Second life battery storage

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News, Announcements, and Rules - Second Life Storage & Solar

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Frequently Asked Questions - Second Life Storage & Solar

During the next few decades, the strong uptake of electric vehicles (EVs) will result in the availability of terawatt-hours of batteries that no longer meet required specifications for usage in an EV. To put this in perspective, nations like the United States use a few terawatts of electricity storage over a full year, so this is a lot of energy-storage potential. Finding applications for these still-useful batteries can create significant value and ultimately even help bring down the cost of storage to enable further renewable-power integration into our grids.

EV batteries have a tough life. Subjected to extreme operating temperatures, hundreds of partial cycles a year, and changing discharge rates, lithium-ion batteries in EV applications degrade strongly during the first five years of operation and are designed for approximately a decade of useful life in most cases. Yet, these batteries can live a second life, even when they no longer meet EV performance standards, which typically include maintaining 80 percent of total usable capacity and achieving a resting self-discharge rate of only about 5 percent over a 24-hour period. After remanufacturing, such batteries are still able to perform sufficiently to serve less-demanding applications, such as stationary energy-storage services.

Due to the rapid rise of EVs in recent years and even faster expected growth over the next ten years in some scenarios, the second-life-battery supply for stationary applications could exceed 200 gigawatt-hours per year by 2030. This volume will exceed the demand for lithium-ion utility-scale storage for low- and high-cycle applications combined (Exhibit 2), which by 2030 will constitute a market with global value north of $30 billion.

However, to unlock this new pool of battery supply, several challenges in repurposing EV batteries must be overcome.

The first is the large number of battery-pack designs on the market that vary in size, electrode chemistry, and format (cylindrical, prismatic, and pouch). Each battery is designed by the battery manufacturer and automotive OEM to be best suited to a given EV model, which increases refurbishing complexity due to lack of standardization and fragmentation of volume. Up to 250 new EV models will exist by 2025, featuring batteries from more than 15 manufacturers.

The second challenge involves falling costs for new batteries. As new batteries become cheaper, the cost

differential between used and new diminishes, given that the rate of decline in remanufacturing cost is expected to lag the rate of decline in new manufacturing cost. We estimate that, at current learning rates, the 30 to 70 percent cost advantage that second-life batteries are likely to demonstrate in the mid-2020s could drop to around 25 percent by 2040. This cost gap needs to remain sufficiently large to warrant the performance limitations of second-life batteries relative to new alternatives.

Challenge number three concerns the nascency of second-life-battery standards. No guarantees exist regarding second-life-battery quality or performance, and few industry standards focus on battery-management systems or state-of-health disclosures, let alone standard performance specifications for a battery that is to be used for a given application.

The fourth challenge is the immature regulatory regime. Today, while most markets have some form of regulation requiring the recycling or remanufacturing of consumer electronics in general, most markets do not have EV-battery-specific requirements or delineations of responsibility between the producer and the consumer, save a few examples where goals have been set (such as in California and China). The lack of regulation creates uncertainties for OEMs, second-life-battery companies, and potential customers. The lack of regulation also gives rise to regional differences regarding whether recycling or reuse is the dominant pathway.

While these challenges are significant, they can be overcome by targeted action from the suppliers, end users, and regulators in the sector, enabling a sustainable second-life-battery industry to emerge. In fact, many of these targeted actions are already being taken by forward-looking players and industry associations.