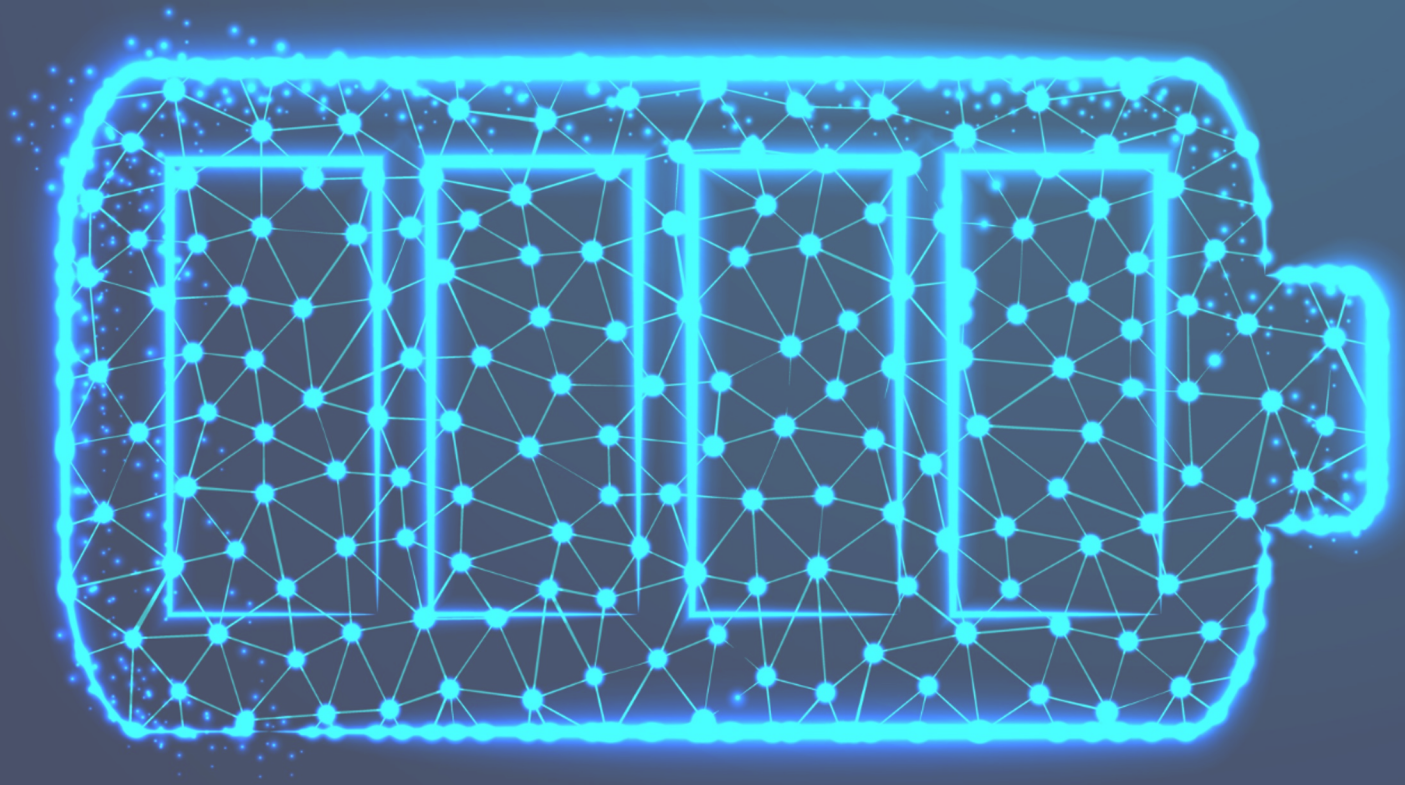
The Future of Circular Economy: Digital Battery Passport by TVS



Digital Battery Passport by TVS

TECHNOVATIVE SOLUTIONS

TVS – Brief Overview

- **28+ European and UKRI projects**
- **12 years of experience**
- **70+ Experienced scientists, engineers and developers**
- **200 M Euro Project size in Total**

Domains

- Renewables
- Manufacturing
- Recycling
- Robotics and Automation
- Thermal Storage
- Cyber Security
- Deep Drilling
- Waste Heat Recovery
- Battery
- Energy Efficient Buildings
- Materials Discovery
- Healthcare
- Carbon Capture and Utilisation
- Disaster Resilience
- Climate Change
- Societal Resilience

