The lithium-ion battery end-of-life market 2018-2025

Analysis of volumes, players, technologies and trends

July 2018

Circular Energy Storage
Research and Consulting

Table of contents

Table of charts, figures and tables

About the report

In November 2017 Circular Energy Storage (then Creation Inn) published the report “Circular Opportunities in the lithium-ion industry”. The original goal was to provide a comprehensive overview of the end-of-life market, list current and future technologies for recycling and to clarify the feasibility of a second life of used batteries. The conclusions were for many surprising.

The report pointed out that low recycling rates had not so much to do with lack of technology, and that only because the recycling rates for lithium-ion batteries might be low in Europe and North America, it doesn’t mean these batteries aren’t recycled anywhere else. That “else” primarily is in China and South Korea.

Additionally, the report concluded that the prerequisites for second use of batteries from electric vehicles often are excellent and gets only better if the batteries can be kept in a tight loop in which the batteries are designed for second life from the beginning. The most suitable operators of the batteries when used a second time in energy storage applications are the players which have access to both the batteries and the information about how they have been designed and used – normally battery, car, bus and other vehicle makers.

This report was initially intended to be an update of the first one. However, during our work we realised that our own learning curve, which admittedly was steep already in the first report, had taken us to a level where completely new conclusions had been reached and the amount of new data we had, entitled us to write an completely new report.

Scope of the report

This report covers what could be described as three pillars in the lithium-ion battery end-of-life market:

- How lithium-ion batteries reach end-of-life and how they are collected
- How lithium-ion batteries are recycled
- How lithium-ion batteries are reused in new or old applications

Based on this research we have worked out forecasts on how much batteries that will be recycled and reused, which end-products that will come from the different processes and how much raw materials from recycling that will be available for the lithium-ion battery supply chain.

The report also provide extensive information on which types and what amounts of batteries that are placed on the market, how the cost and revenue structure looks like in the different steps of the value chain and what the drivers are that move batteries around the world.

The report list more than 80 players in recycling and second life industry around the world, the latest research within the area and applied patents in the the lithium-ion recycling industry.

Methodology

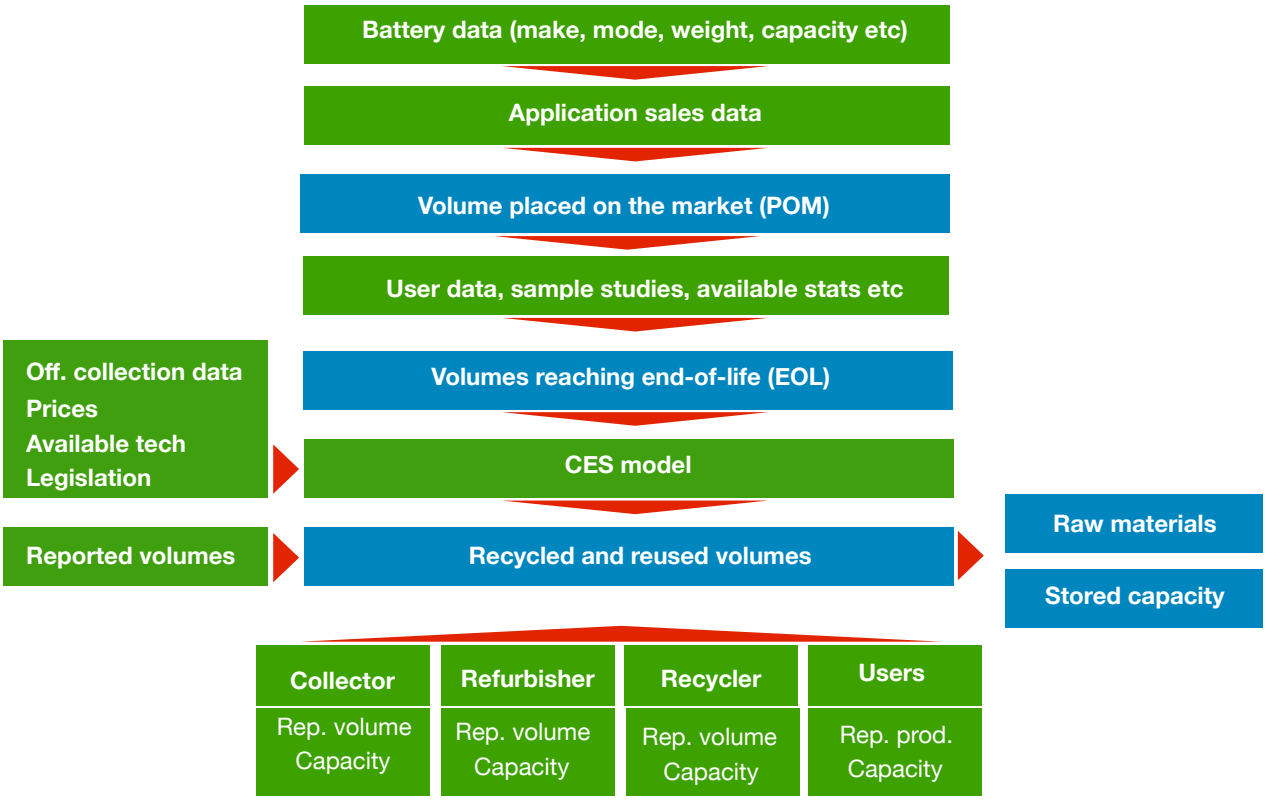
There is a paradox in all research covering end-of-life markets which is not found in research about new products or raw materials: There is more information about the future than there is about today and the past.

