

WHITE PAPER

Battery Traceability Is Becoming a National Priority

How India's Battery Pack Aadhaar (BPAN) framework is redefining the EV battery as a traceable digital asset — and what it means for manufacturers, OEMs, and technology platforms.

80–90%

of India's Li-ion demand from EV batteries

21-char

unique Battery Pack Aadhaar Number per battery

50+

lifecycle parameters tracked per battery pack

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Executive Summary

India's electric vehicle ecosystem is entering a new phase. The Ministry of Road Transport and Highways (MoRTH) has proposed a system called the Battery Pack Aadhaar Number (BPAN) — a unique 21-character identity for every EV battery sold in India. Similar to how Aadhaar identifies individuals, BPAN will give each battery its own digital identity, allowing it to be tracked throughout its entire lifecycle.

This white paper explores why the government is introducing BPAN, how it will impact different parts of the battery ecosystem, and the opportunities it creates for manufacturers, OEMs, recyclers, and technology companies.

Key Takeaway

Under the BPAN framework, a battery will no longer be treated as just a power component. It will become a regulated and traceable digital asset that continuously generates data. Manufacturers who start building strong battery traceability systems today will be much better prepared for the compliance-driven EV market of the future.

1. Policy Context: What Is Battery Pack Aadhaar?

In January 2026, the Ministry of Road Transport and Highways released draft guidelines introducing the Battery Pack Aadhaar system. Under this framework, every battery manufacturer or importer must assign a unique identifier to each battery they sell or use internally. The standard is currently being developed through the Automotive Industry Standards Committee (AISC), which includes representatives from battery manufacturers, EV companies, recyclers, testing bodies, and regulators.

What BPAN Tracks

Each BPAN will store both fixed information and real-time operational data about the battery throughout its lifecycle.

- ▶ **Static Data:** Static data includes details such as the manufacturer, battery chemistry, material composition, production date, country of origin, and even the carbon footprint associated with manufacturing the battery.
- ▶ **Dynamic Data:** Dynamic data includes information that changes over time — such as battery health, charging cycles, maintenance history, and how the battery is eventually retired or repurposed.

- **Metadata:** The system will also track the battery's supply chain — including where raw materials came from, which suppliers were involved, how the battery is recycled, and whether it is reused in a second-life application.

Scope of Applicability

Battery Category	Application / Mandate Status
L-Category EV Batteries	Two-wheelers & three-wheelers — primary mandate phase
M & N Category EV Batteries	Passenger and commercial vehicles — primary mandate phase
Industrial Batteries (>2 kWh)	Recommended applicability in initial guidelines
Other Battery Types	May be extended in subsequent standard iterations

2. Why Battery Traceability Is Now a Strategic Imperative

Until now, battery tracking in India has largely relied on fragmented systems and paper records. However, EV adoption is growing rapidly, and EV batteries already account for around 80–90% of India's lithium-ion demand. This growth has made traditional tracking methods impractical.

Without proper traceability, several risks emerge — unsafe reuse of batteries, entry of low-quality imports, inefficient recycling processes, and increasing environmental risks.

The Circular Economy Mandate

India's Battery Waste Management Rules introduced extended producer responsibility (EPR), which requires manufacturers to ensure batteries are properly collected and recycled. The goal is to recover 90% of critical minerals from batteries by 2030. BPAN provides the digital infrastructure needed to track batteries at scale and ensure that these recycling targets can actually be enforced. Without a unique digital identity for every battery, tracking and recovering materials from millions of battery packs would be extremely difficult.

The Domestic Manufacturing Imperative

India is investing ₹18,100 crore through the Production Linked Incentive (PLI) scheme to strengthen domestic battery manufacturing under the Advanced Chemistry Cells program. The goal is to build around 50 GWh of battery production capacity in the country while ensuring that at least 30% of the value comes from locally sourced materials and components. BPAN will help verify whether these local manufacturing requirements are being met by tracking where battery cells are produced and sourced.

