

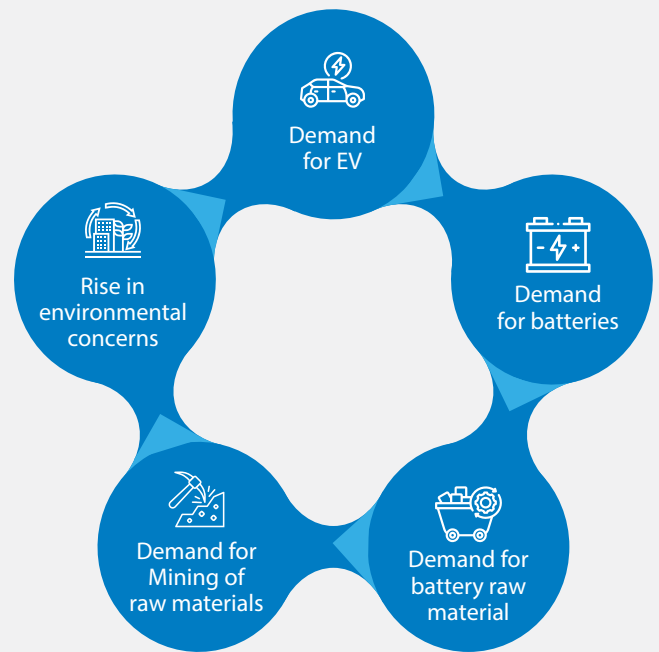
DIGITAL BATTERY PASSPORT OF THE FUTURE: BEYOND SUSTAINABLE EV BATTERY VALUE CHAIN

Abstract

Digital Battery Passport is a revolutionary platform for ensuring sustainability and circularity in the Electric Vehicle (EV) battery value chain. It is a digital platform for customers, regulators and other battery ecosystem players to exchange information to allow tracking and managing the EV battery data throughout its lifecycle. While the traditional Digital Battery Passport can bring about convenience, accessibility, transparency, compliance and enable circular economy, a more futuristic, AI-enabled vision for the passport can allow EV players to also use it effectively for improved customer experience and conversion. This paper explores the concept, benefits, and implementation strategies of the Digital Battery Passport, and its potential to drive a more futuristic avatar of itself while retaining the core principles of sustainability and circular economy.

Introduction

The Electric Vehicles (EV) movement is a seismic shift in mobility. It is a win-win proposition for the consumer as well as the environment: low decibel, fewer moving parts, minimal maintenance costs, and lower tailpipe carbon and particulate matter emissions. As digital consumers increasingly prioritize technology and sustainability, they are drawn to EVs for their potential to make a positive environmental impact. This preference has fueled a surge in EV adoption. While EV OEMs continue to register higher volumes of sales, regulators and environmental ministries worldwide are closely monitoring the industry to ensure that this transition aligns with broader sustainability goals.



The Regulation Imperative

The battery is the primary component in an EV. It uses several critical metals and strategic minerals such as lithium, cobalt, nickel, copper, vanadium and indium. The process of mining and processing these metals and minerals requires a significant amount of water and energy, which impacts the environment. In this context, industry analysts are questioning the viability of a full transition to EVs given the scarcity of resources.

Regulators in US, Europe, China, India and Japan seek to strike a balance between the transition to EVs and sustainability. They are drafting statutes to incorporate sustainability and embed a circular economy paradigm in battery manufacturing, ownership and

end-of-life. For instance, the European Union (EU) has transcended policy definitions to milestone-defined regulations, which will start impacting operations of EV automotive companies in EU.

Sustainability and circular economy underpin current and emerging legislation for EV batteries. Regulation is focused on tracking the battery during its lifecycle to ensure reuse or repurposing it at the appropriate phase. Once the battery's end-of-life is determined, legislation proposes that it be sent for recycling to extract critical metals and minerals, which can be reintroduced into battery manufacturing rather than being consigned to toxic waste.

So, how can a battery be tracked throughout its lifecycle?



Presenting the Digital Battery Passport

A circular economy is successful only by bringing together different battery stakeholders and empowering them with the ability to access, view and take decisions based on battery information made available to them. In this battery ecosystem, different stakeholders should be able to access relevant information –

- A customer needs information about the battery type, model, manufacturing details, carbon footprint, and other specifications to make an informed purchase or replacement decision.
- A battery repairer needs data about the chemical composition to mitigate any risk of hazardous chemicals and to ensure that safety instructions are followed during battery repair.
- A regulator needs visibility into ownership of battery to ensure that the principles of circular economy and sustainability are followed.

