The implications for Italy of the new EU battery regulation

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Scope and Purpose

Motivations, Methodology, and Objectives of the Report

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Objectives and Methodology of the Report

The study aims to provide useful tools for understanding and applying the new European regulation on batteries, which came into force on 18/02/2024.

THE WORK CARRIED OUT INCLUDES

- **Study** on the **Italian battery ecosystem**, identifying the various actors and their positions in the value chain,
- **In-depth analysis** of the **European Regulation** on batteries and waste batteries, with particular attention to the articles that have the greatest impact on the members and to secondary legislation,
- Assessment of the **impact of regulation** on the identified actors, including timing, costs, and increased sustainability of the supply chain,
- **Insights** into the three main themes identified by the members:
  - Carbon footprint,
  - End of life and post-use,
  - Digitization and data transparency.

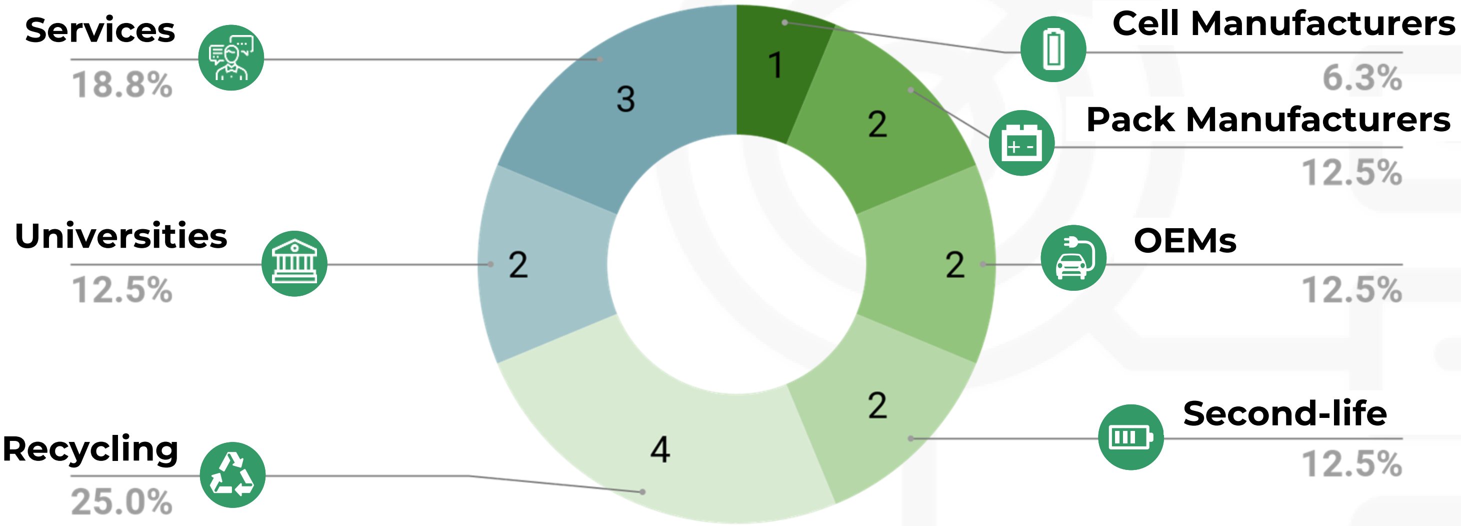
THE METHODOLOGY OF THE REPORT INCLUDES

- **Independent analysis** of the European regulation on batteries and other relevant official documents, such as the Critical Raw Materials Act or il Regulation on Ecodesign for Sustainable Products.
- Series of **interviews** conducted between October 2023 and January 2024, with actors active in the Italian and European battery supply chain, in order to receive feedback on regulation, understand their doubts, and understand how they are preparing for implementation.

Attached to the report is a **Battery Passport model**, appropriately explained and compliant with the regulation.

Analysis of Interviewed Stakeholders by Role in the Value Chain

The total number of **interviewed stakeholders is 11**, including both association members and external partners, with two-thirds primarily active in the Italian market, while the others have a more international scope. It is worth noting that the sum of the numbers in the pie chart is greater than 11, as some stakeholders fulfill more than one role within the battery value chain.



Report Framework

- Italian Battery Value Chain
- Introduction to Regulation
- Secondary Legislation
- Definitions
- Focus on Carbon Footprint
- Focus on End of Life and Post-use
- Focus on Digitalization e Data Transparency
- Final Conclusions

Italian Battery Value Chain

Overview of Key Players

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Battery Value Chain

Production and Use	Raw material suppliers	**Extraction of crucial raw materials**, such as lithium, cobalt, and nickel, needed for battery production
Production and Use	Refined materials and cell components suppliers	**Transformation** of raw materials **into refined materials and components** for cell production (active materials, electrolytes, separators).
Production and Use	Cells manufacturers	Assembly of refined components to **form battery cells**
Production and Use	Battery pack manufacturers	**Assembly** of cells **into modules** and battery **packs**. Integration of thermal management, electronic, and safety systems
Production and Use	OEMs	**Integration** of the battery **into the vehicle** or other devices
Production and Use	Repairers	**Repair** of **damaged** or defective **batteries** during their first life
End of Life and Reuse	Collection and disposal centers	**Removal** of the battery from the vehicle and collection of end-of-life batteries
End of Life and Reuse	Transporters	**Transport** of the battery under safe conditions to specialized centers for end-of-life battery treatment
End of Life and Reuse	Reuse and refurbishment centers	**Reuse**, **repurposing**, or **remanufacturing** of the battery for second-life applications, after which the battery is recycled
End of Life and Reuse	Recyclers	Treatment of end-of-life batteries for the **recovery of raw materials**

Additional Stakeholders

- Suppliers of machinery for battery production
- Testing and certification centers
- Electronic components suppliers
- Specialized packaging suppliers
- EPR (Extended Producer Responsibility) consortia
- Research and development centers
- Software and management systems providers
- Security solutions providers
- Consulting services
- Logistics and supply chain management services

The Italian Battery Industry: Trends and Perspectives

Motus-E's analysis focuses on the Italian battery industry, which, although characterized by lively activity, operates in an environment not yet entirely favorable to investments, especially concerning precursor materials and cell production for the automotive sector. Currently, most industrial projects in cell production are yet to begin, with **48 GWh of Gigafactories planned**, placing Italy **below the average of other European countries**. A distinctive element is the absence of Asian or American players, unlike other European nations.

Battery pack manufacturers are widespread but tend to be **medium-small** compared to global players. For this reason, they tend to organize themselves through collective systems like consortia to fulfill obligations imposed by regulations, such as Extended Producer Responsibility (EPR). The battery recycling chain is still in its **infancy** and involves players with previous experience in other recycling chains or in lead battery recycling. This situation can be seen as an opportunity, as the new recycling plants needed will be state-of-the-art. It is interesting to note that many players who were leaders in the lead battery market are now shifting towards the lithium battery sector. Regarding the second life of batteries, there are currently mostly pilot projects and case studies.

Italy hosts **advanced research centers** that contribute to innovation in the battery industry. The Italian manufacturing tradition plays a significant role, producing key players in the development of machinery for battery production and in the electronic and thermal control of these devices.

The Italian Battery Industry: Stakeholders

Below is a **non-exhaustive** map of the stakeholders active in the Italian battery supply chain. This map does not aim to provide a comprehensive overview of all stakeholders but serves as an indicative representation based on our knowledge.

Battery Pack Manufacturing

- E-GAP ENGINEERING
- P4 FUTURE
- TAB Italia
- VOLTMEC member of P&CSYSTEM
- archimede energia
- FLASH BATTERY
- Eltec CUSTOM BATTERY PACKS
- ATON GREEN STORAGE
- MIDAC BATTERIES

Cell Manufacturing

- ACC AUTOMOTIVE CELLS Co
- FAAM

Machinery for Production

- Digatron Systems
- COMAU
- manz
- sovema GROUP Member of the SCHULER GROUP

Recycling

- MIDAC BATTERIES
- SPIRIT S.R.L.
- cobat ecofactory

EPR Consortia

- cobat RIPA
- Erion Energy

Electrical Components

- SET ENGINEERING SMART EMBEDDED TECHNOLOGIES
- MARELLI

Second-Life

- enel x

Introduction to Regulation

Motivations and Framework

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Introduction to the New European Regulation

The new European regulation concerning batteries and battery waste was approved by the European Parliament on July 12, 2023, published in the Official Journal of the EU on August 17, 2023, and **entered into force on February 18, 2024**.

Its **chapters, articles, and paragraphs** will **not** be **applied simultaneously** but will follow a timeframe from 2024 to 2037.

The official document is divided into **14 chapters** and **15 annexes**.

The regulation is part of the **EU Green Deal**, a package of policy initiatives aimed at leading the EU towards a green transition, with the ultimate goal of achieving climate neutrality by 2050.

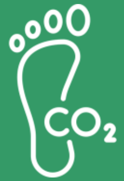
The document approved on July 12, 2023, constitutes the **regulatory architecture** for the battery sector in the European market for the coming decades.

