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D 8.6 – Position paper for standardization and legislation – First version

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2.0	ENVIROBAT	2nd draft	25/11/2019
3.0	JRC	3rd draft	25/11/2019
4.0	FCA	Deliverable Review by FCA	25/11/2019
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Executive Summary

This deliverable is directly consequential to D8.5 - Standardization and legislation plans and actions, consisting on the analysis of the state of the art of the current legislation and standard regulations in general concerning technical and legal requirements, together with safety issues, relative to disassembly and re-manufacturing, transportation and storage of reusable/recyclable parts and components, extended producer responsibility (EPR) regarding new parts and products put on the market. These topics were mainly focused on the batteries value chain by identifying limits and barriers of the current legislation and standard regulations for the development of CarE Service project, and furthermore by elaborating proposals to remove these limits and barriers with the clear indications of potential benefit associated.

The contents of D8.5 were used to elaborate this deliverable as a formal position paper with proposals on legislation and standard regulations to be submitted to the relevant European stakeholders (CEN-CENELEC, Standardization Committee, National and Regional Authorities, European Commission).

D8.6 is a living and dynamic document due to the upcoming changes in the EU regulations for the revision of the Battery Directive, the ELV Directive and the battery sustainability initiatives.

Thus, this is the first version of D8.6, potentially upgradeable up to the end of the CarE-Service project (M36).



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List of Acronyms

ACEA	European Automobile Manufacturers' Association (French: Association des Constructeurs Européens d'Automobiles)
ANSI	American National Standards Institute
BD	Battery Directive 2006/66/EU
BMS	Battery Management System
CE	Conformité Européenne (Certification mark applicable in the European Economic Area)
CEN	European Committee for Standardization (French: Comité Européen de Normalisation)
CENELEC	European Committee for Electrotechnical Standardization (French: Comité Européen de Normalisation Électrotechnique)
E&HEV	Electric and Hybrid electric vehicles
EC	European Commission
ELV	End-of-life Vehicle
EoL	End-of-Life
EoW	End-of-Waste
EPR	Extended Producer responsibility
EU	European Union
EV	Electric vehicle
GTR(s)	Global Technical Regulations
HV	Hybrid Vehicle
IEC	International Electrotechnical Commission
IMDS	International Material Data System
LFP	Lithium Iron Phosphate(LiFePO ₄)
Li-batteries	Lithium batteries
Li-Ion	Lithium-Ion
NCA	Lithium Nickel Cobalt Aluminium Oxide (LiNiCoAlO ₂)
Ni-Cd	Nickel- Cadmium
Ni-MH	Nickel metal hydride battery
NMC	Lithium Nickel Manganese Cobalt Oxide (LiNiMnCoO ₂)
OEM	Original Equipment Manufacturer
RE	Recycling Efficiency
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SoH	State-of-Health



1 INTRODUCTION AND OBJECT

Deliverable 8.5 focused on the analysis of the current legislation and standards (concerning legal, safety and technical requirements about de-manufacturing and re-manufacturing, transportation and storage of reusable/recyclable parts and components, extended producer responsibility (EPR) for new parts and products put on the market), in order to identify limits and barriers for the development of CarE Service project and to exploit the potentials of circular economy of E&HEVs.

Considering the three main streams of CarE Service project (batteries, metal parts and techno-polymers), the real criticalities concerned mainly the batteries stream; this is the reason why D8.5 focused exclusively on the batteries value chain.

In D8.5 precise limitations and barriers posed by the existing standardization and regulatory framework for the implementation of the most important targets regarding batteries in the CarE Service project were identified, with the aim of proposing solutions to remove them.

Two main frameworks were in general identified to highlight existing limits and barriers:

- Legal and administrative: relative to important lack of 'design and use' requirements to enhance battery sustainability, lack of coherence between different regulatory instruments, to ensure smooth functioning of the internal market for batteries, waste batteries and materials obtained from recycled batteries and how to facilitate the use of batteries in second-life applications.
- Technical: relative to significant gaps regarding manufacturing requirements in order to maximize re-use and second-life applications, and also gaps regarding requirements for second-life applications. Furthermore, very important gaps were also identified for the final recycling and recovery of waste batteries.