Such an ecosystem manifests in a Digital Battery Passport that contains information spanning ownership, both current and past, across the battery lifecycle.

The Digital Battery Passport is a centralized location, hosted on

cloud, where the history of the battery is maintained and accessed during any phase of the battery lifecycle. It offers a 360° view of the battery for any stakeholder to access and take decisions.

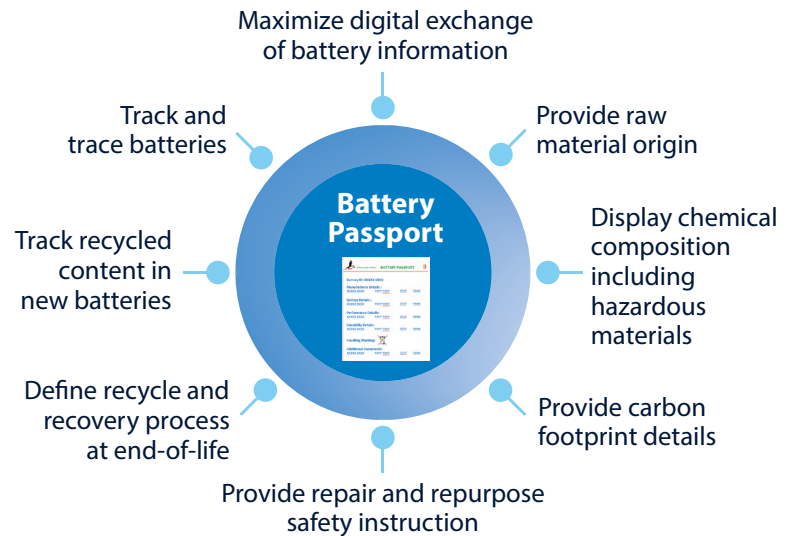
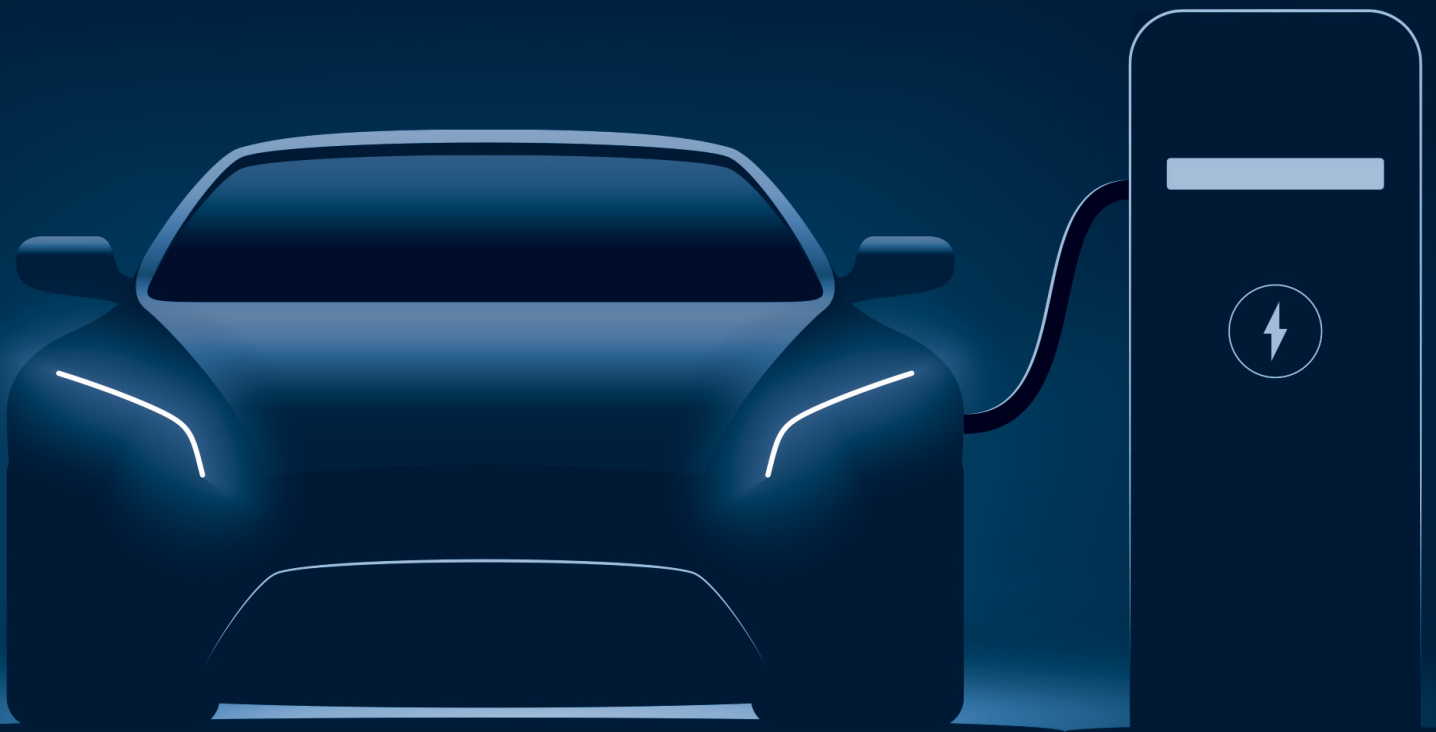