However, the regulation leaves room for **delegated acts** and **implementing acts**, which will be crucial for filling gaps in regulation, harmonizing its implementation, and adapting it to future technical and market developments. The publication of these acts is expected **between 2024 and 2031**.

Topics Covered by the Regulation

The regulation **governs the entire life cycle of batteries**, from production to their reuse and recycling. The main objective is to promote a circular economy within the battery sector, aiming to reduce their environmental and social impact. At the same time, it identifies the fundamental importance of ensuring that the battery market remains safe, sustainable, and competitive through fair and uniform rules and regulations for all operators.

To achieve these objectives, the regulation addresses various aspects of the battery industry, which can be divided into the following areas:



Carbon Footprint and Sustainability

Battery Performance and Durability

Notification and Administrative Procedures

Circularity and End of Life

Battery Data and Digitalization

Chapters

Ch. I	General provisions
Ch. II	Sustainability and safety requirements
Ch. III	Labelling, marking and information requirements
Ch. IV	Conformity of batteries
Ch. V	Notification of conformity assessment bodies
Ch. VI	Obligations of economic operators other than the obligations in Chapters VII and VIII
Ch. VII	Obligations of economic operators as regards battery due diligence policies
Ch. VIII	Management of waste batteries
Ch. IX	Digital battery passport
Ch. X	Union market surveillance and Union safeguard procedures
Ch. XI	Green public procurement and procedure for amending restrictions on substances
Ch. XII	Delegated powers and committee procedure
Ch. XIII	Amendments
Ch. XIV	Final provisions

Annexes

Ann. I	Restriction on substances
Ann. II	Carbon footprint
Ann. III	Electrochemical performance and durability parameters for portable batteries of general use
Ann. IV	Electrochemical performance and durability requirements for LMT, industrial and EV batteries
Ann. V	Safety parameters
Ann. VI	Labelling, marking and information requirements
Ann. VII	Parameters for determining the state of health and expected lifetime of batteries
Ann. VIII	Conformity assessment procedures
Ann. IX	EU declaration of conformity
Ann. X	List of raw materials and risk categories
Ann. XI	Calculation of collection rates for waste portable and LMT batteries
Ann. XII	Storage and treatment, including recycling, requirements
Ann. XIII	Information to be included in the battery passport
Ann. XIV	Minimum requirements for shipments of used batteries
Ann. XV	Correlation table

Timeline and Objectives

The chapters, articles, and paragraphs of the new European regulation will not be implemented simultaneously but will follow a timeline spanning from **2024** to **2037**.

2024

Entry into Force of the Regulation.

2025

Carbon footprint declaration (starting from EVs).

Mandatory due diligence process.

65% lithium battery recycling efficiency.

2026

Application of performance categories for carbon footprint (starting from EVs).

2027

Entry into force of the battery passport.

Recovery efficiency:

- 90% Cu, Co, Ni
- 50% Li
- 90% Pb

2028

Application of maximum threshold for carbon footprint (EV).

Minimum values for performance and durability.

Declaration of recycled content.

2029

2030

70% lithium battery recycling efficiency.

2031

Recovery efficiency:

- 95% Cu, Co, Ni
- 80% Li
- 95% Pb

Minimum recycled content:

- 16% Co
- 6% Ni
- 6% Li
- 85% Pb

2036

Minimum recycled content:

- 26% Co
- 15% Ni
- 12% Li
- 85% Pb

Articles of Interest

Art. 1,2	Subject, Scope of Application, and Objectives of the Regulation
Art. 3	Definitions, including the definition of various battery categories and the different actors within the value chain.
Art. 6	Substances subject to restrictions (completed with annex I)
Art. 7	**Battery carbon footprint (completed with Annex II)**
Art. 8	**Recycled content in batteries**
Art. 9,10	Performance and durability requirements for portable batteries (completed with annexes III e IV)
Art. 13	Labelling and marking of batteries (completed with annex VI)
Art. 14	Information on the state of health and expected lifetime of batteries (completed with annex VII)
Art. 59, 60, 61	Collection of waste batteries (completed with annex XI)
Art. 71	**Targets for recycling efficiency and recovery of materials (completed with annex XII)**
Art. 72,73	Shipment and preparation of waste batteries (completed with annex XIV)
Art. 77, 78	**Battery passport: introduction, technical design, and operation (completed with annex XIII)**

- Bold the articles that will have a specific focus in this report.

FAQ: What's Included and What's Not Included in the Regulation

What is the methodology and procedure I need to follow to determine the carbon footprint of my batteries? Are there any specific limits I need to adhere to?

There is: the minimum information content to include in the carbon footprint declaration, the dates on which the declaration and requirements will apply for various battery categories, guidance on the methodology to be applied for calculating the carbon footprint.

There is not: the exact methodology for calculating and verifying the carbon footprint, the format for the carbon footprint declaration, performance classes related to the carbon footprint.

What is the minimum recycled content required in my batteries?

There is: minimum contents of cobalt, lead, lithium, and nickel; with different percentages and deadlines.

There is not: the methodology for calculating and verifying these percentages.

What are the requirements regarding the performance and durability of my batteries?

There is: the definition of parameters that define the performance and durability of the batteries, the tests to be conducted to define these parameters.

There is not: the binding minimum values of electrochemical performance parameters and durability.

What are the sanctions in case of violation of the regulation?

There are not: Article 93 stipulates that by August 18, 2025, Member States shall establish rules on applicable sanctions and adopt all necessary measures to ensure their implementation. The envisaged sanctions must be effective, proportionate, and dissuasive.

Secondary Legislation

Delegated Acts and Implementing Acts

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Introduction to Secondary Legislation

Within the Battery Regulation, both **delegated acts** and **implementing acts** are foreseen, which will be crucial to fill gaps in regulation, harmonize its implementation, or adapt it to future technical and market developments. These acts will be **published between 2024 and 2031**, and different categories of batteries will follow differentiated regulatory timelines.

In addition to bureaucratic differences in the publication process, it should be emphasized that **delegated acts** are intended to **fill gaps** or add provisions to the regulation, while **implementing acts** are aimed at **establishing uniform conditions** for application.

As with the regulation's topics, acts can also be divided into the following 5 main areas:

The acts may:

- **Be necessary** within the current structure of the regulation, usually with a related expiry date
- **Become necessary** in case of changes in market or technological conditions, or in particular cases at the discretion of the Commission.

Necessary Acts of Interest

For the **carbon footprint**:

- Delegated act to establish the methodology for calculating and verifying the carbon footprint (Article 7(1)).
- Delegated act to establish performance classes related to the carbon footprint (Article 7(2)).
- Delegated act to determine the maximum threshold of the carbon footprint over the lifecycle (Article 7(3)).

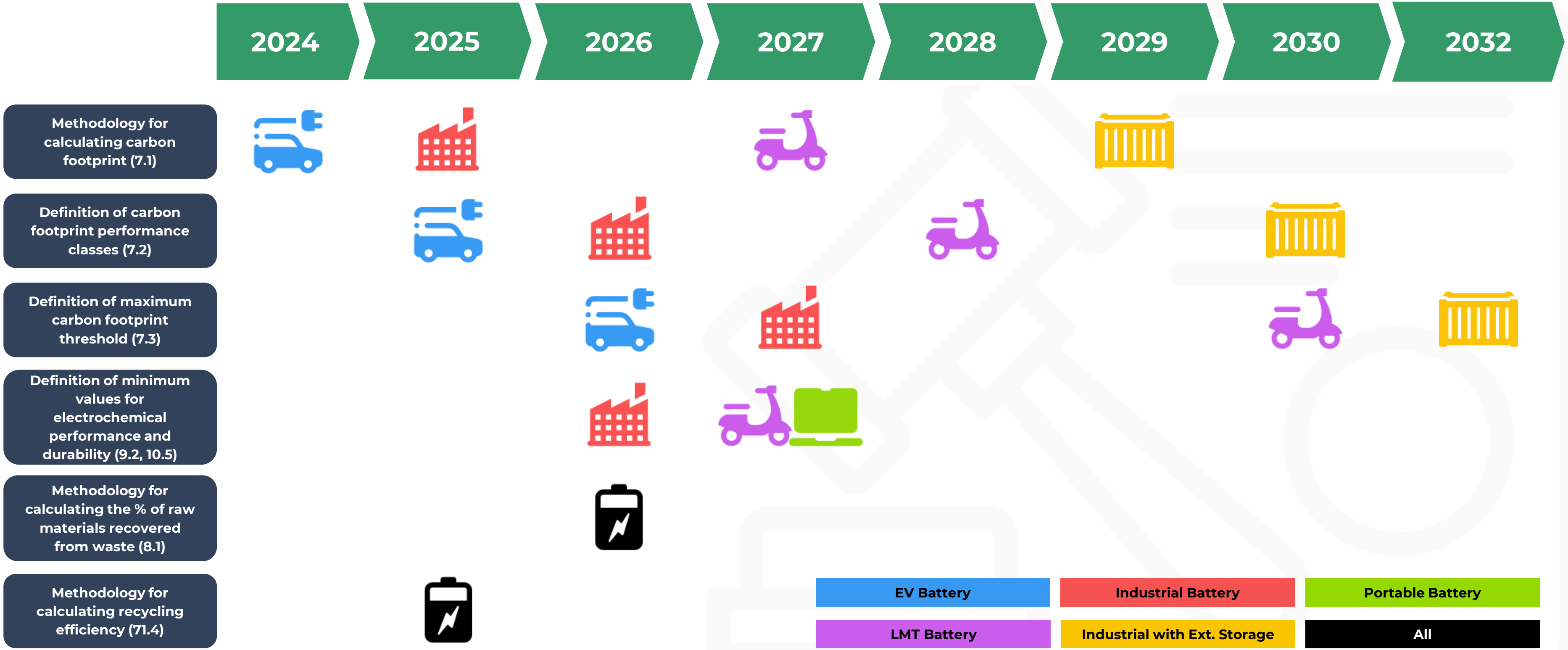
For **circularity**: Delegated act for the methodology for calculating and verifying the percentage of raw materials recovered from waste from battery manufacturing or post-consumer waste (Article 8(1)).

