

ECODESIGN BATTERIES – FIRST STAKEHOLDER MEETING DRAFT TASK 5

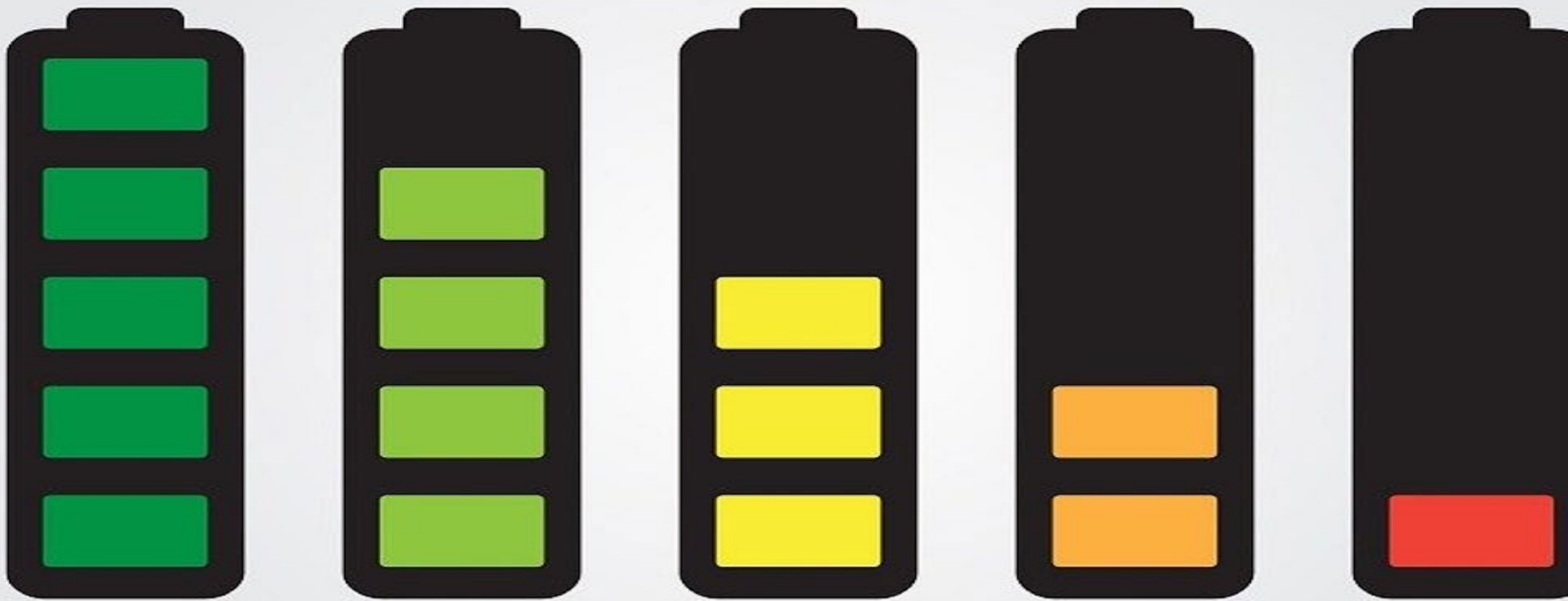
Paul Van Tichelen, Karolien Peeters, Wai Chung Lam

December 20th, 2018 – Albert Borschette Centre - Brussels



AGENDA

1. Introduction on the used Life Cycle Assessment (LCA) method
 - Short presentation on the MEErP EcoReport 2014 tool
2. Selected Base Cases (BCs) and Functional Unit (FU)
 - Overview of the seven base cases
 - The applied FU
3. First draft results BC1 - environmental impact assessment
 - Used parameters for first draft results BC1
 - LCA results based on EcoReport tool
 - Critical Raw Materials based on EcoReport tool
4. First draft results of BC1 - financial impact assessment
 - Used parameters for first draft results BC1
 - Life Cycle Costs (LCC) and Levelized Cost of Energy (LCOE) results
5. Comparison with the Product Environmental Footprint (PEF) pilot



ECODESIGN BATTERIES – FIRST STAKEHOLDER MEETING TASK 5 - 1. USED LCA METHOD

Wai Chung Lam

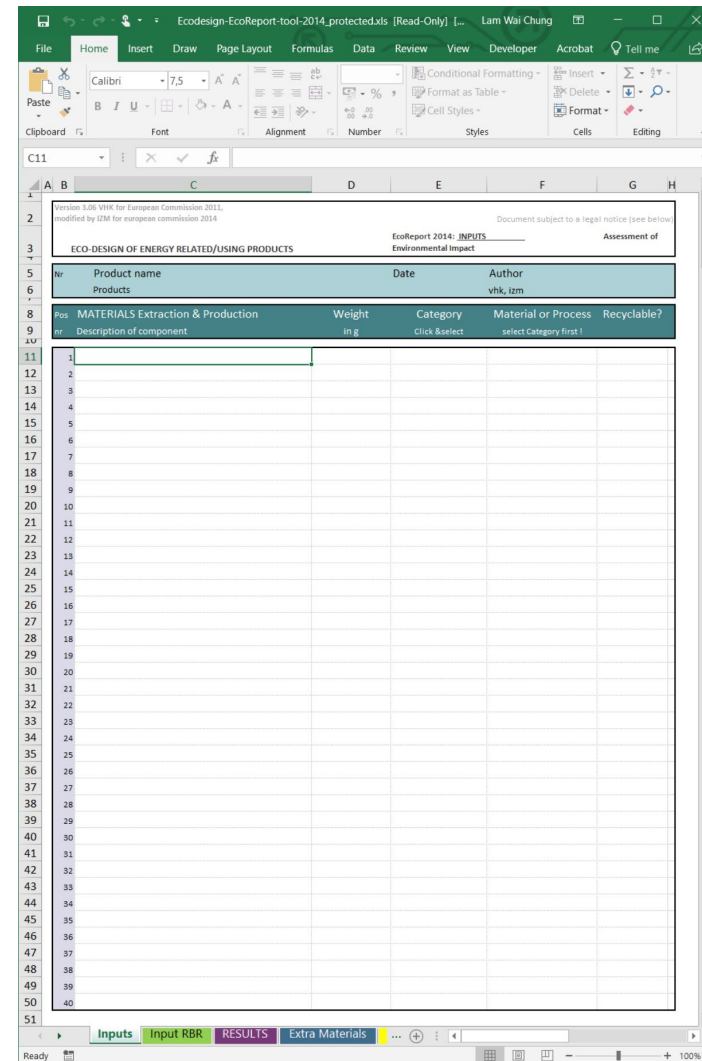
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1. INTRODUCTION ON THE USED LCA METHOD

