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Data Implications of the EU Battery Regulation

Content

Introduction

The European Union's new Battery Regulation (Regulation EU 2023/1542) marks a paradigm shift in how battery data is handled across the entire lifecycle. Replacing the 2006 Battery Directive, the updated regulation introduces strict requirements for sustainability, transparency, and traceability, placing data at the heart of compliance with unprecedented data collection and sharing to advance a circular, sustainable battery economy.

A key pillar of the regulation is the Digital Battery Passport, a mandatory electronic record that tracks each battery's lifecycle and performance. Required for electric vehicles, light transport (e-bikes, e-scooters), and large industrial batteries (>=2 kWh) placed on the EU market, the passport becomes compulsory starting **18 February 2027** and is accessible via QR code.

> This article highlights the key data management challenges associated with implementing the Digital Battery Passport and how businesses can address industry best practices using DataArt's proven strategies and expertise in data governance.

Regulatory Requirements for Battery Data

The EU Battery Regulation introduces multiple data-centric obligations: a digital battery passport, end-to-end supply chain transparency, due diligence reporting, and performance tracking. Companies must fulfill this broad set of data requirements to achieve compliance.

The passport is a paperless data system containing a comprehensive set of attributes: manufacturer identity, production date and location, materials and chemical composition, battery model specifications, carbon footprint, recycled content, electrochemical performance metrics, and durability parameters. Critically, the passport includes both:

- **Static data** (design and model information that is publicly available)
- **Dynamic data** (in-use data specific to each battery, accessible only to authorized stakeholders)

Supply Chain Traceability and Chain of Custody

Batteries must have detailed chain-of-custody records tracing raw materials like lithium, cobalt, nickel, and graphite from extraction to manufacturing. Ten years of transparency records are required to verify ethical sourcing and environmental impact.

Environmental and Social Due Diligence

Starting August 18, 2025, companies selling batteries in the EU must conduct supply chain due diligence, addressing environmental and human rights risks. **Special focus is on high-risk materials** (cobalt, graphite, lithium, nickel). Larger companies (€40 M+ turnover) must audit suppliers, assess risks, and publish annual reports.

Performance, Durability, and Safety Data

New standards ensure batteries are long-lasting and efficient. Since February 2024, producers must report the state of health and expected lifetime; by August 2024, electrochemical performance and durability data must also be documented. The Battery Passport will track these metrics over time.

Carbon Footprint and Recycled Content Declarations

Since February 2025, manufacturers must declare each battery's carbon footprint, covering raw material extraction to distribution, following EU standards (PEFCR). Minimum recycled content targets for cobalt, lithium, nickel, and lead will apply by 2030–2035, with documentation required.

