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Title: Draft BS EN IEC 63369 Methodology for the Carbon Footprint calculation applicable to Lithium-ion batteries.

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Full document details: 21/30433536 DC

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



21A/783/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 63369 ED1

DATE OF CIRCULATION:

2021-12-10

CLOSING DATE FOR COMMENTS:

2022-02-04

SUPERSEDES DOCUMENTS:

21A/734/NP, 21A/751A/RVN

IEC SC 21A : SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES	
SECRETARIAT: France	SECRETARY: Mr Pierre Bourg
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 21	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☒ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Methodology for the Carbon Footprint calculation applicable to Lithium-ion batteries

NOTE FROM TC/SC OFFICERS:

In this first CD, several technical inputs especially regarding sections 7, 10 and 13 are required from battery carbon footprint experts from the different National Committees

The comments to be received will be discussed during the IEC SC21A WG6 meeting expected to be held on February 25th 2022

A second CD will then be issued

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CONTENTS

1		
2		
3	FOREWORD.....	5
4	INTRODUCTION.....	7
5	1 Scope.....	8
6	2 Normative references	8
7	3 Terms and definitions	8
8	4 General information	9
9	5 Classification.....	9
10	5.1 Repetitive energy supply in mobile equipment (“REP-MOB”).....	9
11	5.2 Repetitive energy supply in stationary equipment (“REP-STA”).....	10
12	5.3 On demand energy supply in mobile equipment (“OND-MOB”).....	10
13	5.4 On demand energy supply in stationary equipment (“OND-STA”).....	10
14	6 Calculation methodology	10
15	6.1 Generalities	10
16	6.2 Representative product	11
17	6.3 Functional Unit and Reference Flow for repetitive cycling use (REP-MOB &	
18	REP-STA).....	15
19	Example of REP-MOB load profile – Forklift ? (Figure XX)	16
20	Example of REP-STA load profile – ESS container (Figure XX)	16
21	6.4 Functional Unit and Reference Flow for On-demand use (OND-MOB & OND-	
22	STA).....	17
23	Example of OND-MOB load profile – Regional train / EMU (Figure XX)	19
24	Example of OND-STA load profile – UPS/ data centers (Figure XX) ... Error! Bookmark not	
25	defined.	
26	6.5 System boundaries	20
27	6.5.1 Raw material acquisition stage and production stage	23
28	6.5.2 Use stage	25
29	6.5.3 End-Of-Life stage	25
30	6.6 Carbon footprint assessment	27
31	6.7 Limitations	27
32	7 Most relevant life cycle stages, processes and elementary flows	27
33	8 Life cycle inventory	29
34	9 HOTSPOT IDENTIFICATION:.....	30
35	9.1 List of mandatory company-specific data.....	31
36	9.1.1 Company-specific data based mainly on the electrode and cell	
37	manufacturing common to all cases	31
38	9.1.2 Company-specific data specific per use case	31
39	10 List of secondary data	32
40	10.1 Data gaps	32
41	10.2 Data quality requirements	32
42	10.2.1 Which datasets to use?	32
43	10.2.2 How to calculate the average DQR of the study	32
44	10.2.3 Allocation rules.....	33
45	10.2.4 Energy modelling.....	33
46	10.2.5 Climate change modelling.....	33
47	10.2.6 Modelling of waste and recycled content.....	33