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EU Funded Projects

Smartrec, GEO-COAT, WELD GALAXY, GEODRILL, GEOSMART, GEOHEX, GEOPRO, PharmaLedger, VOJEXT, FORGE, optiDrill, ALBATROSS, IMPHORAA, ComBioTES, COCACO2LA, JIDEP, TRUMPET, C2IMPRESS, COMPASS, CLIMAS, flute, SEHRENE, ALABAMA, RESTORE, RECOMP, POWERPATH, NGEL, BASE

Partners

Fahim

Dr Fahim Chowdhury

Founder – CEO

Sohag

Sohag Salauddin

Head of Product

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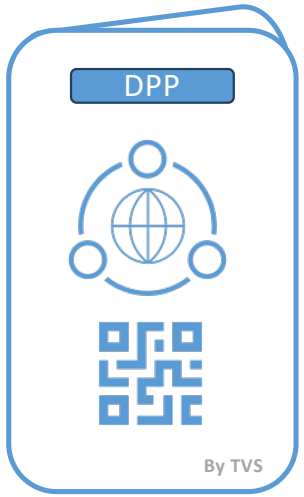
Digital Product Passport



What?

A framework/tool that tracks a product's lifecycle to facilitate a circular economy and foster economic growth.

It's a collection of product data that covers general information, labels & certification, carbon footprint, supply chain due diligence, materials & composition, circularity & resource efficiency, performance & durability.

Why?

Promotes Circular Economy and Sustainability through effective management of waste flows and end of life treatment.

DPP solves the longstanding issue of transparency and traceability in the production industry helping decision making across the value chain.

Legislative Backing and Industry Focus - broader Circular Economy Action Plan (CEAP).

When?

The initiative sets a clear timeline for adoption, with batteries expected to be the first industry to implement DPPs by 2026/7, and other sectors to follow by 2030, demonstrating the EU's commitment to enforcing sustainability practices.

Who?

- Material Supplier
- Manufacturer
- Distributor/Importer
- Consumer
- Governments & Public Authorities
- Repairer/Re-Manufacturer
- Recycler

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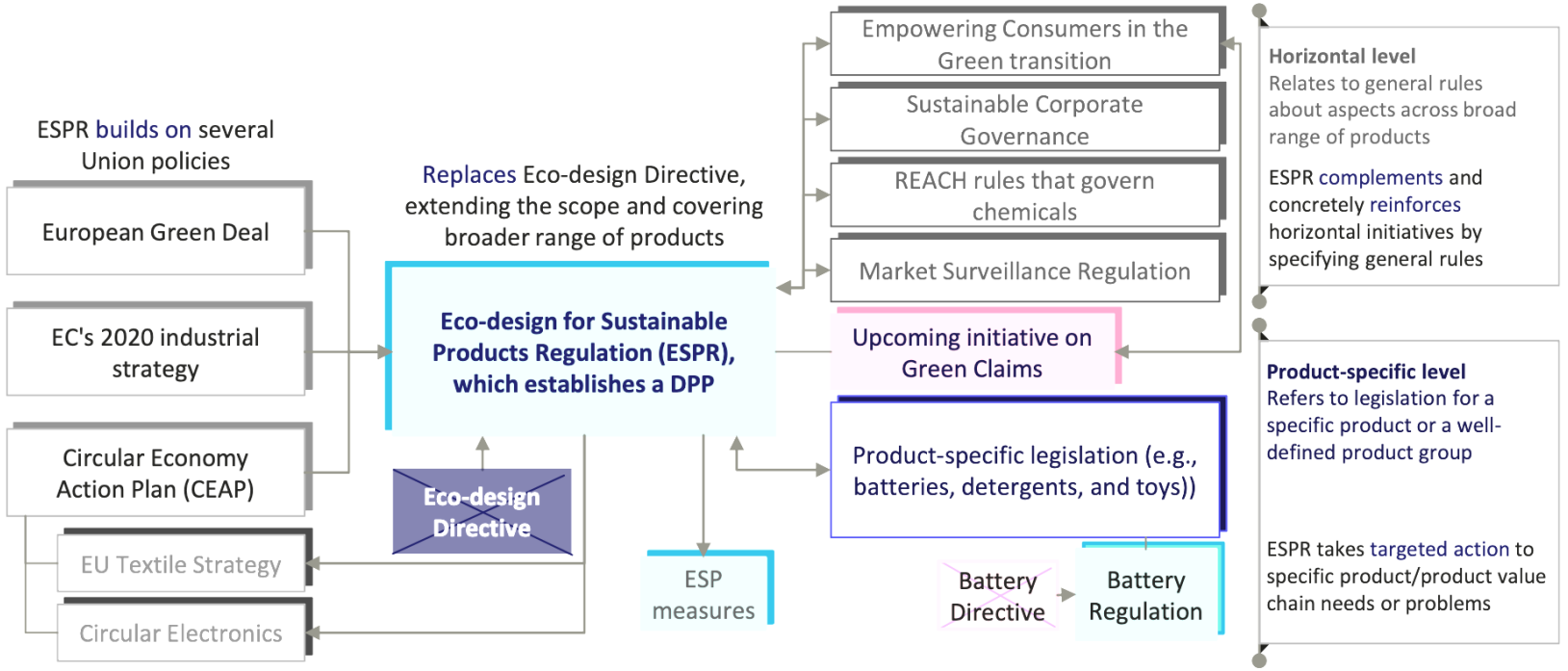
EU push for Circular Economy : DPP

