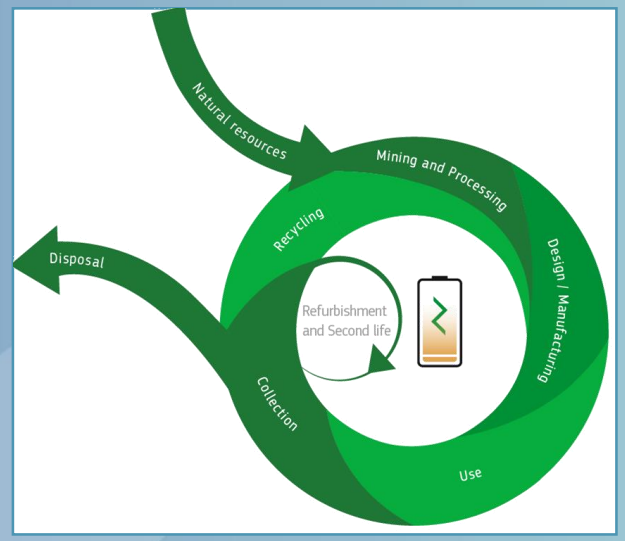
Circularity and sustainability as a means to build resilient and responsible value chains: the example of batteries



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JRC-IEA Workshop, December 12th and 13th 2023

Session III. Sustainability, ESG and Circularity - Challenges and Innovation in recycling

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Outline

- (Short) Policy context
- EC Battery regulation : objectives and impact on innovations
- Going beyond Battery regulation provisions
- Take home messages
- Discussion

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Policy context

Why batteries as a relevant starting point for promoting resilient value chains?