This deliverable, by using the contents and results of D.8.5, is an official position paper with specific proposals on legislation and standard regulations to be submitted to the relevant European stakeholders (CEN-CENELEC, Standardization Committee, National and Regional Authorities, ACEA, European Commission), in order to remove limits and barriers for the development of some basic processes along the batteries value chain in CarE-Service project.



2 PROPOSALS TO REMOVE LIMITS AND BARRIERS

2.1 Proposals to remove legal and administrative gaps

2.1.1 EPR (Extended Producer Responsibility) transferability

EPR is the principle according to which producers are responsible for the correct management of waste generated by the put on the market of their products.

Currently, the responsibility for the correct management of an end-of-life battery is laying on the first producer which put it on the market (where “first producer”, according to the law, is any person in a Member State that, irrespective of the selling technique used, places batteries or accumulators, including those incorporated into appliances or vehicles, on the market for the first time); EPR isn’t transferable, and no one can get it.

The actor who is putting on the market a second-life battery pack, should bear obligations pertinent to their responsibility as a producer, including the possibility of full or partial transfer of the EPR from the first producer to the second one.

The original assumptions are the following:

- in the National Register, together with the other information requested, it should be provided (at least for industrial and automotive batteries) the declaration of the serial number of the battery
- the legislation in force should introduce the concept of the “Authorized representative” for foreign producer

Starting from these original assumptions, we can have two different scenarios:

1- Reuse of the battery as product (no end-of-life)

The battery can be addressed to second applications without becoming waste.

The different options can be the following:

a) The battery is sold/delivered by the first producer (for instance the car manufacturer) to a second producer in the same country

The second producer indicates in the National Register the serial number of the battery that he received from the first producer, also with the percentage of the weight of the battery concretely re-used.

The first producer must confirm in the National Register its agreement to the EPR transferring (total or partial).

1. The joint declaration between the first and second producer validate the EPR transfer (total or partial);
2. The second producer must declare on the National Register the new second-life battery put on the market, attributing to it a new brand and a new serial number and becoming totally responsible for its end-of-life management (new EPR).



b) The battery is sold/delivered by the first producer (for instance the car manufacturer) to a second producer in a foreign country

1. The first producer must indicate in its National Register the serial number of the battery to be sold/delivered through its “Authorized Representative” to a second producer in a new country. Then the first producer must report in the foreign National Register (to which is obliged to enroll through its “Authorized Representative”) the battery put on the market, with its serial number. In that way, the record with all the information regarding the battery put on the market moves from the National Register in the original country to the National Register in the foreign country. EPR moves from the first country to the second one being assumed by the “Authorized Representative”, which assumes in the new country the role of first producer.
2. The following steps are the same of the previous point “a”.

For the “reusers”, i.e. actors willing to work with batteries for a second life, a “license” should be required that guarantees equal conditions for handling the batteries (e.g. electrical safety of the facilities, staff well instructed, fire extinguish controls, user warranties) with a “EU manufactured Stamp” as a sign of high quality.

2- Re-use of the battery declared waste (end-of-life)

If the battery has been declared waste, for instance by a car’s dismantler, it cannot be re-used without applying to it the End-of-Waste status (see the following paragraph).

If the battery respects all the technical and safety requirements to be reclassified from waste to good, the EPR transfer will follow the steps of the points “a” and “b” described above.

2.1.2 “End of Waste” regulation

The possibility of reusing (totally or partially) an end-of-life battery coming from an electrified vehicle, which is a waste, for a different application, should provide the application of the “end-of-waste” status.