Global Alignment

India's BPAN framework is not an isolated domestic initiative. The European Union has mandated a Digital Battery Passport (EU Regulation 2023/1542) for batteries over 2 kWh beginning February 2027. The United States is exploring similar supply chain transparency requirements under the Inflation Reduction Act. India has designed BPAN with offline accessibility — a cost-effective adaptation for a market dominated by two- and three-wheelers — positioning it as a potentially exportable model for developing economies.

3. The Battery as a Traceable Digital Asset

BPAN fundamentally changes how batteries are viewed. Instead of being just a manufactured component, a battery becomes a regulated asset that continuously generates data. This shift will change how manufacturers, fleet operators, insurers, and regulators monitor and manage batteries throughout their lifecycle.

Lifecycle Stages Now Under Digital Governance

Lifecycle Stage	Data Generated / Captured	Stakeholders Involved
Raw Material & Cell Manufacturing	Material composition, supplier origin, carbon footprint baseline	Raw material suppliers, cell manufacturers, importers
Pack Assembly & Vehicle Integration	BPAN assignment, QR code placement, initial BMS data upload	Battery pack manufacturers, OEMs, vehicle assemblers
In-Service & Warranty Lifecycle	SoH trends, charge cycles, fault codes, maintenance events	OEMs, fleet operators, service providers, insurers
Second-Life Usage	Residual capacity, repurposing application, updated SoH baseline	Second-life solution providers, energy storage operators
Recycling & Disposal	Material yield, EPR compliance record, final disposal certificate	Authorised recyclers, EPR administrators, regulators

4. Implications for EV Manufacturers and OEMs

For manufacturers, BPAN will bring new compliance requirements — but it also creates opportunities to differentiate and gain strategic advantages. Moving from manual records to digital battery intelligence will require companies to invest in better data systems, integrate processes across teams, and work more closely with suppliers.

Compliance Obligations

- Assign a unique BPAN to every battery introduced to the market or used internally
- Display the BPAN in a visible, durable location resistant to lifecycle deterioration
- Upload Battery Pack Dynamic Data to the official BPAN portal regularly

- ▶ Ensure supplier data flows (material composition, carbon footprint) are captured at source
- ▶ Maintain traceability records accessible to authorised recyclers and regulators via tiered data access

Competitive Differentiation Opportunities

Manufacturers that adopt intelligent traceability systems early are likely to gain clear competitive advantages.

- ▶ **Lower Warranty Risks:** When every battery’s history is recorded, manufacturers can detect recurring defects early and fix them before they turn into large-scale warranty problems.
- ▶ **Stronger Premium Positioning:** Verified records of carbon footprint and material sourcing allow companies to justify premium pricing and support ESG reporting for investors.
- ▶ **More Value for Fleet Customers:** With reliable battery health data, OEMs can offer services like predictive maintenance and better residual value guarantees.
- ▶ **Recycling as a Revenue Opportunity:** Proper end-of-life data helps manufacturers work with certified recyclers and recover value from important minerals inside used batteries.
- ▶ **Easier Access to Export Markets:** Battery records that align with EU Battery Passport requirements make it much easier to comply with regulations when exporting products.

5. The Role of AI and Digital Manufacturing Platforms

The BPAN framework will generate an enormous amount of battery data. Managing this information manually — across thousands of battery models, millions of charge cycles, and complex multi-tier supply chains — simply isn’t practical. As a result, AI-powered digital manufacturing platforms will play a critical role in helping companies manage this data and stay compliant with BPAN requirements.