Critical Data Challenges for Compliance

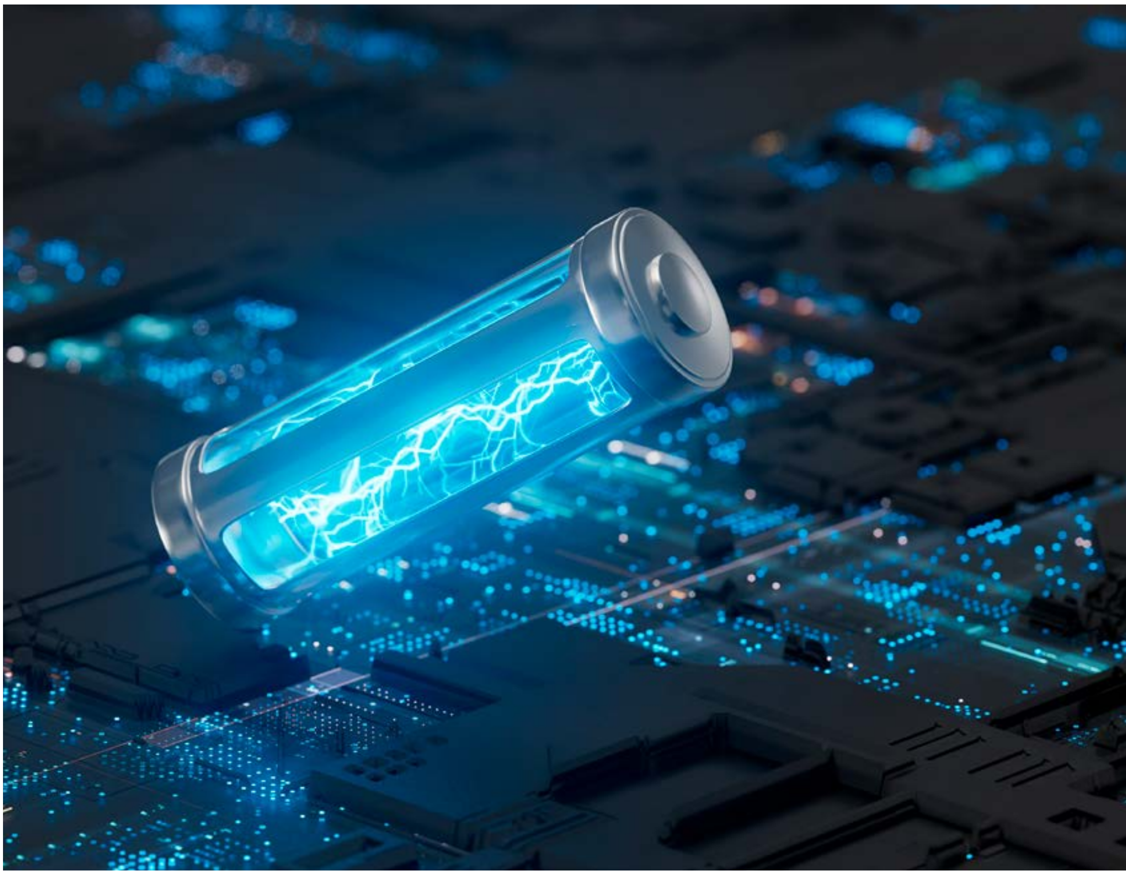
Achieving compliance will require organizations to overcome significant data management challenges. Here's where data systems fall short:

Data Collection and Integration Across the Value Chain

Battery production spans a highly fragmented value chain (mining, refining, cell production, battery assembly, usage in products, second-life, recycling). Capturing accurate data across these stages and integrating it into one system is a major operational challenge. Today, most organizations lack the infrastructure to collect, standardize, and consolidate data at each step for the Battery Passport. For instance, an EV manufacturer must gather sourcing data from mining companies, material composition from cell suppliers, and usage data from vehicles in the field: a complex, time-intensive task.

- **Data Quality and Accuracy**
  Inaccurate or inconsistent data can lead to regulatory breaches or public trust issues. Carbon footprint claims, recycled material percentages, or health status reports must be verified and audited by authorities. One approach to ensure accuracy is to use **third-party data services or audits** to verify claims (e.g., an independent LCA consultant verifies the carbon footprint).

- **Interoperability and Standards**
  Different suppliers and partners may use various formats and systems for their data. This means data **interoperability** is critical. The Battery Passport concept requires a standardized data format so that information can flow seamlessly from one stakeholder to another and ultimately into a unified passport. This challenge involves adopting common standards (for example, the Battery Pass consortium's data schema or emerging ISO/IEC standards for digital product passports) and possibly using technologies like APIs or Data Sharing to exchange data. The EU is fostering a **battery data space** (as part of the Digital Product Passport framework) to enable interoperability.



- **Lifecycle Tracking and Traceability**
  One of the most demanding data tasks is maintaining a **continuous digital thread for each battery's entire lifecycle**. Batteries may change ownership or get repurposed for second-life stationary storage before reaching end-of-life. The regulation requires that the history (original manufacture, any repurposing, and eventual recycling) is all documented. This means tracking a unique identifier for the battery and updating its status as it moves through different phases. The challenge is ensuring the data remains linked to the correct battery and is updated by whoever is responsible. If a battery is removed from an EV and reused in a home storage system, the passport must be updated to reflect the new application and continued performance data.