MEErP: Methodology for Ecodesign of Energy-related Products

- MEErP shall be used as basis for ecodesign and energy labelling preparatory studies
- EcoReport tool developed for MEErP assessments
 - Latest version from 2014
- Translates product-specific characteristics (from Task 1-4) into environmental impact indicators per product
- Excel-based tool
- LCC assessments also possible
 - Not used given the complexity of the LCC and LCOE calculation



1. INTRODUCTION ON THE USED LCA METHOD

MEErP EcoReport tool 2014

- Life cycle impact assessment data of 91 materials included
 - 7 material categories:
 - Bulk plastics
 - Technical plastics
 - Ferrous metals
 - Non-ferrous metals
 - Electronics
 - Miscellaneous
- 20 extra materials can be added by the user

The screenshot shows an Excel spreadsheet titled 'Ecodesign-EcoReport-tool-2014_protected.xls (Read-Only) [Compatibility Mode]'. The spreadsheet contains a table with the following columns: nr, Name material, Recycle %*, Primary Energy (MJ), Electr. energy (MJ), feedstock, water proces, Water cool, waste ha, waste non, GWP, AD, VOC, POP, Hma, PAH, PM, HMw, and EUP. The table lists materials such as 'New Materials production phase (category: Extra)', 'Office paper (from recycled paper)', and 'Office paper (from primary cellulose)'. The 'nr' column ranges from 7 to 120, and the 'Name material' column contains the material names. The 'Recycle %*' column shows values like 15.14 and 39.71. The 'Primary Energy (MJ)' column shows values like 3.81 and 1.80. The 'Electr. energy (MJ)' column shows values like 20.46 and 52.23. The 'feedstock' column shows values like 0.93 and 1.20. The 'water proces' column shows values like 2.57 and 9.09. The 'Water cool' column shows values like 2.45 and 8.45. The 'waste ha' column shows values like 0.35 and 0.74. The 'waste non' column shows values like 0.35 and 0.74. The 'GWP' column shows values like 1.20 and 9.09. The 'AD' column shows values like 2.45 and 8.45. The 'VOC' column shows values like 0.35 and 0.74. The 'POP' column shows values like 0.35 and 0.74. The 'Hma' column shows values like 0.35 and 0.74. The 'PAH' column shows values like 0.35 and 0.74. The 'PM' column shows values like 0.35 and 0.74. The 'HMw' column shows values like 0.35 and 0.74. The 'EUP' column shows values like 0.35 and 0.74.

nr	Name material	Recycle %*	Primary Energy (MJ)	Electr. energy (MJ)	feedstock	water proces	Water cool	waste ha	waste non	GWP	AD	VOC	POP	Hma	PAH	PM	HMw	EUP
7	New Materials production phase (category: Extra)	%	MJ	MJ	MJ	L	L	g	g	kg CO2 eq.	g SO2 eq.	mg	ng I-Teq	mg Ni eq.	mg Ni eq.	g	mg Hg/20	mg PO4
9	100 Office paper (from recycled paper)	15,14	3,81	20,46						0,93	2,57					2,45		0,35
10	101 Office paper (from primary cellulose)	39,71	1,80	52,23				0,00	0,02	1,20	9,09					8,45		0,74
11	102																	
12	103																	
13	104																	
14	105																	
15	106																	
16	107																	
17	108																	
18	109																	
19	110																	
20	111																	
21	112																	
22	113																	
23	114																	
24	115																	
25	116																	
26	117																	
27	118																	
28	119																	
29	120																	
30	New Materials use phase (category: Auxiliaries)																	
31	121																	
32	122																	
33	123																	
34	124																	
35	125																	
36																		

1. INTRODUCTION ON THE USED LCA METHOD

MEErP EcoReport tool 2014

- Results are given for:
 - Raw materials
 - Manufacturing
 - Total production phase
 - Distribution
 - Use phase
 - End-of-life disposal
 - End-of-life reuse and recycling
 - Total life cycle
- Results for 13 environmental impact categories
 - Greenhouse Gases in GWP100 [kg CO₂ eq.]
 - Particulate Matter (PM, dust) [g]
 - Acidification, emissions [g SO₂ eq.]
 - Eutrophication (water) [g PO₄]
 - Process water and cooling water [ltr]
 - Total energy [MJ]
 - Waste, non-haz./ landfill [g]
 - Waste, hazardous/ incinerated [g]
 - Volatile Organic Compounds to air [g]
 - Persistent Organic Pollutants to air [ng i-Teq]
 - Heavy metals to air [mg Ni eq.]
 - PAHs to air [mg Ni eq.]
 - Heavy metals to water [mg Hg/20]