DPP is seen as the first regulatory mover at scale.

EC is the first legislator to mandate DPP across various industries with a clear timeline – Start with **Battery industry** in 2027 followed by other sectors i.e. Textiles, Furniture, Plastic etc.

DPP regulation will have major impacts on the global supply chain.

DPP is essentially the key link among all the polices as shown below,



Source: European Commission, European Union, ESPR proposal, BCG analysis

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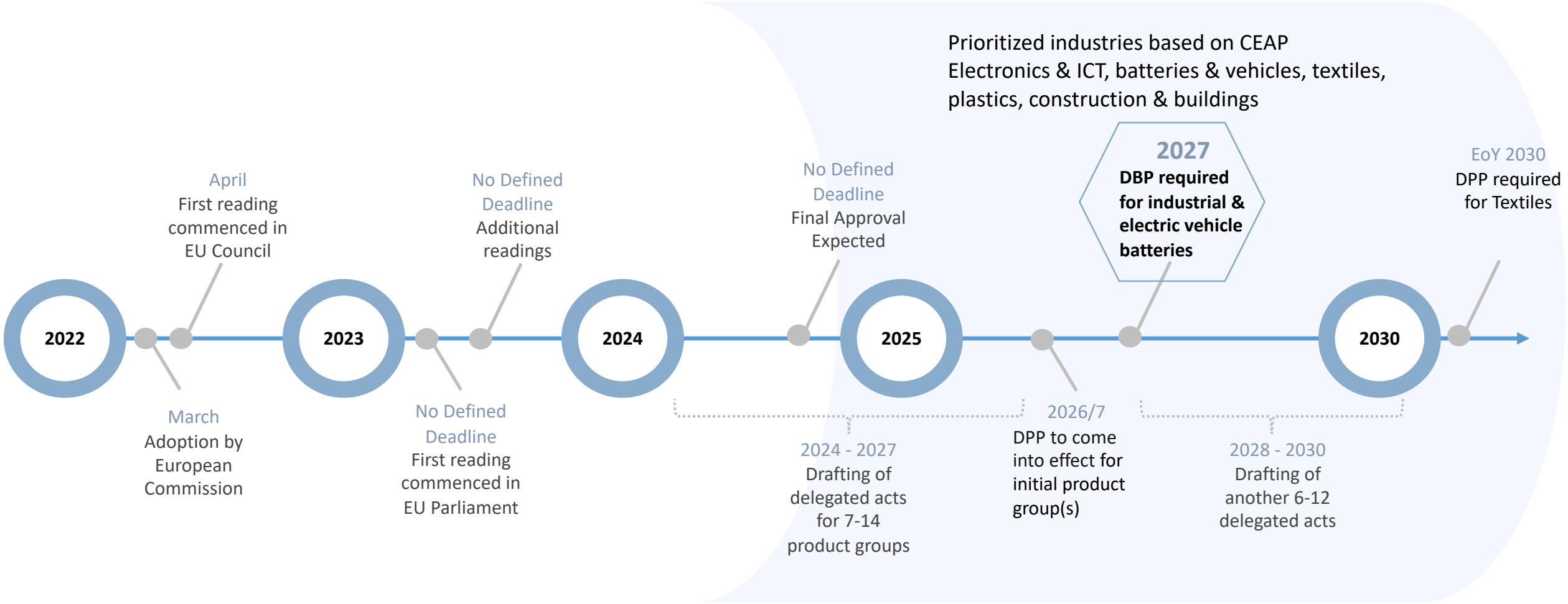
Digital Product Passport : Timeline