For **battery performance and durability**: Delegated act to supplement the regulation by establishing the binding minimum values of electrochemical performance parameters and durability (Articles 9(2), 10(5)).

For **circularity**: Delegated act to supplement the regulation by establishing the methodology for calculating and verifying recycling and material recovery rates (Article 71(4)).

For **digitalization**: Implementing acts specifying which individuals are to be considered persons with a legitimate interest in accordance with Annex XIII, to which information they have access, and to what extent they can download, share, publish, or reuse such information.

Secondary Legislation: Necessary Delegated Acts



Delegated and Implementing Acts in Detail

Art	Par	Area	Type	Deadline	Description	Battery Type	Motive
6	2	Carbon Footprint and Sustainability	Delegated	31/12/2027	Delegated act to amend the restrictions on hazardous substances in Annex I.	All	Technological
7	1	Carbon Footprint and Sustainability	Delegated	18/02/2024 18/02/2025 18/02/2027 18/02/2029	Delegated act to establish the methodology for calculating and verifying the carbon footprint in relation to Annex II.	EV Industrial LMT Industrial Ext.	Necessary
7	1	Carbon Footprint and Sustainability	Implementing	18/02/2024 18/02/2025 18/02/2027 18/02/2029	Implementing act establishing the format for the carbon footprint declaration.	EV Industrial LMT Industrial Ext.	Necessary
7	2	Carbon Footprint and Sustainability	Delegated	18/02/2025 18/08/2026 18/08/2028 18/08/2030	Delegated act to supplement this regulation by establishing performance classes related to the carbon footprint, taking into account the conditions in Annex II, point 8.	EV Industrial LMT Industrial Ext.	Necessary
7	2	Carbon Footprint and Sustainability	Implementing	18/02/2025 18/08/2026 18/08/2028 18/08/2030	Implementing act establishing the formats for labeling and the format for declaring the performance class related to the carbon footprint.	EV Industrial LMT Industrial Ext.	Necessary
7	3	Carbon Footprint and Sustainability	Delegated	18/08/2026 18/02/2028 18/02/2030 18/02/2032	Delegated act to supplement this regulation by determining the maximum threshold of the carbon footprint over the lifecycle.	EV Industrial LMT Industrial Ext.	Necessary

Delegated and Implementing Acts in Detail

Art	Par	Area	Type	Deadline	Description	Battery Type	Motive
8	1	Carbon Footprint and Sustainability	Delegated	18/8/2026	Delegated act for the methodology for calculating and verifying the percentage of raw materials recovered from waste from battery manufacturing or post-consumer waste.	All	Necessary
8	5	Carbon Footprint and Sustainability	Delegated	31/12/2028	Delegated act to review the minimum percentages of raw materials recovered from waste.	All	Technological, Market
8	6	Carbon Footprint and Sustainability	Delegated	-	Delegated acts to potentially add other materials to be regulated in addition to cobalt, lead, nickel, and lithium.	All	Technological, Market
9	2	Battery Performance and Durability	Delegated	18/08/2027	Delegated act to supplement the regulation by establishing the binding minimum values of electrochemical performance parameters and durability.	Portable	Necessary
10	5	Battery Performance and Durability	Delegated	18/02/2026 18/02/2027	Delegated act to supplement the regulation by establishing the binding minimum values of electrochemical performance parameters and durability.	Industrial LMT	Necessary
10	6	Battery Performance and Durability	Delegated	-	Delegated acts to modify the electrochemical performance and durability parameters listed in Annex IV.	All	Technological, Market
11	4	Battery Performance and Durability	Delegated	-	Delegated acts to add further products to be exempted from the requirements on removability and substitutability.	Portable, LMT	Technological, Market
12	3	Battery Performance and Durability	Delegated	-	Delegated acts to modify the safety parameters listed in Annex V.	BESS	Technological
13	8	Battery Data and Digitalization	Delegated	-	Delegated acts to amend the regulation to provide for alternative types of smart labels that can be used instead of or in addition to the QR code.	All	Technological
13	10	Battery Data and Digitalization	Implementing	18/08/2025	Implementing acts to establish harmonized specifications for labeling requirements.	All	Necessary
14	4	Battery Data and Digitalization	Delegated	-	Delegated act to modify the parameters for determining the health status and expected lifespan of batteries in Annex VII.	All	Technological, Market
16	1	Notification and Administrative Procedures	Implementing	-	Implementing acts establishing common specifications for the requirements under Articles 9, 10, 12, 13, 14, and 78 or the tests under Article 15.	All	Exceptional cases listed in the article

Delegated and Implementing Acts in Detail

Art	Par	Area	Type	Deadline	Description	Battery Type	Motive
48	8a	Carbon Footprint and Sustainability	Delegated	-	Delegated acts to modify the list of raw materials in Annex X, point 1, and the risk categories in Annex X, point 2.	All	Technological
48	8b	Notification and Administrative Procedures	Delegated	-	Delegated acts to modify the list of international instruments in Annex X, point 3.	All	Market
48	8c	Notification and Administrative Procedures	Delegated	-	Atto delegati per modificare gli obblighi degli operatori economici di cui al paragrafo 1 articolo 48 stabiliti agli articoli 49 e 50	All	Market
53	3	Notification and Administrative Procedures	Delegated	-	Delegated acts to modify the obligations of economic operators referred to in paragraph 1 of Article 48 as established in Articles 49 and 50.	All	Discretionary
57	7	Notification and Administrative Procedures	Implementing	-	Implementing act establishing criteria to ensure that financial contributions paid to producers by producer responsibility organizations are compliant.	All	Discretionary
59	7	Circularity and End of Life	Delegated	18/08/2027	Delegated acts to modify the calculation methodology for the collection rate of portable batteries in Annex XI.	Portable	Technological, Market
60	8	Circularity and End of Life	Delegated	18/08/2027	Delegated acts to modify the calculation methodology for the collection rate of batteries for light transport vehicles in Annex XI.	LMT	Technological, Market
70	4	Circularity and End of Life	Delegated	-	Delegated acts to modify the requirements for the treatment of battery waste in Annex XII, Part A.	All	Technological
71	4	Circularity and End of Life	Delegated	18/02/2025	Delegated act to supplement the regulation by establishing the methodology for calculating and verifying recycling and material recovery rates (Annex XII A).	All	Necessary
71	5	Circularity and End of Life	Delegated	18/08/2026	Delegated act to modify the objectives regarding recycling efficiency and material recovery (Annex XII B and C).	All	Technological, Market
71	6	Circularity and End of Life	Delegated	-	Delegated act to modify Annex XII C, adding further materials with specific objectives for material recovery, and Annex XII B, adding further chemical compositions of batteries with specific objectives for recycling efficiency.	All	Technological, Market
72	4	Circularity and End of Life	Delegated	-	Delegated act to establish detailed rules supplementing those for the shipment of battery waste.	All	Discretionary

Delegated and Implementing Acts in Detail

Art	Par	Area	Type	Deadline	Description	Battery Type	Motive
73	4	Circularity and End of Life	Implementing	-	Implementing act establishing technical and verification requirements that waste from batteries for light vehicles, waste from industrial batteries, or waste from electric vehicle batteries must meet to cease being waste.	Industrial, EV, LMT	Discretionary
77	2	Battery Data and Digitalization	Delegated	-	Delegated acts to amend Annex XIII regarding the information to be included in the battery passport.	All	Technological
77	3	Battery Data and Digitalization	Delegated	-	Delegated acts replacing or adding other European or international standards to which the QR code and the unique identifier must conform.	All	Technological
77	9	Battery Data and Digitalization	Implementing	18/08/2026	Implementing acts specifying which individuals should be considered persons with a legitimate interest in accordance with Annex XIII, which information they have access to, and to what extent they can download, share, publish, or reuse such information.	All	Necessary

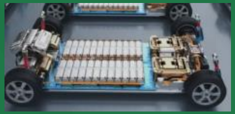
Definitions

Definitions Introduced by the Regulation

Battery Components Definitions (Art. 3)

Battery (3.1): any device delivering electrical energy generated by direct conversion of chemical energy, having internal or external storage, and consisting of one or more non-rechargeable or rechargeable battery cells, modules or of packs of them.