Second use of batteries fulfils the End-of-Waste criteria (as they defined in Article 6, §1 of Waste Framework Directive 2008/98/EC) which are described as follows:

- a. the substance or object is commonly used for specific purposes: Several studies and analysis indicate that end-of-life HEV-EVs batteries may still have residual charge capacity (75-80%) to be suitable for new second-life applications, for instance in energy storage. The intrinsic lower capacity of the batteries/modules/cells isn’t a critical gap for energy storage applications in which the need of space is not a fundamental issue (unlike in automotive applications) and the residual gap can be easily solved with the implementation of more battery packs.
- b. there is an existing market or demand for the substance or object: The strong development of renewable sources, firmly sustained in Europe by specific programs and energy politics, already needs new big systems to store the produced energy, and forecasts show exponential increasing



for the future. The growth in demand for electrical storage systems can be supplied by end-of-life batteries coming from the growing market of electrified mobility, in a virtuosic circular economy perspective.

- c. the use is lawful (substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products): Even if the original battery is de-manufactured, the original cells are left intact and they have to be checked and tested before being re-manufactured in a new battery pack. Technical and safety standards in second-life batteries must be compliant with the same requirements foreseen for a new battery
- d. the use will not lead to overall adverse environmental or human health impacts: Cells or modules correctly checked and tested, then re-manufactured in new second-life batteries in accordance to the same technical and safety standards of a new battery, should not pose any risk for the environment or human health.

These assumptions had been adopted in The Netherlands by the Ministry of Infrastructure and Environment, specifically with the “Legal judgement End-of-Waste status lithium-ion cells” of 22 September 2017, Reference IENM/BSK-2017/215501.

2.1.3 Harmonization required between ELV Directive, new Battery Directive, Directive 2005/64/EC and REACH regulations

Regulations concerning reusability of batteries involve different legislative frameworks.

In End-of-life Vehicle Directive and Waste Framework Directive some definitions of “re-use are provided”, however in the Battery Directive is missed as in any other waste legislations.

It is also of utmost importance to clarify the meaning of some terms often used as synonymous like re-use, second use, repurposing, refurbishment, reconditioning, redesigning etc.; for each of them, specific regulations should be provided.

Regarding the International Material Data System (the automobile industry's material data system used by almost all the global OEMs), the information and calculation required for the recycling type approval process and the corresponding recycling targets should be harmonized with the Battery Directive requirements.

And referring to the hazardous substances eventually included in the EV battery, they should be exclusively dealt within the REACH regulation.

Furthermore, the dismantling documentation required by the ELV Directive should include the dismantling information of the EV battery pack.

In addition to these, it's useful to highlight that ELV Directive 2000/53/EC regulates all recycling relevant items around the design/production, use/repair and EoL-phase of vehicles and its components: all batteries and accumulators used in a vehicle are included.

On another hand the current Battery Directive includes again batteries used in vehicles and it regulates identical items like recycling quotas, takeback obligations, labeling and the restricted use of hazardous substances.



Having this regulated twice does not add value for the environment, but leads to confusion in practice where still clarity is lacking and harmonization would be important.

2.2 Proposals to remove technical gaps

2.2.1 Requirements for the manufacturing phase

Reusability of batteries, including the possibility of reusing single modules or cells, is more technical and economical sustainable the easier can be the disassembling of the battery and the testing of its parts and components.

Regarding design for easy disassembling, testing, repairing, repurposing of EV batteries, the following technical issues could be highlighted with suggestions on how to address them:

- The assembly of the battery pack should follow a modular approach with a ubiquitous access to all the modules, cells and electric/electronic components to ensure easy testing and dismantling.
- To allow an easy disassembly of modules and cells it is suggested to use screws or other Plug-&-Play systems for easy electrical disconnection instead of welding.
- Improved information and coding (e.g. type of screws, HV components, steps to follow in the dismantling process).
- The supporting systems should not hinder the dismantling operations (e.g. cooling system, low voltage hardware, cabling and feedthroughs).
- Easiness of dismantling should not hinder safety and functional aspects (e.g. gas tightness, location of the pressure release valve, location and easy access to the main HV disconnection plug, structural strength and integrity of the battery pack, efficient thermal management)
- Ensure a clear labelling containing information on chemistries and other relevant features of the pack (e.g. nominal voltage, capacity, weight). Currently the standard IEC 62902 is limited to mark only the main battery technologies (e.g. lead-acid, Ni-MH, Li-ion, Li-metal, Ni-Cd); the marking should also include the Li-ion cathode (e.g. LFP, NxMyCz, NCA) and anode (e.g. Graphite, Si content) chemistries.
- Ensure a BMS partial open access for retrieving of SoH and battery lifetime relevant information including the usage of the EV battery.

The European Commission promoted an “Ecodesign” preparatory Study for Batteries, which started in September 2018 (ref: <https://ecodesignbatteries.eu/welcome>) and expected to be completed by middle 2020, remembering that regulation of electric vehicle batteries under the Ecodesign Directive should not be applied as the same Ecodesign Directive is not applicable to products that are designed only for use in a means of transport for persons or goods.

All the proposals hereby suggested above could be included in the aforementioned study.

2.2.2 Requirements for “End of Waste” status and second use

In order to correctly apply the “End of Waste” status on batteries for re-using purposes, safety and technical standard regulations need to be adopted, and specifically:



- 1) Standard procedures for the “state of health” evaluation of EoL batteries, modules and cells to be re-used in second-life applications.
- 2) The production of second-life battery packs shall meet the same requirements of the new industrial batteries, especially in terms of safety.

The only existing standard that specifically cover the second use option is the ANSI/CAN/UL 1974, however may be resource and time consuming; a faster/more reliable check it may be necessary.

The impedance-based measurements and evaluation methods should be considered (see LibForSecUse project¹). Once tested, a proper labelling for SoH classification for repurposed battery may be necessary to be developed, both for getting cheaper transportation costs and for more precise assignment to a specific second use application.

The regulatory framework defined in the context of Health and Safety at Work and Fire Safety measures in buildings and industrial activity should allow a safe operation for the dismantling of EV battery packs.

Once the EV battery (either the full pack, modules or cells) is repurposed for a stationary storage second use application there are some concern regarding safety of the stationary storage systems. The process for a clear regulatory mandatory framework (e.g. equivalent to the EV safety GTR) for the stationary energy storage system, especially addressing the lithium-ion technology should be initiated.

2.2.3 Requirements for improved efficiency in the recovery of materials

A circular economy approach to secure access to secondary raw materials through recycling may give strategic leverage to the future EU cell manufacturing industry.

In this sense, a clear decision of fostering those processes that look for recovering compounds to be used again in battery manufacturing would be fostered.

A RE measured in terms of recovery rate of the different materials composing the batteries entering the recycling facility seems more appropriate.

However, in this point it has to be very taken with careful the idea that “the higher RE the best”. Sometimes, a higher RE in terms of recovered materials does not warranty the best environmental protection and, it can be at the same time much more dangerous in terms of resources needed for recycling.

On the other hand, the recycling industry is looking for higher recovery rate only for those materials that can maximize their benefit (e.g. cobalt, nickel, copper), since usually higher recovery rate come with higher cost.

Therefore, RE should address mentioned concepts:

- Number of chemical compounds ready to be used in Battery Manufacturing Industry.

¹ <https://www.ptb.de/empir2018/libforsecuse/project/overview/> (accessed November 2019)



- Environmental impact of the process in terms of energy consuming, emissions and waste generation.
- Promote the recovery of many compounds and materials as possible.
- The possibility of reusing directly some compounds of the batteries (e.g. casing, BMS, etc.)

The possibility to include a minimum recycled content in the manufacturing of new cells. However, a big barrier could be the difficulties in the traceability for battery's secondary raw materials and the technical challenge to have an economically viable recycling processes to allow the production of battery grade secondary raw materials.

