Industrial electrification enters maturity phase

EUROPE'S INDUSTRIAL ELECTRIFICATION MOVES BEYOND THE PIONEERING PHASE AS LFP TECHNOLOGY DOMINATES, SODIUM BATTERIES EMERGE AND MISCONCEPTIONS ABOUT SAFETY FADE

Across Europe's industrial landscape, electrification is no longer a future prospect but a reality that's transforming production processes, supply chains and business models. The question is no longer whether to electrify, but how to do it efficiently, sustainably and competitively.

After a pioneering first phase, 2025 marks the start of a new era, one of technological and cultural maturity. The industry has entered a stage of technological and cultural consolidation, where innovation, cooperation and awareness are the key drivers of the future.

Analysing key market trends and the direct experience of companies like Flash Battery reveals three main directions that are currently reshaping the off-highway sector: the consolidation of LFP chemistry and the arrival of sodium batteries, the shared growth of the supply chain towards co-design models and the dispelling of popular misconceptions and concerns that are still surrounding the world of electrification.

The new era of chemistry

The first major change begins at the heart of storage systems: cell chemistry. Lithium-iron-phosphate (LFP) technology, once seen as a niche option, has now become one of the main pillars of the electric transition. In just a few years, LFP chemistry has evolved from just an emerging solution into the benchmark standard today for manufacturers and industrial operators.

The reasons are tangible and measurable. LFP offers superior operational safety thanks to greater thermal stability than other chemistries and significantly higher thermal-runaway thresholds. The technology uses no critical materials such as nickel, manganese and cobalt. In addition, it delivers a service life exceeding 4,000 cycles, with average degradation below 2% per year. LFP also provides reduced costs along the entire value chain and greater supply availability.

Moreover, there's been a significant reduction in costs throughout the value chain and an improved supply outlook, factors that are consolidating its adoption on an industrial scale. The new generations of LFP cells, known as LFP 2.0, have reached energy densities of around 190Wh/kg, approaching NMC performance while offering a higher level of safety and lower costs. These features make the technology particularly well-suited to heavy-duty and off-highway applications where reliability is paramount.

At the same time, 2025 saw the launch of the first commercial applications of sodium-ion batteries. Still in its infancy but with notable potential, this technology focuses on the availability of raw materials and low production costs. It's an interesting solution for stationary systems or light vehicles, although for the moment its still-limited energy density is slowing its spread to high-energy segments.

"The coexistence of LFP and sodium-ion will define the future of industrial electrification. LFP is the certainty of the present, while sodium represents the medium-

Flash Battery customised lithium batteries for the industrial sector

Battery assembly phase of one of Flash Battery's customised lithium batteries, carried out directly at our HQ in Sant'Ilario

term frontier," says Alan Pastorelli, CTO of Flash Battery.

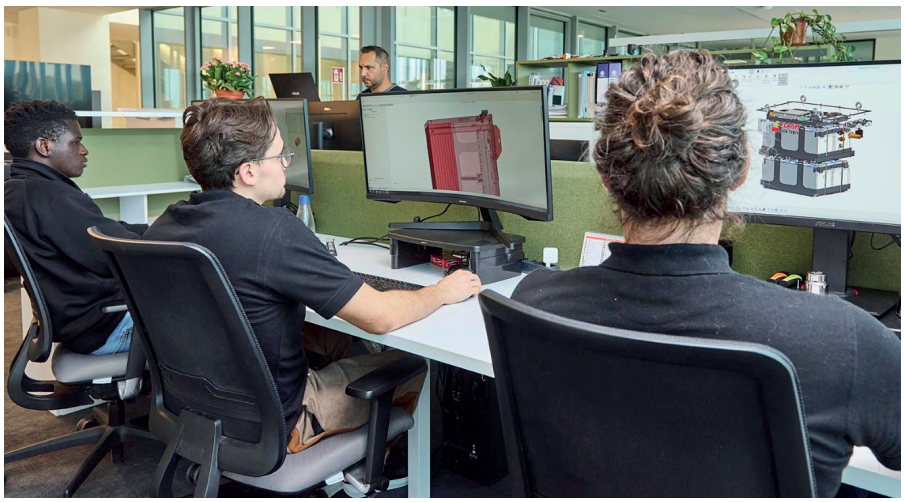
Challenging misconceptions

Despite having reached a high level of technological maturity, industrial electrification still faces a range of misconceptions and preconceptions that are slowing its expansion. Analyses and dialogue with operators clearly show a gap between what technology can now offer and the market's actual awareness.

The first misconception to dispel concerns battery safety. Data from the Insurance Institute for Highway Safety show that the risk of fire in electric vehicles is roughly ten times lower than in internal-combustion vehicles. In industrial contexts, LFP batteries ensure high thermal stability and minimal reactivity even when impacted or in the event of a short circuit. The integration of continuous monitoring systems and AI predictive algorithms now makes it possible to take preventive action, further reducing risks.

Another major concern is about the lifespan of the battery. Modern LFP solutions easily last more than 10 years and reach more than 4,000 charge and discharge cycles. Thanks to efficient thermal management and advanced balancing systems, average annual degradation can drop below 2%. In many cases, the battery outlasts the mechanical life of the vehicle or machine it's installed in.

Many users also worry about the number of charging stations available. According to ACEA, the number of public charging points in Europe grew by 42% in 2024 alone, reaching over 870,000. Added to these are industrial-grade infrastructures, increasingly widespread at production plants and logistics hubs. The real challenge is quality, not quantity: standardising charging protocols and managing energy flows have become the new priorities to ensure a truly efficient ecosystem.



ABOVE: **Customised design of Flash Battery lithium batteries, optimised for the needs of industrial machines and vehicles**

BELOW: **Different formats of LFP lithium battery cells, including cylindrical and prismatic cells**

Overcoming these perceptual barriers requires communications that are more clear and based on objective evidence. Making data, case studies and tangible results accessible is essential to build trust in industrial electrification, which is already a competitive solution from technical, environmental and economic perspectives.

Co-design and data analysis

The electric transition isn't a solitary journey but a process involving the entire value chain. Moving from prototype to industrial production takes years of development, testing and validation, with higher levels of complexity than traditional combustion systems.
Every phase – from design to electronic integration, through to testing and monitoring – demands specialised expertise and constant collaboration among sector players. Co-design between battery manufacturers, machine builders and system integrators helps significantly to shorten development times and improve system reliability.

Data management plays an increasingly important role. Remote monitoring platforms and predictive AI technologies like Flash Data Centre are transforming maintenance and fleet management, enabling anomaly prediction, optimised charging cycles and cost reduction, while hardware/software integration boosts efficiency and sustainability. Data collection and analysis capabilities are now the basis for ensuring transparency along the entire supply chain: the EU Battery Regulation 2023/1542 introduces new requirements on traceability, environmental sustainability and social responsibility, turning regulatory compliance into a competitive advantage for companies able to demonstrate the origin and quality of their products.

Towards a shared industrial ecosystem

Electrification is a systemic transformation that calls for expertise, collaboration and a shared culture built on transparency. The off-highway sector's future depends on its ability to integrate technology, data and people, creating value not only through innovation but also through knowledge sharing.In this vision, companies like Flash Battery are playing an active role in promoting a strong, innovative and sustainable European supply chain. Sharing data, know-how and vision has become the true accelerator of change.

2025 marks the beginning of a maturity phase for industrial electrification. An important stage in which technology becomes the key instrument for building a more efficient, safer and more competitive economy. The challenge for the coming years will be to consolidate this transformation, making electric power an integral, enduring part of Europe's industrial fabric. **iVT**