Battery Pack (3.2): any set of battery cells or modules that are connected together or encapsulated within an outer casing, to form a complete unit which is not meant to be split up or opened by the end-user



Battery Module (3.3): any set of battery cells that are connected together or encapsulated within an outer casing to protect the cells against external impact, and which is meant to be used either alone or in combination with other modules.

Battery Cell (3.4): the basic functional unit in a battery, composed of electrodes, electrolyte, container, terminals and, if applicable, separators, and containing the active materials the reaction of which generates electrical energy.

Active Material (3.5): a material which reacts chemically to produce electric energy when the battery cell discharges or to store electric energy when the battery is being charged.

Battery Typology Definitions (Art. 3)

Num.	Typology	Definition
9)	**Portable** Battery	Battery weight equal to or less than 5 kg, is not designed specifically for industrial use and is neither an electric vehicle battery, an LMT battery, nor an SLI battery
10)		General-Use Portable Battery if it has one of the following common formats: 4.5 Volts (3R12), button cell, D, C, AA, AAA, AAAA, A23, 9 Volts (PP3)
11)	**LMT** Battery (Light Means of Transport Battery)	Battery weight equal to or less than 25 kg, for wheeled vehicles that can be powered solely by an electric motor or a combination of a motor and human power, including category L vehicles, and that is not a battery for electric vehicles.
12)	**SLI** Battery (Start Light Ignition Battery)	Designed to provide electrical power for starting, lighting, or ignition and can also be used for auxiliary or support purposes in vehicles, other means of transportation, or machinery.
13)	**Industrial** Battery	For industrial use, intended for industrial use after being prepared for reassignment or reassignment, or any other battery weighing more than 5 kg that is neither a battery for electric vehicles nor a battery for light transport vehicles, nor a battery for motor vehicles.
14)	**EV** Battery (Electric Vehicle Battery)	Designed to provide electrical power for the traction of hybrid or electric vehicles in category L, weighing more than 25 kg, the battery designed to provide electrical power for traction in hybrid or electric vehicles of categories M, N, or O.

TYPOLOGY: Battery types are differentiated by weight and/or destination. It's important to note that this refers to the destination of the battery, not of the packs, modules, or elements (as defined in the previous slide), which are typically designed to serve multiple destinations, especially in the case of elements

.

REUSE: According to the regulation, an "electric vehicle battery" that is repurposed for a second life with an industrial destination is defined as an "industrial battery".

Definitions of Actors in the Battery Sector (Art. 3)

Economic Operator (3.22): the manufacturer, the authorised representative, the importer, the distributor or the fulfilment service provider or any other natural or legal person who is subject to obligations in relation to the manufacture, preparation for re-use, preparation for repurposing, repurposing or remanufacturing of batteries, the making available or the placing of batteries on the market, including online, or the putting of batteries into service in accordance with this Regulation.

Producer (3.47): any manufacturer, importer, or distributor, or other natural or legal person, who: is established in a Member State and manufactures batteries affixing their own name to them, or resells batteries affixing their own name or brand manufactured by third parties, or supplies batteries for the first time in said Member State, or sells directly to end users in a Member State.

Manufacturer (3.33): any natural or legal person who manufactures a battery or has a battery designed or manufactured, and markets that battery under its own name or trademark or puts it into service for its own purposes.

Importer (3.64): any natural or legal person established within the Union who places on the market a battery from a third country.

Distributor (3.65): any natural or legal person in the supply chain, other than the manufacturer or the importer, who makes a battery available on the market.

Fulfilment Service Provider

Independent Operator (3.23): a natural or legal person who is independent from the manufacturer and the producer and is directly or indirectly involved in the repair, maintenance or repurposing of batteries.

Waste Management Operator (3.56): any natural or legal person dealing on a professional basis with the separate collection or treatment of waste batteries.

Repairer

Authorised Representative for Extended Producer Responsibility (3.48): a natural or legal person established in a Member State in which the producer places batteries on the market and which is different from the Member State where the producer is established, and is appointed by the producer in accordance with Article 8a(5), third subparagraph, of Directive 2008/98/EC to fulfil the obligations of that producer under Chapter VIII of this Regulation,

Authorised Representative (3.63): any natural or legal person established in the Union who has received a written mandate from a manufacturer to act on its behalf in relation to specified tasks with regard to the manufacturer's obligations under Chapters IV and VI.

Conformity Assessment Body (3.40): a body that performs conformity assessment activities including calibration, testing, certification and inspection.

Recycler (3.58): any natural or legal person who carries out recycling in a permitted facility.

Producer Responsibility Organisation (3.49): a legal entity that financially or financially and operationally organises the fulfilment of extended producer responsibility obligations on behalf of several producers.

Definitions Related to the Battery Life Cycle (Art. 3)

16) **Placing on the Market:** the first making available of a battery on the Union market.

18) **Putting into Service:** the first use, for its intended purpose, in the Union, of a battery, without having been previously placed on the market.

53) **Treatment:** any operation carried out on waste batteries after they have been handed over to a facility for sorting, preparation for re-use, preparation for repurposing, preparation for recycling or for recycling.

   29) **Preparation for Re-use:** the operations of inspection, cleaning, and repair through which batteries are prepared to be reused without any further pre-treatment.
   30) **Preparation for Repurposing:** any operation, by which a waste battery, or parts thereof, is prepared so that it can be used for a different purpose or application than that for which it was originally designed.
   32) **Remanufacturing:** any technical operation on a used battery that includes the disassembly and evaluation of all its battery cells and modules and the use of a certain number of battery cells and modules that are new, used or recovered from waste, or other battery components, to restore the battery capacity to at least 90 % of the original rated capacity, and where the state of health of all individual battery cells does not differ more than 3 % between cells, and results in the battery being used for the same purpose or application as the one for which the battery was originally designed.
   54) **Preparation for Recycling:** the treatment of waste batteries prior to any recycling process, including, inter alia, the storage, handling and dismantling of battery packs or the separation of fractions that are not part of the battery itself.

Focus on Carbon Footprint

Art. 7 - Ann. II

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Battery Carbon Footprint

The regulation introduces three new concepts that are currently not present in the battery sector. Their implementation is gradual and reflects the fact that the first two serve informative purposes, while the third imposes restrictions on certain batteries.

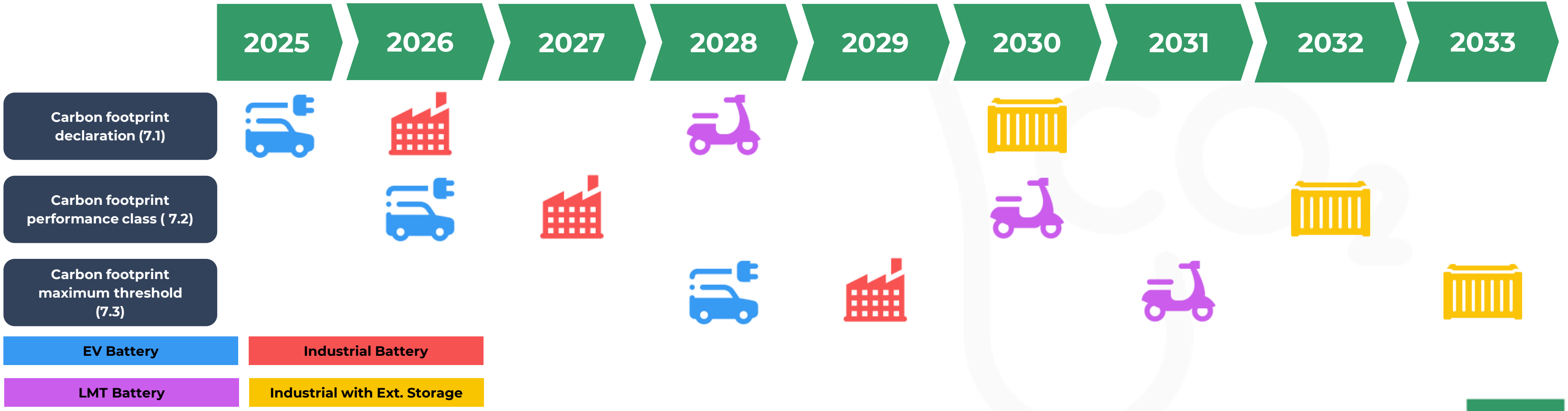
	Definition	Possible Positive Effects
Carbon footprint declaration (7.1)	Requirement for detailed declaration providing comprehensive information on the carbon emissions associated with each stage of the battery life cycle (Annex II)	Ensuring transparency by providing a clear and accessible overview of the environmental implications related to the production, distribution, and disposal of the battery (excluding usage).
Carbon footprint performance class (7.2)	Addition of battery categorization based on their environmental impact.	Providing users and stakeholders with an effective way to assess and compare the environmental performance of different batteries, facilitating the choice of more sustainable solutions.
Carbon footprint maximum threshold (7.3)	Introduction of a maximum threshold for tolerable carbon emissions throughout the entire lifecycle of a battery.	Encouraging the development and adoption of technologies with lower environmental impact and stimulating the selection of suppliers and production practices that are more sustainable.

Battery Carbon Footprint

Such analysis applies at the battery pack level, and not all batteries are subject to this process (smaller-sized ones are excluded).