Fig.1 – Key Objectives of the Digital Battery Passport



Infosys partnered with a global automotive company in its journey to comply with EU regulations for EV batteries. This strategic partnership is driving a transformative journey towards regulatory compliance, fueled by a few success factors:

- **Multi-disciplinary team with knowledge of battery regulations**

We formed a team with deep knowledge of regulations before the client engagement. It ensured that project team meetings were productive from Day 1. Importantly, regulatory expertise within the core team ensured timely delivery of project goals.

- **Close coordination with Battery OEM teams**

Data from battery OEMs is critical to comply with regulatory obligations. The team promptly arrived at a consensus on the support required from battery OEMs. It ensured fewer internal iterations. Meetings with battery OEMs were productive since requirements could be finalized quickly.

- **Experience of successful cloud deployments**

Our team pooled robust cloud capabilities and experience in partnering with the client's preferred choice of hyperscaler. It reduced infrastructure bottlenecks during hosting and deployment.

- **Addressing integration challenges with battery OEM systems**

Typically, battery OEM systems are a blind spot for integration. Our team partnered with the client and the battery OEM to navigate a seamless process for sharing data between their systems. We put General Data Protection Regulation (GDPR) and cybersecurity at the heart of data sharing.

- **UX/UI portal design**

Our team included UX/UI design professionals who collaborated with the client to meet their branding guidelines.

- **Automotive domain expertise**

Our automotive domain consultants collaborated with the client and battery OEM team to make prompt and informed decisions. Past experience in automotive projects was a key success factor.



