

Repurposing EV Batteries for Off-grid Homes

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Electric vehicles, sometimes known as EVs, are automobiles that use electric motors instead of internal combustion engines. Electric vehicles (EVs) get their power from rechargeable batteries that can be charged using a standard wall socket or a special charging station. These vehicles are being heralded as a game-changer for the transportation sector due to their ability to drastically cut greenhouse gas emissions, reduce our dependence on fossil fuels and boost our energy independence creating a greener and more environmentally friendly transportation network.

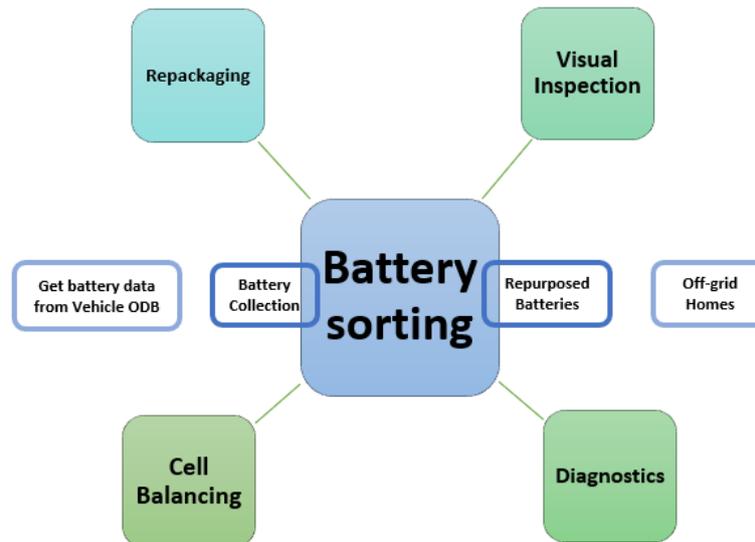
By 2030, the worldwide fleet of EVs is predicted to grow to 85 million[2]. For the most part, these EVs are powered by Lithium-ion (LIB or li-ion) batteries. Their high energy density and high cycle life make them ideal for high-power applications like an EV[1]. However, the remaining capacity of EV batteries is insufficient for automobile use once they have reached 70-80% of their initial capacity, forcing EV owners to replace the batteries[3]. As a result, a high influx of disposed EV batteries is expected in the coming decade [2].

At the end of their useful lives, these batteries, along with the vehicles they once powered are disposed of in conventional scrap yards which poses a serious environmental contamination and pollution risk. Many countries are making an attempt to recycle these LIBs more effectively, but there is often a dearth of both initiatives and facilities [1]. The scientists claim that even after LIBs have been discharged, they still contain considerable amounts of energy, posing safety issues throughout transit, disposal, and recycling [5] [6]. Although the battery pack for an EV could look dead, the cells inside are still functional [7].

One of the ways to protect the environment from this large number of battery ditching and to make full use of their potential while making revenue could be achieved by repurposing End-of-Life (EOL) EV batteries for powering off-grid homes [2]. Off-grid homes are accommodations that are not hooked up to the public power grid but instead generate and store their own electricity from alternative energy sources. In addition to creating a sense of energy independence and security, the fact that off-grid homes are self-sufficient and do not rely on external sources of energy also contributes to their significance. This concept plays a crucial role in bringing about a more resilient and sustainable future.

This project focused on technology that can determine when End-of-Life (EOL) is reached and the process needed in place to repurpose these batteries for second-life application. The methodology utilizes a very simple tool using the vehicle's self-diagnostic and reporting capability or the On-Board Diagnostics (OBD). OBD systems allow vehicle owners/technicians to access the status of the various vehicle subsystems. This tool can give access to detailed information about battery performance, charging and discharging behavior, temperature threshold and more importantly; individual cell characteristics that can be used to predict the remaining life of the battery pack. In addition, this process includes a collection of

EV packs, visual inspection, diagnostics, partial disassembly of the battery packs, removal and replacement of defective modules, reassembly of the module, resistive cell balancing, temperature sensor testing, voltage sensor testing, and current sensor testing. This will also include the development of an efficient and cost-effective process to rearrange into 48V battery modules which are also safe for transportation.



These refurbished LIBs have multiple applications for off-grid homes and can allow access to a long-term and secure electrical supply [4]. Secondly, this practice can help immensely for peak shaving or storing energy at times of low demand and can assist to lower energy costs as well as overall electrical grid demand. Finally, it can be used to build hybrid systems utilized with other energy storage technologies like solar panels and fuel cells to develop autonomous power grids that are not connected to the traditional power grid [8]. In conclusion, off-grid housings can highly benefit from these systems since they can supply constant and long-lasting electricity. Overall, recycling EV batteries for off-grid use can aid in waste reduction, boost sustainable development, and supply a dependable and long-lasting energy source for those without access to the traditional power grid.

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