48	11	Title of next clause (heading level 1)	Error! Bookmark not defined.
49	11.1	Title of subclause (heading level 2)	Error! Bookmark not defined.
50	11.1.1	Title of next subclause (heading level 3)	Error! Bookmark not defined.
51	12	Data quality requirements	33
52	13	Modelling of waste and recycled content	35
53	14	Title of next clause (heading level 1)	Error! Bookmark not defined.
54	14.1	Title of subclause (heading level 2)	Error! Bookmark not defined.
55	14.1.1	Title of next subclause (heading level 3)	Error! Bookmark not defined.
56	15	Life cycle stages	37
57	15.1	Raw material acquisition and pre-processing	37
58	15.2	Manufacturing	42
59	15.3	Distribution stage	45
60	15.4	Use stage	45
61	15.5	End of life	47
62	16	Carbon footprint results	53
63	17	Verification	53
64	18	Bibliography	53
65	19	Title of next clause (heading level 1)	Error! Bookmark not defined.
66	19.1	Title of subclause (heading level 2)	Error! Bookmark not defined.
67	19.1.1	Title of next subclause (heading level 3)	Error! Bookmark not defined.
68		Bibliography	55
69			
70		Figure 1 – representative products components	12
71		Figure XX– Example of OND-MOB: load profile for regional train / EMU (without starting	
72		up segment)	19
73		Example for UPS : 1.6 MW constant power for 12 mn	Error! Bookmark not defined.
74		Figure XX– Example of OND-STA: load profile for UPS/ data centers	20
75		Figure 2 – System Boundaries- life cycle of a Li-ion battery system	23
76		Figure 3 – cradle to gate process for Li-ion battery production	25
77		Figure 4 – Dismantling and recycling processes	26
78			
79		Table 1 – Representative products for the 4 subcategories	15
80		Table 3a – Key aspects of the Functional Unit defining the key aspects used to define the	
81		FU OND-MOB	18
82		Table 3b – Key aspects of the Functional Unit defining the key aspects used to define the	
83		OND-STA	18
84		Table 5 – Life cycle stages	21
85		Table 6 – Carbon footprint calculation	27
86		Table 7 – most relevant life cycle stages	28
87		Table 8 – How to assess the value of the DQR criteria for datasets with company-specific	
88		information	35
89		Table 9 – Raw material acquisition and processing	42
90		Table 10 – Manufacturing- of electrodes/ cell, module assembly and electrical formation	44
91		Table 11 – Manufacturing- battery assembly	45
92		Table 12 – Guideline for calculation of quantity of Functional Units and Reference flow	47
93		Table 13 – Use stage	47

94	Table 14 – End of Life.....	52
95	Table 15 – EoL Scenario to be applied in the footprint declaration	53
96		
97		
98	Figure 1 – representative products components	12
99	Figure XX– Example of OND-MOB: load profile for regional train / EMU (without starting	
100	up segment).....	19
101	Example for UPS : 1.6 MW constant power for 12 mn Error! Bookmark not defined.	
102	Figure XX– Example of OND-STA: load profile for UPS/ data centers	20
103	Figure 2 – System Boundaries- life cycle of a Li-ion battery system	23
104	Figure 3 – cradle to gate process for Li-ion battery production	25
105	Figure 4 – Dismantling and recycling processes.....	26
106		
107	Table 1 – Representative products for the 4 subcategories	15
108	Table 3a – Key aspects of the Functional Unit defining the key aspects used to define the	
109	FU OND-MOB.....	18
110	Table 3b – Key aspects of the Functional Unit defining the key aspects used to define the	
111	OND-STA	18
112	Table 5 – Life cycle stages	21
113	Table 6 – Carbon footprint calculation.....	27
114	Table 7 – most relevant life cycle stages.....	28
115	Table 8 – How to assess the value of the DQR criteria for datasets with company-specific	
116	information.....	35
117	Table 9 – Raw material acquisition and processing	42
118	Table 10 – Manufacturing- of electrodes/ cell, module assembly and electrical formation	44
119	Table 11 – Manufacturing- battery assembly.....	45
120	Table 12 – Guideline for calculation of quantity of Functional Units and Reference flow	47
121	Table 13 – Use stage.....	47
122	Table 14 – End of Life.....	52
123	Table 15 – EoL Scenario to be applied in the footprint declaration	53
124		
125		
126		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**METHODOLOGY FOR THE CARBON FOOTPRINT CALCULATION
APPLICABLE TO INDUSTRIAL LITHIUM-ION BATTERIES
Part X: Second part of the title in normal letters**

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IEC 63369 has been prepared by subcommittee SC21A/WG6, of IEC technical committee SC21A. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at <http://www.iec.ch/standardsdev/publications>.

178 The committee has decided that the contents of this document will remain unchanged until the
179 stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific
180 document. At this date, the document will be

- 181 • reconfirmed,
- 182 • withdrawn,
- 183 • replaced by a revised edition, or
- 184 • amended.

185

INTRODUCTION

The introduction is an optional/conditional element of the text.

For rules on the drafting of the introduction, refer to the ISO/IEC Directives, Part 2:2018, Clause 13.

