STATUS OF THE RECHARGEABLE LI-ION BATTERY INDUSTRY 2019

Market & Technology Report - May 2019

E-mobility continues to strongly drive Li-ion battery demand.

WHAT'S NEW

- Expanded overview of the application trends driving future needs for battery characteristics and demand
- Insights into battery recycling methods
- Focus on NCM 811 battery technology
- Broader coverage of battery integrators, in different applications

REPORT KEY FEATURES

- 2018 - 2024 battery demand (in GWh and $M) for three main application segments: consumer electronics, electric mobility, and stationary energy storage
- Analysis of different Li-ion chemistries and their applicative potential
- Technology trends for Li-ion battery cells, cell components, and battery packs
- Li-ion battery supply chain, ranging from raw material supply, cell components, and manufacturing/ testing equipment, to battery integrators and battery recycling companies

GLOBAL LI-ION BATTERY DEMAND IS GETTING HUGE!

Global Li-ion battery demand continues its impressive growth and will reach a massive 638 GWh of yearly demand by 2024. The main reason for this growth is the demand for electric and hybrid electric vehicles (EV/HEV) and other e-mobility applications. According to Yole Développement's analysis, e-mobility alone will represent about 87% of global Li-ion battery demand.

In this report, Yole Développement analyses three key battery market segments: consumer applications, e-mobility, and stationary battery storage. Market trends for the different applications and their battery characteristic requirements are detailed in the report.

Li-ion battery demand's amazing growth is due to various factors. First is the increasing demand for a given application (i.e. electric vehicles, electric buses, smartphones, utility-scale battery storage systems, etc.). Also, battery capacity per system is expanding in most applications, leading to higher demand on battery cells (in GWh). Moreover, in some applications (i.e. electric bikes, power tools, and stationary battery storage), Li-ion battery's share is increasing via progressive replacement of "older" battery technologies like lead-acid and NiMH batteries. And yet another factor fuelling global battery-demand growth are new battery applications and a growing share of battery-powered power tools and consumer devices.

Factors driving the huge rechargeable Li-ion battery demand

(Yole Développement, May 2019)

THE SUPPLY CHAIN IS RESHAPING IN ORDER TO REDUCE COST AND GET CLOSER TO CUSTOMERS

Li-ion battery has become the technology of choice for many applications, and it attracts attention from numerous players: R&D labs, material suppliers, cell component developers and manufacturers, cell and battery pack manufacturers, and system integrators.

The cost pressure that increases as battery technology matures and as EV/HEV market competition grows drives the battery integrators' move towards suppliers offering more competitive pricing. Chinese players like CATL have largely benefited from this trend and have signed supply partnerships with car makers in Europe and the USA. Also, Asian battery manufacturers are developing manufacturing capacities in Europe in order to be closer to European car manufacturers and to satisfy the specific needs of "made in Europe" batteries.

Battery factories getting closer to electric vehicles manufacturers

Many companies have announced their plans to construct battery manufacturing facilities close to electric car manufacturers in Europe and the USA.

(Yole Développement, May 2019)

Meanwhile, car manufacturers unrestricted by exclusive cell-supply partnerships can easily change suppliers as a means of getting the best performance/cost ratio. However, changing suppliers can be challenging in the case of specific cell formats and chemistry (i.e. Panasonic's NCA cylindrical cells used in Tesla cars), especially if high volumes in multi-GWh/year-range are needed.

Companies active in the EV/HEV business (BYD, Tesla, BMW, Porsche, etc.) are diversifying their activities towards stationary battery energy storage or EV charging solutions (which might use stationary batteries too). This helps them enlarge their product and customer service offer.