- **Auditability and Compliance Oversight**
  Regulators and independent auditors will have the right to inspect data for compliance, whether verifying the carbon footprint calculation, checking due diligence records, or confirming that performance metrics meet standards. Thus, companies must ensure their data is **auditable**, meaning it is well-organized, traceable to source documents, and tamper-proof. This challenge ties into IT system capabilities: an ideal compliance data system will log who provided each data point, when it was updated, and maintain historical versions. Companies should be prepared for **regular audits**.

- **Data Volume and Storage**
  With potentially thousands of batteries and dozens of data points per battery (some updated in real time), companies will face **large volumes of data** to store and manage. For example, an EV automaker tracking battery health metrics across its fleet could deal with big data streaming from vehicles. The battery passport for each unit might accumulate years of usage information. This presents challenges in scaling data infrastructure and managing costs.

Impact Across the Battery Lifecycle: Stakeholder Perspectives

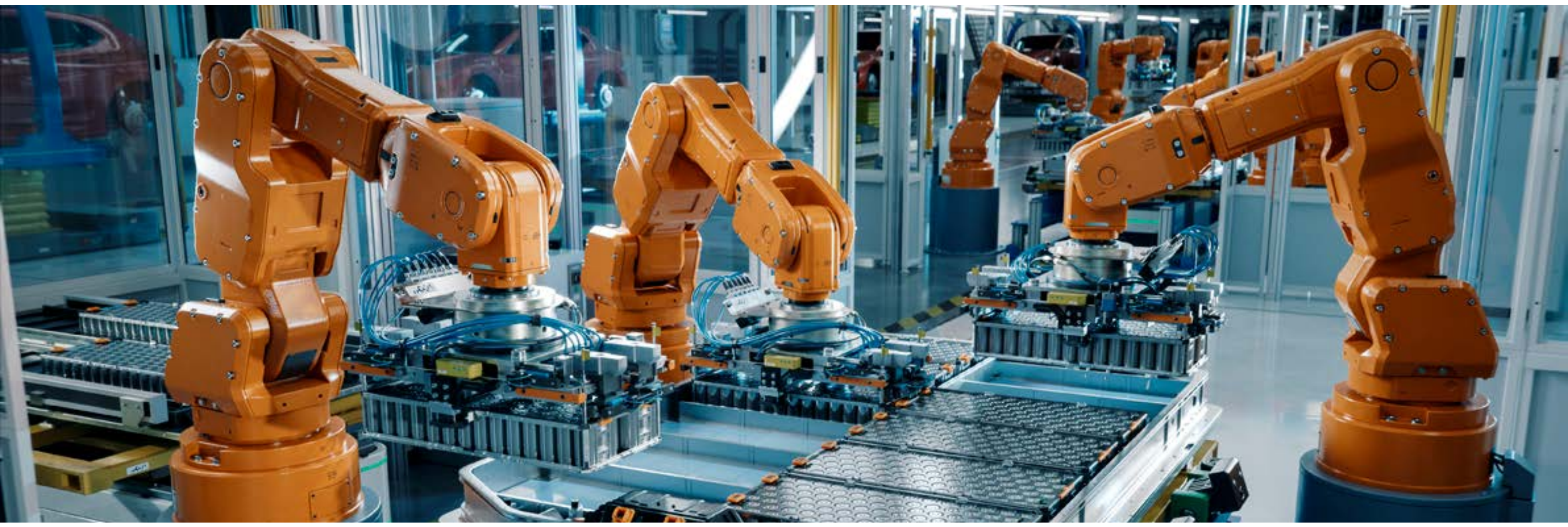
Battery Manufacturers (Cell & Pack Producers)

Battery manufacturers are at the forefront of compliance because they typically qualify as "producers" under the regulation (placing batteries on the market). They will be responsible for creating and populating the battery passports for their products and ensuring all regulatory data is available from day one of a battery's life.

- **Data Infrastructure Upgrades**
  Manufacturers must implement systems to **capture and store detailed data from the point of manufacturing onward**. This includes linking each battery to its production data. Some manufacturers will need to extend their ERP/MES to feed data into a Data Management Platform. For example, the system should automatically generate a digital record populated with required static data (chemistry, capacity, etc.) upon producing a battery.