Life Cycle Impact (per unit) of Products		PRODUCTION		DISTRI-	USE	END-OF-LIFE			TOTAL	RBR
Resources Use and Emissions		Material	Manuf	BUTION	Disposal	Recycl.	Stock			
Materials unit										
1	Bulk Plastics	g			0	0	0	0	0	0
2	TecPlastics	g			0	0	0	0	0	0
3	Ferro	g			0	0	0	0	0	0
4	Non-ferro	g			0	0	0	0	0	0
5	Coating	g			0	0	0	0	0	0
6	Electronics	g			0	0	0	0	0	0
7	Misc	g			0	0	0	0	0	0
8	Extra	g			0	0	0	0	0	0
9	Auxiliaries	g			0	0	0	0	0	0
10	Refrigerant	g			0	0	0	0	0	0
	Total weight	g			0	0	0	0	0	0
Other Resources & Waste										
11	Total Energy (GER)	MJ	0	0	0	0	0	0	0	0
12	of which, electricity (in primary MJ)	MJ	0	0	0	0	0	0	0	0
13	Water (process)	ltr	0	0	0	0	0	0	0	0
14	Water (cooling)	ltr	0	0	0	0	0	0	0	0
15	Waste, non-haz./ landfill	g	0	0	0	0	0	0	0	0
16	Waste, hazardous/ incinerated	g	0	0	0	0	0	0	0	0
Emissions (Air)										
17	Greenhouse Gases in GWP100	kg CO2 eq.	0	0	0	0	0	0	0	0
18	Acidification, emissions	g SO2 eq.	0	0	0	0	0	0	0	0
19	Volatile Organic Compounds (VOC)	g	0	0	0	0	0	0	0	0
20	Persistent Organic Pollutants (POP)	ng I-Teq	0	0	0	0	0	0	0	0
21	Heavy Metals	mg Ni eq.	0	0	0	0	0	0	0	0
22	PAHs	mg Ni eq.	0	0	0	0	0	0	0	0
23	Particulate Matter (PM, dust)	g	0	0	0	0	0	0	0	0
Emissions (Water)										
24	Heavy Metals	mg Hg/20	0	0	0	0	0	0	0	0
25	Eutrophication	g PO4	0	0	0	0	0	0	0	0

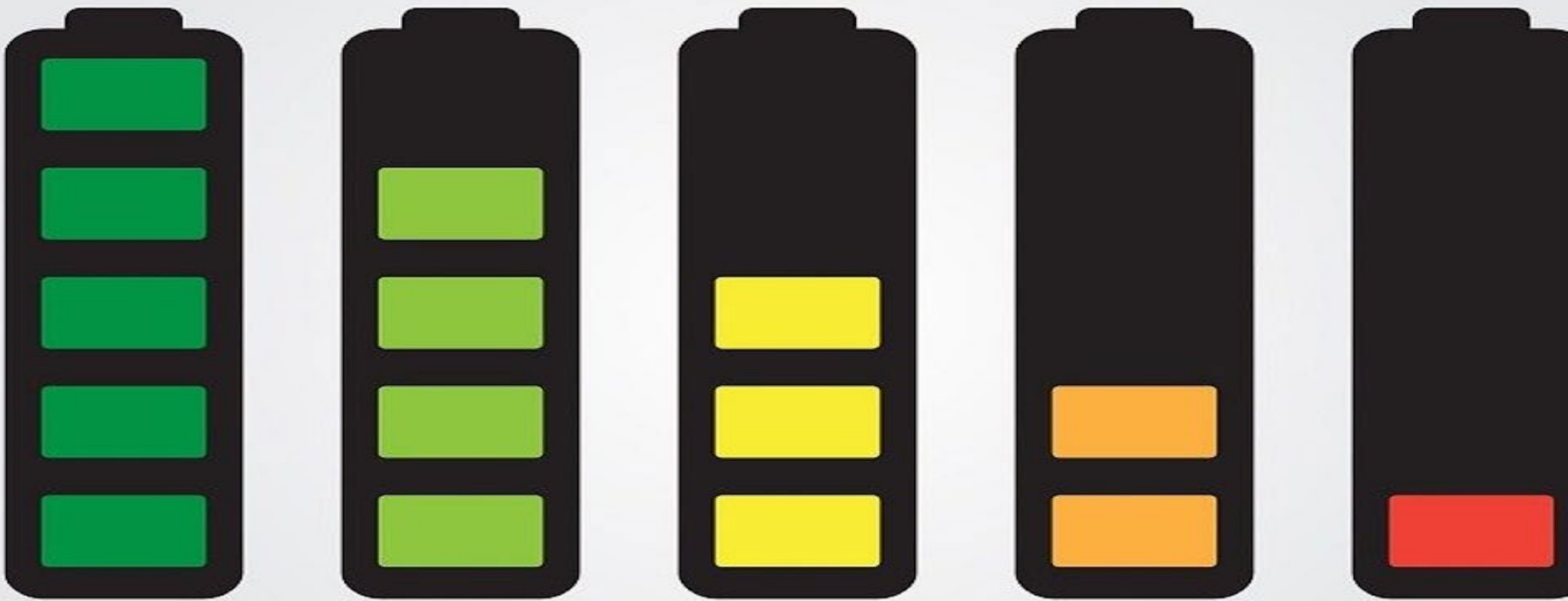
1. INTRODUCTION ON THE USED LCA METHOD

MEErP EcoReport tool 2014

- CRM calculator based on CRM-list of 2011

The screenshot shows an Excel spreadsheet titled 'Ecodesign-EcoReport-tool-2014_protect...'. The spreadsheet contains a table with the following data:

CRM indicator according to MEERP 2011	Critical Raw Material	Weight in g per product	Characterization factor [kg Sb eq./kg]	CRM indicator
3	Germanium (Ge)	0	18	0
4	Beryllium (Be)	0	12	0
5	Tantalum (Ta)	0	9	0
6	Indium (In)	0	9	0
7	Platinum Group metals (PGM)	0	8	0
8	Gallium (Ga)	0	8	0
9	Antimony (Sb)	0	1	0
10	Tungsten	0	0,2	0
11	Niobium (Nb)	0	0,04	0
12	Rare earth elements (Sc, Y, Nd)	0	0,03	0
13	Cobalt (Co)	0	0,02	0
14	Graphite (C)	0	0,01	0
15	Fluorspar (CaF2)	0	0,001	0
16	Magnesium (Mg)	0	0,0005	0
17	CRM indicator			0



ECODESIGN BATTERIES – FIRST STAKEHOLDER MEETING TASK 5 - 2. BASE CASES AND FUNCTIONAL UNIT

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2. SELECTED BASE CASES AND FUNCTIONAL UNIT

Seven Base Cases (BCs)