- **Included:** EV batteries, industrial batteries with capacity > 2 kWh, and LMT batteries.
- **Possible Inclusion:** portable batteries (Art. 7.4) and industrial batteries with capacity < 2 kWh.
- **Excluded:** second-life batteries if previously placed on the market or put into service in their first life.

The obligations are introduced with the following timelines:



Battery Carbon Footprint: Example

Carbon Footprint Declaration, DPI: Xxxxxx, Yyyyy, Zzz	
Manufacturer	The Battery Company s.r.l
Battery Model	Aaa 20 kWh - Destinazione EV
Manufacturing Plant	Via Roma 1, Roma (IT), 01020
Carbon Footprint (CF)	100 kg_{CO2eq}/kWh
Performance Class	B
% CF Raw Material Acquisition and Preprocessing	45%
% CF Manufacturing	35%
% CF Distribution	10%
% CF End-of-Life and Recycling	10%
EU Compliance Declaration	CE
Link	https://www.dichiarazioneco2.it/

Specific information to include about the manufacturer and battery model is not specified in the regulation. The format for the carbon footprint declaration will be established by Implementing Acts starting from February 2024 for EV batteries.

The method for calculating and verifying the carbon footprint will be established by Delegated Acts starting from February 2024 for EV batteries and will be based on the Life-Cycle Assessment (LCA) methodology.

The performance classes will be established starting from 2025 by Delegated Acts, while the labeling format will be determined with the same timing by Implementing Acts.

The percentage of the total footprint that includes the processes of extraction, sourcing, and preprocessing, as well as the transportation of all active materials up to the manufacturing of battery components and electrical or electronic components.

The percentage of the total footprint that includes the assembly of battery elements and the assembly of batteries with battery elements or electrical or electronic components.

The percentage of the total footprint that includes transportation to the point of sale.

The percentage of the total footprint that includes collection, dismantling, and recycling.

Link to access a public version of the study supporting the carbon footprint values and the percentages related to the various stages of the production chain.

Conclusion on Battery Carbon Footprint

Pros	Doubts	Proposals
• It provides **consumers** with **more information** to resolve their doubts **regarding** the actual **sustainability** of electric vehicles compared to their fossil fuel counterparts. • The interviewed **manufacturers** positively welcome this initiative as a **new dimension to differentiate** themselves **from competitors**, especially those in Asia, with whom it is difficult to compete in terms of price. • The inclusion of the end-of-life phase in the calculation could **favor a local supply chain**.	• The regulation leaves **ample room for delegated acts**, making it still difficult to pass a definitive judgment on this measure. • It is essential to **assess the effect on the final cost** of batteries generated by this measure. Given that most of the information concerns the battery model, manufacturers with higher volumes may benefit from lower marginal costs, while those with lower volumes or specific batteries may be penalized. • It is necessary to clarify **who and how will verify the accuracy** of the declared data, especially regarding the acquisition of raw materials and preprocessing.	• **Economic incentives** for higher-performance battery classes could further encourage the adoption of more sustainable solutions. • **Performance classes** and maximum carbon footprint should be **differentiated by battery chemistry and application**, as some higher-performing solutions inherently have a higher impact. • **Exclusion of batteries** with **low volumes** or specific applications if the marginal cost to comply with carbon footprint obligations were significant.

Focus on End of Life and Post-use

Art. 8, 56, 59, 60, 61, 71 - Ann. XI, XII

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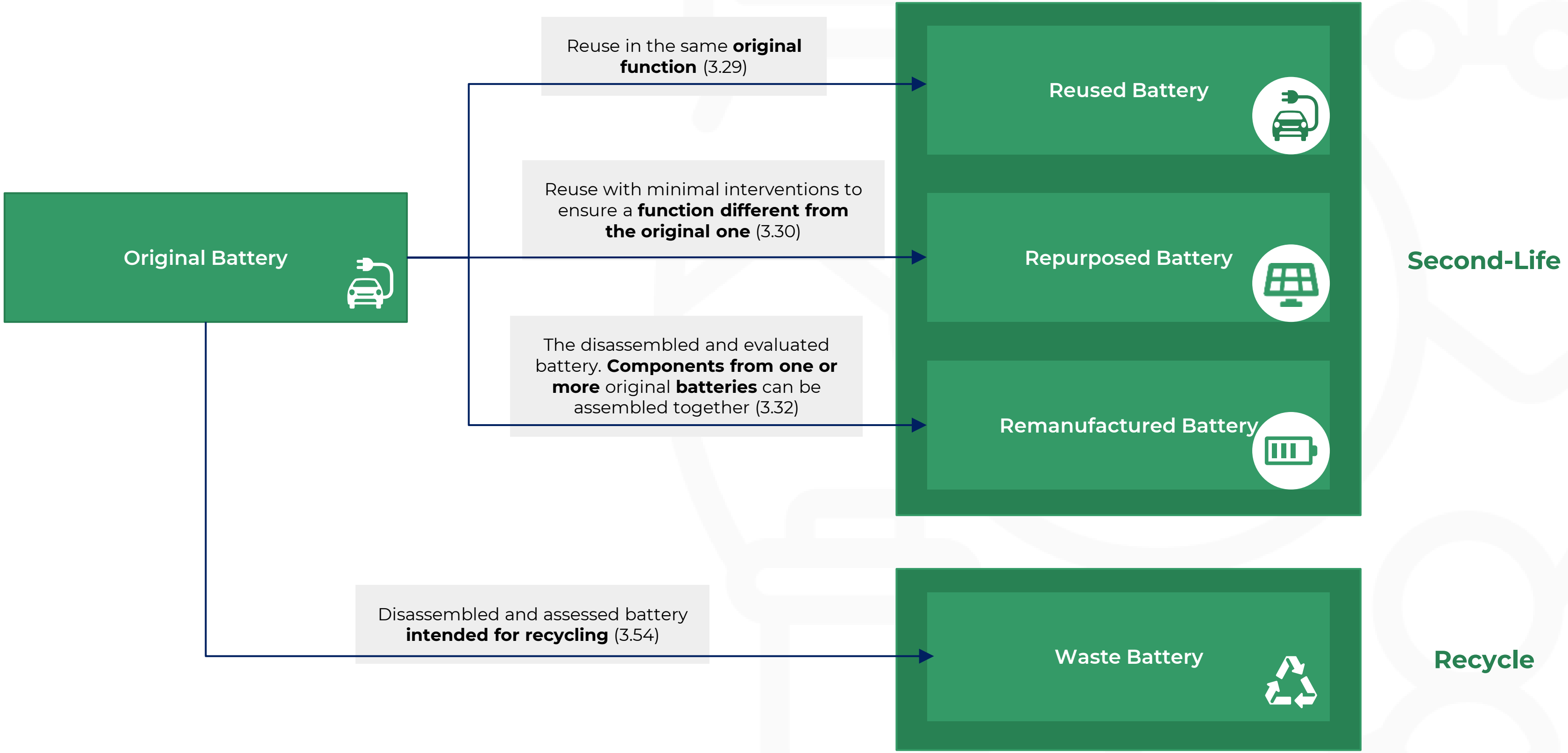
Definitions Related to Battery End-of-Life (Article 3)

