SPECIAL REPORT BY NICK GIBBS

Does China hold the key to cheaper EV batteries?

The rising cost of already expensive raw materials for batteries is forcing Western car makers to reappraise a cheaper chemistry that relies on Chinese expertise at the expense of Korean and other Asian battery players.

The growth of lithium iron phosphate (LFP) from its initial core market of electric commercial vehicles into premium EVs made by the likes of Tesla is causing Western brands to rethink their bets on the more energy-dense – but costlier – nickel-based NMC (nickel manganese cobalt) or NCA (nickel cobalt aluminium oxide) chemistry.

Some Western brands – Renault, for example – have ruled out LFP altogether. We forecast, however, that subsequent battery announcements from car makers are going to bring the iron-based chemistry into the mix for medium-range EVs as costs are ever more closely scrutinised. The soaring cost of nickel in particular will force car makers to seek alternatives.

The cost advantage of LFP was revealed in a teardown by the bank UBS and P3 Automotive of two leading LFP battery packs: the CATL-supplied unit in the standard-range Tesla Model 3 and the BYD 'Blade' battery. Both BYD and CATL are Chinese.

The bank concluded in its subsequent report that the CATL pack was the global battery cost leader at a cell price of $131 (£121) per kilowatt hour, while the BYD Blade LFP battery cost wasn't far behind at $134 (£124) per kWh.

With battery packs accounting for up to one-third of the materials bill of a modern EV, the 9% saving of LFP versus a high-density NMC 811 cell that UBS analysed previously is huge. The cost savings impressed the bank so much that it raised its estimate of LFP's global share from 15% to 40% by 2030.

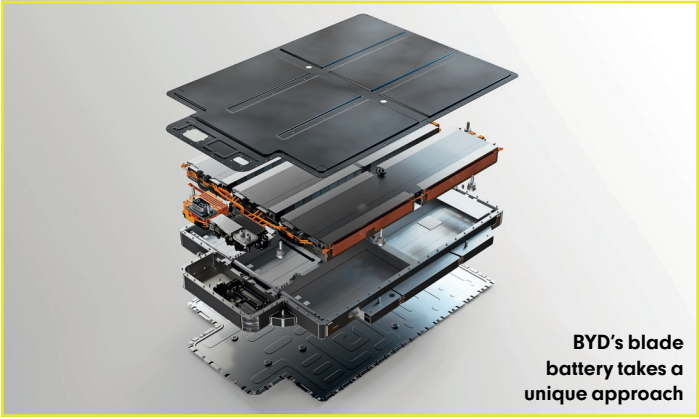
> "BATTERY PACKS ACCOUNT FOR UP TO ONE THIRD OF A MODERN EV'S MATERIAL BILL"

Tesla's commitment to LFP and its acceptance among buyers will be comforting to those car brands that might fear a consumer rejection of a chemistry with a lingering whiff of the commercial vehicle about it.

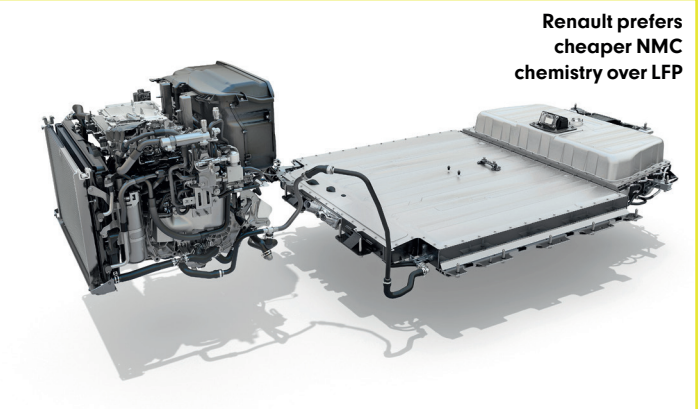
UBS estimates that 90% of Model 3s from the company's Shanghai facility use the CATL battery, including for export to Europe, with the Model Y now using the same battery for China sales, too. Tesla is also expected to use the BYD Blade LFP battery in its Model Y built in Berlin, Germany.