European Commission plans first product group (**Battery**) regulation to come into force in 2026/7



Source: European Commission, European Union, ESPR proposal, BCG analysis

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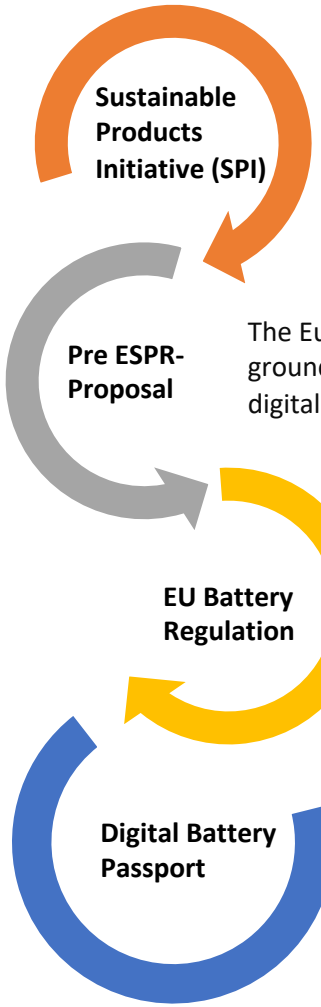
Digital Battery Passport – Context

Batteries are essential for a green shift towards low-carbon transport and renewable power. Efficiently managing the expected surge in large batteries for vehicles and storage is crucial for meeting the Paris climate targets, linking economic growth with less resource use, and ensuring access to vital materials.



March 2022: The European Union launches the Sustainable Products Initiative (SPI), which includes the Proposal for Ecodesign for Sustainable Products Regulation (ESPR). This sets the stage for digital product passports to facilitate the transition to a circular economy across various product categories.

The European Commission introduces a new Battery Regulation **EU 2023/1542**, replacing the **Battery Directive 2006/66/EC** and amending regulation **2019/1020**. This groundbreaking legislation covers the entire lifecycle of batteries, introducing stringent requirements for transparency, recycling rates, supply chain due diligence, and the first digital product passport at the European level for batteries.

August 2023: The new EU Battery Regulation comes into effect following approval by the European Parliament and the Council. It mandates comprehensive life cycle management for batteries, including the use of a digital battery passport for certain types of batteries.

February 2027 (Mandatory by 18th): The digital battery passport becomes mandatory for light means of transport (LMT) batteries, industrial batteries with a capacity greater than 2 kWh, and electric vehicle batteries entering the EU market. This initiative aims to extend battery life cycles, promote recycling, and support the development of circular business models by improving data access and reducing information asymmetries.

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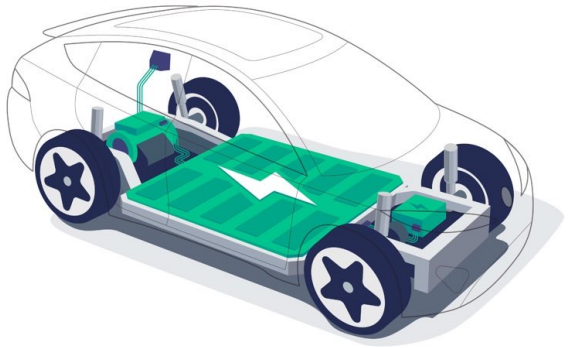
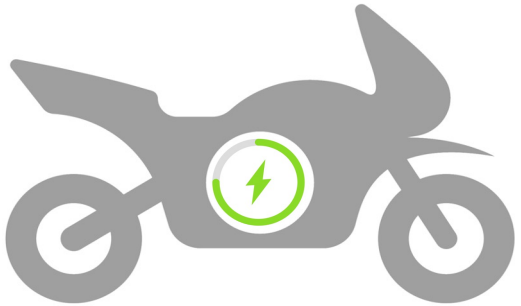
Digital Battery Passport – Scope

The battery passport scope includes EV batteries, LMT batteries, industrial batteries with a capacity greater than 2 kWh and



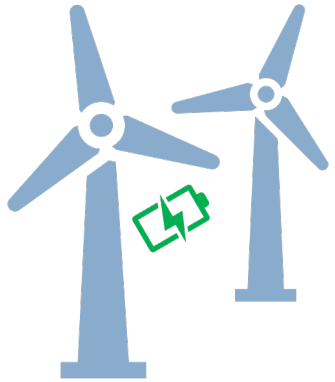
Electric vehicle (EV) battery

- Provide electric power for the traction to hybrid or electric vehicles



Light means of transport (LMT) Battery

- Provide electric power for traction to wheeled vehicles that can be powered by an electric motor alone or by a combination of motor and human power e.g., e-bikes and e-scooters



