High-voltage venture: financing Europe's gigafactory ambitions

Complex task to create resilient battery supply chain

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Financial backers of European battery projects face a paradox. Political and industrial impetus behind creating a resilient regional electric-vehicle (EV) supply chain is strong, but technological, operational and commercial risks remain high.

As the collapse of Northvolt showed, investors in gigafactories, as large-scale battery-making facilities are known, are confronted with significant sector-specific challenges, from the complexity of achieving steady-state production amid uncertain demand for EVs and specific battery types to China's control over important links in the supply chain.

The complex ramp-up process for a new gigafactory with no track record makes it unlikely that any project funded with non-recourse debt will secure an investment-grade rating during the construction phase. At the same time, lenders' risks can be mitigated through suitably adapted financing strategies and structures to create a bankable transaction.

Kick-starting European sector involves delicate trade-offs

Still, there are difficult trade-offs to be made. Focusing on a single product can help manage the complexity of ramping up battery production, but it may weaken the project's long-term economic fundamentals given the uncertainty over how EV-related technology is evolving. Then again, Northvolt's product diversification created extra complexity that helped undermine its business.

Financial backers also need to recognise the lack of clarity over the long-term outlook for specific battery chemistries and higher production costs of European than Asian players. As a result, securing long-term orders through offtake commitments from the automotive sector's original equipment manufacturers (OEMs) is crucial, especially for raising non-recourse financing.

Even then, anyone financing nominally independent European gigafactories faces the reality that the supply chain remains deeply reliant on China – e.g., a near monopoly over anode supply – and therefore vulnerable to tensions in US-China-Europe trade relations which have risen sharply since Donald Trump returned to the White House.

Lenders need to prioritise European projects with a clearly defined scope and viable industrial plan supported by long-term stakeholder commitment, while acknowledging that market dominance will remain out of reach for some time. In this context, the emergence of the "Battery Valley" cluster in northern France is an encouraging sign of progress towards a sustainable sector in Europe.

1. Asian suppliers lead supply chain in Europe

In looking the challenges and risks for lenders financing non-recourse greenfield gigafactories and possible directions for risk mitigation, one of the first things to recognise is that most of the existing battery manufacturing capacity and announced investments in Europe come from established Asian companies. They include China's Contemporary Amperex Technology Co. (CATL), Japan's AESC Group. and South Korea's LG Energy Solution, Samsung Group, and SK Innovation Co. Elon Musk's Tesla Inc. also operates its own gigafactory near Berlin.

Large Asian manufacturers benefit from economies of scale, manufacturing expertise, and strong upstream integration (investing into raw material producers) and supply-chain control, resulting in a cost advantage. As a result, European companies are struggling to compete on price alone with established players.

Nonetheless, considering the strategic importance of car manufacturing to European economies and employment and the significant portion of overall EV costs that batteries represent (up to 40%), European policymakers have become more concerned about the absence of European-controlled gigafactories amid broader efforts to enhance the region's strategic autonomy.

