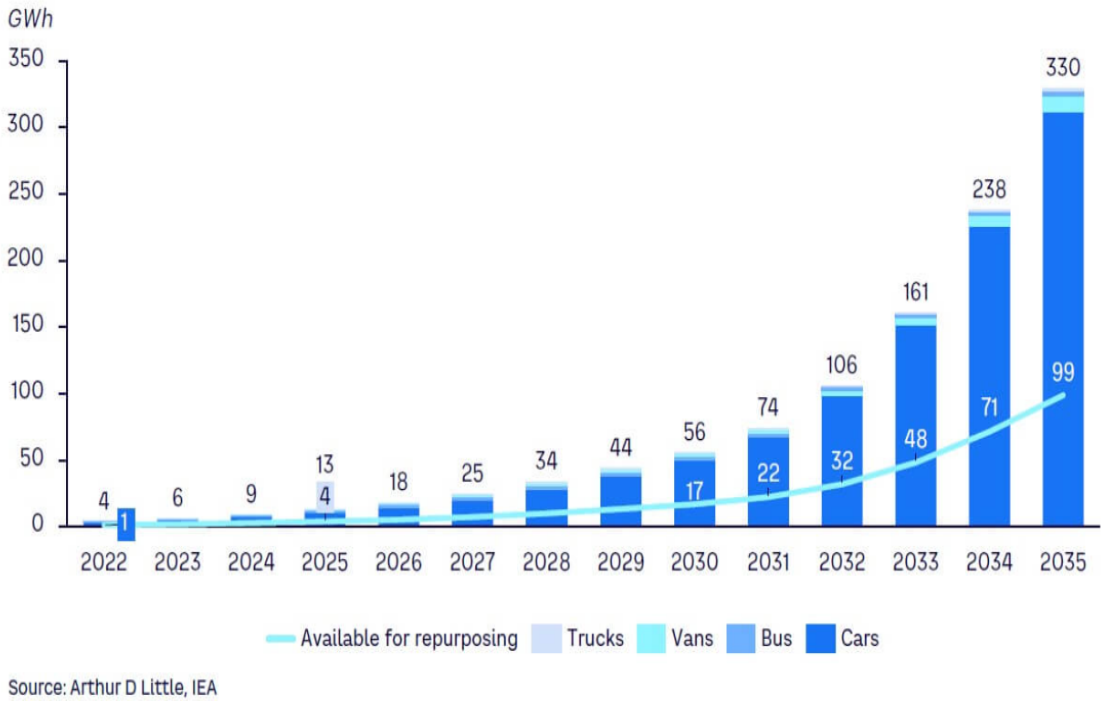
Abstract

- As 2023 closes, the EV and battery industries seem to be in a slowdown
- but there are several watershed events that signal import trends