- Scope (as defined in Task 1 in line with PEF):
'High Specific Energy Rechargeable Batteries for Mobile Applications with High Capacity'
- A BC
 - Is a conscious abstraction of the reality, necessary for practical reasons
 - Represents average EU product on the market in terms of resources efficiency, emissions and functional performance
 - Is defined within Task 4
- BC1 - Passenger car battery electric vehicle
- BC2 - Passenger car plug-in hybrid electric vehicle
- BC3 - Light commercial vehicle battery electric vehicle
- BC4 - Truck battery electric vehicle
- BC5 - Truck plug-in hybrid electric vehicle
- BC6 - Residential storage
- BC7 - Grid stabilisation/large scale ESS
- More details in Task 4 presentation

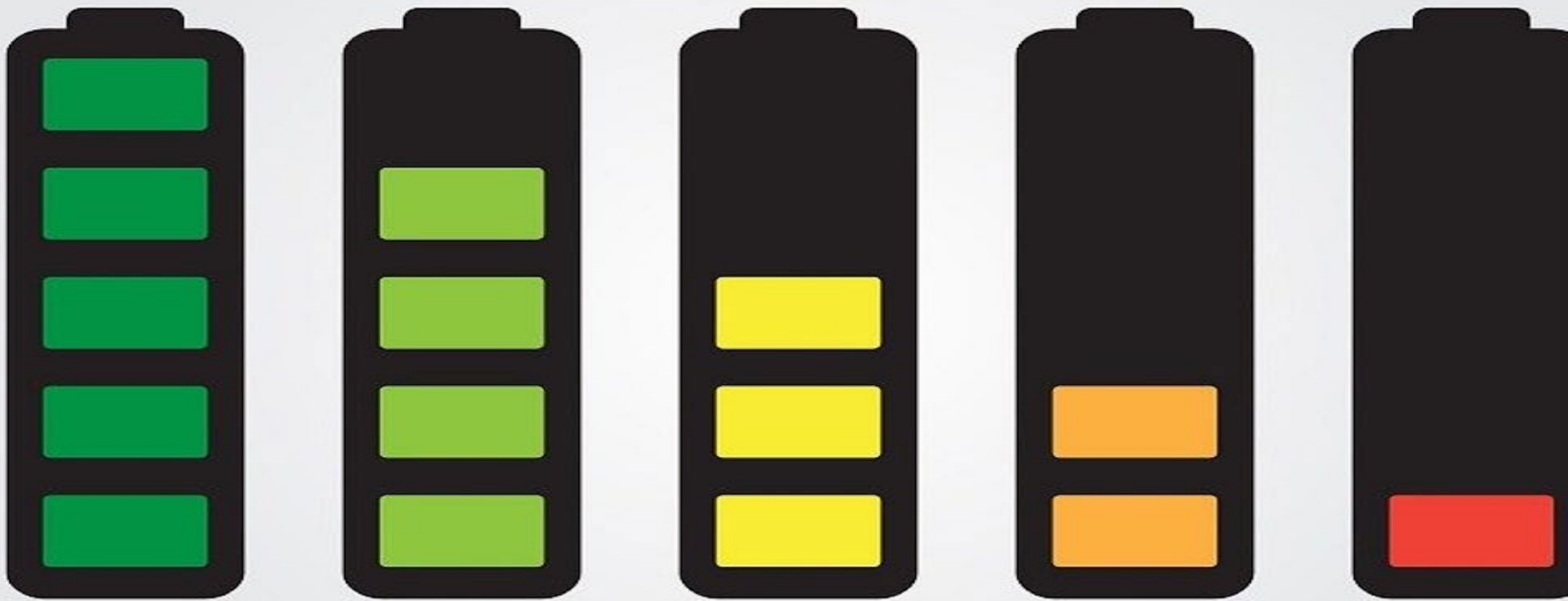


2. SELECTED BASE CASES AND FUNCTIONAL UNIT

Functional Unit (FU)

- Same FU as PEF Category Rules (PEFCR)
- **1 kWh (kilowatt-hour) of the total output energy delivered over the service life by the battery system** (measured in kWh).





ECODESIGN BATTERIES – FIRST STAKEHOLDER MEETING TASK 5 – 3. FIRST DRAFT RESULTS BC1 - LCA

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3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

First draft Task 5 report

- Example to show:
 - How results will be processed
 - Importance of sourcing appropriate data for Task 2, 3 and 4
- **Stakeholders are invited to source data for more accurate modelling for all BCs not only BC1**



3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

Used parameters for first draft results BC1: battery components

Weight based on:

- Nominal battery energy/ battery capacity: 34.375 kWh (based on Task 4)
- Economic lifetime: 10 years (based on Task 3)
- Delivered energy: 28,405 kWh (based on Task 3)
- Functional units per battery life: 8,000 kWh (based on PEF)
- Number of batteries: 4 (i.e. 3 replacements)

Results:

- Battery weight: 232.6 kg/battery (based on Task 4)
- Conversion to 1 FU: 0.033 kg/kWh
- Total weight based on 4 batteries: 930.5 kg



3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

Used parameters for first draft results BC1: Bill-of-Materials (BOM) & production stage

- Materials of the cell, module, and system based on data in section 4.2.1. of Task 4 report
- Auxiliary materials and energy use during production and their related emissions based on PEFCR on rechargeable batteries

Input manufacturing	Amount per kg battery	Unit
n-Methylpyrrolidone (NMP)	0.143	kg
Hydrochloric acid mix (100%)	0.37	kg
Power electrode (manufacturing energy)	40	MJ
Power cell forming (manufacturing energy)	1.2	MJ
Power battery assembly (manufacturing energy)	0.001	MJ

- Stakeholders please provide us Life Cycle Inventory (LCI) data for more accurate modeling**

3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

Used parameters for first draft results BC1: distribution stage

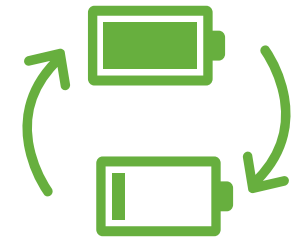
- EcoReport tool based on:
 - Volume of packaged product:
 - 0.4 m³ (2 m * 1 m * 0.2 m)
 - Product type and installation:
 - Not an ICT or consumer electronic product less than 15 kg
 - Is an installed appliance