3 CONCLUSIONS

The different solutions proposed in this position paper aim to remove legal and technical barriers for the development of the CarE-Service project, in particular to increase the opportunity to reuse end-of-life batteries, coming from electrified vehicles, for second life applications.

The illustrated solutions have been defined thinking of their concrete applicability depending, above all, on the various regulatory revisions in progress, some of which already containing updates and new regulations in line with these proposals.

Precisely this last aspect gives hope that these proposals can be more easily accepted by the reference institutional stakeholders to whom this position paper is addressed.

As legislative revisions are imminent and will evolve in the coming months, this is the first version of the position paper that could potentially be upgradeable until the end of the CarE-Service project.





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Review of the Deliverable

D 8.6 – Position paper for standardization and legislation

Reviewer Name	Levizzari Alessandro
Reviewer Organization	FCA
Deliverable lead beneficiary	Luigi De Rocchi (COBSER)
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Overall Assessment of the deliverable	<p><input type="radio"/> The required level of quality is met and the deliverable put forward additional insights which can be beneficial for the progress of the project.</p> <p><input checked="" type="radio"/> <u>The required level of quality is met perfectly and no major improvement is needed. I suggested some minor improvements.</u></p> <p><input type="radio"/> The required level of quality is met but there are major improvements to be made before submission of the deliverable.</p> <p><input type="radio"/> In order to meet the required level of quality of the deliverable, I have major concerns that may delay the submission of the deliverable.</p>



Review assessment

1. Is the information contained in the deliverable technically sound and complete?

X Yes Can be improved

Comments/suggestion/specifications:

2. Is any critical information missing in the content of the deliverable?

X No Yes

Comments/suggestion/specifications:

3. Does the deliverable compliant with the relevant project objectives, targets and KPIs related to its topic?

X Clearly stated and compliant Clearly stated but compliancy can be improved
 Not clearly stated but compliant Not clearly stated and compliancy can be improved
 Other responses, please state:

Comments/suggestion/specifications:

4. Does the objective of the deliverable is clearly stated and compliant with the relevant project objectives, targets and KPIs related to its topic?

X Clearly stated and compliant Clearly stated but compliancy can be improved
 Not clearly stated but compliant Not clearly stated and compliancy can be improved
 Other responses, please state:

Comments/suggestion/specifications:

5. Does the method of the deliverable is clearly stated and appropriate for the scope and objective of the deliverable?

X Clearly stated and appropriate Clearly stated but can be improved
 Not clearly stated but appropriate Not clearly stated and can be improved
 Other responses, please state:

Comments/suggestion/specifications:



6. Does the key messages and results of the deliverable are clearly stated and compliant with the relevant project objectives, targets and KPIs related to its topic?

- Clearly stated and compliant Clearly stated but compliancy can be improved
 Not clearly stated but compliant Not clearly stated and compliancy can be improved
 Other responses, please state:

Comments/suggestion/specifications:

7. Does the layout of the deliverable is compliant with the project template?

- Compliant Can be improved

Comments/suggestion/specifications:

8. Does the language style of the deliverable meet the required quality level?

- Yes Can be improved

Comments/suggestion/specifications:

The style can be improved and, above all, some general conclusions have to be added.

9. Can the deliverable benefit from additional stakeholder expectations (consortium or external stakeholder expectations such e.g. consumers or other value chain stakeholders)?

- The deliverable is completely aligned with both consortium and external expectations
 The relevance of additional expectations can be added to the deliverable

Comments/suggestion/specifications:

10. Does the illustrations, drawing and tables of the deliverable clear and comprehensive?

- Yes Can be improved

Comments/suggestion/specifications:



11. Does the abbreviations, references and/or formulas of the deliverable clear and comprehensive?

X Yes Can be improved

Comments/suggestion/specifications:

Additional comments/suggestions: e.g.