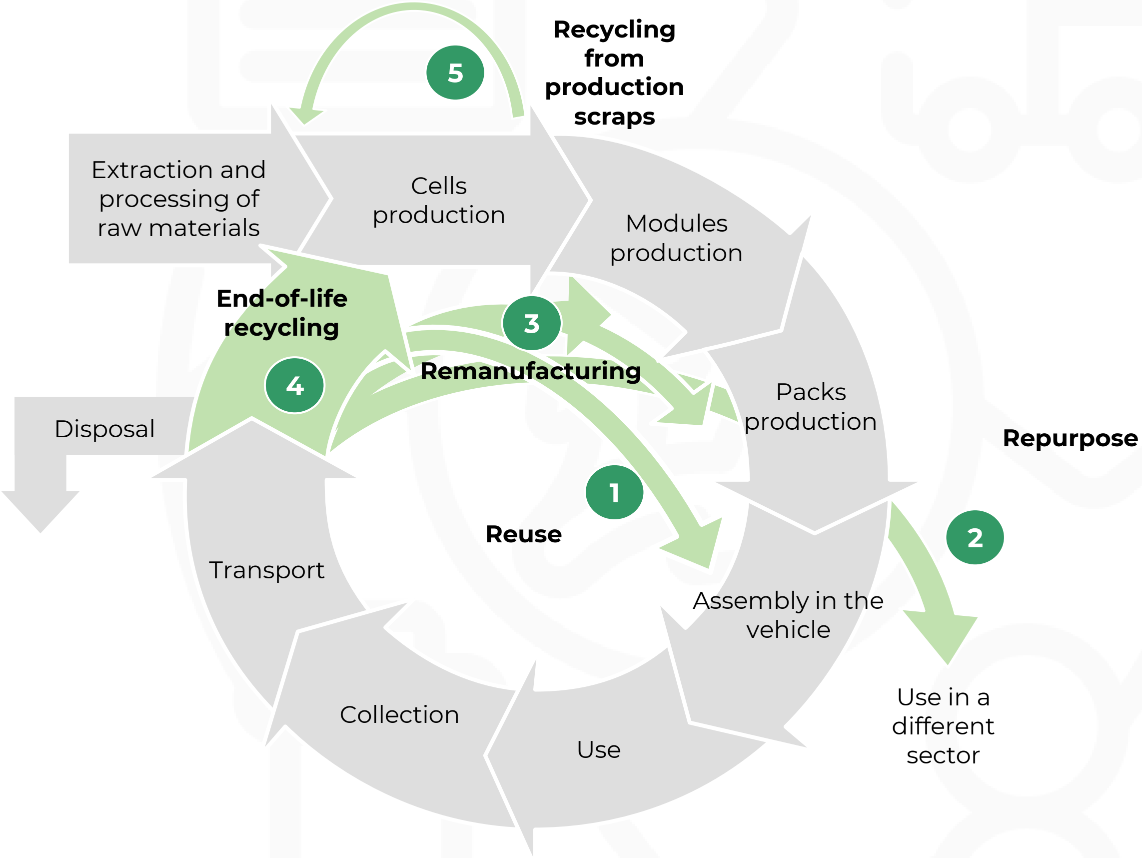


Circular Supply Chain

The circular battery supply chain encompasses various stages aimed at **sustainably managing the entire lifecycle of batteries**. These stages include sustainable production, efficient use, end-of-life recycling, reuse, refurbishment, and material valorization.

In the adjacent diagram, the stages are depicted, with particular emphasis on **activities in green**. These activities, defined by regulations, are **key in promoting battery circularity** throughout their lifecycle.

This approach aims to **maximize operational efficiency**, **reduce environmental impact**, and comply with current regulations, thereby contributing to a more responsible and sustainable system in the battery sector.



Second-life Batteries and EPR

Chapter VIII elaborates the structure of responsibility and duties related to the management of waste batteries, maintaining the Extended Producer Responsibility (EPR) regime as the cornerstone principle.

Extended Producer Responsibility (Art. 56): battery producers must assume extended responsibility, including covering the costs related to the collection, transportation, and treatment of battery waste, along with other associated costs. If an economic operator initially places a battery on the market following operations such as reuse, change of destination, or remanufacturing, they are considered the producer and assume extended responsibility.

Pros	Doubts and Comments
• The clear definition of producer responsibilities r**educes doubts regarding the management of end-of-life batteries**, facilitating the emergence of new operators and investments in the sector. • The definition of **producer responsibility organisation** (Art. 3.49) offers producers the opportunity to reduce the costs associated with extended responsibility. • The clear definition of obligations and roles **can lead** to a potential **liberalization of the end-of-life battery market**, providing clear opportunities and encouraging competition. • Transferring extended responsibility to producers **reduces the burden on consumers**, helping to mitigate the environmental impact of batteries.	• The economic and compliance opportunities related to recycling and reuse pose a significant **trade-off** between the **two end-of-life strategies**. • Despite the prospect of liberalization, the **operators** we interviewed seem **inclined to vertically integrate reuse** or have binding agreements with a few trusted companies. • Battery **repurposing** is **viewed with skepticism** by the interviewed actors, as batteries, starting from the cells, are optimized for a specific final function. • The **lack of design obligations to facilitate reuse** could be a barrier, along with the fact that the Digital Passport does not provide sufficient information at the module level to accelerate the assessment (diagnostic) for reuse.

Recycling Objectives

	2025	2027	2030	2031	2036
Art. 8 - Recycled content in batteries				Minimum recycled content: • 16% Co • 6% Ni • 6% Li • 85% Pb	Minimum recycled content: • 26% Co • 15% Ni • 12% Li • 85% Pb
Art. 71 - Targets for recycling efficiency (completed with Annex XII)	Recycling efficiency lithium-ion batteries 65%		Recycling efficiency lithium-ion batteries 70%		
Art. 71 - Targets for recovery of materials (completed with Annex XII)		Recovery efficiency: • 90% Cu, Co, Ni • 50% Li • 90% Pb (EV Battery, Industrial Battery)		Recovery efficiency: • 95% Cu, Co, Ni • 80% Li • 95% Pb (EV Battery, Industrial Battery, LMT Battery)	

EV Battery | **Industrial Battery** | **LMT Battery**

Focus on Article 8: Recycled Content in Batteries

Obiettivi:

2031
Minimum recycled content:
16% Cobalt
6% Nickel
6% Lithium

2036
Minimum recycled content:
26% Cobalt
15% Nickel
12% Lithium

Pros	Doubts and Comments
• Promoting the **development** of an emerging battery **recycling industry** in **Europe**. • **Strengthening and diversifying the supply chain** in a region lacking in raw materials. • **Raising awareness among producers** about the use of recycled materials..	• The current regulation **does not distinguish between production waste and post-consumer waste**, potentially not favoring a more efficient and sustainable management of the production process. • Currently, there is a lack of data on the amount of recycled material in produced batteries, but producers seem to focus on more urgent issues. However, this is the recycling target with the furthest deadline and allows for an adequate time margin. • There are currently **no specific targets for** the recovery of **graphite** and **LFP** cathode. Both present a supply chain that does not favor Europe, and from our interviews, it emerged that the technology for their recovery is mature. • The regulation **does not specify whether recycling should take place within or outside Europe**, not favoring the development of the European recycling industry. However, the Critical Raw Material Act imposes that by 2030, 25% of European consumption of strategic raw materials must come from internal recycling.

Focus on Article 71: Targets for Recycling Efficiency and Recovery of Materials (Completed with Annex XII)

Obiettivi:

2025	2027	2030	2031
Recycling efficiency lithium-ion batteries 65%	**Recovery efficiency:** 90% Cobalt, Nickel 90% Copper 50% Lithium	**Recycling efficiency** lithium-ion batteries 70%	**Recovery efficiency:** 95% Cobalt, Nickel 95% Copper 80% Lithium

Pros	Doubts and Comments
• Promoting the **development** of an emerging battery **recycling industry** in **Europe**. • **Strengthening and diversifying the supply chain** in a region lacking in raw materials. • **Encourage recycling sector operators** to develop advanced technologies to achieve predetermined recycling and recovery efficiency targets.	• The **methodology** for calculating and verifying the rates of recycling efficiency and material recovery will be **defined by** means of a **delegated act** by February 18, 2025. • Despite uncertainties about the methodology, interviews suggest that the **targets for 2025 and 2027 are achievable with current technology**. However, urgent investments are needed to create new facilities and improve existing ones. • **LFP** batteries, increasingly used, even in the automotive sector, **do not have constraints** for the recovery of cathode active material. However, the Commission has the power to adopt delegated acts to include additional chemical compositions of batteries. • From the interviews, **greater criticalities** have emerged **regarding the waste battery collection** targets (Art. 59, 60, 61). This concerns the upstream phase of the recycling process.

Conclusion on End of Life and Post-use

Pros	Doubts	Proposals
• The clear definition of producers' responsibilities **simplifies the management of end-of-life batteries**, encouraging new operators and investments, with the potential for liberalization of the end-of-life battery market. • The regulation **promotes** the **development** of an emerging battery **recycling industry** in Europe, strengthening and diversifying the supply chain in a region lacking in raw materials. • It **incentivizes** recycling sector operators to **develop advanced technologies** to achieve predefined recycling and recovery efficiency targets.	• A **potential trade-off between battery recycling goals and reuse** opportunities is highlighted, emphasizing that efforts to achieve recycling goals could limit the possibilities of reusing batteries in other applications. • There is a **lack of distinction between production waste and post-consumer waste** in recycling goals. • There is an **absence of design requirements** that promote battery reuse. • The regulation lacks clarity on both the **localization of recycling** (internal or external to Europe) and the obligations and **interactions among different actors** in the recycling chain, which the regulation describes as a single step.	• **Inclusion of specific recovery and recycling targets for materials such as graphite and LFP cathodes.** Some materials are essential in batteries, and their inclusion not only reflects a broader commitment to environmental sustainability and resource recovery but also addresses the current supply chain that does not favor European actors. • Pursuing **alignment** between the **objectives** of the **European Battery Regulation and the Raw Material Act** to promote a stronger local industry.

Focus on Digitalization e Data Transparency

Art. 13, 14, 77, 78 - Ann. VI, VII, XIII

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Evolution of Data Communication Methods

The battery labeling has two **temporal horizons**:

- **In the short term,** a **physical label** on the battery containing the relevant information is required by August 18, 2026.
- **In the long term**, by February 18, 2027, a **QR code** allowing remote access to the relevant information must be implemented.

Art. 13
Labelling and marking of batteries
2026

via QR code

Art. 77
Battery Passport
2027

Art. 14
Information on the state of health and expected lifetime of batteries
2024

Starting from August 18, 2024, the data related to the parameters for determining the state of health and the expected lifespan of batteries (Annex VII) must be contained in the Battery Management System (BMS) of stationary battery energy storage systems, LMT batteries, and EV batteries.

Battery Passport

Starting from February 18, 2027, all **LMT batteries**, **industrial batteries** with a capacity > 2 kWh, and **EV batteries** placed on the market or put into service must be registered in an electronic format known as the "battery passport.