- **Supply Chain Integration**
  To meet traceability and due diligence requirements, battery makers must significantly deepen data exchange with their **raw material suppliers and component providers**. They must establish a provenance data process for key materials (e.g., certificates from a cobalt supplier on responsible sourcing, or data from a lithium hydroxide provider on carbon footprint). This may involve new supplier portals or data-sharing agreements where suppliers input necessary data into the manufacturer's system. All participants in the integration need to agree on data formats and promote transparency upfront.

- **Governance and Compliance Reporting**
  Internally, battery makers need to establish governance processes to ensure ongoing compliance. This could mean creating a **cross-functional compliance data team** that oversees the collection and verification of passport data. They will be responsible for preparing official compliance documents: e.g., the annual supply chain due diligence report, carbon footprint declarations, and performance compliance reports. Moreover, if the manufacturer repurposes or remanufactures, they must update the passport to reflect the battery's new status. Manufacturers might need to expand the product compliance teams' role (or define a new one) to specifically manage these data obligations. Another governance aspect is ensuring data security: manufacturers hold sensitive recipes and design data, so they must balance compliance, transparency, and intellectual property protection.



Electric Vehicle Automakers (OEMs)

EV automakers incorporate large batteries into vehicles and thus share responsibility for compliance. In many cases, the automaker is the "economic operator" putting the battery on the EU market (especially if they integrate a purchased battery into a car). Automakers act as a crucial link between manufacturers and end-consumers and manage the batteries' in-use phase.

- **Collaborative Data Exchange with Battery Suppliers**
  Automakers will need robust systems to receive and manage compliance data from their battery suppliers. This includes verifying that each battery they install has a valid passport and all required static data from the manufacturer. Many auto OEMs will create or utilize digital platforms to **pull battery data into their vehicle records**, for instance, by linking VIN and the battery's passport. If an automaker uses multiple battery suppliers, it faces the challenge of consolidating data from different sources, reinforcing the need for standard data formats.

- **In-Use Monitoring and Data Feedback**
  Once the vehicle is on the road, automakers often have telematics and BMS connections that monitor battery health, performance, and safety. The EU regulation's durability tracking means automakers must **update the battery passport with in-use data** over time. EV OEMs should plan how to periodically take data from the car (state of health, number of cycles, any incidents like overheating) and append it to the passport record. This could be done at service intervals or via over-the-air telemetry. This feedback loop is important not just for compliance but also for product support.

- **End-of-Life Coordination**
  Automakers often ensure batteries are collected and recycled at the end of their lives. From a data perspective, automakers need systems to track where their sold vehicles/batteries end up and coordinate take-back. The automaker must then **pass on the battery's data** to the recycler or second-life operator.

- **Organizational Impact**
  Compliance will likely push automakers to **integrate their sustainability, supply chain, and IT teams** more closely. The sustainability team will define what data is needed (carbon footprint, etc.), the supply chain will ensure suppliers provide it, engineering/quality will monitor performance metrics, and IT will implement the data systems. This could mean new internal roles such as a "Battery Data Compliance Manager" and cross-department committees to govern battery-related data.

Battery Recyclers and Second-Life Operators

Recyclers and companies involved in second-life applications (repurposing used EV batteries for stationary storage, etc.) are at the tail end of the battery lifecycle. Still, the regulation places them squarely within the compliance ecosystem. They must hit recycling efficiency targets and will be both data providers and data users in the new system.