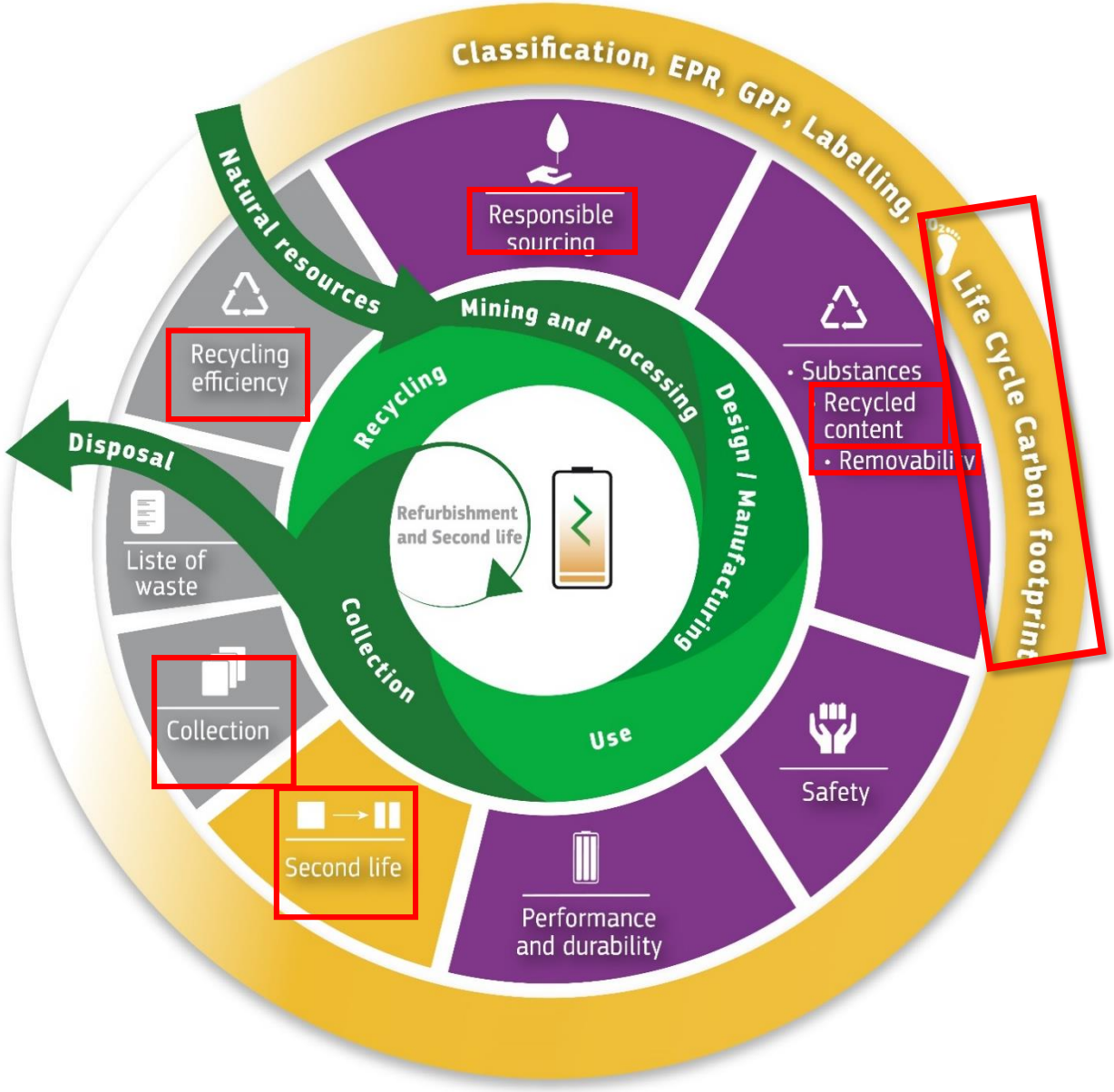


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EC Battery regulation and impact on innovations

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(EU) 2023/1542 Battery regulation: an opportunity to *holistically* address life cycle thinking, circularity, CRMs and the complete value chain



- A life-cycle-based regulation, targeting many aspects and life cycle stages
  - Raw materials, circularity addressed in various articles, at supply / manufacturing and end-of-life stages
  - Life cycle through carbon footprint
- Several first-of-a kind **<u>game changing</u>** entry market requirements incl:
  - E.g. Carbon footprint + recycled content, performance, durability, safety
  - Measurement & calculation methods, data, verification methods needed
  - JRC is supporting

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The objectives: **Article 58-59: COLLECTION**

Annex XI		Target based on the batteries placed available on the market	
Targets for collection of waste portable batteries	Portable batteries	By 31/12/2027 63%	By 31/12/2030 73%
	Light means of transport batteries	By 31/12/2028 51%	By 31/12/2031 61%

- Ambitious targets as we have now new products with longer lifetime of batteries



- Such ambitious targets will require technological and organizational **innovations**:
  - To set-up efficient collection channels
  - To allow preparation for re-use and recycling
  - To minimise losses (“complementary flows”)
  - To ensure monitoring

JRC **will suggest calculation rules for the collection of waste portable batteries and Light Means of Transport (LMT) batteries**

1. Identification of the new market trends (new batteries in the market and yew performances)
2. Development of methodology and rules for calculating the collection rate (based *on available for collection*)



https://dx.doi.org/10.2760/64633 (2021)
New analysis due Q1 2024

The objectives: **Article 71: RECYCLING EFFICIENCY AND MATERIAL RECOVERY**



Annex XII, Part B and C		By 2025 (tRE) By 2027 (tRM)		By 2030 (tRE) By 2031 (tRM)
Targets for recycling efficiency (tRE) recovery of materials (tRMs)	PbA batteries Pb	tRE = 75% tRM = 90%	PbA batteries Pb	tRE = 80% tRM = 95%
	Li-based Co, Cu, Li and Ni	tRE = 65% tRM = 90%, 90%, 50% and 90% resp.	Li-based Co, Cu, Li and Ni	tRE = 70% tRM = 95%, 95%, 80% and 95% resp.
	NiCd	tRE = 80%	NiCd	tRE = 80%
	Others	tRE = 50%	Others	tRE = 50%

tRE/tRM= target for RE/RM as proposed by the regulation

- Such new targets require **innovations** in recycling processes
  - Currently, fast development of processes (**pyro, hydro**) and **pre-processing**
  - To foster recycling of elements that are little recycled (e.g. Li, graphite) -> reviews planned

JRC will suggest Harmonized calculation and verification rules for the rates for recycling efficiency (rRE) and recovery of materials (rRMs) for PbA/Li-based/NiCd and other batteries

(JRC report expected Q2 2024)

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The objectives: **Article 8 | RECYCLED CONTENT**

Article 8		By 2031	By 2036
Targets for recycled content (RC)	Pb	85%	85%
	Co	16%	26%
	Ni	6%	15%
	Li	6%	12%

JRC will suggest methodology for the calculation and verification of the percentage share of

1. Co, Ni and Li recovered from battery manufacturing waste or post-consumer waste,
2. Pb recovered from waste batteries

And the format for the documentation

Such novel target will certainly require technological and organization innovations:

- For *recyclers* to supply high quality materials;
- For *OEMs* to integrate routinely recycled materials in highly performing batteries;
- For reporting and verifications (in EU and outside)

- … More soon (activity only starting for JRC)…

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The objectives: **Article 7 | CARBON FOOTPRINT**