The information is structured on two levels, with three different access levels.

Level of Information
Information related to the battery model (**static**), for example, manufacturing information, carbon footprint, and recycled content.
Specific information regarding the individual battery (**dynamic**), such as Certified Energy State, remaining capacity, and incident history.

Level of Access
Information accessible to the **public** (most static information).
Information accessible only to **notified bodies**, market surveillance authorities, and the **Commission** (all static information).
Information accessible exclusively to individuals or legal **entities with a legitimate interest*** (all static and dynamic information).

*By August 18, 2026, the Commission shall adopt implementing acts specifying who shall be considered individuals or legal entities with a legitimate interest. The indication is that they are actors involved in the dismantling and repair process of the battery or independent energy aggregators and participants in the energy market.

Battery Passport Principles

The Battery Passport is a **Digital Product Passport** (DPP). The DPP is currently defined by the European Commission within the proposal for the Ecodesign for Sustainable Products Regulation (ESPR).

A product passport is a **set of specific product data** that includes the information specified in the relevant regulation and is **electronically** accessible through a data carrier in accordance with the regulation (in the case of the Battery Passport, the data carrier is a QR code).

- The Battery Passport must be interoperable with other DPPs.
- The data carrier (QR code) must be unique.
- The information must be based on an open standard.
- The information must be structured in a way that facilitates reading and searching.
- The information must be accurate, complete, and up-to-date.

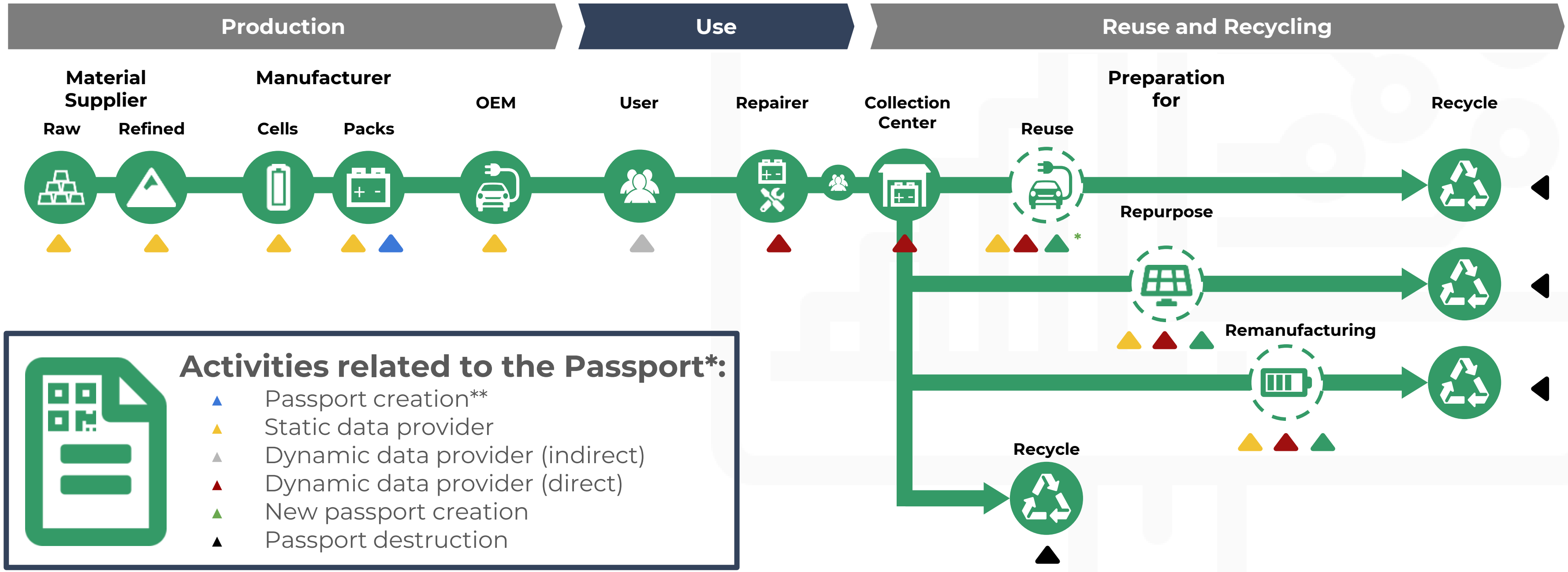
Obligations and Positive Effects on the Value Chain

Phase	Actor	Effects
Production	Raw material suppliers	Requirement to provide data on carbon footprint and due diligence, and the possibility to increase the price for **more sustainable raw materials**.
Production	Cells manufacturers	Opportunity to choose **more sustainable raw materials and active materials**, thereby increasing the price for more sustainable cells.
Production	Battery pack manufacturers	Opportunity to increase the price for **more sustainable and safer batteries**. Obligation to provide almost all the data contained in the digital passport.
Production	OEMs	Obligation to implement a system capable of updating dynamic data according to regulations. Opportunity to choose **more sustainable suppliers**.
Use	Users	**Increased awareness of the environmental impact** when making choices. Better understanding of the level of degradation of one's vehicle.
Use	Repairers	Requirement to update the passport. **Safer and more efficient repairs** thanks to battery data.
Reuse and Recycling	Collection and disposal centers	**Safer battery removal** and disposal thanks to the data contained in the passport. **Facilitated assessment** of the battery's remaining lifespan.
Reuse and Recycling	Transporters	**Better understanding** of transport **risk**.
Reuse and Recycling	Reuse and refurbishment centers	Requirement to update the passport or create a new one. **Improved assessment of battery residual life**. Facilitated remanufacturin-g.
Reuse and Recycling	Recyclers	**More efficient recycling** thanks to information on chemistry and hazardous material content.

Advantages in:

- ▲ Operational efficiency
- ▲ Safety
- ▲ Sustainability

Life of a Battery Passport



* The described activities are not to be considered official but represent an interpretation of the current regulation.
** Officially, the entity responsible for creating the passport is the economic operator placing the battery on the market. This often coincides with the battery manufacturer. An OEM may be considered the responsible entity if it purchases cells and assembles them into packs for use in the vehicle. An importer is the responsible entity if the battery is produced outside the borders of the European Union.
* Edge case for the creation of a new passport.

Doubts and Unclear Aspects from the Regulation

DATA UPDATE FREQUENCY	The **frequency** of updating dynamic data on the required **online platform** is not defined. The need to connect to such a platform could incur significant costs, especially in the case of LMT vehicles. Currently, the regulation does not specify a designated registry or online platform for storing such data.
PASSPORT COST	Initial estimates[1] indicate that the **cost** for the Battery Passport varies between 6 and 12 euros per battery. However, greater clarity in the rules is needed to obtain a more precise estimate. This cost is independent of the size of the battery and could represent 5-10% of the total cost for regulated batteries of smaller sizes.
ALGORITHMS ACCURACY	The data related to the assessment of the remaining useful life of batteries, such as the SOCE (State of Certified Energy), do not stem from direct measurements but are influenced by the **accuracy of the algorithms** used by OEMs to calculate them.
DATA LEVEL OF DETAILS	Most of the data, both static and dynamic, in the Battery Passport pertains to the battery pack. However, to ensure **more efficient reuse and remanufacturing**, it would be desirable to have data at least at the module level. Additionally, it is not yet clear how the new passport should be linked to the previous one in case of battery reuse or remanufacturing.
DATA SHARING AND GOVERNANCE	The sharing of **chemical composition data** is mandated by the regulation, unless it conflicts with business interests. However, it should be noted that many of these pieces of information are trade secrets, and the accuracy of such data may be challenging to determine.
PASSPORT STANDARDS	**There is no single standard for the Battery Passport**, including the data to be included and their format. Different consortia and working groups are working to interpret the regulations effectively to provide a useful and appropriate passport format. It is crucial that, in the event that different passport formats are created, they are compatible with each other.

[1] https://www.autocar.co.uk/car-news/electric-cars/battery-passports

Focus on the Battery State of Health

Understanding the battery's State of Health (SOH) is crucial to ensuring its safe use, maximizing its residual value, and making informed decisions regarding its proper end-of-life management.

The Annex XIII specifies that the information regarding the battery **state of health** within the battery passport must comply with Article 14, which states:

- For **EV** batteries, it is represented by the **State of Certified Energy** (SOCE).
- For **stationary battery** energy storage systems and **LMT** batteries, it is represented by the **remaining capacity**, and where possible, the ohmic resistance.

SOCE

The SOCE is a metric rarely considered in the battery industry, and currently, there is limited documentation available on it. From an open survey we conducted with industry experts, 69% reported being unaware of this indicator, while 27% stated they were aware of it but had never used it in their work.

According to the definition of the United Nations Economic Commission for Europe (UNECE), the SOCE is the state of health of a renewable energy storage system (REESS) installed in a vehicle. The associated performance metric is the usable battery energy (UBE), determined upon reaching the break-off criterion during the applicable charge depleting test (e.g., NEDC, WLTP).

Therefore, the SOCE can be defined as the ratio between the UBE over the battery's lifetime and the certified battery energy, which is the UBE calculated during the vehicle certification tests. The SOCE differs from the potential ambiguity of the SOH, which is often calculated as the ratio between the residual capacity and the initial capacity or as the ratio between the ohmic resistance during usage and the initial resistance.