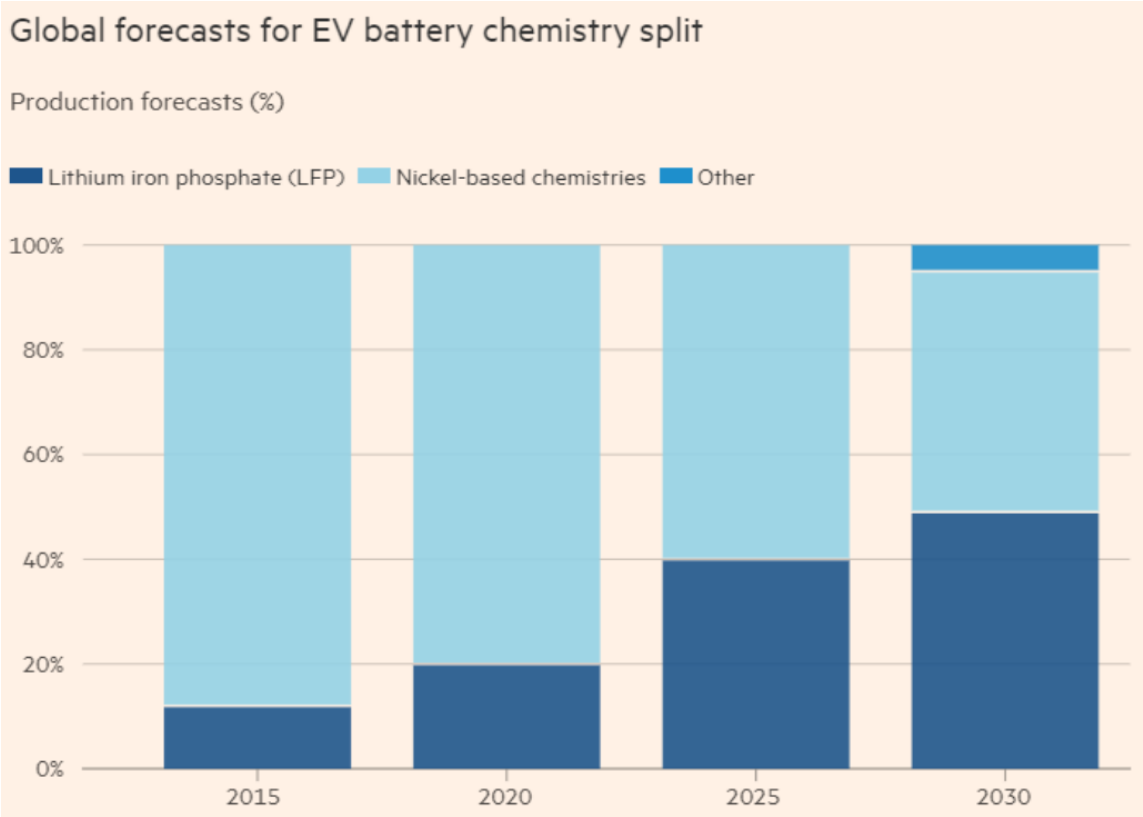
Growth of EV



[Fig 1. Global returning EV batteries forecast]

- As more EVs approach the end of their lifecycle, attention shifts to handling the batteries of retired vehicles

