R3PACK - REDUCE, REUSE, RETHINK PACKAGING TOWARDS NOVEL FIBRE-BASED PACKAGING AND REUSE SCHEMES

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LCA Inventory and scenario building

Acronyms

CFF: Circular Footprint Formula

EF: Environmental Footprint

LCA: Life Cycle Assessment

LCI: Life Cycle Inventory

PEF: Product Environmental Footprint

PEFCRs: Product Environmental Footprint Category Rules

PP+M: PreProduction & Manufacturing

Pt= Points

EoL: End-of-life

EF: Environmental Footprint

Definitions

Life cycle Assessment (LCA) – Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle (ISO 14040:2006).

Product Environmental Footprint Category Rules (PEFCRs) – Product category specific, life cycle based rules that complement general methodological guidance for PEF studies by providing further specification at the level of a specific product category. PEFCRs help to shift the focus of the PEF study towards those aspects and parameters that matter the most, and hence contribute to increased relevance, reproducibility and consistency of the results by reducing costs versus a study based on the comprehensive requirements of the PEF method. Only the PEFCRs listed on the European Commission website:

(http://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm) are recognised as in line with this method).

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1. INTRODUCTION

The primary aim of this document is to establish the methodology for future comparative analyses, explain the data collection process, and outline the datasets to be used. These elements are crucial for ensuring a solid and reliable framework for comparisons, aligned with the project's objectives.

It was necessary to make several changes respect to the analysis presented in D6.1A and D6.1B due to the following reasons:

Variations in product quantities: The contained food weight in the packaging selected for the new reuse systems have significantly changed compared to the state-of-the-art. This would have led to inconsistencies on the comparative analysis making it necessary to adjust the analysis framework.

Alignment of the two research streams: To ensure consistency between the two research streams: reuse and substitution, parameters related to state-of-the-art substitution products were also updated, allowing for a more effective comparison.

Based on these considerations, the following parameters have been integrated or modified:

Functional Unit definition: A standardized Functional Unit of 100g has been set to ensure comparability between all the studies.

Distribution data relevant to both systems: Transport data on distribution has been integrated to all the studies (both the state-of-the-art analysis and substitution products), in order to align all the comparisons.

Integration of the Circular Footprint Formula (CFF): The inclusion of CFF will further refine the environmental assessments.

Update of Simapro and datasets: SimaPro version 9.6.0.1, the ecoinvent 3.10 datasets, and the EF 3.1 impact assessment method were implemented.

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2. PART A: SUBSTITUTION

The main scope of the Substitution research is to develop innovative paper-based food packaging solutions, with a **minimum of 90% paper ratio** and able to fully substitute existing **complex multi-component** flexible and rigid plastic packaging, the latter called state-of-the-art products.

The first part (A) of the deliverable D6.1 (*https://www.r3pack.eu/livrables*) provided the results of Life Cycle Assessment (LCA) studies related to ten existing plastic-based packaging (state-of-the-art) selected to be substituted by cellulosic materials. WP4 activities are divided in two different routes:

- ***Long-term*:** strong R&D/pilot work with experts to develop innovative packaging solutions by targeting very high biobased and paper ratio, while preserving the food product shelf-life.
- ***Short-term:*** relevant commercial paper-based packaging solutions (flexible or rigid) regularly proposed to the industrials to validate the transfer to the packaging line (technically complicated), with a view to commercialization.

The data collection phase has retrieved data for commercial materials. Table 1 presents both the single-use products initially identified and assessed in D6.1A and the substituted alternatives introduced. As shown in Table 1, many of the selected plastic packaging options have been substituted by paper-based materials. No change in size is occurred for this selection.

Tab 1. Products analyzed for Substitution

STATE-OF-THE ART (SUBSTITUTION)			SUBSTITUTION PACKAGING	
Food category: Prepared fruit				
Product: Florette Shaker Ananas				
	**Format**	Preformed PET Shaker, thin PET foil lid	No material selected	
	Food weight	400 ml		
	Company	Floréale		
	LCA ID	01		
Food category: Prepared salad				
Product: Salad MDD				
	**Format**	PET Tray	**Format**	Cardboard bowl + barrier coating
	Food weight	250 g	**Food weight**	250 g
	Company	LSDH	**Company**	LSDH
	LCA ID	02	**LCA ID**	02-s
Food category: Sour cream				
Product: Yoghurt				
	**Format**	PP Cup	**Format**	LDPE + Paperboard + HDPE
	Food weight	200 g	**Food weight**	200 g
	Company	Yoplait	**Company**	Yoplait/SODIAAL
	LCA ID	03	**LCA ID**	03-s
Food category: Yoghurt				
Product: Greek Yoghurt				

