

KEEPING TODAY'S INNOVATION FROM BECOMING TOMORROW'S PROBLEM



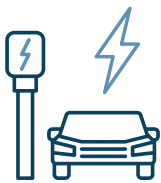
SECOND LIFE *for* EV BATTERIES

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EXECUTIVE SUMMARY

This article serves as an in-depth research report exploring the possible fates of first life Lithium-ion (Li-ion) Electric Vehicle (EV) batteries, main players in the industry, factors impacting the second life market, and more. In this report, we will analyze the potential challenges this field faces and will continue to face. Our main goals are to provide a broad, all-encompassing perspective on the subject while identifying potential opportunities and areas for collective improvement as EV batteries continue to become more prominent in the auto industry.



THE PROBLEM

EVs continue to make their debut in the auto industry, as more and more Lithium-ion batteries come into play, with the projection that by 2040 over half of the new-car sales and a third of the global fleet - equivalent to 559 million vehicles will be electric¹. With the inevitable surge in EV sales, the automotive industry has begun to ask itself a difficult question - what happens once these batteries have run their course? What do we do with them?

Issues ranging from the emission of toxic waste to the inevitable precious metal supply risk come to mind. The majority of EV batteries come to the end of their useful life after approximately 7-10 years, after which, most are currently thrown away. The estimated global stockpile is forecast to exceed the equivalent of about 3.4 million packs by 2025, in comparison to approximately 55,000 in 2018². With this issue at the forefront of global concern, innovation and new solutions to source a second revenue stream for these batteries are more relevant than ever. These solutions involve the recycling and reuse of batteries in the effort to maximize their potential after they can no longer support their primary function in a car. We could be seeing the same batteries that once powered cars, assume a more low-key role, and be used to chill beer, grill hot dogs, and power homes.

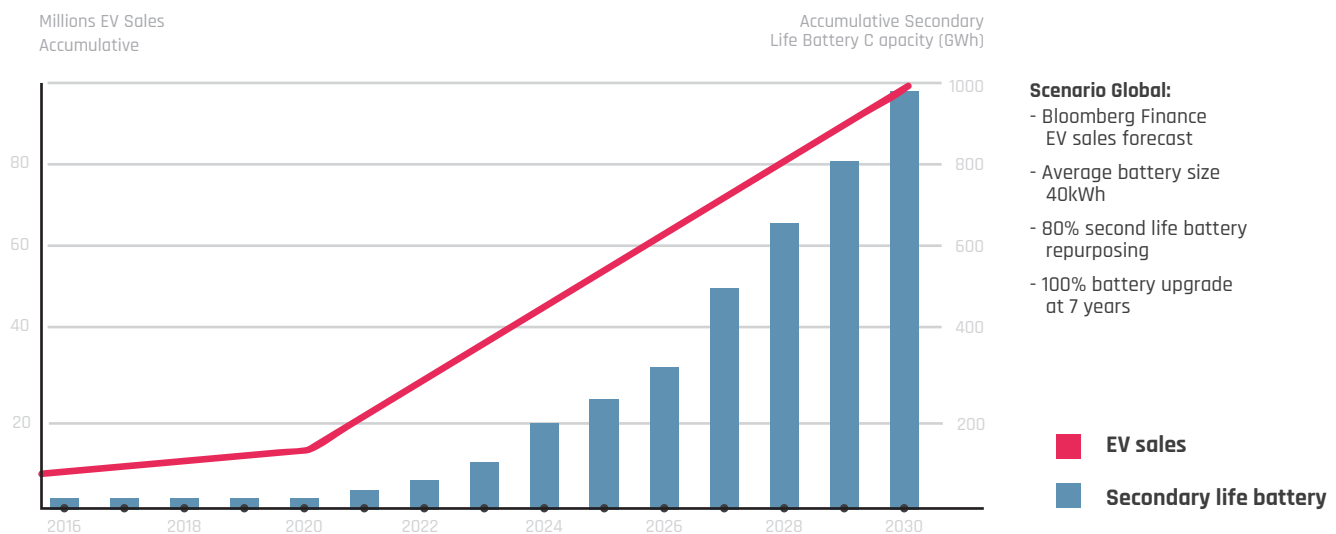
¹ <https://www.bloomberg.com/news/features/2018-06-27/where-3-million-electric-vehicle-batteries-will-go-when-they-retire>

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BY 2025, THE WORLD COULD BE LOOKING AT ~3.4 MILLION DISCARDED BATTERY PACKS. THIS IS A PROBLEM TO WHICH WE DO NOT CURRENTLY HAVE A FULL SOLUTION.

GLOBAL ACCUMULATIVE SALES OF EV AND SECOND LIFE BATTERIES³



The problem at hand is larger than the individual issues mentioned above. The transition to EV is not just an eco-friendly innovation within the automotive industry - it is causing the entire industry to do a systematic 180-degree rotation. The Internal Combustion Engine (ICE) has dictated the characteristics of the automotive field for over a century, with very little change. Ever since we can remember, there have been oil mining companies, conveniently placed gas stations, car dealerships, and even set criteria for emissions tests. The lifecycle of ICE vehicles has designed an entire ecosystem, with an intricate economy, infrastructure, regulators, enforcers, and even consequences with which we are familiar (air pollution). But again, this ecosystem is tailor-made to fit gasoline-driven vehicles. When it comes to EV, there is not yet a mechanism for what the lifecycle is supposed to look like, where the regulators will need to be, resources need to invest in proper infrastructure, and what will drive the economy - thus making the EV battery problem that much more intricate.

³ https://www.bee-ev.de/fileadmin/Publikationen/Studien/201604_Second_Life-Batterien_als_flexible_Speicher.pdf