3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

Used parameters for first draft results BC1: use phase

- Direct losses due to energy efficiency: 4%
- Indirect losses battery charger: 5%
- Brake energy recovery: 15%
- Indirect losses thermal management system: 1%
- **Stakeholders are invited to source data for Task 3 for more accurate modelling**
- MEErP takes 1% of the raw materials use of the production as default maintenance scenario



3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

Used parameters for first draft results BC1: end-of-life stage

- Default values EcoReport tool
 - End-of-life scenarios assigned to material categories
- 53,9% of battery weight material category 'Extra Materials'
 - Default for 'Extra Materials':
 - 60% recycling
 - 10% incineration
 - 29% landfill
 - 1% reuse
 - **Stakeholder are invited to source data for Task 3 regarding recycling for a more detailed evaluation**



3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

LCA results based on EcoReport tool

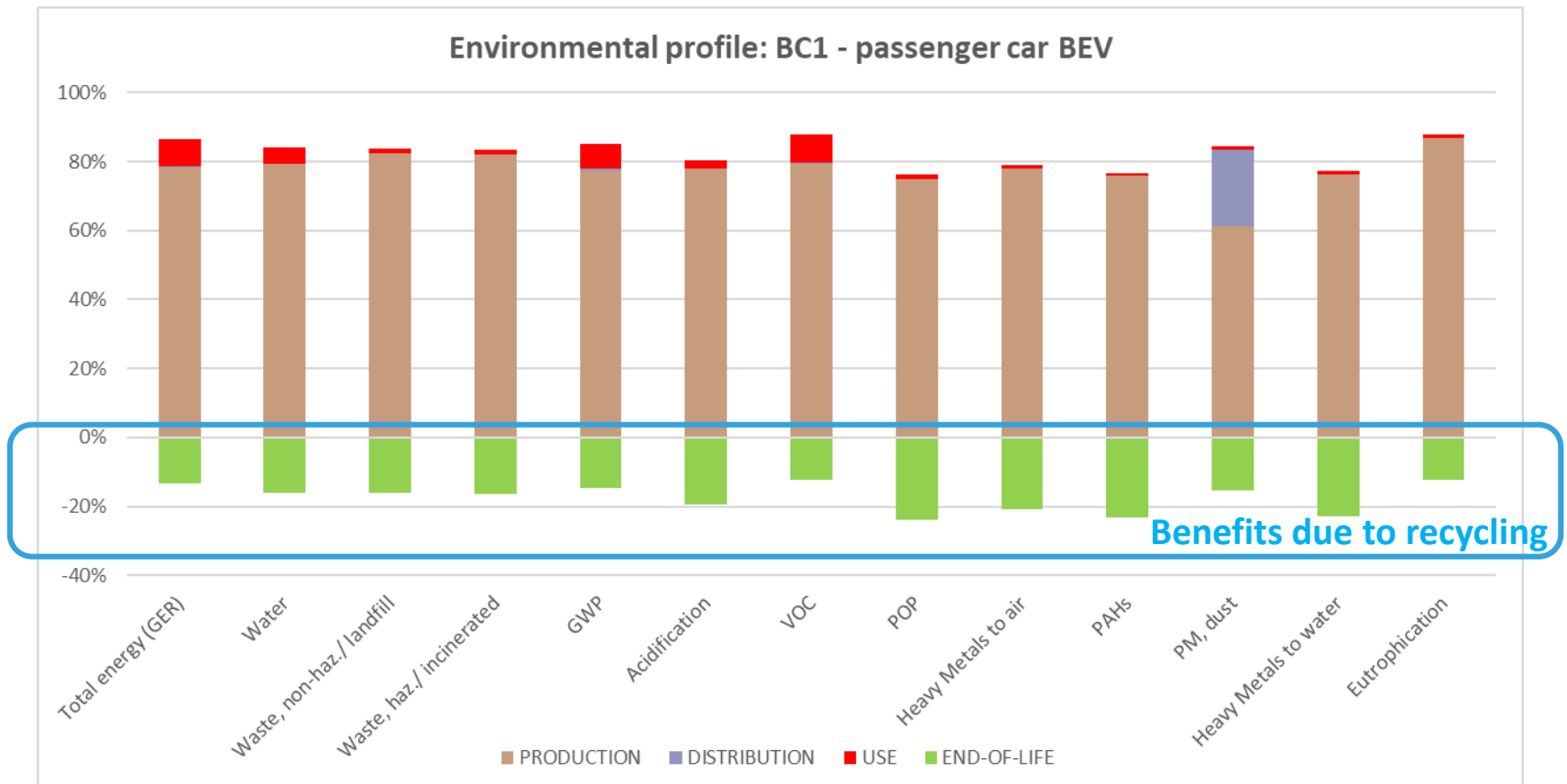
Life Cycle phases -->		PRODUCTION			DISTRIBUTION	USE	END-OF-LIFE			TOTAL
Resources Use and Emissions		Material	Manuf.	Total			Disposal	Recycl.	Stock	
Materials		unit								
1	Bulk Plastics	g		1,28		0,01	0,71	0,58	0,00	0,00
2	TecPlastics	g		0,00		0,00	0,00	0,00	0,00	0,00
3	Ferro	g		2,50		0,03	0,13	2,40	0,00	0,00
4	Non-ferro	g		10,84		0,11	0,55	10,41	0,00	0,00
5	Coating	g		0,15		0,00	0,01	0,14	0,00	0,00
6	Electronics	g		0,34		0,00	0,17	0,18	0,00	0,00
7	Misc.	g		0,00		0,00	0,00	0,00	0,00	0,00
8	Extra	g		34,45		0,00	13,57	21,22	0,00	-0,34
9	Auxiliaries	g		0,00		0,00	0,00	0,00	0,00	0,00
10	Refrigerant	g		0,00		0,00	0,00	0,00	0,00	0,00
	Total weight	g		49,56		0,15	15,13	34,93	0,00	-0,34
Other Resources & Waste							debet	credit		
11	Total Energy (GER)	MJ	5,49	3,63	9,12	0,06	0,91	0,09	-1,65	8,54
12	of which, electricity (in primary MJ)	MJ	0,53	3,50	4,03	0,00	0,86	0,00	-0,18	4,72
13	Water (process)	litr	0,17	0,01	0,18	0,00	0,00	0,00	-0,04	0,14
14	Water (cooling)	litr	0,34	0,22	0,56	0,00	0,04	0,00	-0,11	0,49
15	Waste, non-haz./ landfill	g	81,93	2,58	84,52	0,03	1,26	4,86	-21,48	69,19
16	Waste, hazardous/ incinerated	g	1,42	0,05	1,47	0,00	0,03	0,00	-0,29	1,20
Emissions (Air)										
17	Greenhouse Gases in GWP100	kg CO2 eq.	0,259	0,159	0,418	0,00	0,04	0,00	-0,08	0,38
18	Acidification, emissions	g SO2 eq.	6,95	0,71	7,65	0,01	0,23	0,02	-1,93	5,98
19	Volatile Organic Compounds (VOC)	g	0,12	0,08	0,20	0,00	0,02	0,00	-0,03	0,19
20	Persistent Organic Pollutants (POP)	ng i-Teq	0,22	0,02	0,24	0,00	0,00	0,00	-0,08	0,17
21	Heavy Metals	mg Ni eq.	1,86	0,06	1,92	0,00	0,03	0,01	-0,52	1,43
22	PAHs	mg Ni eq.	1,76	0,01	1,77	0,00	0,02	0,00	-0,54	1,25
23	Particulate Matter (PM, dust)	g	0,50	0,03	0,52	0,19	0,01	0,01	-0,15	0,59
Emissions (Water)										
24	Heavy Metals	mg Hg/20	1,28	0,02	1,29	0,00	0,02	0,00	-0,39	0,92
25	Eutrophication	g PO4	0,17	0,00	0,17	0,00	0,00	0,02	-0,04	0,15