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	**Format**	PP Cup		**Format**	wet molded cellulose + PE
	Food weight	450 g		**Food weight**	200 g
	Company	Yoplait		**Company**	
	LCA ID	04		**LCA ID**	04-s
Food category: In-shop product **Product: Pork chop**					
	**Format**	EPS Tray		**Format**	cellulosic + modified starch
	Food weight	500 g		**Food weight**	1355 ml
	Company	(none)		**Company**	System U & Carrefour
	LCA ID	05		**LCA ID**	05-s
Food category: Bagged salad **Product: Florette Mache**					
	**Format**	OPP Film		**Format**	Bleached paper + PE
	Food weight	125 g		**Food weight**	125 g
	Company	Floréale		**Company**	Floréale
	LCA ID	06		**LCA ID**	06-s
Food category: Butter **Product: Butter classic**					
	**Format**	Aluminium & OPP Film		**Format**	Paper + Aluminium + coating
	Food weight	250 g		**Food weight**	250 g
	Company	Sodiaal		**Company**	Sodiaal
	LCA ID	07		**LCA ID**	07-s
Food category: Cheese **Product: Grated cheese**					
	**Format**	OPA & LDPE Film		**Format**	Paper + Aluminium + coating
	Food weight	180 g		**Food weight**	180 g
	Company	Sodiaal		**Company**	Sodiaal
	LCA ID	08		**LCA ID**	08-s
Food category: Chips **Product: Peanutes curl**					
	**Format**	OPP Film		**Format**	Paper + PP
	Food weight	125 g		**Food weight**	125 g
	Company	Altho		**Company**	Altho
	LCA ID	09		**LCA ID**	09-s
Food category: Savory biscuits **Product: Savory biscuits**					
	**Format**	OPP Sachet & Cardboard		**Format**	Paper + PP
	Food weight	85-105 g		**Food weight**	85-105 g
	Company	Europe Snacks		**Company**	Europe Snacks
	LCA ID	10		**LCA ID**	10-s

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2.1. GOAL OF THE STUDIES

The aim of this study is to compare the paper-based packaging solution selected in WP4 to the "state of the-art" solution. The impact evaluation will be conducted through Life Cycle Assessment (LCA) defined by standards ISO 14040 and 14044, using the SimaPro software (PRé Sustainability). The impact assessment will be carried out considering datasets and environmental indicators defined in the PEF methodology proposed by European Commission. The standard methods to measure the life cycle environmental performances have been included in the Commission Recommendation 2021/2279 published in December 2021. Environmental Footprint (EF) methods are in a transition phase, and – to date – no PEFCRs are available for packaging products.

2.2 SCOPE OF THE STUDIES

a. Functional Unit and reference flow

The **Functional Unit** of the analyzed system is defined as follows: "The packaging required to contain, protect, and preserve 100 grams of food over the duration of the expected shelf life, to ensure food safety, quality, and integrity throughout the distribution chain".

Tab 2. Functional Unit aspects

ASPECT	DESCRIPTION
i) Functions or services provided (What)	Contain, preserve, protect food, and provide product information about the product content defined in the "Food category" item in Table 1 (e.g. prepared fruits) throughout the distribution chain.
ii) Extent of the function (How much)	The quantity of product to be packaged is 100 grams.
iii) Expected level of quality (What quality)	Guarantee food safety performance and shelf-life
iv) Duration/lifetime of the product (For how long)	Equal to the food's expected shelf-life.
Reference Flow	The mass of packaging material (single-use or allocated for reuse cycles) required to deliver 100 grams of food.

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2.3 SYSTEM BOUNDARY

The nine food categories selected in the state-of-the-art for substitution in R3PACK project have been: bagged salad, butter, cheese, chips, in-shop products, prepared salad, savory biscuits, prepared fruits and yoghurt. The project partners have selected a representative product for each category (both state-of-the-art and substituted product) and are those in Table 1.