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METHODOLOGY FOR THE CARBON FOOTPRINT CALCULATION APPLICABLE TO INDUSTRIAL LITHIUM-ION BATTERIES

Part X: Second part of the title in normal letters

1 Scope

This document provides a comprehensive technical guidance on how to use a methodology for the calculation of carbon footprint of industrial type Li-ion battery systems. Battery systems equal battery. Second life or usage that was not intended when the battery is put on the market are not taken into account.

The definition of the parameters used for the calculation allows for an improved comparability of results for all rechargeable Li-ion chemistries.

The calculation may be used by cell designers/manufacturers and battery manufacturers for a variety of purposes such as for battery system development and participation in voluntary or mandatory programmes.

The result of the calculation may be used by the battery purchaser or the battery end-user in order to compare the carbon footprint of a variety of battery systems being considered for their application over their entire intended lifetime.

This document offers also general guidance for the specific application of ISO 14067 to such a calculation.

This document does not pertain to secondary Li-ion batteries of portable type or for use in electric road vehicle.

The carbon footprint calculation of charging and power conversion equipment is not covered in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

3 Terms and definitions

3.1

Primary data

Company-specific data

Foreground data¹

Definition to be agreed on in future work

EXAMPLE 1 First example for term 1.

EXAMPLE 2 Second example for term 1.

Note 1 to entry: First note for term 1.

Note 2 to entry: Second note for term 1.

[SOURCE: where definition 1 was found]

3.2

Secondary data

Background data

Definition to be agreed on in future work EXAMPLE Only one example for term 2 – no numbering.

Note 1 to entry: Only one note for term 2 – still needs to be numbered.

4 General information

This document provides the necessary guidance and structure to ensure that all Product Carbon Footprint (PCF) calculations for industrial Li-ion cells and batteries are derived, verified and presented in a consistent and comparable way.

Industrial Li-ion batteries are used in a large variety of applications and for proper Product Carbon Footprint calculations, their critical functionality has to be identified.

The following functionalities classes are covered in this document:

- Applications with frequent and repetitive charge and discharge cycles, and
- Applications with sporadic on demand energy delivery.

The methodology should be used to assess the carbon footprint of single, multiple or all stages of the life of a battery.

This document can be applied to assess the Carbon Footprint of one or several stages of the battery life.

Note: The total energy transmitted by the battery to the application is considered by the industrial application provider for the use phase of its Product Carbon Footprint profile. The energy consumption during the use stage of the battery is defined by the energy losses linked to the battery and related component efficiency (e.g. BTMS) during charge, discharge and storage.

5 Classification

The specific uses of industrial Li-ion cells and batteries are classified as follows:

5.1 Repetitive energy supply in mobile equipment (“REP-MOB”)

The battery is storing and supplying energy in mobile equipment very frequently over its service life.

The metrics for this duty is the total energy throughput capability in kWh over the expected service life.

In such an application, the specific volumetric and gravimetric energy density is of key importance.

5.2 Repetitive energy supply in stationary equipment (“REP-STA”)

The battery is storing and supplying energy in stationary equipment very frequently over its service life.

The metrics for this duty is the total energy throughput capability in kWh over the expected service life.

In such an application, the gravimetric energy density is of less importance.

5.3 On demand energy supply in mobile equipment (“OND-MOB”)

The battery is supplying auxiliary energy in mobile equipment sporadically, when main power is lost and as required over its service life.

The metrics for this duty are specific power capability (W/Wh) and expected service life in calendar years of operation.

In such an application, the specific volumetric and gravimetric energy density is of key importance.

5.4 On demand energy supply in stationary equipment (“OND-STA”)

The battery is supplying auxiliary energy in stationary equipment sporadically, when main power is lost and as required over its service life.

The metrics for this duty are specific power capability (W/Wh) and expected service life in calendar years of operation.

In such an application, the specific gravimetric energy density is of less importance.

Example : UPS duty

6 Calculation methodology

6.1 Generalities

This part describes the global methodology consisting of 2 main steps::

- Step 1) Derivation of a virtual representative product

- The components and process having a significant carbon footprint (“hot spots”) shall be identified.

- These items shall receive particular attention during the calculation of the carbon footprint of actual products.

