




**ECODESIGN BATTERIES – TASK 7.1 POLICY MEASURES ON SUSTAINABILITY**

Paul Van Tichelen, Grietus Mulder








**TASK 7 POLICY SCENARIO ANALYSIS**

*Objectives of task 7*

- Policy options aimed at reducing the impacts on the environment as analysed in previous tasks (task 7.1).
- An analysis of the impacts of future scenarios scenarios in line with policy measures that could be introduced at EU level (task 7.2).
- A sensitivity analysis (task 7.3).
- Provision of an analytical basis in support of the Ecodesign decision-making process.
- Proposition of possible extensions to the study scope.

2

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*Intro task 7.1*Objectives:

- Policy options aimed at reducing the impacts on the environment as analysed in previous tasks.

There are proposals for:

1. Minimum battery pack/system lifetime requirements
2. Requirements for battery management systems
3. Requirements for providing information about batteries and cells
4. Requirements on the traceability of battery modules and packs
5. Carbon footprint information and the option for a threshold
6. Minimum battery pack design and construction requirements

3  
Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*Intro task 7.1*There are proposals for:

- Minimum battery pack/system lifetime
- Battery management systems
- Information about batteries and cells to be stored in a European database
- Traceability of battery modules and packs
- Carbon footprint information and considering the option for a threshold
- Minimum battery pack design and construction
- A 'R-R-R-R' index supporting all phases of repair, re-use, repurpose and recycle.
- Hardware requirements for a BMS open data diagnostics connector and for Vehicle to Grid and Vehicle to Test mode DC interface.

4  
Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*1. Minimum battery pack/system life time requirements*Rationale:

- To gain this trust, demonstrate that
  - the batteries have a long service life and
  - that energy waste is minimised.
- High upfront cost and lack of confidence can be important barriers.
- The main objective of the proposal is to reduce the carbon footprint (per FU) by warranting its projected useful life time.
  - They are in line but already little more ambitious as warranty claims currently offered.
  - A combination of a type test for battery systems/packs and a warranty on batteries to ensure the envisaged lifetime.
- If manufacturer gives higher warranty, it can lower the carbon footprint indicator.

<sup>5</sup> Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*1. Minimum battery pack/system life time requirements*Rationale:

Preference to shorter life test with increased thresholds, e.g. 90 % instead of 80 %, because this can shorten laboratory and market surveillance testing.

Table 7-1 Life time related performance parameters for a first Tier to support with policy

	BC1 PC BEV HIGH	BC2 PC BEV LOW	BC3 PC PHEV	BC4 Truck BEV	BC5 Truck PHEV	BC6 Resid. ESS	BC7 Comm. ESS
Max. calendar lifetime installed battery (no cycling ageing) [yr]	20	20	20	20	20	25	25
Max. number of cycles for battery system until EOL (no calendar ageing) [-]	1,500	1,500	2,000	2,000	3,000	8,000	10,000
Service life of battery (Tbat) [y]	14.40	13.43	10.67	8.04	5.33	17.02	17.02
Number of battery application systems per Tapp (Ass) [-]	1	2	2	2	3	2	2
Average efficiency of battery system [%]	96	96	96	96	96	96	96
Self-discharge (@STC) [%]	2	2	2	2	2	2	2

<sup>6</sup> Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

**ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS**

*1. Minimum battery pack/system life time requirements*


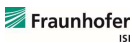

**Proposal:**

- Standards

Table 7-43: Battery requirements covered in current standards for the discerned base cases.

Base case	Level	Reference	Capacity	Energy	Power	Energy efficiency	Resistance	Cycle life test	Calendar life test	Auxiliary power need	Cooling & heating need
BC1 & BC2	PC BEV high & low	Cell	IEC 62660-1: 2010	x	x	x	x	x	x		
			DOE-INL/EXT-15-34184(2015)	x	x	x		x	x	x	
	Module	DOE-INL/EXT-15-34184(2015)	x	x	x		x	x	x		
		SAE J1798:2008	x	x	x		x				
		Pack	ISO 12405-4: 2018	x	x	x	x	x			
			DOE-INL/EXT-15-34184(2015)	x	x	x		x	x	x	
Battery system	ISO 12405-4: 2018	x	x	x	x	x	x	x			
		DOE-INL/EXT-15-34184(2015)	x	x	x		x	x	x		
Batt.appl.system											
BC3	PC PHEV	Cell	DOE-INL/EXT-07-12536 (2008)				x	x	x	x	x
		Module	DOE-INL/EXT-07-12536 (2008)				x	x	x	x	x
	Pack	ISO 12405-4: 2018	x	x	x	x	x	x			
			DOE-INL/EXT-07-12536 (2008)				x	x	x	x	
	Battery system	ISO 12405-4: 2018	x	x	x	x	x	x	x		
			DOE-INL/EXT-07-12536 (2008)				x	x	x	x	
Batt.appl.system											

Other base cases: almost nothing to nothing covered, see report

7 Ecodesign Batteries 05.11.2019   

**ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS**

*1. Minimum battery pack/system life time requirements*

**Proposal:**

- 1. Cycle-life performance test
  - At mid-life (counted in cycles) a minimum performance must be met.