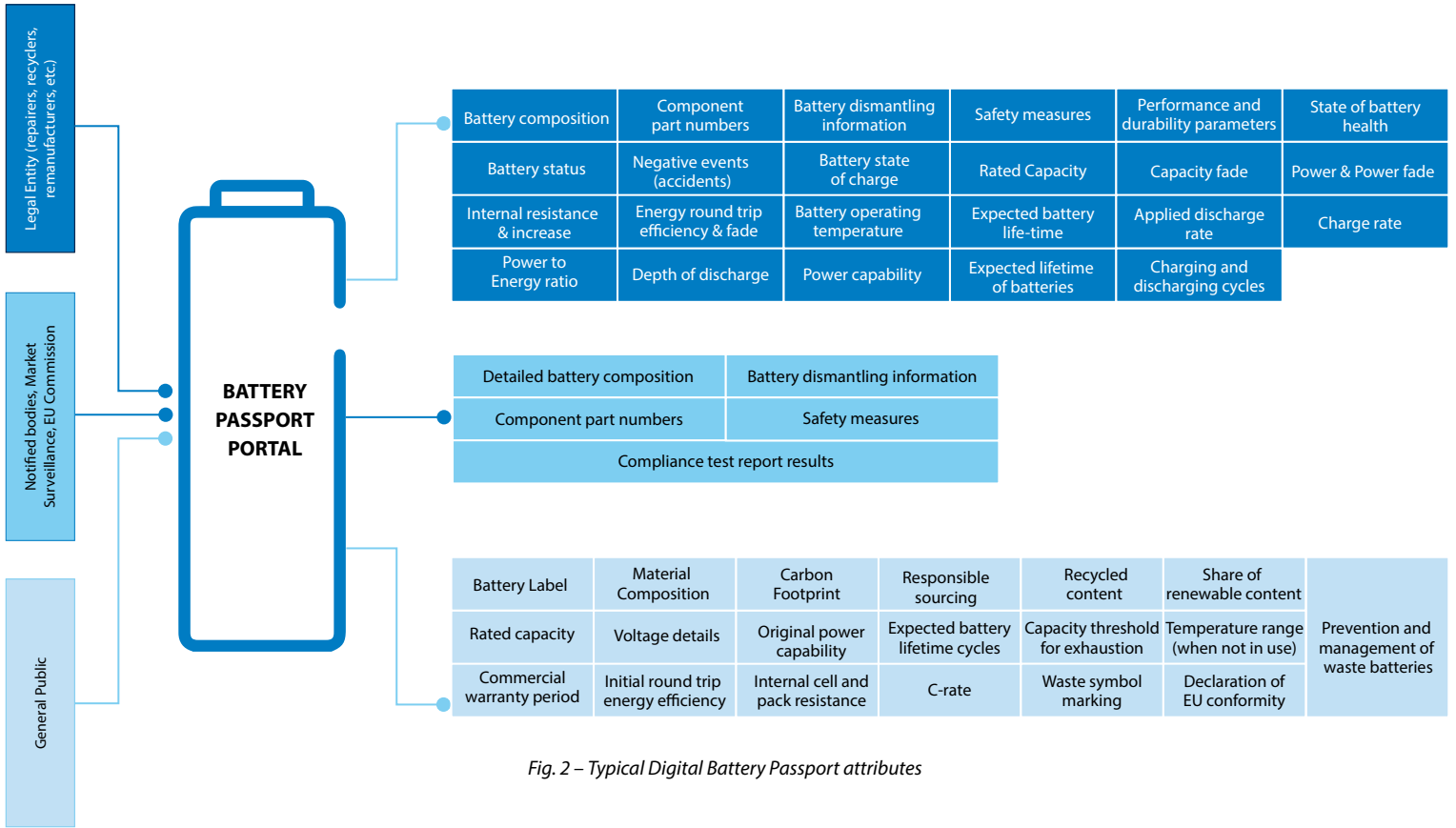
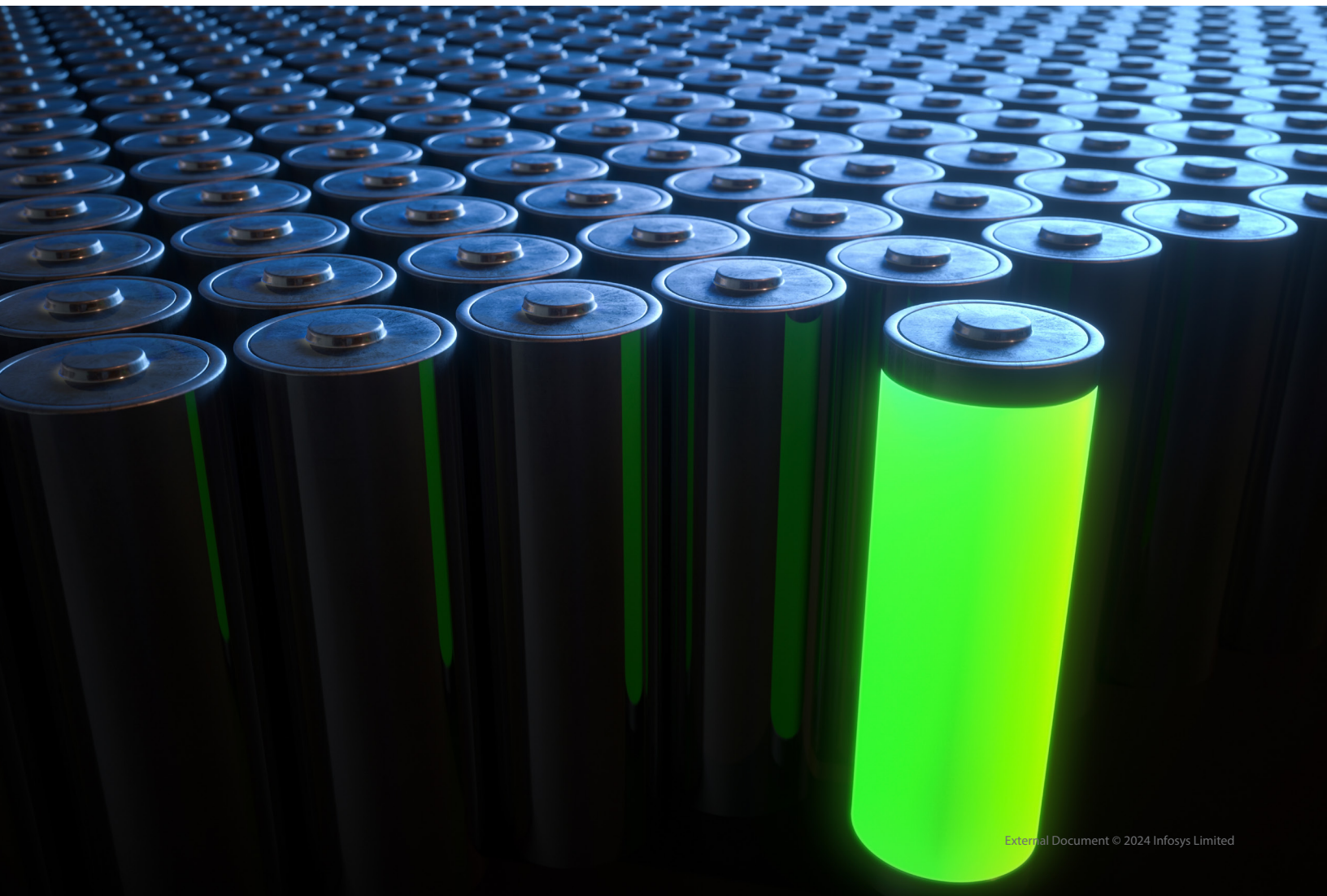