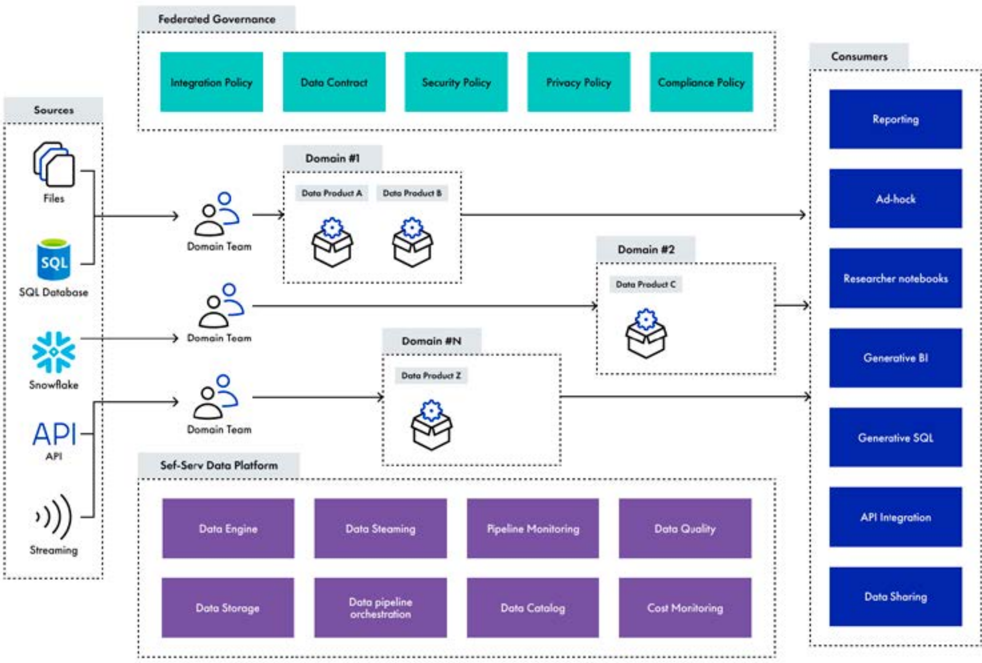
- **Data for Recycling Targets and Efficiency**
  The EU Battery Regulation sets ambitious recycling efficiency and material recovery targets. By 2025/2030, specific percentages of lithium, cobalt, and nickel must be recovered from waste batteries. This means collecting data on how many batteries were collected, how much material is recovered vs. sent to waste, and the recycled content returned to the market. In the context of data infrastructure, recyclers should have systems in place to log each batch of batteries received. However, accurate reporting of recycling data is both a compliance requirement and a value-add; that data helps battery makers prove they used recycled materials. Recyclers might integrate directly with battery passport platforms – when a battery is recycled, the recycler can update the passport to mark it as recycled and record the yield.

- **Utilizing Battery Passports**
  Recyclers stand to benefit from the battery passport system as users of data. Each incoming battery will carry rich information about its contents (chemistry, hazardous substances, etc.) and possibly a history of usage (which might indicate how to handle it safely). Recyclers will need to equip their operations with the ability to read and use battery data. Therefore, recyclers must have interoperable systems to meet industry data standards.

- **Second-Life Data Considerations**
  Some companies specialize in taking used EV batteries and redeploying them for less demanding uses (home or grid storage). Compliance means these second-life operators must update the battery's digital record to reflect the change in ownership and application. They will add new data about the battery's re-certification or refurbishment. This is a niche but essential part – the passport should persist through the second life.

Data Platform Architecture for Compliance and Traceability

To effectively comply with the regulation, organizations will likely need to implement a robust data platform architecture that supports end-to-end traceability, real-time data sharing, and secure access. Take a look at effective architecture, its components, and how they enable compliance. The architecture should be presented as a model that can be adapted by battery makers, OEMs, and others to fit into their existing IT landscape.



Data Ingestion Layer

At the base, the platform needs to ingest data from various sources across the battery lifecycle. The expected sources are:

- **Manufacturing systems:** Integration with factory data (MES/ERP) to capture production details, Bill of Materials, and initial quality metrics for each battery.
- **Supply chain inputs:** Interfaces (APIs or portals) for suppliers to submit upstream data, such as material origin, certificates, and carbon footprint data directly into the system. This could involve standardized templates or direct database connections. For instance, a mining company might upload a JSON/XML file with the raw material batch ID and associated ESG data for that batch.
- **Battery Management Systems (BMS) and IoT devices:** Real-time or periodic data streams from batteries in use. Telemetry such as state of charge, state of health, cycle count, temperature, etc., can be sent via IoT gateways or the vehicle's telematics for EV batteries. Advanced software in this layer would filter and preprocess this data (e.g., summarizing usage stats monthly for passport updates).
- **External data services:** If using third-party due diligence or LCA tools, the ingestion layer can pull data from those (e.g., connecting to a lifecycle assessment service that computes carbon footprint when given production data).