The analyses will consider **primary packaging** raw material acquisition and pre-processing, manufacturing, distribution stage and end-of-life. Use stage, secondary packaging, packaging-related food waste, packaging geometric features (e.g. emptyability) and the packaging filling phase will be excluded from the system boundary because they are taken as unvaried characteristics for the substitution purpose. All the processes attributed to the packaging are listed in the Life Cycle Inventory (LCI) divided by life cycle stages. Here below, a list of the processes considered for each stage is provided:

- **Raw material acquisition and pre-processing:** this life cycle stage begins when resources are extracted from nature and ends when product components enter the packaging production plant. In particular, it includes the pre-processing of material inputs. The transportation related to the acquisition of raw material is partly modelled by Ecoinvent (embedded in the Market processes, selected whenever available).
- **Manufacturing:** the production stage begins when the product components enter the production site and ends when the finished product leaves the production facility. The transportation related to the acquisition of material is partly modelled by Ecoinvent (embedded in the Market processes, selected whenever available).
- **Distribution stage:** this phase corresponds to the packaged product's distribution and storage (warehouse/retail). It won't be associated with any process both for the lack of primary data and considering that with the same Functional Unit (that should be adopted to establish comparative analyses in the following deliverables), impacts related to distribution are comparable between the state-of-the-art packaging and the one manufactured with newly materials.
- **End-of-life:** this stage begins when the user disposes of the packaging and ends when it is returned to nature as a waste product or enters another product's life cycle (i.e. as a recycled input). In this case, recycling operations, incineration and landfilling are considered. The following analyses will account for incineration and landfilling-related contributions to define the impact assessment results. At the same time, processes that offer environmental benefits, such as recycling and energy recovery, are excluded from the calculation due to the cut-off approach that will be described later. A specific waste scenario has been modelled for the analyses considering French data on packaging EoL.
- **System boundary diagram:** the following map in Figure 1 shows the different life cycle stages considered. Pre-processing and Manufacturing phases, Distribution and End-of-life are merged in the process inventory and in the presentation of the results. As described above, use is not associated with any

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flow.

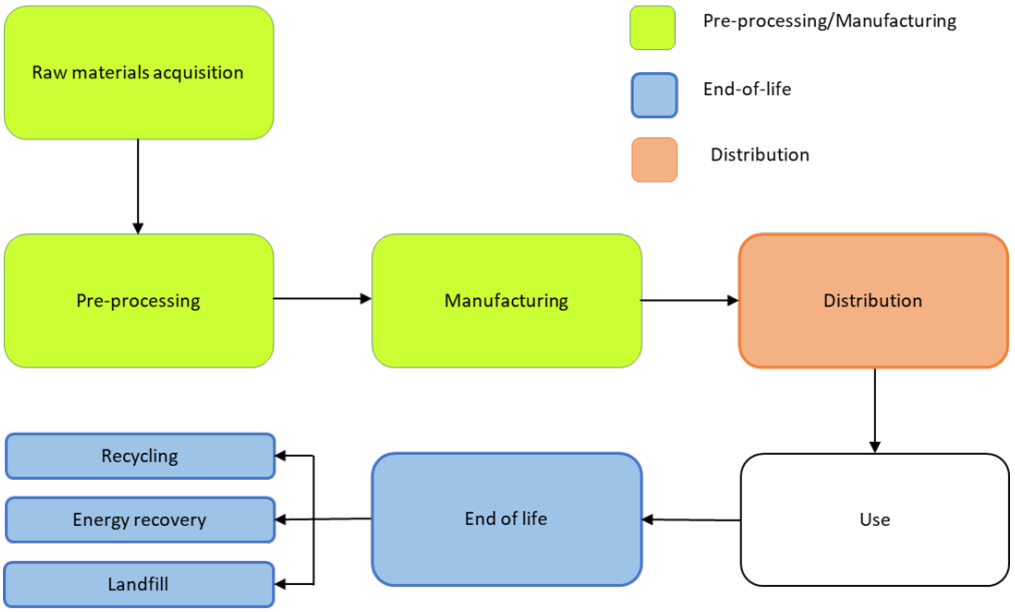

Figure 1: System boundaries diagram.

2.4 ENVIRONMENTAL FOOTPRINT IMPACT CATEGORIES

LCA results are presented through various environmental impact categories. For the impact assessment all the 16 EF (Environmental Footprint) impact categories shown in Table 3 are considered together with an all-encompassing value expressed in Pt obtained by weighting the different categories through appropriate factors. In the interpretation phase, only the most relevant impact categories are considered. Table 3 shows the list of all the EF 3.1 impact categories and related indicators and units are provided[1].

Tab 3. EF 3.1 impact categories and related indicators and units.