Industrial Battery

- Designed specifically for industrial uses or Intended for industrial uses after repurposing i.e. agricultural activities, energy storage, traction in other transport vehicle including rail, ships/boats, aviation etc.
- Any other battery above 5 kg that is not an LMT, EV nor SLI(Starting, Light, and Ignition) battery

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Digital Battery Passport – Data Requirements

The EU Battery Regulation mandates comprehensive content requirements for the digital battery passport, including general battery and manufacturer information, compliance and certifications, carbon footprint, supply chain due diligence, battery materials and composition, circularity and resource efficiency, and performance and durability.

We are leveraging the work "Battery Pass" has done in creating guidance on the back of the EU regulation!

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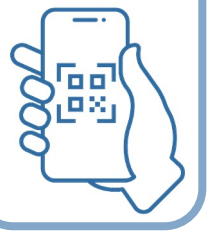
Digital Battery Passport – Data Management

Data Carrier



- A digital Battery Passport will have a unique identifier accessible via a QR code.
- QR codes can be scanned by a device to access battery information, including recycling details.
- The code must follow all the international standard including considerations for accessibility.
- These codes must be visible, legible, and permanent on the battery or its packaging.

Access Groups

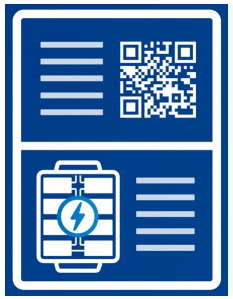
- General Public
- Notified Bodies, Market Surveillance Authorities, and the Commission
- Any Natural or Legal Person with a Legitimate Interest

Data Storage

- The Battery Regulation suggests a **decentralized data system** for storing battery passport data.
- By adopting a decentralized approach, the system aims to be more **flexible and dynamic**.
- Economic operators have the autonomy to manage their data in ways that best suit their operations and compliance requirements, potentially leading to **innovative solutions** for data handling and access.

Data Security

- The decentralised model of storing data, reduce the risk of single point of failure.
- Economic operators are responsible for the data but may authorize other operators to store data on their behalf.
- The industry is also going for Distributed Ledger Technology to apply greater encryption, mandating immutability and providing transparency & traceability



- At TVS, we are keeping the data security and privacy at the heart of our DPP solution
- We have made our DPP interoperable and working closely with Catena-X for data standards
- We are also working with Gaia-X project in relation to federated data infrastructure

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Digital Battery Passport – Challenges

Data Collection & Standardisation - Gathering comprehensive lifecycle data for products can be complex, especially for companies that haven't historically tracked detailed environmental or sourcing information. The lack of standardised data formats can hinder the interoperability between different systems and sectors, complicating the integration of product passports.

Data Changes - Handling data changes resulting from the repair/follow-up events could get lost in the process.

Heterogenous Battery Performance Indicator- Current battery performance indicator calculation processes are heterogenous. It needs to be harmonised to be acceptable by the stakeholders globally.

New Passport for Remanufactured battery - It is noted that remanufacturing, repurposing, or undergoing certain treatment operations require issuing a new battery passport. The challenge here involves updating static data, like sourcing information or rated capacity, that may be altered during these processes.

Auditability - The challenge lies in verifying the accuracy of data that spans the entire lifecycle of the battery, from design to end-of-life, especially since some dynamic data points cannot be retested afterwards.

Economic & Market Acceptance – Companies may view “Product Passport” as costly overhead and the value proposition might not be understood among the supply chain actors.

Global Regulatory Variance - Differences in regulations and standards across countries can complicate the adoption of product passports internationally.