For most applications such as cars, buses, and consumer electronics there is consistent information about how many units that are shipped on an quarterly or even monthly basis. Matched with data about user behaviour, import and export movements etc, it's then possible to say how much of these products that eventually will come back in the future. To verify exactly how much that reached recycling last year is much more difficult.

The main reason is that both the recycling and refurbishment industries are secretive by nature. The business model is to acquire materials for as little as possible to then sell it with a premium on a much more transparent commodity, device or energy market. This means that processed volumes, acquisition prices and level of refinement is information which many keep tight within the companies.

Secondly, most companies in the industry are small or mid-sized enterprises with no obligation to disclose information. Neither are there reliable official sources as the reporting requirements to authorities usually is on a too high level and many times incomplete.

As consultants and researchers with long experience in the industry we usually get this information anyway. However there are always gaps and the rapid development of the market with new capacity coming online every month requires a more comprehensive method than to only ask what recyclers have in their warehouse. Therefore we use a combination of top-down and bottom-up approach.



We combine secondary data with our own intelligence acquired from discussions with companies in the industry. We match modelled volumes with real capacity. And we combine future demand and raw material availability with current and planned recycling capacity and forecasted energy storage capacity with both end-of-life volumes and capacity to refurbish the batteries.

We want to make the reader aware of that it's nearly impossible to get to a fully accurate picture of all different volumes in the end-of-life market. We don't guarantee that neither our numbers of today nor of the future are 100 per cent correct. We do however believe this is the most qualified estimate that has been done so far in this fast-growing market.

Specific secondary sources in the report are referred on each page. Data which lack reference is information provided directly to Circular Energy Storage and can not be disclosed.

About the author

The report is authored by Hans Eric Melin, founder and director at Circular Energy Storage. Hans Eric has been working more than 15 years in the recycling and renewable energy industries. Before starting Circular Energy Storage in 2017 he served as Vice President of New Markets at the largest waste battery collector in the US, Battery Solutions. Before that he was a co-founder and CEO of Refind Technologies which is the world leader in automatic classification and sorting of batteries and electronics for reuse and recycling.

Hans Eric has authored reports on renewable energy and eco design for the Nordic Council of Ministers and Swedish Energy Agency and have been involved in several EU projects around reuse, recycling and second life.