Impact category	Indicator	Unit	LCIA method
Acidification	Accumulated Exceedance (AE)	mol H+ eq	Accumulated Exceedance
Climate change	Radiative forcing as Global Warming Potential (GWP100)	kg CO2 eq	Baseline model of 100 years of the IPCC (based on IPCC 2013)
Ecotoxicity, freshwater	Comparative Toxic Unit for ecosystems (CTUe)	CTUe	USEtox model
Eutrophication, marine	Fraction of nutrients reaching marine end compartment (N)	Kg N eq	EUTREND model
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment	Kg P eq	EUTREND model

[1] Zampori, L. and Pant, R., Suggestions for updating the Product Environmental Footprint (PEF) method, EUR 29682 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76- 00654-1, doi:10.2760/424613, JRC11595. § 3.2.3 Environmental Footprint impact categories, Tab. 2

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	(P)		
Eutrophication, terrestrial	Accumulated Exceedance (AE)	mol N eq	Accumulated Exceedance
Human toxicity, cancer	Comparative Toxic Unit for humans (CTUh)	CTUh	USEtox model
Human toxicity, non-cancer	Comparative Toxic Unit for humans (CTUh)	CTUh	USEtox model
Ionising radiation	Human exposure efficiency relative to U235	KBq U-235 eq	Human health effect model
Land use	Soil quality index	Dimensionless (pt)	Soil quality index based on LANCA (ECJRC)
Ozone depletion	Ozone Depletion Potential (ODP)	kg CFC-11 eq	Steady-state ODPs as in (WMO 1999)
Particulate matter	Impact on human health	Disease inc.	PM method recommended by UNEP
Photochemical ozone formation	Tropospheric ozone concentration increase	kg NMVOC eq	LOTOS-EUROS model as implemented in ReCiPe 2008
Resource use, fossils	Abiotic resource depletion – fossil fuels (ADP-fossil)	MJ	CML 2002
Resource use, minerals and metals	Abiotic resource depletion (ADP ultimate reserves)	kg Sb eq	CML 2002
Water use	User deprivation potential (deprivation-weighted water consumption)	m3 depriv.	Available WAter REmaining (AWARE)

2.5 DATA COLLECTION AND QUALITY

a. Data collection

In the present deliverable D6.2, the comparison between the packaging materials should have been initially between the state-of-the-art and the paper-based packaging solutions developed in WP4 with experts.

Due to the complexity of obtaining new cellulose based packaging materials with all the required properties and performances, it was decided to have a short term strategy for pilot and industrial up-scaling towards a potential demonstration, using mature barrier products commercially available and with a potential compromise on fossil-based content.

Consequently, in this deliverable the comparison is made with these packagings identified among those already available on the market. The research activity continues in parallel with a long-term strategy, which involves laboratory work and may eventually be considered in the final comparative analyses.

To build the life cycle inventory (LCI), a data collection form was sent to (RE)SET . Tab. 4 shows a *fac-simile* of the data collection model: was asked to specify, for each layer of the packaging, the material (possibly accompanied by the relative technical datasheet), the weight in grams of the layer itself and its manufacturing process(es). Was also asked to indicate packaging nominal capacity, the overall production technology and to provide a reference image of the product.

The data collection is based on commercial solutions and some products are more detailed than others. Indeed, as most of them are only "theoretical" products, it has been assumed that the dimensions are the same as the ones of the state-of-the-art packaging solutions.

The paper-based packaging solutions chosen are commercial products, for

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confidentiality reasons the name of the product is omitted.

Tab 4. Fac-simile of data collection model

STATE OF THE ART PRODUCT ID	ID 01 - Prepared fruits				
Name of the NEW product		New product image			
PACKAGING WEIGHT					
CAPACITY (FOOD WEIGHT) - FORMAT					
TECHNICAL DATASHEETS AVAILABLE	yes/no (please attach)				
PRODUCT COMPOSITION					
	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1					
Layer 2					
PACKAGING LID					
ADHESIVE					
INK					
OVERPRINT VARNISH					
OTHERS					
TOTAL PACKAGING WEIGHT		0,00	0,00		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

b. Data quality

To support the initiation of Life Cycle Assessment (LCA) studies, the quality and consistency of the collected data are essential. In the present data collection, regarding Substitution, it is possible to see primary and secondary data sources.