Unified Data Repository (Data Lake/Warehouse)

All ingested data should land in a secure, unified storage system – often a cloud-based data lake or relational data warehouse. This repository acts as **the single source of truth** for all battery-related data. It will store both static data (e.g., product design info, supplier lists) and dynamic data (usage and lifecycle events).

Key considerations are

- The data store should support large volumes and various data types (structured tables for passport fields, semi-structured logs for IoT telemetry, documents like certificates).
- Data modeling: The schema must accommodate the battery passport structure, linking each battery ID to all its data points. A possible approach is to use a unique Battery ID as a primary key, with related tables or JSON objects for sub-data (materials, performance metrics, etc.).
- Traceability and immutability: For compliance, specific data entries might be stored in an append-only fashion to maintain history (e.g., each update to state-of-health is a new record rather than overwriting). This ensures an audit trail.
- Security: This layer implements encryption and access controls, protecting sensitive data (like detailed composition or supplier identities). Data could be partitioned or flagged by access level (public, restricted, confidential) in line with the regulation's concept of public vs. authorized access to data.
- Data Processing and Analytics Layer: On top of raw storage, companies will need applications to process and analyze the data. This layer includes:
  - **Compliance rules engine:** Software that automatically checks if a battery's data meets regulatory requirements. For example, upon compiling a battery's data, the engine can verify that all required fields for the passport are present and flag any missing info (like a missing recycled content figure). It might also compute needed values (summing up recycled content percentages, calculating if performance stays within allowed degradation limits, etc.).
  - **Analytics & Reporting:** Tools to generate the required reports and dashboards. This could be an internal dashboard showing each battery's compliance status or a report generator for the annual due diligence report. Analytics could also help identify trends (e.g., compare carbon footprints of batteries from different factories, or track field failure rates).
  - **Lifecycle tracking logic:** Business logic to update the status of batteries. For instance, if a battery is flagged as recycled, the system automatically marks it as inactive for further use and perhaps triggers creation of a recycling report. If a battery changes owner, the system ensures the data record is handed over appropriately (potentially writing a new supporting transaction).

This part of the architecture turns raw data into actionable information and ensures continuous compliance monitoring. When a battery is manufactured, the rules engine checks that all required data (carbon footprint, materials, etc.) have been ingested. Any data missing or outside regulatory limits raises an alert for corrective action before the product ships.

External Interface and Sharing Layer:

A crucial aspect of the platform is how it interfaces with external stakeholders and allows data sharing under controlled conditions:

- **Digital Passport Access:** This includes the mechanism for QR code scanning. Each battery will have a QR code that pulls up the relevant data from the repositorywhen scanned by an authorized user. The platform must support a web or mobile interface to display the passport data in human-readable form (possibly a web portal where entering the battery ID or scanning directs to a webpage). One challenge is ensuring the QR code (which might be static on the battery label) can always fetch the latest data – the system might use a dynamic redirect or an ID lookup in the database. The content shown will depend on who is accessing (public vs. regulator vs. manufacturer login).