- For this purpose, a virtual product should be assembled by using a weighted average of several actual products. This shall be followed by its footprint calculation using a common secondary data (returns from NCs expected for the reference, also refer to clause 8)

- <https://nickelinstitute.org/policy/nickel-life-cycle-management/nickel-life-cycle-data/>

-

- **Step 2) Derivation of footprint data of actual products**

The components and process steps with a significant carbon footprint shall be investigated and documented with company specific data (DEFINITION TO BE ADDED).

,TO BE REWORDED LATER : stored on data platform of company specific data accessible to the user and the manufacturer

For other components and production processes of the Bill Of Materials (BOM) , secondary data are acceptable

6.2 Representative product

The main components of the representative products are identified as follows:

- The cell and its safety essential components (Safety Management Unit -SMU) incorporated during the battery assembly stage and, if present, the modules and their structures.
- The system component parts necessary for ensuring proper battery function as required for the application:
 - o The BMS (Battery Management System):
 - The BCU (Battery Control Unit) consisting of electronic components like switches and contactors
 - The BMU (Battery Management Unit) consisting of the electronic part for battery management (Note: A SMU may be incorporated in a BMS for the presentation of the PCF results)
 - o The BTMS (Battery Thermal Management System) consisting of components directly associated to the battery for its thermal management. It can consist in various components allowing for static or dynamic heat exchanges such as thermal conductive parts, tubes for circulating fluids, etc..
- - The final outer casing of the battery if applicable
- In some configurations part of the BMS might be positioned in the charger or application (for example: contactors or switches). In this case, these components are considered to be part of the BMS.