Focus on the Battery State of Health: Degradation

The **degradation processes** in lithium batteries occur naturally, even when not in use. However, during their operational life, they **can be accelerated by various risk factors**, including excessively high or low temperatures, maintaining a state of charge that is too high or too low, and the use of a high C-rate (where the C-rate represents the ratio between the battery capacity and the current used to charge or discharge it).

Risk Factors:

- High Temperatures
- Low Temperatures
- High State of Charge
- Low State of Charge
- High C-rate

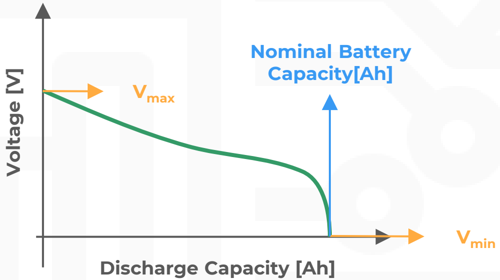
The battery **degradation phenomena are diverse** and vary throughout the battery's life cycle, depending on the battery chemistry and the predominant risk factors contributing to its degradation. At the microscopic level, the most common degradation mechanisms include the growth of the Solid Electrolyte Interphase (SEI) on the anode, electrolyte decomposition, lithium plating and dendrite formation, degradation and loss of active material, and corrosion of current collectors. At the macroscopic level, these phenomena result in increased battery resistance and decreased capacity.

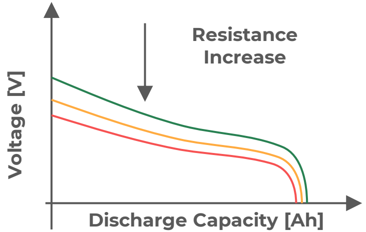
Macroscopic Effects of Degradation:

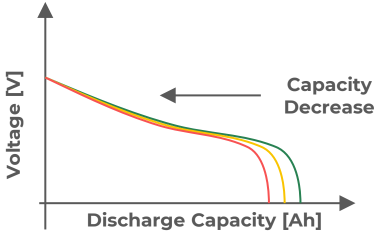
- Resistance Increasing
- Capacity Decreasing

Focus on the Battery State of Health: Voltage Profiles

On the right, the voltage profile during a constant current discharge, typical of a lithium battery, is illustrated. For each battery, a maximum voltage (V_{max}) and a minimum voltage (V_{min}) within which the battery operates are defined. The capacity of a battery is measured by discharging a fully charged battery to V_{min}. If the current is constant, the nominal capacity of the battery [Ah] is the result of the product between the current [A] and the time [h] required to reach V_{min}, coinciding with the discharge capacity between V_{max} and V_{min}.

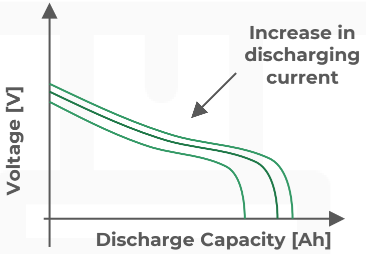






During the degradation process, the resistance of the battery may increase while its capacity decreases. Both of these factors contribute to a decrease in the discharged capacity, which may result in being lower than the nominal capacity (in green), as illustrated on the left, where the effects of the two factors are represented individually.

Attention! It's important to specify the discharge current at which the nominal capacity is measured because simply increasing the discharge current can lead the battery to reach the minimum voltage more quickly even without any degradation process. The same applies to temperature.



Focus on the Battery State of Health: SOCE vs SOH

While SOH associates performance metrics with capacity or resistance, SOCE uses energy. It's important to note that the energy of a battery [Wh] is calculated as the product of its capacity [Ah] and its voltage [V], the latter of which is influenced by resistance, as highlighted in the previous slide. Therefore, energy accounts for both macroscopic effects of degradation.

	SOH	SOCE
Measure	Indirect	Indirect
Associated Metric	Capacity [Ah] o Resistance [Ohm]	Energy [Wh]
Test	Not defined: Both the initial and current associated metrics heavily depend on the specific test conducted.	Defined: Charge Depleting Test*
Computation	It depends on the associated algorithm, it can also be instantaneous and on-board.	From the available documentation, it seems to be linked to the test duration and to the specific profile (no possibility of performing it on-board).

* Still to be defined in the regulation which Charge Depletion Test profile is applicable.

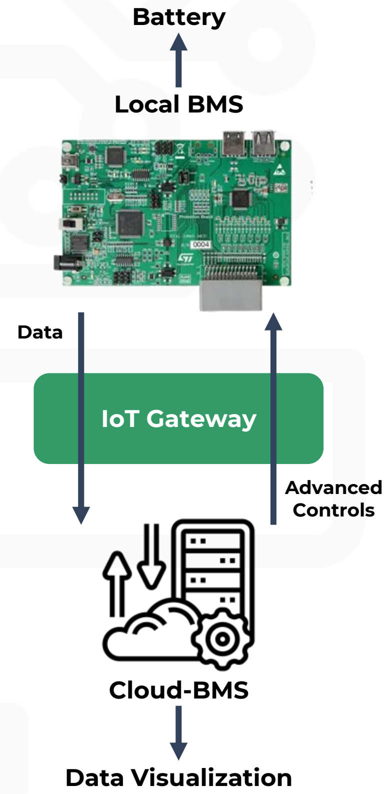
Focus on the Battery State of Health: BMS and Cloud-BMS

The **BMS** (Battery Management System) is a system designed to **manage, monitor, and control batteries**. Its main functions include:

- Monitoring the state of health (SOH) and state of charge (SOC) of the cells
- Protection against overcharging and excessive discharging
- Balanced distribution of charge among the cells
- Thermal management to prevent overheating
- Data logging for performance analysis and communication with other vehicle or application systems

The **BMS has some limitations**, including short-term memory, limited ability to adapt to degradation over time, and difficulty in predicting incidents due to hardware memory and computational capacity constraints.
To overcome these limitations, cloud-based solutions offer advantages such as scalable computing power and extended access to historical data. The adoption of a **cloud-BMS**, which is complemented by the local BMS through an IoT Gateway, can help **improve** the **accuracy** and efficiency of the battery management system, while also ensuring **greater transparency of data**.

Given that the regulation requires regular updating of dynamic data on the online platform, we anticipate an increase in the adoption of cloud-based BMS.



Battery Passport

Given the absence of a defined passport format, Motus-E is at the forefront of providing a **battery passport model** that is compliant with the regulations, derived from a comprehensive analysis of the articles of the regulation and their related annexes.

Attached to the report is a **Battery Passport model,** appropriately explained and compliant with the regulation.

Within the passport model, it is possible to consult:

- 75 parameters, divided into 5 types, and distinguished between static and dynamic parameters
- Information on the level of access to individual parameters
- The battery category to which the parameters apply
- The level of architecture to which the parameters refer (cell, module, pack)
- The impact on stakeholders in the value chain (responsibilities and benefits)

Conclusions on Battery Digitalization

Pros	Doubts	Proposals
• The digital battery passport offers the opportunity to promote the use of **more sustainable materials and processes**, allowing suppliers to increase prices based on sustainability criteria, and consumers to have greater awareness of the environmental impact of their choices. • For various actors in the chain, from manufacturers to repairers and disposal centers, access to detailed battery data through the digital passport **facilitates safer and more efficient operations, and more informed decisions**.	• The **lack of specifications on the update frequency** for dynamic data and the potential costs of connecting to the online platform raise concerns, especially for non-EV applications. • The **assessment of remaining useful life** is **influenced by the accuracy of algorithms** developed by OEMs. The **absence of data at the module level** could also limit the efficiency of battery reuse and remanufacturing, making it crucial to conduct longer and more detailed end-of-life tests. • The **absence of a unified standard** for the Battery Passport, including data format, requires efforts to ensure compatibility among different formats that may emerge.	• Although **additional data at the module and cell level** are not currently mandated, incentives could be introduced to encourage OEMs to voluntarily declare them within the passport. This would facilitate a more thorough assessment, streamline repairs, and, if possible, promote battery reuse, contributing to the implementation of more sustainable practices and efficient component management.

Final Conclusions

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Final and General Conclusions

As an association committed to promoting the transition to electric mobility, we hope to see the **following conditions and regulatory advancements** in the battery value chain:

- Improved definition of **operational practices**, which are currently left to secondary regulation and sometimes to the free interpretation of national stakeholders, particularly regarding:
    - Carbon footprint calculation;
    - End-of-life battery management: limits and boundaries of operational possibilities;
    - End-of-life battery management: roles of stakeholders and consortia;
    - Digitization and digital passport.
- Especially concerning the management of end-of-life batteries, it will be necessary to **consider the practices developed by the operators themselves**.
- Compared to the previous regulation (2006/66/EC), the new regulation, by directly involving various phases of the battery life cycle, **increases the burdens and efforts required for all actors in the value chain**.
- Clear definition is needed regarding data exchange among the various actors along the battery life cycle, ensuring smooth interaction **to obtain accessible and accurate data**.

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