Critical Platform Capabilities

Capability	Business Impact
Battery Genealogy Tracking	Trace every component from cell supplier to final vehicle, enabling rapid field action targeting for defective batches without blanket recalls
Early Defect Pattern Detection	AI models trained on fleet-wide charge cycle and SoH data identify anomalous degradation patterns weeks before failure events, reducing safety incidents and warranty liability
Lifecycle Compliance Management	Automated BPAN portal uploads, EPR compliance tracking, and audit-ready lifecycle records reduce manual compliance overhead and regulatory risk

Warranty Risk Prediction	Predictive models correlating usage profiles with warranty claims enable proactive provisioning, reducing reserve requirements and improving profitability margins
Second-Life Value Optimisation	Accurate residual capacity assessment from verified battery history enables data-driven second-life matching, maximising recovered asset value for manufacturers and recyclers

6. Industry Ecosystem Response

Early responses from the industry to the BPAN framework have been largely positive. Hiren Pravin Shah, Founder and CEO of REPLUS Engitech, highlighted that the framework can help bring greater standardisation in compliance and improve quality control across the battery ecosystem. He also pointed out that it could discourage the entry of substandard battery imports, supporting the broader vision of Atmanirbhar Bharat.

The initiative also builds on groundwork laid during the Battery Summit 2025, where a pilot concept called “Battery Aadhaar” was introduced using Tata Elxsi’s MOBIUS+ blockchain-enabled platform. This shows that the technology needed to support BPAN compliance is already evolving alongside the policy framework.

Stakeholder Opportunities by Segment

- ▶ **Battery Pack Manufacturers:** With digital quality records from the moment cells arrive to the final battery pack assembly, manufacturers can trace issues more easily, reduce field defects, and hold suppliers more accountable.
- ▶ **Vehicle OEMs:** Access to battery intelligence across entire fleets allows OEMs to offer services like predictive maintenance, better residual value warranties, and more differentiated service packages.
- ▶ **Fleet Operators & Logistics Companies:** Real-time insights into battery performance help reduce unexpected downtime and allow companies to better understand and manage the total cost of owning electric vehicles.
- ▶ **Insurers:** Reliable battery health data helps insurers assess risks more accurately, making it possible to price EV insurance products based on real usage and battery condition.
- ▶ **Recyclers & Second-Life Operators:** When the full history of a battery is available, it becomes easier to sort, repurpose, and recycle batteries efficiently — while also recovering valuable minerals and reducing reliance on imports.

7. Strategic Recommendations for Manufacturers

As the BPAN framework moves through the Automotive Industry Standards Committee and closer to becoming a formal regulation, EV manufacturers and OEMs need to start preparing now. BPAN

readiness should be viewed as a strategic priority for leadership and the board, not just another compliance task handled in the back office.

Recommended Actions

1. **Review your current traceability gaps:** Start by mapping how battery data currently flows through your supply chain. Identify where information is being captured, where it is missing, and where it sits in disconnected systems.
2. **Strengthen your digital manufacturing infrastructure:** Look at AI-enabled manufacturing platforms that can track battery genealogy, integrate BMS data, and automate reporting or compliance with the BPAN portal.
3. **Work with suppliers early:** Begin including BPAN data requirements in supplier agreements now. This will help avoid last-minute compliance challenges once regulations become mandatory, especially at the cell and raw-material level.
4. **Experiment with second-life data strategies:** Use early BPAN data to build battery state-of-health models. This can help your organisation explore second-life services or certify remaining battery capacity for recycling partners.
5. **Plan for global compatibility:** Design your BPAN data systems so they can work alongside frameworks like the EU Battery Passport, making it easier to access export markets without having to rebuild your data infrastructure later.

8. Conclusion

India's Battery Pack Aadhaar framework is more than just another compliance rule. It represents a shift in how batteries will be viewed in the regulatory and business ecosystem. Batteries will increasingly function as traceable digital assets, with their entire lifecycle — from manufacturing to end-of-life — recorded, verified, and accessible to authorised stakeholders.

In this environment, data becomes almost as valuable as the battery itself. Manufacturers that invest in strong digital traceability systems, supported by AI and modern manufacturing platforms, will not only meet compliance requirements but also gain real advantages in quality control, warranty management, and recovering value throughout the battery's lifecycle.

In the EV era, traceability will be driven by data rather than paperwork. The companies that recognise this early and build the right digital foundations will help shape the next generation of battery manufacturing — in India and potentially across global markets

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