Application	Remaining capacity (relative to the declared value)	Maximum internal resistance increase	Minimum round-trip energy efficiency	Standards (provisional -see notes on review)
PC BEV	90 % @ 750 cycles	30 % @ 750 cycles	90 % @ 750 cycles	ISO 12405-4:2018
PC PHEV	90 % @ 1000 cycles	30 % @ 1000 cycles	90 % @ 1000 cycles	ISO 12405-4:2018
Trucks BEV	90 % @ 1000 cycles	30 % @ 1000 cycles	90 % @ 1000 cycles	To be developed
Trucks PHEV	90 % @ 1500 cycles	30 % @ 1500 cycles	90 % @ 1500 cycles	To be developed
ESS	90 % @ 2000 cycles	NA	94 % @ 2000 cycles	IEC 61427-2

8

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*1. Minimum battery pack/system life time requirements*Proposal:

- 2. Battery warranty during use
  - A minimum amount of stored energy must be possible or
  - A minimum calendar life
  - Threshold values are the double of the previous test conditions

Application	Warranty period (whatever reached first)		Minimum warranty				Methods
	Calendar life <sup>1</sup> warranty	Exceedance of minimum warranted amount of stored energy during the lifetime	Minimum energy that can be stored over life time in kWh	Remaining capacity (relative to the declared value)	Maximum internal resistance increase	Minimum round-trip energy efficiency	
PC BEV	10 years	See prescription at the right	Declared capacity [kWh]x750	80%	60%	80%	ISO 12405-4:2018
PC PHEV	10 years	See prescription at the right	Declared capacity [kWh]x1000	80%	60%	80%	ISO 12405-4:2018
Trucks BEV	10 years	See prescription at the right	Declared capacity [kWh]x1000	80%	60%	80%	To be developed
Trucks PHEV	10 years	See prescription at the right	Declared capacity [kWh]x1500	80%	60%	80%	To be developed
ESS	12 years	See prescription at the right	Declared capacity [kWh]x2000	80%	NA	88%	IEC 61427-2

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*1. Minimum battery pack/system life time requirements*Timing:

- Should take effect as soon as possible, e.g. 2021.
- A second Tier with more ambitious requirements could be considered later in time, e.g. from 2025 onwards.

Challenges:

- Only two standards appear to cover the test requirements but for a limited amount of base cases (BC1, 2 and 3): IEC 62660-1 and ISO 12405-4.
- For ESS, the existing standard appears to lead to unrealistic long testing time.
- For all other battery levels and applications new standards and test methods must be defined before thresholds can be determined.

<sup>10</sup> Ecodesign Batteries  
05.11.2019

ED BATTERIES – TASK 7.1. POLICY REQUIREMENTS

2. Requirements for battery management systems

Rationale:

- The BMS plays a key role in the battery life.
- A BMS with partially open data has multiple benefits
  - consumer confidence
  - support life time warranty
  - Support repair
  - Support 2<sup>nd</sup> hand car sales trust, second life applications,
    - > Increased life time to reduce carbon footprint per FU
- A BMS with updatable firmware allows easier second life use.

11 Ecodesign Batteries  
05.11.2019

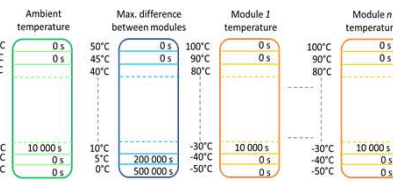


ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

2. Requirements for battery management systems

Proposal:

- Battery Management System with partially open data
  - State of health information
  - Lifetime information by statistics
  - General battery information
- BMS firmware update possibility
  - No replacement need in second life application
  - May prevent new UN38.3 testing
- BMS open data diagnostics connector
  - Needed if battery is not in an xEV anymore
  - CAN messages to be standardized
  - Messages accessible over OBD connector as well



12 Ecodesign Batteries  
05.11.2019



## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*2. Requirements for battery management systems*Timing:

- The timing is one to one related to the standardization need, typically this will take 2 to 4 years to develop.