Fig. 2 – Typical Digital Battery Passport attributes



From Regulation to Reinvention

EV OEMs are adopting the Digital Battery Passport to comply with regulatory mandates. They are prioritizing domains based on stipulations. Automotive companies are adhering to conditions laid out for 'economic operators' in the regulation.

Infosys believes that automotive enterprises should take a holistic view of battery-related regulation and visualize a Digital Battery Passport for the future. Regulation calls for access to information from the battery passport for potential and existing customers. EV manufacturers should capitalize on this opportunity to transcend regulation with the Digital Battery Passport and use the portal of information to unleash innovation.

- **EV product information:** The Digital Battery Passport can be used to share product information with the objective to influence purchase behavior.
- **AI chatbot:** The passport can be integrated with an AI chatbot to address queries about the battery and its parameters.
- **Product feedback:** The passport can be a gateway to collect feedback directly from customers.
- **EV battery repair:** A customer accessing battery information from the passport can book a service appointment for repair or replacement.
- **Battery catalogue:** A customer can be redirected to the online battery (product) catalogue where new-age batteries and information about their compatibility with in-use EVs is provided.
- **Battery upgrade:** A customer can raise a service request for a battery upgrade and book an appointment with a preferred service center.
- **AI-enabled battery usage feedback:** A customer can access a detailed report (AI generated via an LLM) on how battery handling behavior deviates from recommended battery usage, with suggestions to boost battery performance.



Conclusion

Infosys proposes a two-step approach to design a Digital Battery Passport: Firstly, automotive companies should partner with a digital automotive orchestrator with rich experience in building EV battery solutions and a deep understanding of EV battery regulations and the battery OEM ecosystem.

Secondly, the Digital Battery Passport should be a touchpoint to engage with potential customers. By providing product information, a battery passport can help prospects take an informed decision. It can also support existing customers with analytics and service requests for their EV batteries.

Regulation can be a starting point for EV OEMs to innovate with the Digital Battery Passport. Just as a battery is only as good as its charge, a battery passport will be only as good as the value it delivers.



About the Authors



Avinash Kamat
Industry Principal

Avinash has over 23 years of experience in consulting. He has advised clients across manufacturing and resources industries on simplifying technology for business. He has published POVs on how new and emerging technologies shape businesses of the future. Avinash has rich experience in executing complex global transformational projects.



Alok Sharma
Senior Industry Principal

Alok has 32 years of experience spanning products and solutions across verticals of manufacturing, mining, agriculture, energy, and utilities. Currently, he leads AI, EV, IoT and other advanced technologies for manufacturing, mining and agriculture. He partners with customers in their digital transformation journeys. Alok leverages a suite of technologies to create innovative solutions and delivers value across their business value chains.

For more information, contact askus@infosys.com



© 2024 Infosys Limited, Bengaluru, India. All Rights Reserved. Infosys believes the information in this document is accurate as of its publication date; such information is subject to change without notice. Infosys acknowledges the proprietary rights of other companies to the trademarks, product names and such other intellectual property rights mentioned in this document. Except as expressly permitted, neither this documentation nor any part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, printing, photocopying, recording or otherwise, without the prior permission of Infosys Limited and/or any named intellectual property rights holders under this document.