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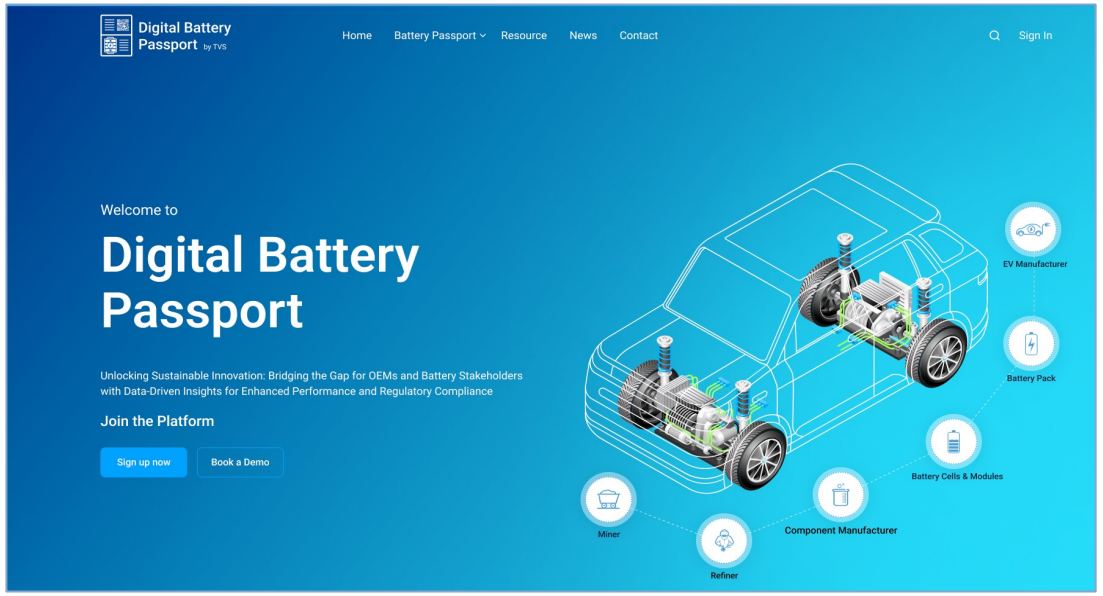
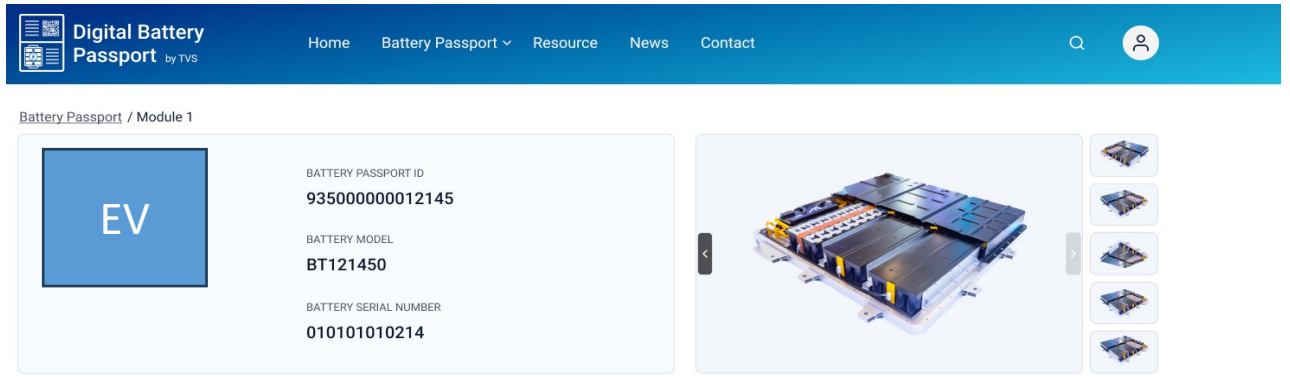
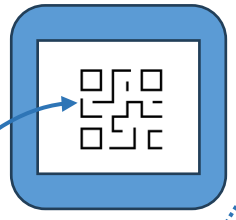
Digital Battery Passport – Possible User Interface