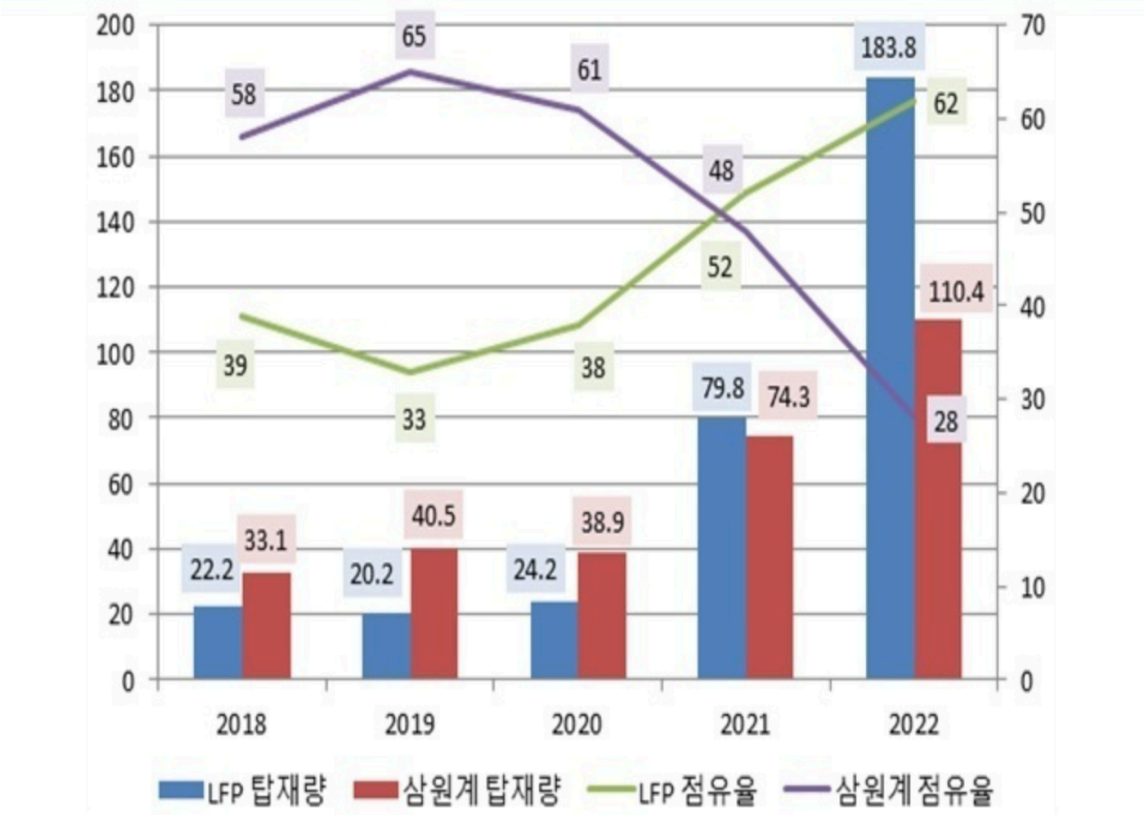
LFP



[Fig 2. NMC to LFP]

- Changes are coming to the materials used in electric vehicle lithium batteries

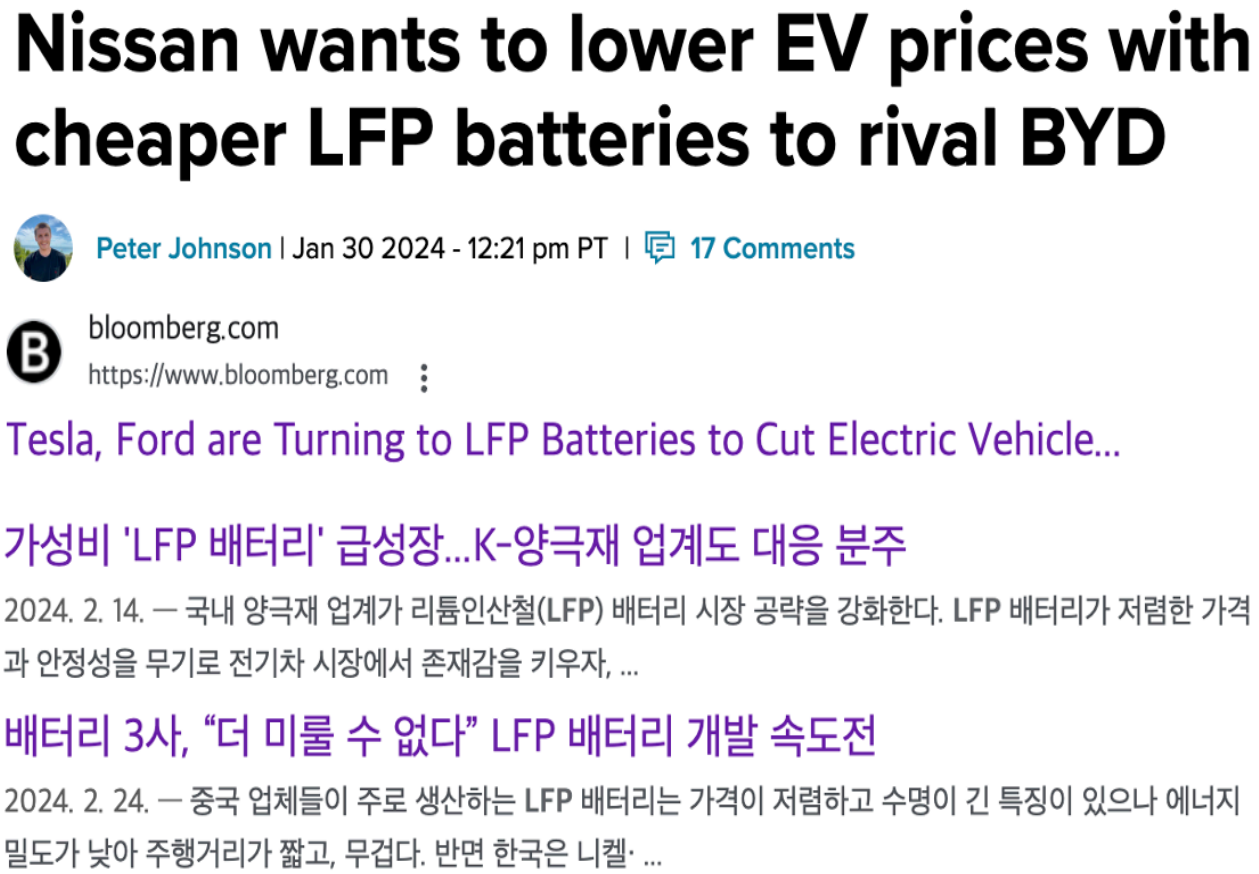
LFP



[Fig 3. China's LFP market]

- China already accounts for over 60% of the entire electric vehicle market with LFP batteries

Global trends



Nissan wants to lower EV prices with cheaper LFP batteries to rival BYD

Peter Johnson | Jan 30 2024 - 12:21 pm PT | 17 Comments

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Tesla, Ford are Turning to LFP Batteries to Cut Electric Vehicle...