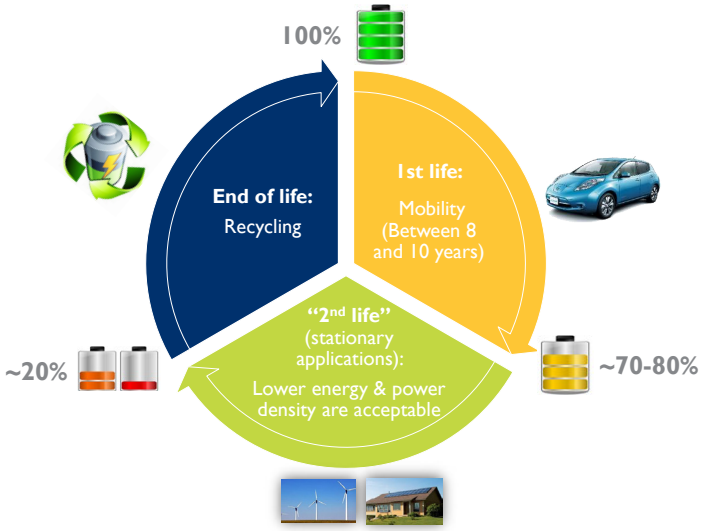
Several factories in multi-GWh scale have been announced or are under construction to fulfil the future huge demand for Li-ion battery cells and to drive down cell manufacturing costs.

BATTERY TECHNOLOGY: NO REVOLUTION IN SIGHT, BUT POTENTIAL EXISTS FOR PERFORMANCE IMPROVEMENT AND COST REDUCTION

As EV/HEVs drive global battery demand, most technology innovations and development efforts are focused on battery cells for these vehicles. The increasing battery pack capacity per vehicle creates growing needs for large-capacity battery cells. Pouch and prismatic cells are increasingly used here: for example, in consumer electronics, the customer's growing attraction to the slim-device format is accelerating the move from cylindrical to pouch/prismatic cells. Cylindrical cells are still used in some electric cars (i.e. Tesla models), small e-mobility applications, and consumer electronics.

End-of-life battery = opportunities and burdens

The safety, economic, and environmental issues associated with the handling, reuse, and recycling of end-of-life EV batteries is growing in importance and has attracted the attention of battery supply chain players.



(Yole Développement, May 2019)

Regarding battery cathode chemistries, there is a clear trend towards NCM (also called NMC) technology, due to its "universal" characteristics which match with the requirements of a large variety of products and applications. Within NCM technology, the trend is to minimize the expensive cobalt content and increase the energy density by switching to nickel-rich chemistries like NCM811. NCM811 represents a strong competitor to the NCA technology currently used in Tesla cars, for example. Thanks to its superior energy density, NCM811 is in the sights of the leading battery cell makers (i.e. CATL, BYD, LG Chem, SK Innovations). In fact, NCM 811 commercial applications have been announced by several companies for 2019. However, the deployment of NCM811 technology in large-scale applications remains challenging due to manufacturing, lifecycle, and safety challenges.

Although there is a strong development effort towards alternatives to existing Li-ion technologies (so-called "beyond Li-ion" technologies), according to Yole Développement there will be no major battery breakthrough in the coming years. There are very strong technology and market challenges to overcome before better battery characteristics and competitive pricing compared to Li-ion technologies can be achieved. Battery improvements will therefore be rather progressive, and the focus will be on cost reduction and improvement on the battery-pack level. Another focus is on environmental, economic, and safety issues related to end-of-life battery handling, reuse, and recycling. The most effective and eco-friendly battery recycling approaches are being actively researched in order to anticipate the huge future volume of end-of-life batteries, especially from electric vehicles.

REPORT OBJECTIVES

- Offer deep insight into the rechargeable Li-ion battery market, covering the three main application segments: consumer electronics, electric mobility, and stationary energy storage
- Furnish 2018 - 2024 battery demand data (in GWh and $M) for different Li-ion battery applications
- Provide extensive analysis of different Li-ion chemistries and their future applicative potential
- Present the main technology trends for Li-ion battery-cell materials, formats, sizes, cell components (cathode, anode, electrolyte, and separator), and battery packs
- Deliver a detailed overview of the Li-ion battery supply chain, ranging from raw material supply, cell components, and manufacturing/testing equipment, to battery integrators in different applications, and battery recycling companies

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