- Mistakes in first draft:
 - auxiliary material not taken into account number of batteries: effect small contribution on total production energy (15%)
 - Impact category water extra materials m³ instead of ltr: no effect on the results

3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

LCA results based on EcoReport tool

Relative contribution of the life cycle stages



3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

LCA results based on EcoReport tool

Relative contribution raw materials used in the production phase (w/o energy for manufacturing)

	weight	GER	water (proces + cooling)	haz. waste	non-haz. waste	GWP	AD	VOC	POP	HMa	PAH	PM	HMw	EUP
Cathode active material	25%	25%	0%	0%	75%	31%	71%	41%	24%	62%	4%	43%	45%	72%
Cathode, other materials	5%	5%	0%	0%	1%	5%	1%	1%	3%	1%	5%	5%	2%	2%
Cell anode	22%	10%	0%	0%	1%	10%	10%	49%	5%	7%	51%	12%	16%	4%
Cell electrolyte	11%	5%	0%	0%	9%	6%	2%	5%	2%	5%	0%	5%	0%	8%
Cell seperator	2%	2%	3%	0%	0%	2%	0%	0%	1%	0%	2%	1%	1%	0%
Auxillary materials		15%	0%	0%	3%	5%	1%	3%	2%	6%	0%	3%	1%	6%
Cell packaging	9%	15%	57%	1%	5%	15%	6%	1%	32%	16%	11%	10%	8%	8%
Module	5%	4%	6%	0%	1%	5%	1%	0%	6%	1%	5%	6%	3%	0%
System - BMS	4%	3%	13%	39%	1%	3%	3%	0%	7%	2%	0%	1%	8%	0%
System - thermal management	4%	4%	0%	0%	1%	5%	1%	0%	4%	0%	6%	4%	3%	0%
System packaging	12%	12%	21%	59%	3%	14%	3%	0%	16%	1%	15%	10%	13%	0%

contribution to impact category	X > 50%
contribution to impact category	25% < X < 50%
contribution to impact category	10% < X < 25%
contribution to impact category	X < 10%

3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

LCA results based on EcoReport tool

Relative contribution raw materials and manufacturing in production stage

	GER	water (proces + cooling)	haz. waste	non-haz. waste	GWP	AD	VOC	POP	HMa	PAH	PM	HMw	EUP
Raw materials	60%	97%	96%	97%	62%	91%	62%	92%	97%	99%	95%	99%	99%
Manufacturing	40%	3%	4%	3%	38%	9%	38%	8%	3%	1%	5%	1%	1%

Relative contribution different life cycle stages

	GER	water (proces + cooling)	haz. waste	non-haz. waste	GWP	AD	VOC	POP	HMa	PAH	PM	HMw	EUP
Production - raw materials	64%	123%	118%	118%	68%	116%	65%	132%	130%	141%	84%	139%	114%
Production - manufacturing	43%	4%	5%	4%	42%	12%	40%	11%	4%	1%	4%	2%	1%
Distibution	1%	0%	0%	0%	1%	0%	1%	0%	0%	0%	32%	0%	0%
Use	11%	1%	2%	2%	10%	4%	11%	2%	2%	2%	1%	2%	1%
EOL - recycling/reuse	-19%	-28%	-24%	-31%	-21%	-32%	-16%	-45%	-37%	-44%	-24%	-42%	-30%
EOL - disposal	1%	0%	0%	7%	0%	0%	0%	0%	1%	0%	2%	0%	13%

contribution to impact category	X > 50%
contribution to impact category	25% < X < 50%
contribution to impact category	10% < X < 25%
contribution to impact category	X < 10%