Strategic autonomy becomes policy-making priority in Europe

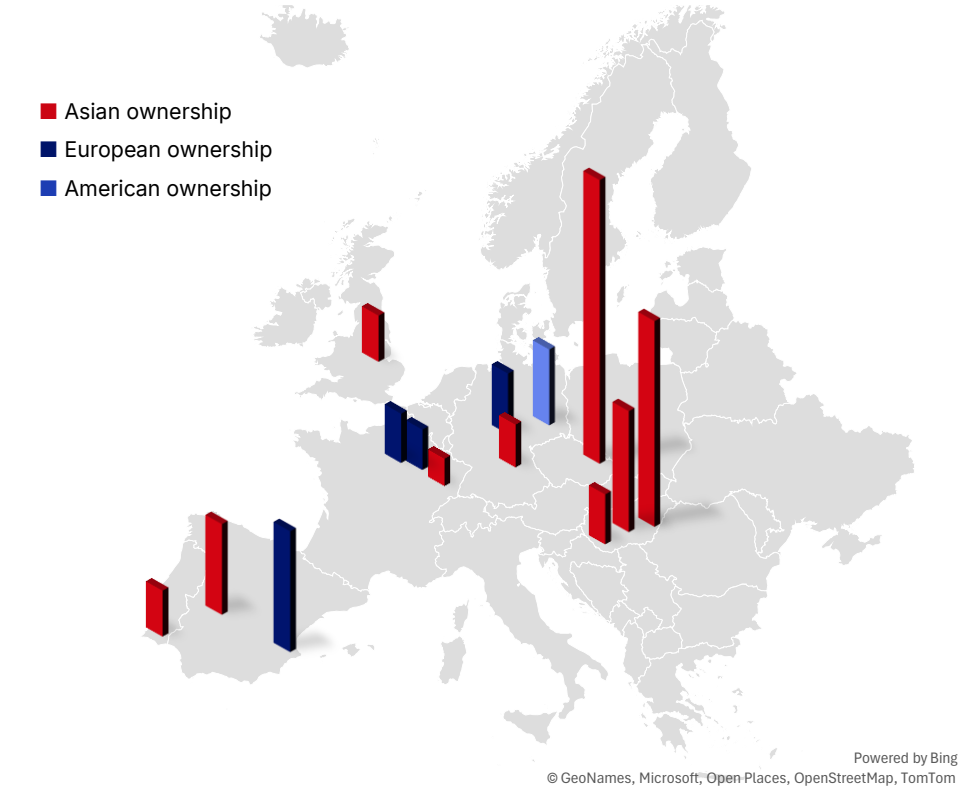
The reality, however, is that the projects in the pipeline are likely to only partially close this gap. Northvolt's bankruptcy removed substantial capacity from the European battery pipeline. What is left is ACC – a joint venture of Stellantis NV, Mercedes-Benz AG and TotalEnergies SE – which has postponed gigafactory projects in Germany and Italy, focusing instead on its French site.

Volkswagen AG has two gigafactories under construction, one in Germany and one in Spain, but has reduced the initial capacity of the Salzgitter plant by half.

France's Verkor – backed by Renault SA and financial sponsors – is building a gigafactory in Dunkirk in northern France.

Figure 1: Europe's battery backbone

Major gigafactories in operation or under construction (phase-one capacity only) in Europe



Source: Scope Ratings

European set to remain reliant on Asian battery suppliers

By 2026-27, the phase one capacity of these European gigafactories is likely to be sufficient to power around a million EVs. However, even with only a slow shift to EV adoption by European consumers, the region will rely extensively on battery producers owned by Asian companies, as the European-owned capacity will only supply about a third of the batteries estimated to be required in 2027.

We estimate the total capital expenditure of confirmed European gigafactory projects underway at around EUR 7 billion, excluding R&D, financing costs, and ramp-up losses. These projects can take four to five years to complete, from construction to full-scale operation. Given the size of the European car industry, this investment focuses on securing essential knowledge rather than strategic independence.

2. Ramping up without breaking down

Do not underestimate industrial complexity of battery making

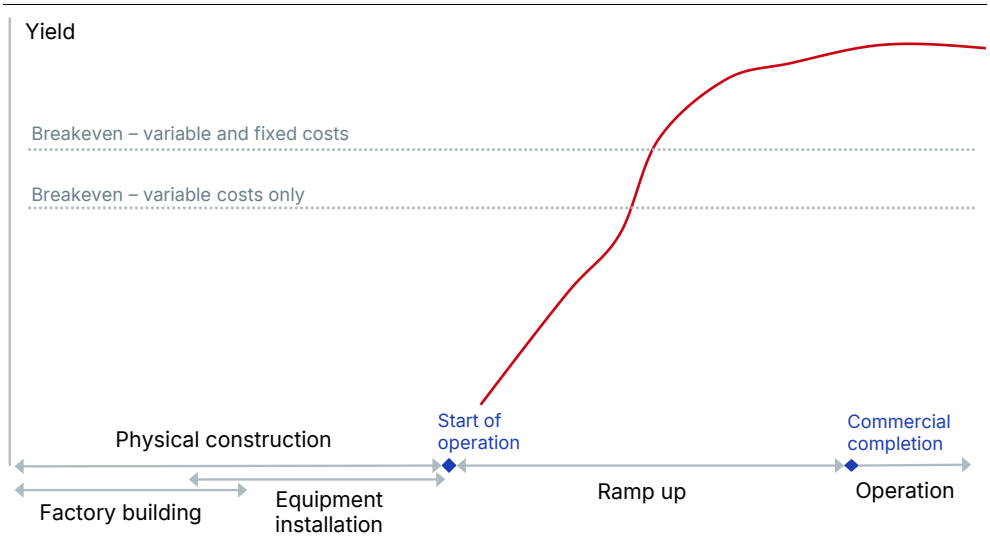
The technical complexity of scaling up of battery production exceeds conventional project risks and is at the higher end of our project finance rated universe (which includes more than 150 transactions). Battery manufacturing involves producing cells, which are then assembled into battery modules.