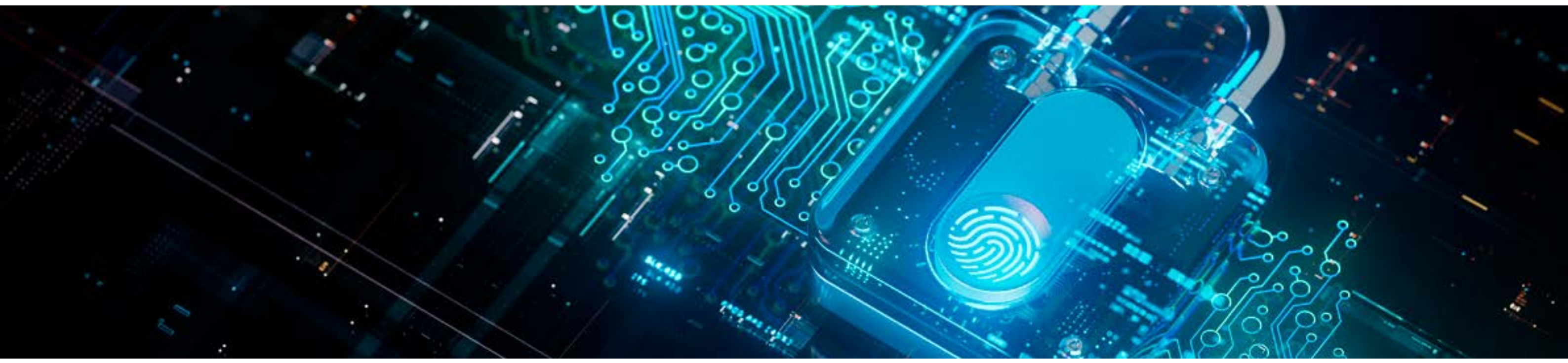
- **APIs for Partners and Regulators:** The architecture should expose APIs or data feeds so that trusted partners (e.g., an automaker receiving data from a battery maker, or a recycler sending data back) can interface machine-to-machine. It should also allow regulatory bodies to query or receive dumps of data for oversight purposes. For instance, regulators might require a periodic submission of all battery passports issued – an automated feed from the data platform can facilitate that.

- **Certification and Verifiable Credentials:** To build trust in data sharing, the architecture may use a system of verifiable credentials (as mentioned in some battery passport prototypes). This means pieces of data can be cryptographically signed by their issuer (e.g., a supplier signs the data about raw material origin) and the signature is stored, so anyone viewing the data can verify it hasn't been altered and indeed came from the trusted source. This concept ensures that even though data flows across organizations, its integrity and authenticity are maintained.

- **User Portal and Controls:** Provide a front-end for internal users (and possibly suppliers) to input or edit data with proper permissions. The user experience should be considered – it needs to be straightforward to enter new data (like a new material source) and to retrieve information when needed.

Security and Privacy Mechanisms (end-to-end)

Robust security is enforced throughout the architecture. This means encryption of data at rest and in transit, strong user authentication, role-based access control (e.g., a supplier can only see their portion of data, a recycler can mark a battery as processed but not see unrelated batteries, etc.), and compliance with privacy laws (especially if any personal data is involved in tracing usage). The battery passport will contain mostly product data. Still, caution should be taken if any user-specific data (like EV owner identity or usage habits) could be inferred – anonymization or aggregation may be necessary. The architecture design should treat compliance data as sensitive because of its commercial and regulatory value.



Competitive Advantages of Proactive Data Compliance

While the battery regulation imposes compliance costs and challenges, organizations that **proactively build robust data systems** can gain significant competitive advantages. It could be the strategic benefits to embrace the regulation's spirit early, turning compliance into a catalyst for innovation, efficiency, and market leadership.

Transparency as a Market Differentiator
Consumers, investors, and partners increasingly value transparency in supply chains and product sustainability. By implementing the battery passport and traceability before the deadline, companies can offer a **unique selling point**: guaranteed provenance and sustainability of their batteries. For example, an EV automaker might market its batteries with a verified sustainability profile (low carbon footprint, responsibly sourced materials) visible to consumers. This builds brand trust and meets growing customer demand for ethical products. There's evidence that forward-looking companies leverage digital product passports as a selling point and a way to stand out in a crowded market. Being transparent can enhance brand reputation and open up new customer segments who prioritize green credentials.

Leadership in the Circular Economy
Those who establish strong data tracking will be best positioned to implement **circular business models**. With detailed knowledge of their battery materials and status, companies can more easily retrieve batteries for second-life use or recycling, feeding recovered materials back into production. This creates a virtuous loop that can reduce raw material costs over time and insulate the company from price volatility or shortages. Being a first mover in such closed-loop systems can make an organization a leader in the circular economy space, which may attract partnerships or government support. For instance, a battery manufacturer that efficiently recollects and recycles could offer batteries with higher recycled content than competitors, meeting future targets well in advance. Remember, **data is the enabler** for these circular initiatives – without tracking, a circular economy is challenging to execute. Hence, compliance data infrastructure doubles as a platform for innovation in recycling and reuse.