Article 7		Performances classes	Carbon footprint threshold
For batteries with a capacity greater than 2 kWh and LMT batteries a carbon footprint declaration shall be drawn up for each battery model per manufacturing plant,	Electric vehicles	By 2025	By 2028
	Rechargeable Industrial batteries	By 2026	By 2029
	Light Means of Transport	By 2028	By 2031

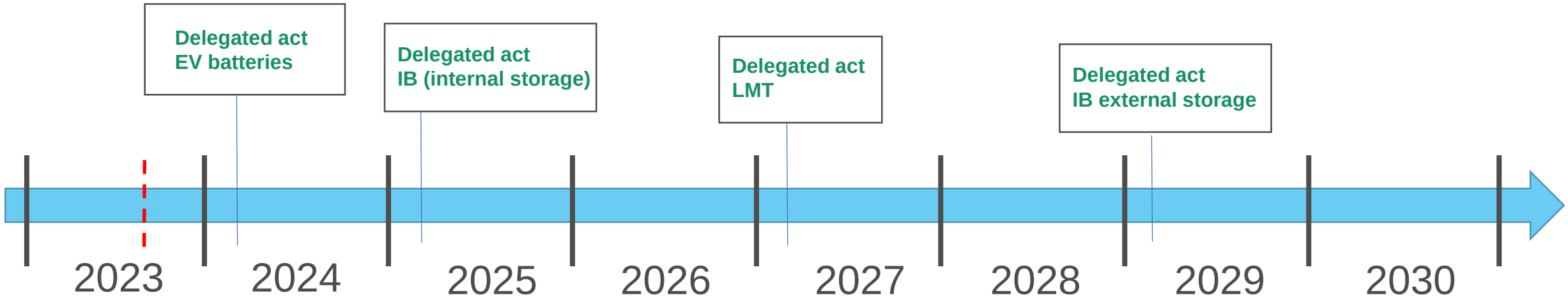
JRC **will suggest first set of rules for Carbon Footprint accounting and declaration**

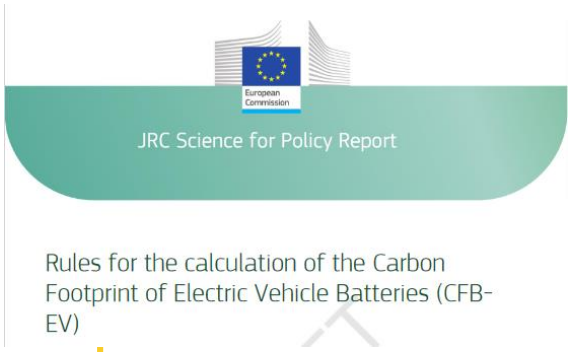
1. EV
2. Industrial batteries
3. Light Means of Transport

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Objectives of the study

Since 2021, JRC supported the development of the Carbon Footprint Rules, as required by Battery Regulation





- JRC developed first set of rules for Carbon Footprint accounting and declaration, to be used as technical basis for the future Commission's Delegated Acts.

- Study relied on a intense dialogue with stakeholders and consensus building

https://eplca.jrc.ec.europa.eu/permalink/battery/GRB-CBF_CarbonFootprintRules-EV_June_2023.pdf

A value chain approach: from raw materials to end-of-life…

- Raw Materials:
  - A wide range of batteries exist with different chemistries -> a wide range of raw materials (**cathode & anode active materials** or **electrolytes** and **precursors**)
  - EV batteries can contain : Critical Raw Materials (Li, Ni, Co, Mn, REEs), relevant materials (Au, Si, PGMs groups), and copper and aluminum
- End-of-life:
  - Raw materials can be recycled at the end-of-life:
    - The default collection rate is 70%.
    - The default battery recycling process is a pyro metallurgical + hydrometallurgical process. Company-specific recycling process may be modelled if evidence is provided that the batteries will be recycled in a specific recycling plant.