The critical part is cell manufacturing, encompassing a series of sequential industrial processes. Achieving scaled production for a specific design solution is highly complex, requiring the integration of various bespoke equipment. The yield reflects the percentage of cells produced that meet required quality standards; if the manufacturing process is not optimised to achieve consistently high yield of 85-90%, production is likely to be loss-making given the low margins of the business.

So, from a project-risk perspective, the length of the construction period includes not only the physical construction phase but also the ramp-up period. The key phases are illustrated in the chart below.

Figure 2: Building a gigafactor: from blueprint to fullscale production

The chart illustrates the phases of construction and the yield profile during the ramp up phase



Source: Scope Ratings

Northvolt, for example, struggled to achieve the required quality and yield at its flagship factory in Sweden, which contributed to the company's collapse. Post-mortems have raised several critical issues during the ramp-up phase, including inadequate manufacturing experience, a mismatch between specifications and manufacturing capabilities, and the inability to effectively transfer operational knowledge from China to the local teams.

Multi-contracting required for projects introduces risk of delays

For a gigafactory project, expecting a fixed-price, turn-key construction contract – a common risk mitigation tool in project finance – is unrealistic. Instead, the factory building and key equipment are typically provided by various contractors and suppliers, with the integration risk resting with the owner.

This likely multi-contracting approach, coupled with potential delays during the inherently loss-making phase of production ramp-up, translates to significant uncertainty in total project costs. Ramp-up delays not only postpone positive cashflow for a typical project but can also prolong periods of cash outflows. Access to a sufficient funding contingency is critical.

The technical challenge of achieving the required yield is the highest risk factor in a greenfield battery investment.

Achieving this for a single product line is already a significant undertaking, so attempting multiple projects can escalate the risks exponentially – as Northvolt discovered. The company had

ambitions to leapfrog the organic growth of Asian competitors and become a potent challenger, with its strategy encompassing vertical integration into cathode active material production, projects at multiple sites, and a multi-chemistry approach.

Having a sponsor with established track record can mitigate ramp-up risk, as is the case for AESC's projects in Douai (Northern France) and Sunderland (UK), given the company's global experience.

No European-owned gigafactory yet fully operational

European sponsors operating independently from established Asian players face a steep learning curve. ACC's Billy-Berclau (Northern France) facility is the most advanced, currently in the ramp-up phase, while Verkor's Dunkirk facility remains under construction. To date, none of these facilities has yet completed ramp-up.

Technical overview

A **lithium-ion cell** consists of four main parts: the **anode, cathode, separator**, and **electrolyte**.

The **cathode** is the most expensive component (over half of variable costs), driving performance and differentiating battery technologies. The two primary battery types are NMC (**nickel, manganese and cobalt**) and LFP (**lithium iron phosphate**). NMC offers higher energy density and faster charging. LFP, conversely, is cheaper, safer, and has a longer lifespan, but its lower energy intensity means it has primarily been used in entry and mid-level EVs. Most European brands use NMC batteries, and they are expected to remain the dominant type on the continent, while LFP is more common in China.