Challenges:

- Development of the format for data access, and test protocols
- General uncertainty on SOH exists. No clear definition of SOH.
- Standardisation of the BMS diagnostics connector and its data transfer.
- Key challenges cover health & safety concerns, regulatory and technical ones
- Ensuring not to endanger the functional safety (esp. for firmware update)
- Link information in the BMS to the information in the European database on battery information and link part to the traceability set-up.

<sup>13</sup> Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*3. Requirements for providing information about batteries and cells*Rationale:

- To allow repair, reuse, remanufacturing, repurposing, recycling
- To facilitate the End-of-Life (EoL) treatment for sustainable collection-sorting-recycling
- Linked to other policy proposals on
  - product performance
  - on BMS + some essential manufacturer dependent parameters.

<sup>14</sup> Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*3. Requirements for providing information about batteries and cells*Proposal:

- The battery should carry at all levels (battery system, battery pack and module) a bar code, QR code or similar with an EAN number and serial number.
- This code provides data on a server which the manufacturer or supplier bears the responsibility of updating, e.g. such as the European Product Database for Energy Labelling (EPREL), in three levels:
  - Level 1: Public part (no access restriction)
  - Level 2: Data available to third party accredited professionals
  - Level 3: Compliance part (Information available for market surveillance authorities only)
- Separately a database with cell information is set-up.
  - Same access levels as above

15

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*3. Requirements for providing information about batteries and cells*Proposal:

- Data on a server
  - Level 1: Public part (no access restriction), e.g.:
    - General info
    - Lifetime info
    - Results test requirements
    - Carbon footprint info
  - Level 2: Data available to third party accredited professionals, e.g.:
    - Battery composition
    - Precise contents critical raw materials
    - Repair information
    - Dismantling information
  - Level 3: Compliance part (market surveillance authorities), e.g.:
    - Test reports proving compliance

16

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito



## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*3. Requirements for providing information about batteries and cells*Timing:

- From 2021 onwards on declared suitable cells for the intended application.
- From 2022 onwards on battery systems, packs and modules.

challenges:

- The proposed contents differ from other product groups so far in the European product database for energy labelling (EPREL)
- Requiring to detailed information on battery pack design might compromise or conflict intellectual property rights
- For battery marking several standards exist, updates probably needed
- For recycled content it relies on a credible traceability system throughout the value chain

17

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*4. Requirements on the traceability of battery modules and packs*Rationale:

- The previous section dealt with information that can be included per model or type and not per individual battery.
- Traceability systems are organized for raw materials to exclude e.g. child labour and conflict zones
- Prolong traceability to battery modules and packs
  - Promoting statistics on and implementation of Li-ion battery recycling in Europe.
  - Reducing illegal traffic of batteries at EOL to other continents.
  - The Global Battery Alliance is setting up a passport for batteries to address these challenges.
- In China already the “traceability management platform” started for batteries covering all phases from production to recycling.

18

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*4. Requirements on the traceability of battery modules and packs*Proposal:

- Battery modules and packs have an individual serial number that is linked to a database system that tracks the battery modules and packs that come on the European internal market.
- This database can be a public-private cooperation.
- This database has to be linked to material databases for ethical mining.
- The suitability of initiatives from the European Battery Alliance and the Global Battery Alliance should be examined.

19

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*4. Requirements on the traceability of battery modules and packs*Timing:

- A target date of 2023 seems feasible.
- This policy measure is supported by public-private initiatives. The timing is therefore less in own hands.

challenges:

- Auditing schemes as well as databases for traceability must be developed.

20

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

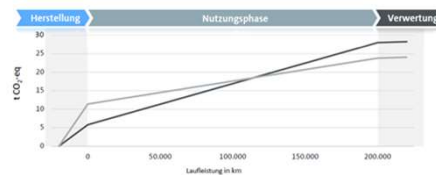
## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

### 5. Specific requirements for carbon footprint information and considering the option for a threshold

#### Rationale:

- battery requires far more energy compared to its storage capacity, typically 500 to 1000 times.
- electricity takes a large share in the carbon footprint and this opens the opportunity to use low carbon electricity but also lignite and hard coal + there are also in manufacturing process energetical optimizations.
- help to promote "cleaner" BEV and might be a useful benchmarking between car manufacturers.