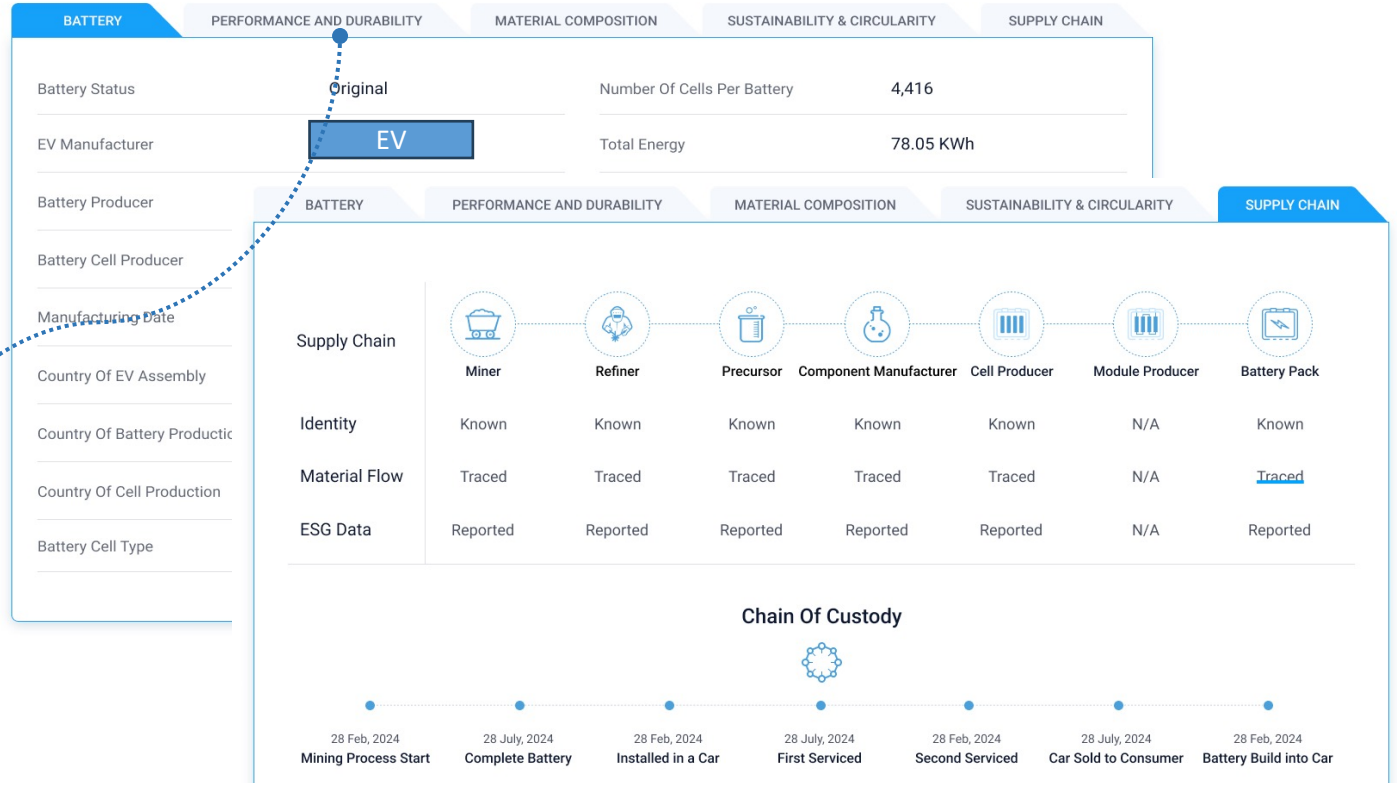




Access the passport via scanning the QR code printed on the body of the battery pack.