Tesla, however, doesn't advertise that its standard-range Model 3 and Model Y use LFP batteries, and there's little reason to flag it up. It doesn't even give a kWh figure (UBS reports that this is now 62kWh after a recent upgrade). Buyers instead note the claimed 374 miles on a single charge for the Model 3 and compare it favourably against rivals, which often use the more expensive NMC chemistry.

Chinese premium-angled electric brands



BYD's blade battery takes a unique approach



Renault prefers cheaper NMC chemistry over LFP

such as Nio and Xpeng have embraced LFP just as enthusiastically as their role model Tesla and now we're starting to see Western brands follow suit.

Before this summer, the main proponent of LFP in Europe was the Volkswagen Group, which bought the single-largest stake in Chinese battery maker Gotion and said it would use the company's LFP chemistry in the "cost-sensible entry segment". No VW EV has yet to use the chemistry.

However, we expect VW to significantly change its position from this narrow usage if it can see similar cost savings as Gotion's (much bigger) rivals have unlocked.

VW is one of the few with a path to European supply of the cheaper chemistry. In June, Gotion inaugurated its forthcoming plant in Gottingen, Germany, scheduled for production starting in September 2023. VW and Gotion are also working on a plant in Salzgitter, Germany, due in 2025.

ALL EYES ON THE NICKEL PRICE

The nickel price is likely to be the deciding factor on cost competitiveness for LFP versus NCM: at UBS's predicted long-term nickel price of $18.7 per kilogram, NCM batteries win.
But iron batteries are the cost winner with nickel price above $25 per kg.

Source: UBS

NCM'S DENSITY ADVANTAGE

A difference in cathode crystal structure means that NCM can store a greater amount of lithium relative to LFP cathodes.

Ford will use LFP batteries in its EVs from 2023 - claiming 10%-plus cost reduction

VW rival Stellantis has so far only said it would roll out an 'iron-manganese' battery pack in 2024, without indicating who would supply it. Mercedes, meanwhile, promised last year it would "vary chemistries depending on customer needs in different markets". However, CATL's recent announcement that it will build a factory in Hungary could mean LFP production for Mercedes, the plant's primary customer.

The most dramatic conversion to the new chemistry after Tesla among Western car makers so far is that of Ford, which announced it would source LFP batteries from CATL for use in its EVs starting with the Mach-E next year. Ford has praised its cost efficiency, claiming a 10-15% cost reduction over nickel-based chemistries. Ford CEO Jim Farley also noted China's control of the chemistry. "It's a very significant advantage for them. All the IP [intellectual property] is there," Farley told the bank Bernstein's annual conference in June.

Aside from cost, there are other reasons to choose LFP. Its chemistry makes it less susceptible to thermal runaway events (ie catching fire) compared with NCM batteries and it also better withstands repeat rapid charging.

There are problems with LFP, however. Those choosing it will become reliant on Chinese companies and supply chains, which we believe will worry all car makers after the painful lesson of recent months not to rely on a single region for crucial parts.

LFP is also a heavier chemistry, which throws up issues surrounding the car's weight (although CO2 output from the car itself is no longer a concern). LFP is less energy dense too, meaning that for cars it's mostly confined to cheaper, shorter-range variants.

> "LFP IS LESS SUSCEPTIBLE TO THERMAL RUNAWAY EVENTS"

Tesla, ironically, managed to make it work because its battery packaging for the Model 3 and Model Y was less efficient than rivals with dedicated electric platforms, meaning it had more room to install a decent-sized LFP pack (although not enough to launch a long-range LFP model).

VW's MEB platform, for example, might be too efficiently packaged in terms of its battery space to provide an LFP alternative with sufficient range for a European market, with UBS estimating that the 370 litres of available battery pack space can accommodate only a 57kWh LFP battery system. VW has promised MEB cars with LFP packs for China.

Finally, LFP's cost advantage could evaporate if nickel prices fall back from their current elevated heights, especially if LFP takes off as predicted. Next-generation nickel-based batteries could overtake LFP in the future on a cost/range basis, meaning car makers will need to engineer pack systems that are chemistry-agnostic. This will allow them to be super-flexible to take advantage of the most cost-effective chemistry in a manner shown by Tesla.