3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

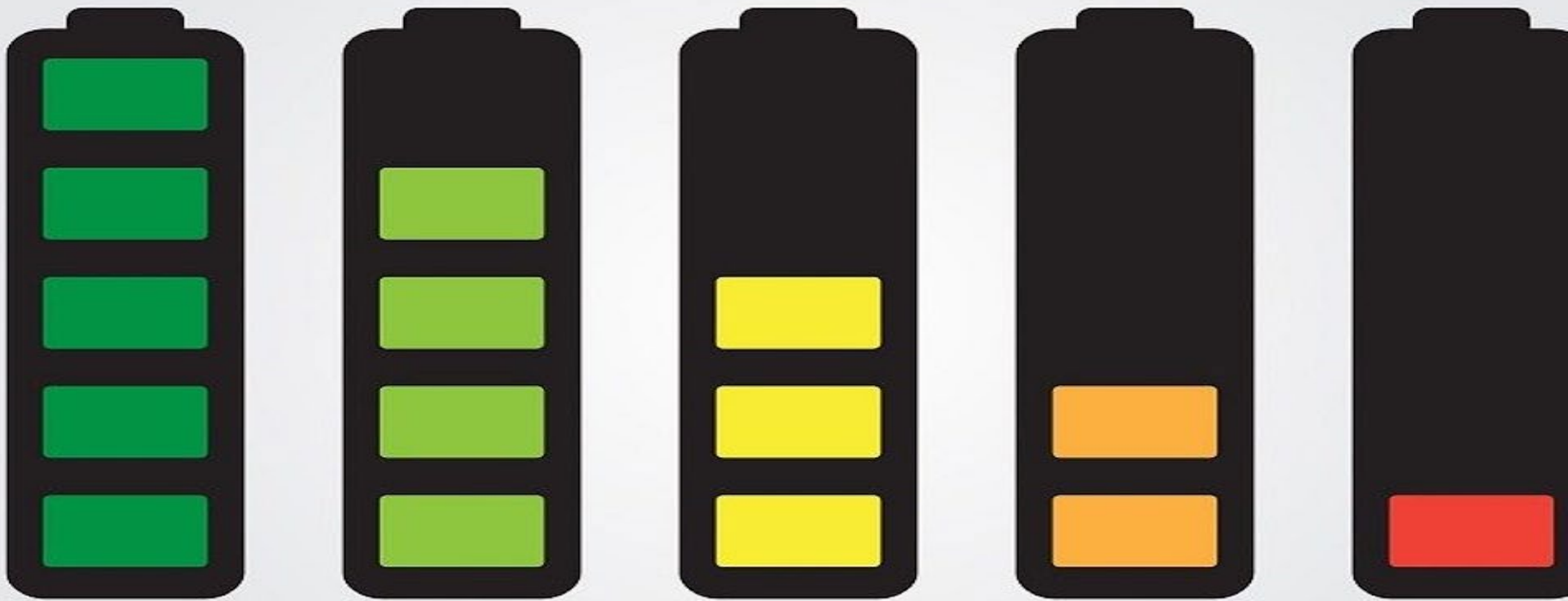
Critical Raw Materials (CRM) based on EcoReport tool

- Total battery weight per FU: 32.8 g
(mistake in report: weight was for 1 battery, not 4)
- Cobalt (CRM since 2011): 0,634 g
1,9% of total battery weight
CRM indicator 1.27E-05

3. FIRST DRAFT RESULTS BC1 - ENVIRONMENTAL IMPACT ASSESSMENT

(non-)CRM not in EcoReport tool

- Lithium (non-CRM):
 - 0,914 g
 - 2,8% of total battery weight
 - CRM indicator 1.25E-04
- Natural graphite (CRM since 2014):
 - 4,923 g
 - 15,0% of total battery weight
 - CRM indicator 2.62E-05
- These CRM indicators are calculated with same formula as in the MEErP dating from 2011
- However the values used to calculate the indicators, such as the EU consumption, are from 2017
- For next report version, to see whether to update all figures, including the Antimony (Sb) reference



ECODESIGN BATTERIES – FIRST STAKEHOLDER MEETING TASK 5 – 4. FIRST DRAFT RESULTS BC1 - LCC/LCOE

Paul van Tichelen

December 20th, 2018 – Albert Borschette Centre - Brussels



4. FIRST DRAFT RESULTS OF BC1 - FINANCIAL IMPACT ASSESSMENT

Used parameters for first draft results BC1

		Based on
Economic life time of application (Tapp) (y)	10.00	Task 3
Electricity cost (incl. VAT) (€/kWh)	0.205	EUROSTAT
r (discount rate=interest - inflation)	4.0%	MEErP
r (corrected discount rate for electricity)	0.0%	MEErP
Battery system capacity (kWh)	34.375	Task 4
Battery system cost (€/kWh)	200	Task 3/4
CAPEX battery system(€)	6875	Task 2
CAPEX for decommissioning (€)	400	Own estimate
OPEX replace battery (€/service)	400	Own estimate
Functional units for a battery system(kWh/batt life)	8000	Task 4 / PEF
Application service energy (AS) (kWh/app life)	28405	Task 3
Application service energy/year (AS/y) (kWh/app life/y)	2841	Task 3
Total number of batteries per application	4	Task 4
Frequency of replacement (y)	2.8	Task 4
$\eta_{\text{coul}} \times \eta_{\text{v}} = \text{energy efficiency}$	96%	Task 4
% of brake energy recovery	15%	Task 3
Battery charger efficiency	95%	Task 4