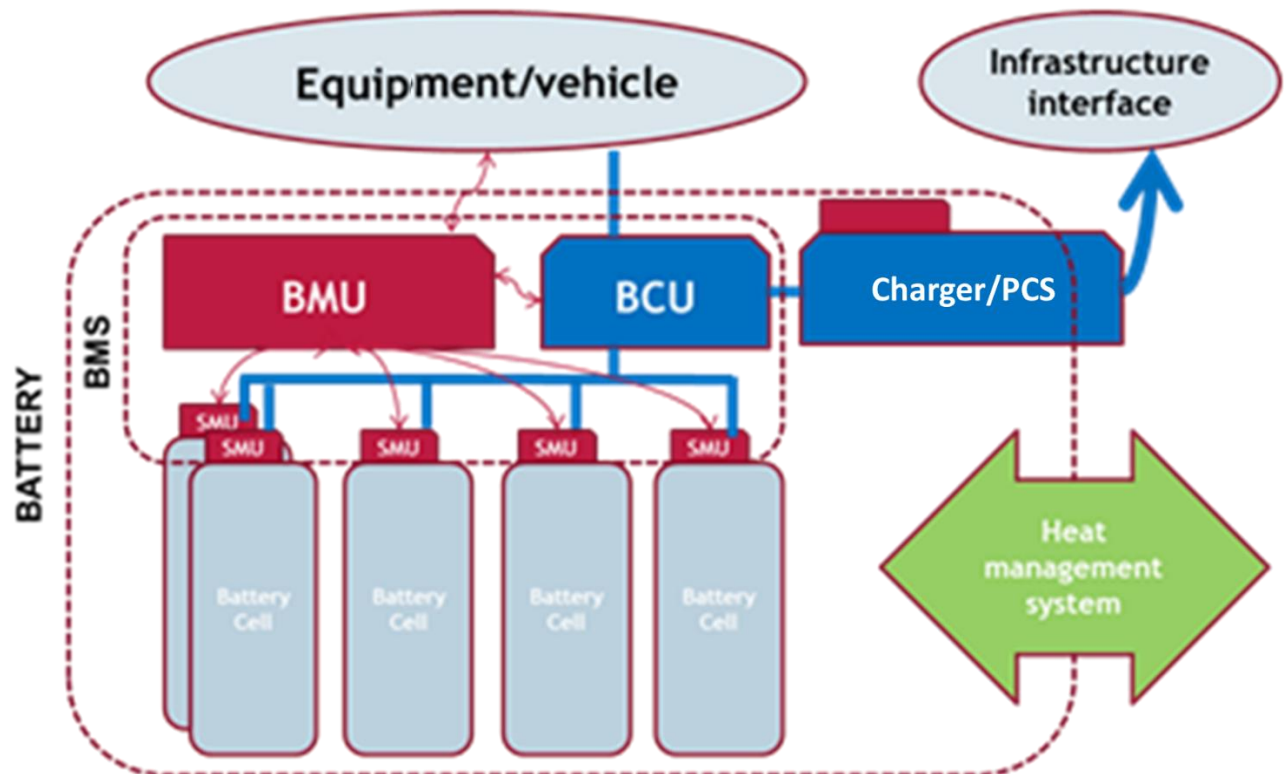


Figure 1 – representative products components

Part of the charger or the Power Conversion System (PCS) or the FFS in case of large battery systems which is required for functional safety of the battery has to be taken into account in the battery scope for carbon footprint calculation. This part is variable, depending on the application (mobile application or stationary application).

When the battery (including all its functional components) is disconnected from the application, all components staying with the battery must be considered when performing the calculation of its carbon footprint.

This section introduces the representative products which have been classified to calculate the carbon footprint of the batteries in each application.

One for each of the 4 classes considered, based on the market share of the Lithium based chemistries used.

(WG6 will need to define if it is possible to have a single representative product for a given class)

The following table displays the structure and content of the representative products (values to be defined in WG6)

- REP-MOB: Forklifts (very large market share) , off-road vehicles

		VIRTUAL Product
Voltage		48V
Energy		20 kWh
Charge and discharge rates		1C charge, 0.3 C discharge
Cooling		No
Chemistry		70% LFP/ 20% NMC / 10% LMO
Life duration		7 years
Nb of cycles		2000 cycles

361

362

363 - REP- STA ESS container (home storage, industrial storage)

	VIRTUAL TYPICAL	VIRTUAL CONTAINER
Voltage	200V	1200V
Energy	15 kWh	20 MWh
Charge and discharge rates	0.3C C&D	C Ch & disch
Cooling	No	50% air conditioning 50% liquid cooling)
Chemistry	70% LFP/30%NMC	50% LFP, 50% NMC
Life duration	12 y	15 y
Nb of cycles	5000 cycles	
FSS	No	YES

364

365 - OND-MOB Example : Railways auxiliaries

366

	VIRTUAL
Voltage	300V
Energy	18 kWh

Charge and discharge rates	0.5 C Ch & C Disch
Cooling	Natural ventilation
Chemistry	60% NMC/LTO and 40% LFP/graphite
Life duration	15 years
FFS	No

367

368

OND- STA : UPS/ data centers	VIRTUAL AVERAGE
Voltage	200V
Energy	400 kWh
Charge and discharge rates	0.6C ch and 4C discharge
Cooling	Natural ventilation
Chemistry	LFP
Life duration	15 years
FFS	No

369

Elements		REP-MOB	REP-STA	OND-MOB	OND-STA
Specify if it is a real or a virtual product		Virtual	virtual	virtual	Virtual
Description of the product		Repetitive energy supply in mobile equipment Chemistry composition based on market share	Repetitive energy supply in stationary equipment Chemistry composition based on market share	On demand energy supply in mobile equipment Chemistry composition based on market share	On demand energy supply in stationary equipment Chemistry composition based on market share
Typical Energy		20 kWh	20 000 kWh	18 kWh	400 kWh
Typical voltage		48 V	1200 V	300 V	200 V
Bill of materials (BOM) as appropriate		See 13.1 and 13.2			
System boundary	Production stage	Included	Included	included	Included



Documents

Document Sharing Hub

	Use stage	Included	Included	included	Included
	EoL stage	Included	Included	included	Included
Product Boundary	Charger (except part of battery if any)	Excluded	Excluded	Excluded	Excluded
Assumptions related to transportation and storage scenario		Representative conditions of transport for the materials and the batteries are described (see 13.3). As today most cell manufacturing is in Asia, the transport of the active material used for this purpose has been considered only locally. In addition, as the impact of the transport has been proven negligible in the footprint, no specific condition is described, and default data is provided.			
Assumptions related to use scenario		Only charging energy losses are accounted (related to battery efficiency including BTMS efficiency)			
Assumptions related to EoL		Recycling process of the cell based on "Recycling rechargeable lithium ion batteries: Critical analysis of natural resource savings", Dewulf et al, Resources, conservation and recycling, 2009 Following steps has been considered in the End-of-Life stage (see 13.5) Dismantling process of the battery Pyrometallurgical treatment process for the cell Then, Hydrometallurgical treatment process for the cell			