Klimabilanz von e-Golf versus Golf Diesel



21 Ecodesign Batteries  
05.11.2019

e-Golf: Stromverbrauch, kWh/100 km: kombiniert 14,1 mit 17 Zoll-Bildschirm 13,2 16 Zoll CO<sub>2</sub>-Emissionen kombiniert, g/km: 0; 190km/kilometer, Ax

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

### 5. Specific requirements for carbon footprint information and considering the option for a threshold

#### Proposal:

- Carbon footprint(GWP) according to the Product Environmental Footprint Category Rules (PEFCR ) and relative (gCO<sub>2</sub>eq/kWh):
  - to minimum FU(kWh) based on product warranty life
  - to the specified average life time (EN standards test cycles)
 > strong link with the proposed lifetime requirements
- In addition:
  - the calculated Primary Energy (MJ) and the share of electricity (MJ)
  - If no local electricity mix is used: a warranty that the low carbon electricity (if any) has been supplied based on hourly net metering (this might require ESS)

22 Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*5. Specific requirements for carbon footprint information and considering the option for a threshold*Proposal:

- Potential (long term) minimum carbon footprint threshold:
  - Not recommended to in the short term, due to the challenges to be addressed for the carbon footprint information first.

23  
Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*5. Specific requirements for carbon footprint information and considering the option for a threshold*Timing:

- For cells: as of 2021 ; For packs and modules: as of 2022
- Reconsider the option to set a minimum threshold on carbon footprint 2 years after that this information is made available.

Challenges:

- First ever implementation & might benefit from learning. However some manufacturers already participated in the PEF pilot.
- Issues on how to deal with electricity should be defined.
- LCA in PEF is exhaustive method, might be simplified?
- Note: only PEFC available for LiB for mobile applications!
- Market surveillance and verification procedures to be developed.

24  
Ecodesign Batteries  
05.11.2019

viegand  
maagøe  
energy people

Fraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*6. minimum battery pack design and construction requirements*Rationale:

- To support reusability/recyclability/recoverability
- Create an index showing the aptness for this support
- Simplify recycling at the end of life
- Create a more competitive market and level of playing field
- Create consumer confidence (second source supplier available, avoid a vendor lock in, back-up solution in case of bankruptcy)
- Modular design can help in the safety during disassembly by streamlining procedures and training for the personnel
- Note that all vehicles have already a recycling information system in place, called IDIS .

25

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*6. minimum battery pack design and construction requirements*Proposal:

- Mandatory adding dismantling information to a database such as IDIS.
- A mandatory DC charging/discharging interface that supports vehicle-to-grid mode (V2G) and a vehicle-to-test mode (V2test)
  - to verify the performance and information criteria previously proposed
  - needed to warrant a long product lifetime.
- Introduce a R-R-R-R index (repair, re-use, repurpose and recycle) wherein:
  - Easy assembly/disassembly
  - Standardized interfaces for hardware and software
  - Standardized thermal interface
  - Standardized dimensions and connections in a bonus/malus system
  - Use of multi-vendor battery packs
  - ...

26

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*6. minimum battery pack design and construction requirements*Timing:

- The mandatory requirements can be introduced only at earliest after 2022
  - to allow manufacturers to update the software to allow V2G and V2test mode DC interfaces.
  - Vehicles with battery packs below 10 kWh that have not yet a DC interface could be temporarily exempted.
- It is recommended to start developing a standard for two main applications before introduction.
  - It is also recommended to introduce this requirement first for vehicle applications due to the size of the market volume and they are familiar with the concept due to Directive 2005/64/EC.

27

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*6. minimum battery pack design and construction requirements*Challenges :

- Most vehicles today have DC mode charging, hence adding a V2G and V2test mode is probably a software issue
- Must also fit to the Directive 2005/64/EC on type-approval of motor vehicles
- Recycled material calculation could built on the ISO 22628 + IEC/TR 62635
- Data(base) on material recycling rates for the calculation must be correct.
- Second sourcing of battery packs for EVs might result in lower performance and in worst cases can lead to safety issues.
- On the negative side is that EV batteries are a new market and setting such strong requirements could hamper innovation
- Car manufacturers have already a long track record in O&M tools and methods making separate disassembly information redundant.

28

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## ED BATTERIES – TASK 7.1 POLICY REQUIREMENTS

*Summary**Objectives:*

- Policy options aimed at reducing the impacts on the environment as analysed in previous tasks.

*There are proposals for:*

1. Minimum battery pack/system lifetime requirements
2. Requirements for battery management systems
3. Requirements for providing information about batteries and cells
4. Requirements on the traceability of battery modules and packs
5. Carbon footprint information and the option for a threshold
6. Minimum battery pack design and construction requirements

29

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito

## NOTE ON COMMENTING

- **Important notice on commenting:**
  - **The task 7 report is final and won't be recompiled**
  - **For comments on policy sent them directly the the policy officer of the EC in charge and put :**
    - **Cesar Santos: [Cesar.SANTOS@ec.europa.eu](mailto:Cesar.SANTOS@ec.europa.eu)**
    - **Cc to: [edbatteries@vito.be](mailto:edbatteries@vito.be)**

30

Ecodesign Batteries  
05.11.2019viegand  
maagøe  
energy peopleFraunhofer  
ISI

vito