

Where do all electric vehicle batteries go?

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The number of electric vehicles grow at a tremendous rate, electrifying our roads. A necessary growth for transitioning to a sustainable society. However, the batteries are the products of a largely unsustainable and sometimes ethically questionable supply chain. To create a truly sustainable society, every electric vehicle battery must be recycled when spent. Have you ever wondered where these batteries go when they reach end-of-life, and why?

The lithium ion battery demand is predicted to grow by at least fourteen times between 2020 and 2030. Northvolt, the commissioner of this report and Europe's boldest startup, is on the quest to meet this demand by establishing Sweden's new industry, namely lithium ion battery manufacturing. Their unique selling point is manufacturing the world's greenest batteries by for example producing with green energy as well as vertically integrating recycling.

The demand has grown exponentially since the first commercially electric vehicles started to roll on our roads in the end of the 2000's. Their lifetimes vary greatly depending on usage, but large battery systems tend to average 8-10 years. Consequently, the amount of used lithium ion batteries in vehicles is about to start growing exponentially, too. Used batteries can either be reused in a similar application, re-purposed and used in new applications (so called second life) or recycled. How these return flow looks like was previously kept to the industry experts.

the literature. It covers the battery structure and technicalities, the market trends, logistic and recycling processes as well as the governing regulations. By analyzing the findings from 22 interviews with industry experts and leveraging knowledge from an extensive literature research, a uniquely detailed map of the electric vehicle battery return logistics was developed. The map includes the actors and stakeholders as well as the key aspects, events and processes and was divided into the natural and the unnatural return flow, which in turn were divided into multiple smaller return flows. The maps may advice a strategical deployment of a recycling pretreatment plant.

The thesis advances the small pool of literature on the highly relevant topic of return logistics of electric vehicle batteries. Efficient and large-scale recycling is crucial for the transition to a circular society and dependent on understanding how the stream of end-of-life electric vehicle batteries looks like. Hopefully it emphasizes the need to drastically improve the return logistics. The key contribution is bringing together viewpoints from stakeholders in all areas of the return logistics and the current challenges in recycling have been nuanced and detailed.

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The thesis conglomerates the scattered knowledge among the field experts and