Table 1 – Representative products for the 4 subcategories

Due to the large number of applications, and therefore the large number of usage phase descriptions, it is not possible to define a simple benchmark classification applicable for all batteries. Nevertheless, a benchmark is possible per sub-category, based on each of the 4 representative products (see limitations and benchmark restrictions in parag XXX), as long as they use the same default data described in this table.

6.3 Functional Unit and Reference Flow for repetitive cycling use (REP-MOB & REP-STA)

The function of the rechargeable batteries used in mobile or stationary applications is to supply electrical current at a desired voltage range. The rechargeable battery is the main storage of energy for mobile and stationary applications. Therefore, the functional unit (FU) for rechargeable batteries is defined as **1 kWh (kilowatt-hour) of the total energy provided over the service life by the battery system** (measured in kWh).

Example with two fictive cases for REP-MOB:

What ?	unit	unit precision	who ?	remark	REP-MOB case 1	REP-MOB case 2
identify the need	kWh_needed (over life)	Total needed by the application over the complete life (in years or cycles)	end-user request (technical specification)		5000 cycles of 2 kWh (under conditions in the application specification) = 10 000 kWh needed over life (1)	5000 cycles of 2 kWh (under conditions in the application specification) = 10 000 kWh needed over life (1)
identify the "physical unit"	kWh_produced	IEC kWh = rated energy at production including the whole system	battery system manufacturer (sizing)	the sizing can be a big battery for all life, or several small ones with replacement over life	10 kWh (selected at sizing as capable of 1000 cycles)	2,5 kWh (selected at sizing as capable of 500 cycles)
define the functional unit	normalized_kWh by	system boundaries as	used to allow comparison of 2	1 kWh of all kWh_needed	1kWh (from 10 MWh)	1kWh (from 10 MWh)
reference flow (as per the IEC 63369 definition)	nb of batteries to provide the kWh_needed	can be one big battery with high cycling properties, or	battery system manufacturer (sizing)	Nb_ref_flow	1 battery	8 batteries
intermediate calculation	"physical unit" CO2 footprint	(for 1 battery produced)	battery system manufacturer (with real production lines values and	full system scope as per figure 1	900 kg CO2 eq for 1 battery system of 10 kWh	375 kg CO2 eq for 1 battery system of 2.5 kWh
CO2 footprint calculation (intermediate)	kg CO2 eq for reference flow		battery system manufacturer (production &	=CO2_production_per_battery_system (cradle to	=900 kg CO2 eq * 1 battery over life ==> 900 kg CO2 eq (2)	=375 kg CO2 eq * 8 batteries over life ==> 3000 kg CO2 eq (2)
CO2 footprint calculation	kg CO2 eq (as result if IEC				= 900 (2) / 10 000 (1) ====> 0,09 kg CO2 eq IEC	= 3000 (2) / 10 000 (1) ====> 0,3 kg CO2 eq IEC 63369

The energy consumption during the use stage of the battery is defined **by the energy losses** linked to the battery including BTMS during charge, discharge and storage. The total energy transmitted by the battery to the application has to be taken into account by the application/OEM provider, for the use phase of its Product Carbon Footprint profile.

The charge is included in the load cycle for the REP use cases, as the battery is in regular cycling mode in usual operating conditions.

Example of REP-MOB load profile – Forklift ? (Figure XX)

Typical load profile to be considered to be supplied by the forklift stakeholders

Example of REP-STA load profile – ESS container (Figure XX)

Typical load profile to be considered to be supplied by TC-120

What?	Specific power capability (W for full discharge of the application at the end of battery service life /Wh) when demanded during the expected service life of the application in calendar years of operation. eg example of FU for railways : 18 kWh spread over a period of three hours once a year during 30 years of train operation according to the profile xxxxxxx
How much?	1 kWh of the total energy delivered over service life per year
How well?	Maximum specific energy, measured in Wh/kg for mobile application