4. FIRST DRAFT RESULTS OF BC1 - FINANCIAL IMPACT ASSESSMENT

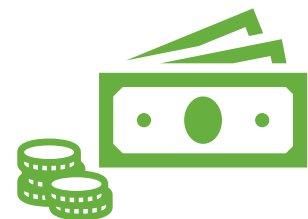
Details of LCC calculations per year

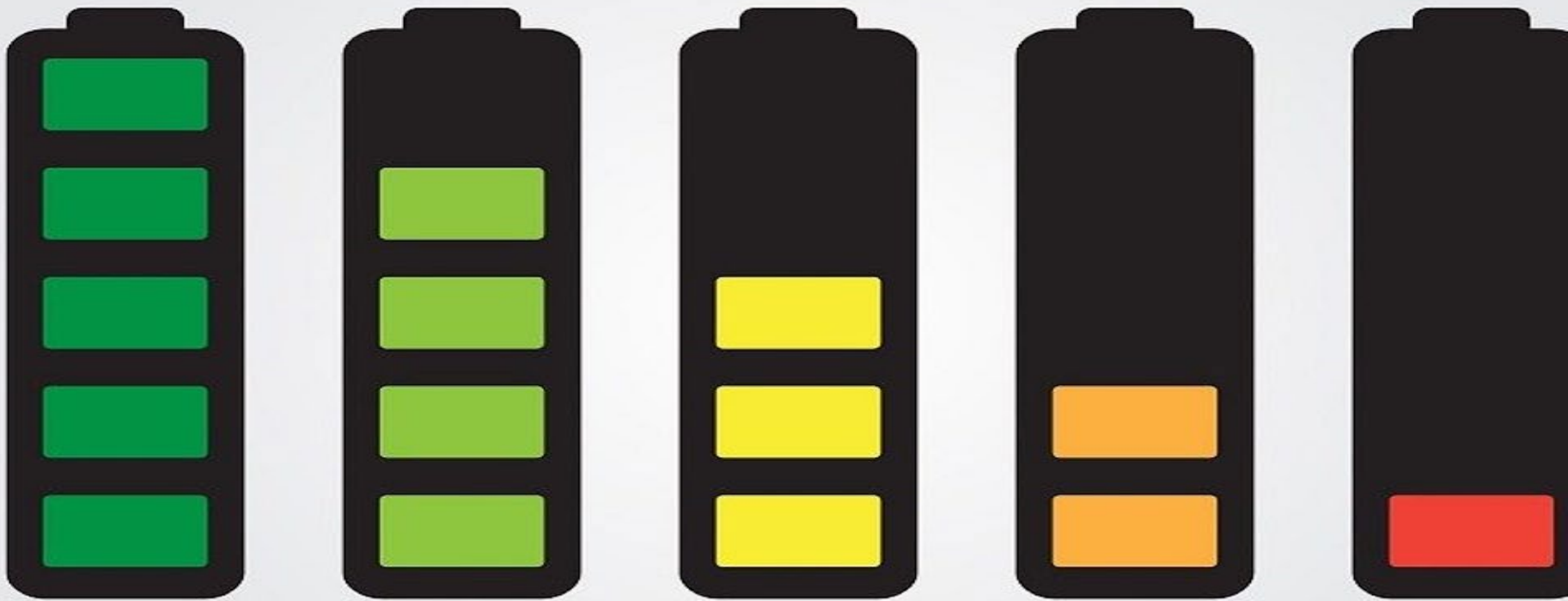
OPEX and CAPEX processing based on LCCinputdata									
event	Year	other PWF ratio	elec. PWF ratio	CAPEX euro	other OPEX euro	electricity OPEX euro	NPV OPEX+CAPEX euro/y	Direct loss Elec. per year kWh	Indirect loss Elec. per year kWh
purchase EV	1	1,000	1,000	6.875 €	400,00 €	48,61 €	7.323,61 €	113,62	123,50
	2	0,925	1,000			48,61 €	48,61 €	113,62	123,50
O&M	3	0,889	1,000	6.875 €	400,00 €	48,61 €	6.516,06 €	113,62	123,50
	4	0,855	1,000			48,61 €	48,61 €	113,62	123,50
	5	0,822	1,000			48,61 €	48,61 €	113,62	123,50
O&M	6	0,790	1,000	6.875 €	400,00 €	48,61 €	5.798,15 €	113,62	123,50
	7	0,760	1,000			48,61 €	48,61 €	113,62	123,50
	8	0,731	1,000			48,61 €	48,61 €	113,62	123,50
O&M	9	0,703	1,000	6.875 €	400,00 €	48,61 €	5.159,93 €	113,62	123,50
EoL	10	0,676	1,000		400,00 €	48,61 €	318,84 €	113,62	123,50
Total							25.359,63 €	1136,20	1235,00

4. FIRST DRAFT RESULTS OF BC1 - FINANCIAL IMPACT ASSESSMENT

LCC and LCOE results

- LCOE or LCC per functional unit 0.893 EUR/kWh
- LCC total for all batteries in application 25360 EUR/application
- Electrical energy produced over its lifetime 1136.20 kWh
- **Stakeholders are invited to source data for Task 3 for more accurate modelling**





ECODESIGN BATTERIES – FIRST STAKEHOLDER MEETING TASK 5 – 5. COMPARISON WITH PEF

Wai Chung Lam

December 20th, 2018 – Albert Borschette Centre - Brussels

viegand
maagøe
energy people

 **Fraunhofer**
ISI

 **vito**

5. COMPARISON WITH THE PRODUCT ENVIRONMENTAL FOOTPRINT PILOT

PEF Li-ion e-mobility

- **Just to check the order of magnitude of the results**
- Only one comparable impact category with same unit: global warming [kg CO₂ eq.]
- Only production
 - Scenarios for distribution, use phase, and EOL not comparable
- Same FU: 1 kWh of the total output energy delivered over the service life by the battery system

Specifications	e-mobility Li-ion PEF	BC1 – passenger car BEV	BC1' – passenger car BEV
Battery weight [kg]	225	232.6	232.6
Number of batteries [-]	1	4	1
Total energy delivered over the lifetime [kWh]	8000	28405	8000
Conversion to unit analysis [kg/kWh]	0.028	0.033	0.029
GWP results production phase [kg CO₂ eq./FU]	e-mobility Li-ion PEF *	BC1 – passenger car BEV	BC1 – passenger car BEV
Raw material acquisition	0.229	0.259	0.230
Manufacturing of the main product	0.133	0.159	0.141
Total production phase	0.362	0.418	0.371

* These figures are corrected compared to the ones in the draft Task 5 report

THANKS FOR YOUR ATTENTION

For commenting please use form

https://ecodesignbatteries.eu/files/attachments/ED_Battery_commentsv2.docx

and e-mail it to edbatteries@vito.be

Deadline for sending comments on draft Task 5: **18 January 2019**