First-of-a-kind target requires technological and organizational innovations:

- For OEMs and supply chain to calculate, report and minimise;
- For *JRC and EC* to set calculation and verification rules (in EU and outside)

Dedicated RMIS page on critical raw materials in batteries value chain: https://rmis.jrc.ec.europa.eu/bvc#/

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The objectives: **Chapter VII: BATTERY DUE DILIGENCE POLICIES**

Supply chain due diligence obligations

- **Companies** that place batteries on the EU market have to put in place a **due diligence system** for lithium, cobalt, nickel, and natural graphite contained in those batteries:
  - Adopt company **due diligence policy**
  - Operate a **system of controls and transparency** over the supply chain
  - **Identify** environmental and social risks (list of risk categories included in the Regulation)
  - Implement **a strategy** to respond to the risks
  - Be verified by a 'notified body'
- Companies with turnover of less than 40 million euro and not part of a large group are **exempted**
- Applying from mid-2025
- Commission will:
  - adopt guidelines early 2025
  - assess any due diligence schemes that are submitted to the Commission (such submission is optional)

Going beyond Battery regulation provisions

Other policy, other circularity strategies, other materials, other value chains

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Art. 7 of battery regulation in **synergy** with Art. 30 of the CRM Act

Article 30 of the CRMA and Annex V basically mirror requirements and methodological requests of the Battery Regulation. As aiming at:

> *"establishing rules for the calculation and verification of the environmental footprint of different critical raw materials, in accordance with Annex V and taking into account scientifically sound assessment methods and relevant international standards"*

Main difference: Battery Reg. focuses specifically on carbon footprint, whereas the CRMA refer to "*the most important impact category*". This may have additional research implication as on the identification of most relevant aspects (hot-spot analysis as in PEF).

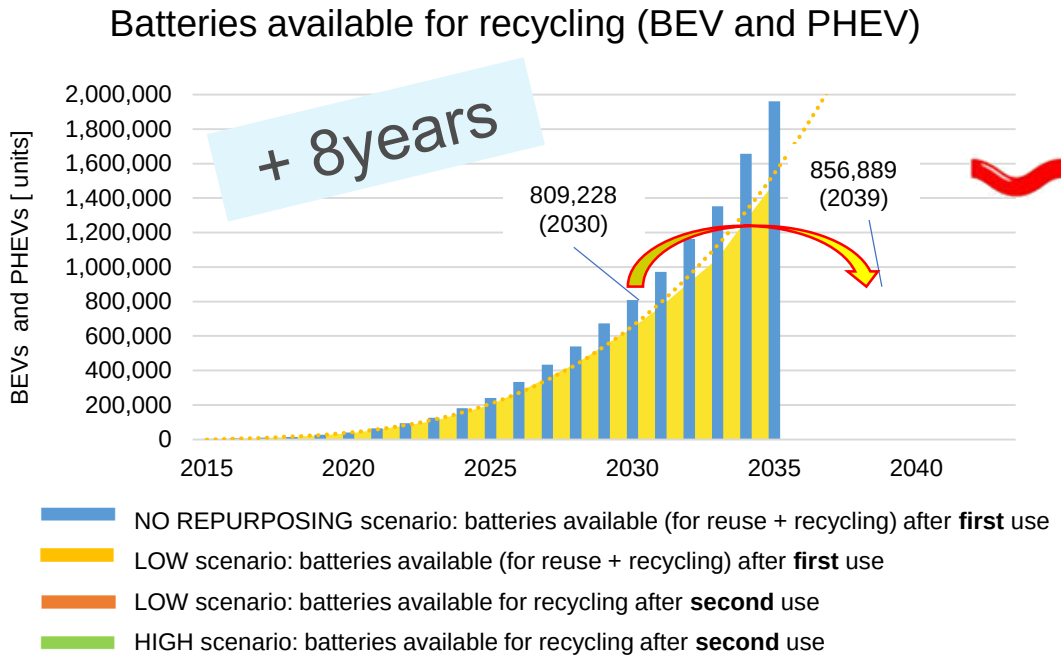
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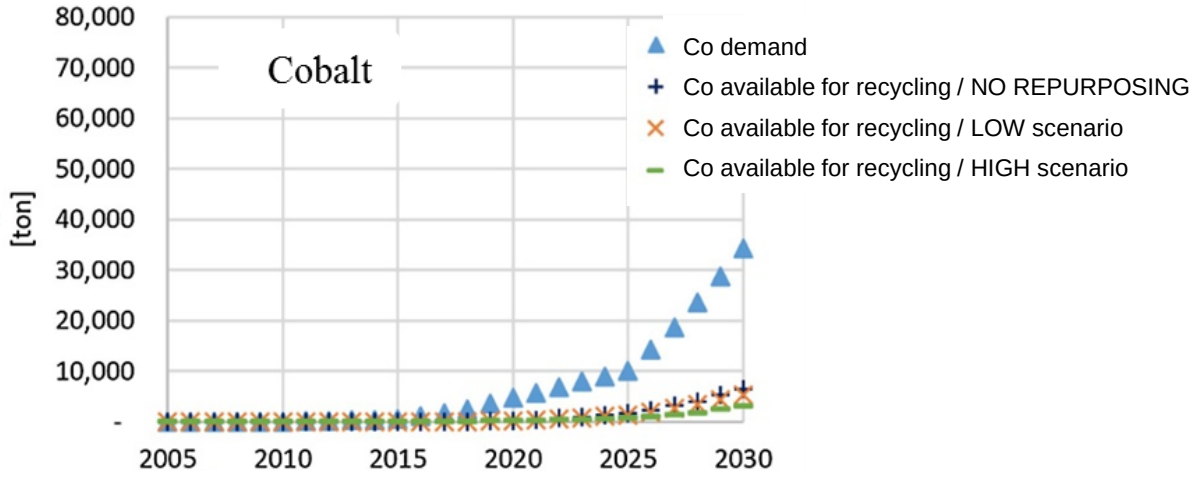
https://doi.org/10.1016/j.resconrec.2019.02.022