가성비 'LFP 배터리' 급성장...K-양극재 업계도 대응 분주

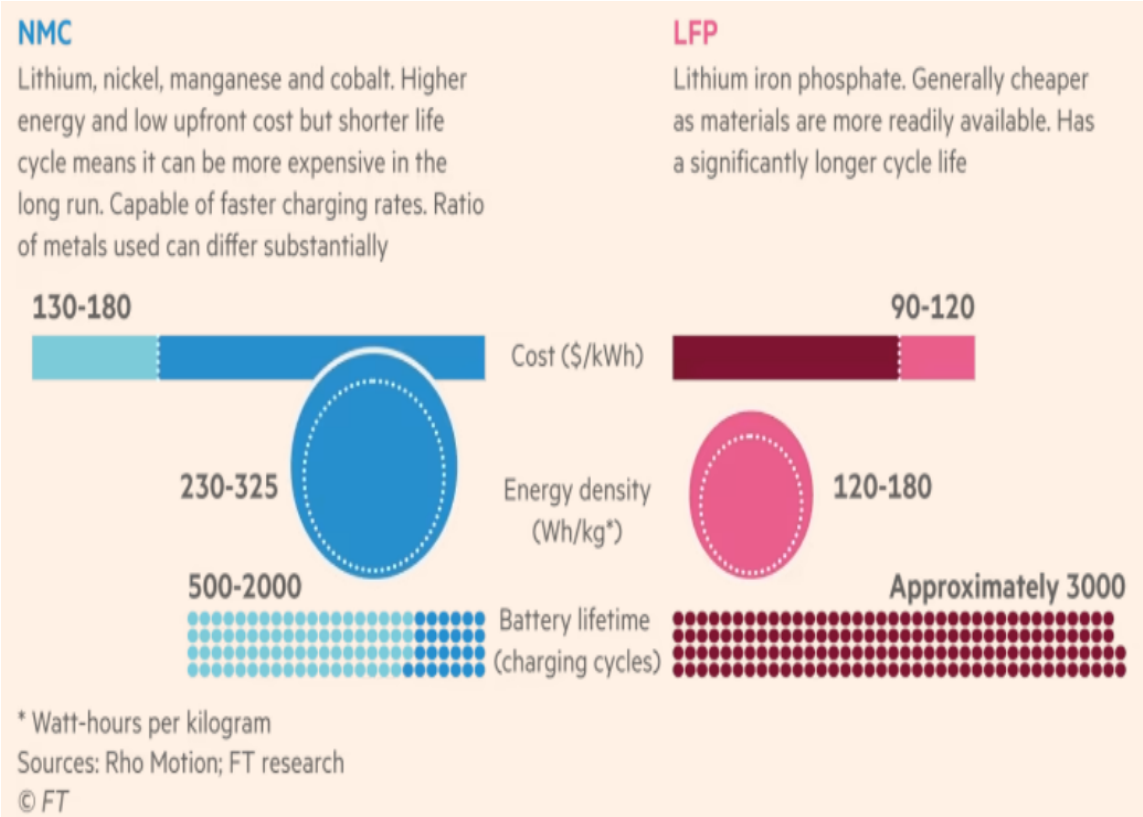
2024. 2. 14. — 국내 양극재 업계가 리튬인산철(LFP) 배터리 시장 공략을 강화한다. LFP 배터리가 저렴한 가격과 안정성을 무기로 전기차 시장에서 존재감을 키우자, ...

배터리 3사, "더 미룰 수 없다" LFP 배터리 개발 속도전

2024. 2. 24. — 중국 업체들이 주로 생산하는 LFP 배터리는 가격이 저렴하고 수명이 긴 특징이 있으나 에너지 밀도가 낮아 주행거리가 짧고, 무겁다. 반면 한국은 니켈· ...

