**Press contact:**
*Florence Lièvre*
*Tel.: +33 1 47 54 50 71*
*Email: florence.lievre@capgemini.com*

# A dual challenge for the battery industry: ramping up production while innovating game-changing chemistries for the future

- *Battery innovation is fueling industry transformation, but overcoming current production ramp-up challenges will be crucial for European and US manufacturers*
- *Lithium-ion batteries currently dominate due to their proven performance, scalability, and well-established supply chain, while next-generation batteries are gaining traction*
- *76% of manufacturers will need to upgrade or build new production lines to support the future generation of battery cells*

**Paris, February 27, 2025 – The Capgemini Research Institute's report *'The battery revolution: Shaping tomorrow's mobility and energy'*, published today, shows that batteries are transforming existing industries and enabling the emergence of new business models. However, despite the surging demand for Electric Vehicles (EVs) and energy-storage solutions, the future of batteries depends on overcoming a series of complex challenges across the entire value chain, from securing sustainable raw materials and optimizing manufacturing processes to advancing recycling capabilities.**

According to the new report, the battery industry is reaching an inflection point, driven on the one hand by the need for higher energy density, faster charging times, improved safety, greater sustainability, and, on the other, the need for manufacturers to reduce costs.

While batteries are playing a critical role in decarbonizing carbon-intensive mobility and driving the renewable energy transition[1], the industry is facing series of challenges that have wide ranging implications for scaling production, gigafactory industrialization and ramp-up, economic viability, and supply chain constraints.

**Battery technology is constantly evolving to improve performance and reduce costs**

While almost all (98%) battery manufacturers surveyed produce lithium-ion batteries (using liquid electrolyte), the industry is actively exploring alternative chemistries to support electric mobility and accelerate energy storage. Amongst them, solid-state batteries (using solid electrolyte), represent a major shift in battery technology, primarily for EVs. They answer the need for improved performance owing to their potentially higher energy densities, faster charging times, and improved safety compared with traditional lithium-ion batteries.

*"Innovation is driving a sustainable and competitive battery industry, with advancements in technologies and alternative chemistries improving performance and longevity. At this transformative time, while European and North American manufacturers are navigating production ramp-ups and exploring next generation of batteries, a solid and scalable digital foundation will be crucial for the industry's future,"* said Pierre Bagnon, Global Head of Intelligent Industry Accelerator at Capgemini. *"Data and digital technologies can enhance the entire battery*

[1] According to IEA, batteries account for 90% of the Net Zero Emissions by 2050 Scenario (NZE Scenario), with 60% of CO2 emissions reductions to be made in the energy sector by 2030 associated with batteries – *Source: IEA, "Batteries and secure energy transitions," April 2024.*

*value chain, optimizing lifecycle management from quality control to waste management and recycling. Equally, collaboration within an innovation ecosystem that brings together all players and regulators is vital to continue the industry's journey towards a battery-driven sustainable future."*

**Advances will enable new business models but not without challenges**

According to the survey, batteries are enabling new business models in the mobility industry to make EVs accessible to a broader range of consumers: a majority (around 64%) of mobility players are exploring battery swapping; nearly two-thirds of automotive organizations are considering battery-leasing and over half Battery-as-a-Service (BaaS) model that allows EV owners to lease or rent their batteries, rather than buy them. However, the success of these business models depends heavily on the implementation of standards, battery performance notably regarding longevity, adequate infrastructure, and economies of scale.

In the energy and utilities sector, two in five organizations say they are integrating batteries with renewable energy systems to optimize energy storage and usage, with most of them (69%) currently offering or planning to offer BaaS solutions. However, key challenges remain; while a battery is considered an expensive asset, the electricity it stores is relatively cheap. Furthermore, most organizations emphasize the lack of robust grid infrastructure and advanced control systems (65%); the need for multiple battery types to facilitate both short-term and long-term storage solutions (61%) and for open performance standards to ensure reliability and transparency (59%).

Beyond the automotive and energy sectors, multiple industries are rapidly integrating batteries into their operations: three in five of the organizations surveyed stated that battery innovation will impact fleet operators and heavy transportation in the next 5-10 years. Disruptions are also expected in aviation and shipping. Innovations in these industries include battery-powered eVTOLs (Electric Vertical Take-off and Landing), heavy-duty vehicles, and electric ships on short sea routes.

**Overcoming production ramp-up challenges with scalable digital foundations**

The battery industry is facing a number of complex and pressing challenges. Over half of battery manufacturers cite time required to build and ramp up gigafactories and difficulties in securing a stable supply chain for battery components and materials (respectively 59% and 53%). Uncertainty, around economic viability and profitability, appears as a key concern to scaling production.

The scarcity of experienced talent also represents a significant challenge for the battery industry, with 60% of organizations facing skills shortages in both battery technology and manufacturing. Expertise gaps extend beyond specialized skills and encompass data scientists and manufacturing engineers who can analyze and correlate production data with battery performance, enabling process optimization and defect reduction.

While batteries are key to decarbonizing carbon-intensive mobility and driving the renewable energy transition, only one in three battery manufacturers surveyed have taken meaningful steps toward establishing a sustainable circular economy.

A majority (67%) of respondents acknowledge that data and digital technologies are crucial to the industry's future. However, digitalization among battery manufacturers is currently low, at just 17% and data usage remains minimal in sustainability-related fields. In Europe, a Digital 'battery passport'[2], setting high

[2] From February 2027, EVs sold within the EU must be equipped with 'battery passports' that provide detailed information on battery composition, including sources of key materials, carbon footprint, and recycled content.

environmental standards for battery production and recycling, will enable suppliers and OEMs to make informed decisions by considering the complete lifecycle of battery manufacturing.

To read the full report: LINK

**Report Methodology**

The Capgemini Research Institute surveyed 750 senior executives from large battery, automotive, and energy and utilities organizations across 15 countries in North America, Europe, and APAC. The survey findings are complemented by in-depth discussions with 22 experts from battery, automotive, and energy and utilities sectors. The organizations surveyed are significant players in their respective segments, including battery manufacturers with annual revenue exceeding $50 million; energy and utilities firms with revenues over $1 billion (except those from Sweden and Norway, whose revenue exceeds $500 million); and automotive manufacturers with revenue above $1 billion (excluding two- and three- wheeler original equipment manufacturers [OEMs] with revenue over $300 million). The global survey was conducted in September-October 2024.

**About Capgemini**

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, generative AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2024 global revenues of €22.1 billion.

Get The Future You Want | www.capgemini.com

**About the Capgemini Research Institute**

The Capgemini Research Institute is Capgemini's in-house think-tank on all things digital. The Institute publishes research on the impact of digital technologies on large traditional businesses. The team draws on the worldwide network of Capgemini experts and works closely with academic and technology partners. The Institute has dedicated research centers in India, Singapore, the United Kingdom and the United States. It was ranked #1 in the world for the quality of its research by independent analysts for six consecutive times - an industry first.

Visit us at https://www.capgemini.com/researchinstitute/