What if re-purposing / re-use develops?

A predictive model to be able to capture: waste flows, creation of stocks and the delay in availability of Secondary Raw Materials (e.g. Co, Li)





- **NO REPURPOSING scenario**:
  no repurposing/remanufacturing of EVs batteries
- **LOW REPURPOSING scenario**:
  linear development of repurposing in Europe (from 0% to 50% between 2005 and 2030); no remanufacturing
- **HIGH REPURPOSING scenario**:
  80% of collected batteries are repurposed in Europe;
  20% of collected batteries are remanufactured

Key message: re-purposing postpone the availability of secondary raw materials

Similar provisions in other value chains?

EC's proposal for a Regulation on:

*Circularity requirements for **vehicle design** and on management of **end-of-life vehicles***





EUROPEAN COMMISSION

Brussels, 13.7.2023
COM(2023) 451 final

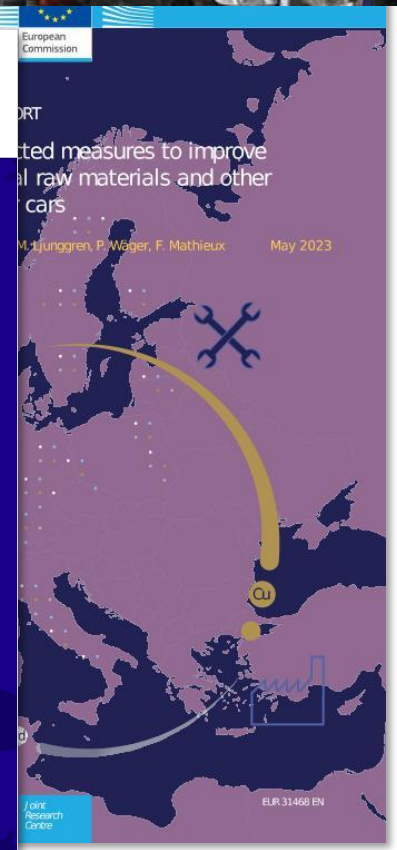
2023/0284 (COD)

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on circularity requirements for vehicle design and on management of end-of-life vehicles, amending Regulations (EU) 2018/858 and 2019/1020 and repealing Directives 2000/53/EC and 2005/64/EC





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ELV Regulation proposal
Art 6(1) - Minimum recycled content for plastics



Article 6
Minimum recycled content in vehicles

The plastic contained in each vehicle type that is type-approved as of [OP: Please insert the date = the first day of the month following 72 months after the date of entry into force of the Regulation] under Regulation (EU) 2018/858 shall contain a minimum of 25 % of plastic recycled by weight from post-consumer plastic waste.

At least 25 % of the target set out in the first subparagraph shall be achieved by including plastics recycled from end-of-life vehicles in the vehicle type concerned.

Waste stream: Post-consumer only

Timeline

Application scope of the target: vehicle-type

Proposed level of the target and unit of calculation: 25% by wt.

Minimum closed-loop criteria: 25% of the total plastic recycled content

For the complete list of target's features and associated criteria, see JRC report



Take home messages

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Take-home messages

- **Batteries** as relevant technologies to promote resilient value chains, in particular **through circularity and sustainability**

- **Novel** (and **ambitious**) provisions of the **2023 EU battery regulation** can provide relevant directions: e.g. recycling to depend less on primary raw materials; carbon footprint declarations and thresholds

- Such ambitions require **technological, organizational** and **policy innovations**

- Circularity and sustainability provisions have to be looked at in **synergy** (collection + recycling efficiency + recycled content + carbon footprint + due diligence); might be completed by **others** (e.g. re-purposing)

- Need to replicate similar approach to **other value chains** (e.g. vehicles, others)


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Thank you



JRC battery recycling Team

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