- As of 2024, there is a global trend toward adopting LFP batteries in electric vehicles.

vs NMC



[Fig 4. NMC vs LFP]

- 안정성
- 긴 수명
- 가격

Second life battery application

전세계적으로 LFP 사용이 확산됨에 따라, 배터리 재사용 산업이 더 주목받을 것으로 예상됨

- 전기차 수요 증가
  - 가격경쟁력, 안정성 확보로 수요 증가
- 경제적 이유
  - LFP 의 철과 인은 재활용 시 경제적 가치가 떨어짐
  - 재사용이 더 매력적인 대안
- LFP의 특성
  - ESS에 주로 사용되던 배터리가 LFP (안정성)
  - 원래 전기차에는 주로 NMC (에너지 밀도)
  - 이제 전기차로부터의 중고배터리도 상당수 LFP이므로, ESS에 재사용 더 적합해짐

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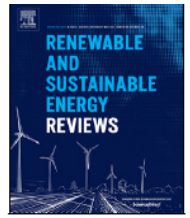

Review article

Challenges and opportunities for second-life batteries: Key technologies and economy

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- degradation models for SLBs
- **economic feasibility of SLBs**
- electronics technologies for SLBs

economic feasibility of SLBs

4.3.1. Price-setting

Determining SLB pricing for large-scale energy storage involves considering FLB prices, refurbishment costs, expenses from auxiliary devices like power electronics, and operational costs. From the perspective of price makers, as FLB prices decrease, SLB profitability becomes highly sensitive to refurbishment and auxiliary device costs. Refurbishment expenses include dismantling, sorting, and refurbishment costs, influenced by testing equipment and labor costs. The cost per kilowatt-hour storage capacity of SLBs decreases with scale, utilizing standardized processing equipment adaptable to various EV battery modules. While sorting is costly due to detailed battery investigations, current expenses mainly stem from testing and research for classification methodologies. Sorting costs vary based on the sorting level, with cell-level sorting being more expensive but vital for optimal performance. Identifying the most cost-effective sorting level is crucial, emphasizing advanced testing methods as well as the importance of historical data. While precise classification increases refurbishment costs, the extended lifespan enhances their value, enabling them to be sold at higher prices. Striking a balance between maximizing SLB longevity and managing reasonable refurbishment expenses remains a fundamental challenge in sustainable energy storage.

4.3.2. Cost analysis

The pricing of reused batteries is intricate [117,118], emphasizing the need for economic analysis beyond comparing new and retired battery costs [119]. To address price uncertainties in SLBs, methods like market surveys, sensitivity analysis, and evaluating SLB benefits are used. Market surveys calculate SLB costs by subtracting refurbishment expenses from the original price [106,120,121]. According to Li et al. [74], the price of SLBs for energy storage is \$72/kWh, and the selling price of FLBs is \$232/kWh. Some statistics in China show that SLBs are originally sold at about \$23-31/kWh, and resell for about \$62-70/kWh after testing, screening, and reconfiguration. It is also predicted that by 2025, the price of SLBs will be 30%–70% of the price of new batteries [53]. Some studies conducted a sensitivity analysis on the cost of SLBs and found the profitable purchase cost of SLBs [8,122–124]. Mathews et al. [113] assessed the profitability of a PV-SLBESS standalone system under different operating conditions and suggested that retailers sell SLBs for less than 60% of the FLBs' price. Moreover, studies also estimated the benefits of FLBs during their SOH drops from 100% to 80% to determine the profit margin and appropriate cost of SLBs [104]. Considering the residual value of batteries in retired EVs, Neubauer et al. [125] constructed a framework to estimate the selling price of retired EV batteries. They estimated the selling price of a battery health model to be \$44-180/kWh for a SLB and \$150-250/kWh for a FLB. However, the cost considerations in

- the need for economic analysis beyond comparing new and retired battery costs.
- to address price uncertainties in SLBs, market surveys, sensitivity analysis, and evaluating SLB benefits are used
  - SLBs for energy storage is \$72/kWh, FLBs is \$232/kWh.
  - the price of SLBs will be 30%-70% of the price of new batteries

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"Thank you for listening"
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