Manufacturers of NMC batteries are tending to use **more nickel** for increased energy density and **less cobalt** due to cost and concerns over supplies from the Democratic Republic of Congo (DRC), a main source. NMC811, the most advanced and widely commercialised form, uses 80% nickel, 10% manganese, and 10% cobalt, significantly lowering cobalt content and offering higher energy density than earlier formulations.

The **volatility of metal and precursor prices** highlights the importance of managing raw material price risk in battery projects.

3. Changing currents: LFP's rise and uncertain market growth

Contrary to many people's expectations of an inexorable rise in EV demand in Europe, new battery-only EV car registrations in 2024 fell 5.9% in the EU last year compared with 2023, pointing to the price sensitivity of customers in an overall soft market. EV registrations rebounded in the first four months in 2025, increasing by 26% compared with the same period in the previous year.

Questions over future demand for different battery types

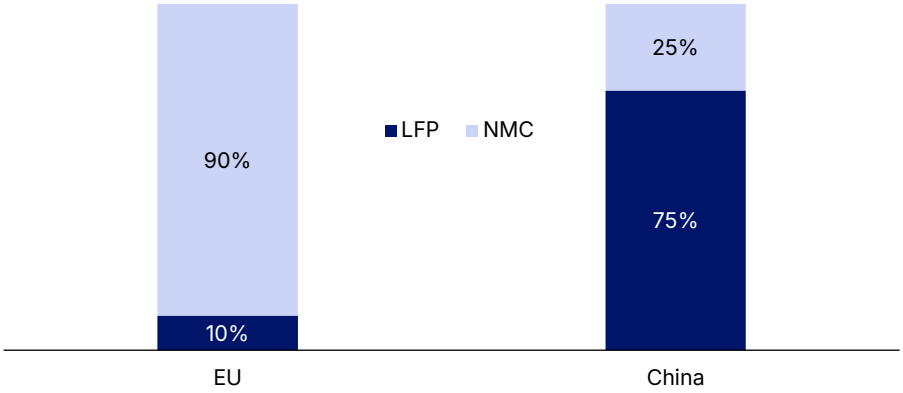
Weaker-than-expected overall EV demand is compounded by the uncertainty surrounding demand for specific battery chemistries. LFP batteries are gaining momentum in Europe, as highlighted by the Stellantis-CATL joint venture announcement of a massive LFP facility in Spain, driven by LFP's 20-30% price advantage (**Figure 3**).

Currently, all gigafactories owned by European companies are based on NMC chemistry. An increase in OEM demand for more affordable LFP batteries would further weaken the market position of European NMC gigafactories and reinforce the dominance of Asian companies, particularly those in China, within the industry. This risk highlights the importance of long-term offtake commitments.

Although alternative technologies like cobalt-free cathodes, sodium batteries, and LMFP are emerging, their development, OEM qualification, and supply chain scaling could take many years.

Figure 3: LFP batteries: poised for a growth in the EU

Share of LFP and NMC batteries in the EU and China in 2024 for EVs



Source: IEA

4. The China syndrome: EV supply chain tightly linked to one country

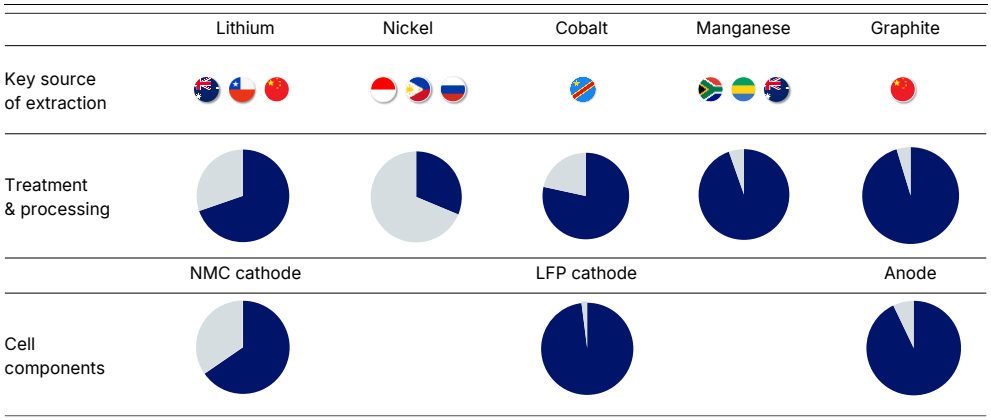
China holds crucial links in battery supply chain