- any other concept is too generically described and requires details and specifications.
- non-homogeneity of the approach with other project activities
- lack of clarity in how the task feeds the demonstrators
- lack of hints on contribution to future tasks of the project
- lack of innovation sources of a tool/method
- lack of differentiation of previous projects and new developments
- lack of potential exploitation routes
- The approach is disconnected from the overall project rationale
- The extendibility of the results to other scenarios is not discussed
- The difference from the initial situation and the output KPIs are not properly measured.
- The implementations are only weakly connected to the overall project objectives and targets.





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Overall Assessment of the deliverable	<input checked="" type="checkbox"/> The required level of quality is met and the deliverable put forward additional insights which can be beneficial for the progress of the project. <input type="checkbox"/> The required level of quality is met perfectly and no major improvement is needed. I suggested some minor improvements. <input type="checkbox"/> The required level of quality is met but there are major improvements to be made before submission of the deliverable. <input type="checkbox"/> In order to meet the required level of quality of the deliverable, I have major concerns that may delay the submission of the deliverable.



Review assessment

1. Is the information contained in the deliverable technically sound and complete?

- Yes
- Can be improved

Comments/suggestion/specifications: [Click or tap here to enter text.](#)

2. Is any critical information missing in the content of the deliverable?

- No
- Yes

Comments/suggestion/specifications: [Click or tap here to enter text.](#)

3. Does the deliverable compliant with the relevant project objectives, targets and KPIs related to its topic?

- Clearly stated and compliant
- Clearly stated but compliancy can be improved
- Not clearly stated but compliant
- Not clearly stated and compliancy can be improved
- Other responses, please state:[Click or tap here to enter text.](#)

Comments/suggestion/specifications: [Click or tap here to enter text.](#)

4. Does the objective of the deliverable is clearly stated and compliant with the relevant project objectives, targets and KPIs related to its topic?

- Clearly stated and compliant
- Clearly stated but compliancy can be improved
- Not clearly stated but compliant
- Not clearly stated and compliancy can be improved
- Other responses, please state:[Click or tap here to enter text.](#)

Comments/suggestion/specifications: [Click or tap here to enter text.](#)



5. Does the method of the deliverable is clearly stated and appropriate for the scope and objective of the deliverable?

- Clearly stated and appropriate
- Clearly stated but can be improved
- Not clearly stated but appropriate
- Not clearly stated and can be improved
- Other responses, please state: [Click or tap here to enter text.](#)

Comments/suggestion/specifications: [Click or tap here to enter text.](#)

6. Does the key messages and results of the deliverable are clearly stated and compliant with the relevant project objectives, targets and KPIs related to its topic?

- Clearly stated and appropriate
- Clearly stated but can be improved
- Not clearly stated but appropriate
- Not clearly stated and can be improved
- Other responses, please state: [Click or tap here to enter text.](#)

Comments/suggestion/specifications: [Click or tap here to enter text.](#)

7. Does the layout of the deliverable is compliant with the project template?

- Compliant
- Can be improved

Comments/suggestion/specifications: Changes on the layout has been proposed.

8. Does the language style of the deliverable meet the required quality level?

- Yes
- Can be improved

Comments/suggestion/specifications: [Click or tap here to enter text.](#)

9. Can the deliverable benefit from additional stakeholder expectations (consortium or external stakeholder expectations such e.g. consumers or other value chain stakeholders)?

- The deliverable is completely aligned with both consortium and external expectations
- The relevance of additional expectations can be added to the deliverable

Comments/suggestion/specifications: [Click or tap here to enter text.](#)



10. Does the illustrations, drawing and tables of the deliverable clear and comprehensive?

- Yes
- Can be improved

Comments/suggestion/specifications: N/A

11. Does the abbreviations, references and/or formulas of the deliverable clear and comprehensive?

- Yes
- Can be improved

Comments/suggestion/specifications: [Click or tap here to enter text.](#)

Additional comments:

- Conclusion should be added at the end of the document with the main key results and recommendation.