Operational Efficiency and Risk Reduction
Gathering and analyzing battery lifecycle data can yield insights that improve operations. Companies might discover inefficiencies or opportunities for cost savings (e.g., identifying a supplier that is consistently high carbon, prompting a switch to a more efficient one, thereby lowering costs or avoiding future carbon taxes). Real-time performance monitoring can lead to better warranty management and product improvements (for example, detecting a pattern in field data that allows a design tweak to extend battery life). Moreover, early compliance reduces the risk of penalties or disruption, avoiding fines, import delays, or reputational damage due to non-compliance issues. It's a form of **risk management** that pays off by ensuring business continuity in the face of strict regulations. Actually, companies not only dodge compliance risks but also **strengthen their resilience** by having deep visibility into their supply chain (which can help navigate other challenges, like identifying alternate sources during supply interruptions).

Data-Driven Innovation
A wealth of structured data about batteries can fuel innovation. Companies can leverage this data for R&D, for instance, correlating material sources with battery performance, which can lead to improved material choices; or analyzing end-of-life data can inspire design for recyclability (DfR) in the next generation of products. Additionally, new services could emerge: companies might offer battery health certificates or residual value estimates based on passport data, which can support secondary markets for used batteries or new financing models (like leasing batteries). If a firm has a superior data platform, it could potentially integrate with energy grid services (e.g., providing data for grid operators on available second-life storage) or enable consumer apps that educate EV owners on prolonging battery life (using passport data as input). These are differentiators beyond what competitors who view compliance as a checkbox will achieve. The narrative here should encourage thinking of the compliance data as a foundation for future digital products or services (like battery performance diagnostics, or sustainability reporting tools offered to customers). Essentially, the investment in compliance data infrastructure can be leveraged for multiple business improvements, giving a competitive leg up.

Reputation and Stakeholder Trust
In an era of ESG investing and strict procurement standards, companies that can demonstrably track and control their supply chain will find favor with a broad set of stakeholders. Regulators will view them as low-risk, possibly resulting in smoother approvals or less scrutiny. Investors might reward them for proactive ESG compliance, seeing reduced long-term risks. Business customers (like an automaker choosing a battery supplier) will prefer partners who make compliance easy and share data readily. All of these effects create a trust advantage. The EU also aims to create a level playing field, and those who adapt early can help shape that field to their advantage. Companies can even influence standard-setting if they are leaders, for instance, by contributing to how battery passports are implemented in practice.

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Conclusion

In the ever-evolving landscape shaped by the EU Battery Regulation, the pivotal role of digital battery passports is becoming increasingly evident. These passports ensure compliance and unlock a myriad opportunities for innovation and operational improvement across the industry. As stakeholders step into this new paradigm, adopting best practices in data management emerges as a decisive factor for success.

Effective data strategies are fundamental to navigating the complexities of the regulations' demands. Robust data infrastructure, interoperability, and precise data governance are essential components that enable companies to manage extensive data and report requirements efficiently. By leveraging structured data from battery passports, organizations can gain valuable insights that drive compliance, operational efficiencies, and proactive risk management.

Moreover, the strategic use of data forms the bedrock for future-forward initiatives such as enhancing product lifecycle management, supporting second-life applications, and embracing circular economy principles. This proactive approach meets regulatory requirements and positions companies to become leaders in sustainability and innovation. Achieving this requires a commitment to continuous improvement and adaptation, which involves regular audits and drills to ensure readiness for external assessments.

In conclusion, while the path to compliance presents substantial challenges, it offers significant opportunities for those who embrace it with foresight and strategic data management practices. Establishing a comprehensive digital battery management platform is not merely a regulatory necessity; it's a transformative tool that enables companies to differentiate themselves, build trust, and drive lasting success in the dynamic battery industry.

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About DataArt

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Since our founding in New York City in 1997, DataArt has grown to bring together 5,000+ experts across 40+ locations in the US, Europe, Latin America, India, and the Middle East, with clients including major global brands like Priceline, Ocado Technology, Legal & General, and Flutter Entertainment. Recognized as a 2023 Newsweek Most Loved Global Workplace and 13 times as an Inc. 5000 Fastest Growing Private Company, we are proud of our reputation as a great place to work and partner with.

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