China dominates the lithium battery industry supply chain, holding a leading position in the treatment and processing of metal ores. Furthermore, the extraction of key metals such as cobalt (DRC), nickel (Indonesia), and graphite (China) is also dependent on resources in a single country. Regarding cathode components, this dependency is most concerning in the case of cobalt, not only because of the instability in the DRC – facing a Rwanda-backed insurgency in the mineral-rich east of the country – but also because most of the cobalt mines are controlled by Chinese companies.

The EV sector accounts for most of the demand for lithium and cobalt, nickel and manganese have broader applications, meaning the overall market is not driven just by EV dynamics. China controls over two thirds of the processing capacity for all battery metals except nickel, and it holds a near-monopoly on flake graphite. China's influence over nickel is significantly higher too when considering its indirect control over Indonesian facilities. This significant reliance on China throughout the battery supply chain renders the industry highly vulnerable to geopolitical risks, as the example of the supply chain for NMC cells shows (**Figure 4**).

Figure 4: China's stranglehold over materials in the battery-making supply chain

China's share of raw-material processing and battery-cell components shown in dark blue



Source: IEA data, Scope Ratings

Gigafactories with access to European-controlled cathode-related supplies have an advantage in terms of hedging China exposure. ACC, for instance, has a long-term strategic agreement with Belgium's Umicore for high-nickel cathode materials from its Polish facility.

Other projects with Chinese suppliers are focusing on localised cathode-related materials. This strategy is partly motivated by economic factors, as EU local content criteria incentivise sourcing within the EU to avoid tariffs under free trade agreements. Cathode components represent the highest raw-material input cost, hence the importance of local EU supplies. XTC, a leading Chinese cathode supplier, has partnered with nuclear-fuel company Orano SA for a Dunkirk EV battery-recycling facility, set to open in 2027. EU-based production might partially reduce concerns over supply-chain interruptions from geopolitical shocks, but the industry remains reliant on China.

Europe finds more local cathode-related battery materials…

Anode material constitutes a smaller share of variable costs (c. 10%), it remains a critical component heavily reliant on Chinese suppliers. The anode material used in NMC and LFP batteries is graphite, which is produced from mechanically treated natural flake or synthetic graphite. China holds more than 90% of the material treatment and processing capacity in both segments and commands around 93% of the final anode market share. European efforts to source natural graphite locally can only support a small fraction of European gigafactory capacity.

… But still heavily reliant on Chinese anode-material supplies

5. Location, location: Europe’s battery-technology clusters emerge

One of Northvolt’s main handicaps was that the remoteness of the main production facility in Skellefteå, near the Arctic Circle, made it hard to attract experienced staff and resulted in other logistical complexities.

In contrast, recent gigafactory developments in France’s Hauts-de-France region, dubbed “Battery Valley,” benefit from policies designed to concentrate players in the battery-related supply chain in the same region. The installations include the Verkor battery plant and ProLogium Technology Co. solid-state battery factory in Dunkirk, ACC’s gigafactory at Billy-Berclau, and AESC’s facility in Douai.

So-called Battery Vallery takes shape in northern France

This emerging cluster should benefit from access to existing industrial facilities and a pool of local labour – at least in principle – in addition to its proximity to suppliers, such as the XTC-Orano project. The local access to affordable baseload electricity and sufficient water resources are also critical when choosing gigafactory location.

Assuming that enough skilled staff are found for existing and future projects, the emergence of battery-technology clusters is encouraging for European gigafactory investors and creditors.

The Northvolt experience showed that a European industry cannot be built overnight, but the new clusters suggest that, with Europe’s political and industrial determination to develop local battery supply chains for the automotive industry and beyond, a sustainable indigenous sector is in the making.

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