On this tab we plan to show dynamic data feed from BMS



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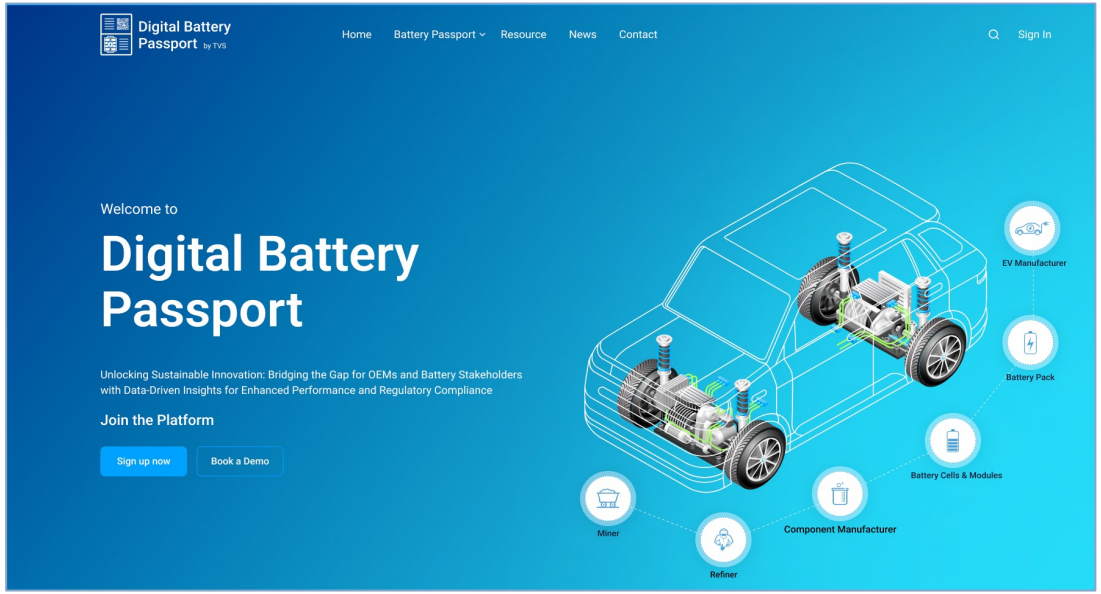
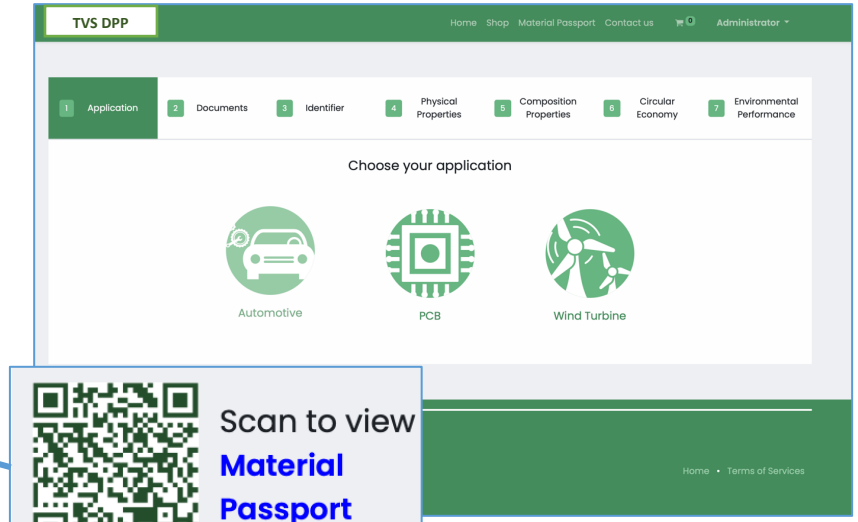
TVS & Digital Product Passport

At TVS, we pride ourselves on being at the forefront of the technological aspects of DPP. We have successfully won multiple EU projects that fund the Digital Product Passport initiative.

- Cutting edge of DPP technology
- Highly skilled team dedicated to solve your problem
- Leading the charge in crafting bespoke DPP platforms
- Post launch - ongoing, expert support to ensure sustained success
- Digital Battery Passport PoC & other live material passports
- Absolute focus on regulatory compliance
- Custom DPP solutions – no one size fits all approach
- Data management through Blockchain and AI expertise





Scan to view **Material Passport**

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DPP, Circularity & Environmental Analysis in Key EU Projects

Name of the Project	Project Full Name	Industry Partners	Use Cases
BASE 	Battery passport for resilient supply chain and implementation of circular economy	MARCEDES-BENZ, Ford Motors, Beeplanet Factory, Parakeet, INND Batteries, European Lithium Institute, ROK Metals, Navtek, Corvus	1. Automotive: frugal EV platform production pilot for MARCEDES-BENZ 2. Automotive: frugal EV platform production pilot for FORD Motors 3. Marine: electric tugboat production pilot 4. Stationary: 2nd-life electric energy storage production pilot
ALBATROSS	Advanced Light-weight Battery systems optimized for fast charging, safety, and second-life applications.	INND Batteries, MARCEDES-BENZ, FIAT, FORD Motors, European Federation for Welding, Joining, and Cutting (EFW), TWI,	1. Automotive
JIDEP	Joint Industrial data exchange Platform	FIAT, ZORLU Energi, TPI Composites Precision Veronic Intl	1. Automotive 2. Wind Turbine 3. E-Waste
RESTORE	Sustainable remanufacturing solution with increased automation and recycled content in laser and plasma-based process	European Federation for Welding, Joining, and Cutting (EFW), FIAT, EIT Manufacturing, Welding Alloys, Naval Technologies, Lucchini Unipart Rail, AB Dalforsån	1. Remanufacturing of the Rail Axe, 2. Remanufacturing of the steel rollers. 3. Ship propellers - Remanufacturing of the propeller's blades 4. Remanufacturing of automotive component.
ALABAMA	Adaptive laser beam for additive manufacturing	SINTEF Manufacturing, AEROBASE, FIAT, GKN Aerospace, Nordic Additive Manufacturing	1. Aviation: high-pressure compressor casing (HPC-case) for aero engine 2. Maritime: Super duplex steel propeller 3. Automotive: high-pressure die-cast part

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