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A billion-dollar industry is emerging from a mountain of hazardous waste considered an ecological timebomb. The nascent and rapidly evolving ecosystem of battery second use (B2U) is being formed from both large and small organizations including OEMs, integrators, recyclers, regulators, and researchers. There has been no shortage of ideation on B2U subject matter including technical viability, safety, component quantity, and regulation. There is however a dearth of accurate data and actionable intelligence that is both available and relevant to the stakeholders in the B2U ecosystem. We will examine the common and unique challenges at the stakeholder level as well as existing and developing solutions and opportunities.

OEMs – OEMs have come under the most scrutiny for end-of-life traction batteries and will likely be subject to some level extended producer responsibility (EPR) in most global jurisdictions. As such, most have voluntarily established collection logistics ahead of new policies and the first large wave of spent battery packs sold between 2010-2013. There are ancillary benefits as OEM refurbished packs carry a price premium and keep vehicle maintenance tied to OEM service shops.

OEMs are looking ahead to the next generation of pack design with circularity in mind. Cell-To-Chassis (CTC) architecture eliminates modules and packs saving space and weight while increasing serviceability. Modular thermal management components like Thermal Ground Planes (TGP), also referred to as 2D heat pipes will allow for greater flexibility and simplicity in design as well as easier disassembly at end of life. Simplicity in the cell portfolio at an OEM level is highly beneficial to all in the B2U value chain. OEMs with strict EPR they will have to plan for total-loss and end-of-life vehicles that may fall outside the OEM service and trade-in scheme. Ratel Consulting estimates that 1.144% of all passenger cars are declared a total loss annually due to accidents and are dismantled and recycled. This can account for 20% of any EV fleet over average vehicle lifespan. Identifying and implementing the best practices of early adopters is critical in the highest-growth vehicle segment that is becoming increasingly regulated.

Integrators – Integrators stand to reap the most value in the B2U ecosystem but face tough challenges. A steady supply of same type and SOH cells is top of the list for



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multiple reasons. Most of the cells available in the market are still useful in their original EV application as they have been salvaged from a total loss vehicle and are purchased by non-OEM pack refurbishers at a premium. Second-life cells are sorted and graded in accordance with UL 1974 outlines, yet no standard equipment or process exists. A lack of cell and module information prevents integrators from qualifying other available cells suitable and available for repurposing. With greater access to cell and module performance and market data integrators will be able to mitigate or eliminate many of the constraints they face today

Recyclers – Recyclers are under pressure to make the EV battery recycling process less expensive and less burdensome to OEMs and ultimately consumers. Sorting by chemistry remains one of the biggest challenges as OEMs are not required to label their EV cells and modules. Logistics can account for half the total cost of recycling and recovery of valuable battery materials like lithium remain uneconomical at a commercial scale. Novel technologies are available and provide solutions to these problems and a robust development pipeline seeks to add value to recyclers globally.

Regulators – Regulators face an unenviable task in creating and enforcing the rules that govern responsible end-of-life procedures for EV batteries. Tracking the batteries through their life cycle requires knowledge of multiple industry best practices and product level data. Most important is to create a flexible regulatory framework that can adapt with the pace of technology and with vetted input from industry stakeholders.

Researchers – Corporate, government, and academic researchers arguably have the broadest market data needs due to the breadth of their mandates and project requirements. Most often research is conducted for developing new and improving existing products and EPR will undoubtedly factor in to existing and future research. Understanding the global research and innovation pipeline for any product category is crucial to optimize allocation of research funding.

Conclusion – The B2U market is opaque and its stakeholders have vastly different challenges ahead of them. Available market research is a one size fits all approach and while useful it is not a tailored to solve any one problem. Market participants need custom, dynamic solutions that look forward in a rapidly evolving market being shaped by forces outside and inside the ecosystem.

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