In particular, for primary data, detailed information on packaging layers—including materials, weights, manufacturing processes, nominal capacity, and production technology—was provided by (RE)SET, supplemented with reference images to ensure accurate representation. Where detailed information was not available or for some commercial products, reference was made to Ecoinvent database to ensure a solid and comprehensive basis for our LCA assessments.

The secondary data included in this study cover key aspects such as Material Composition, which provides insights into the packaging materials' families, combining primary data from (RE)SET with supplementary information from the Ecoinvent database. Production Processes are detailed using standardized datasets from the Ecoinvent database, ensuring alignment with industry norms and practices. Finally, End of Life (EoL) processes are sourced from EUROSTAT and the EU Commission.

Temporal Representativeness: The majority of primary data collected pertains to the current operational context. Secondary data were sourced from the most recent datasets available in Ecoinvent, ensuring alignment with to date industry practices.

Geographical Representativeness: Primary data about the distribution transports provides insights into specific operational sites and logistical routes, offering a clear and precise geographical scope. For secondary data, Ecoinvent datasets related to processes and materials have been aligned with the French Energy Mix. End-of-Life (EoL) rates, including recycling, landfill, and incineration percentages, are based on French national data.

Technological Representativeness: Primary data captures the specific technologies involved in packaging manufacturing, detailing each layer's material composition and associated production processes. Secondary data reflects industry-standard practices for material characteristics and EoL management.

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Completeness: Primary data comprehensively covers all major life cycle stages, enriched by specific secondary data on materials, production processes, and EoL considerations.

Methodological Consistency: The integration of primary and secondary data follows a harmonized approach aligned with the PEF framework. To fill remaining data gaps, Ecoinvent datasets have been utilized to ensure robustness and consistency in the LCA assessments.

It is also worth noting that the quality of the data collected for substitution is aligned with the data obtained for the state-of-the-art, ensuring that these studies remain comparable. Despite these challenges, the data collected so far, supplemented by Ecoinvent, provides a solid foundation for LCA studies, with further refinements expected to enhance the accuracy and reliability of the assessments.

The retrieved data from partners are reported in Annex 1 at the end of this document.

2.6 LCI – LIFE CYCLE INVENTORY

In this paragraph, the inventory tables are provided and organized to keep the various phases of the packaging life cycle separate as described in the system boundary diagram.

PRE-PROCESSING AND MANUFACTURING LCI

The state-of-the-art tables have been updated from the deliverable 6.1A because the amounts have been re-proportioned on 100 grams of food content (new FU).

Here below, for each state-of-the-art product, a table describing the pre-processing (PP) and manufacturing (M) processes of the packaging is provided. The inventory is structured as a bill of materials: each component that makes the product up is associated with a position number that reflects the structure of the assemblies; quantity and weight in grams are indicated for each component/assembly.
Regarding pre-processing, the material (as declared by the company in the data collection form) is indicated for each layer, together with the corresponding raw material selected in SimaPro. With respect to manufacturing, a description of the processes used and an indication of the corresponding processes in Ecoinvent is provided. If the original datasets have been modified to adapt them to the French context by selecting, for example, energy data related to this geographical area, all the modifications made are reported in a dedicated column.

Instead, for each substituted product, the tables are partially filled with the information available at the time of writing this report.

In correspondence with each table, any limitations and assumptions made during the compilation of the inventory are reported.

NOTE: It is possible that some information will occur some changes when LCA analysis will be performed.

PRODUCT 01

- **STATE-OF-THE-ART - TABLE (A1), PP-M LCI, – Florette Shaker, PET Cup**

  Assumptions and limitations: the heat-sealing process for components 1.1 and 1.2 has been omitted due to the lack of specific information retrieved in the data collection and suitable Ecoinvent datasets. Furthermore, no information has been provided regarding eventual printing processes and related ink, which therefore were not included in the analysis.

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Tab A1. PP-M LCI, PRODUCT 01 – Florette Shaker, PET Cup

TABLE A1				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
1	PET Cup	1		/	/	Heat sealing	/	/
1.1	PET Foil Lid	1		PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
1.2	PET Shaker	1		PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

- **SUBSTITUTION - TABLE (B1), PP-M LCI,**

No product selected.

PRODUCT 02

- **STATE-OF-THE-ART - TABLE A2, PP-M LCI, – Salad MDD, PET Tray**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which therefore were not included in the analysis.

Tab A2. PP-M LCI, PRODUCT 02 – Salad MDD, PET Tray

TABLE A2				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
2	PET Tray	1	12	/	/	Inline manual closing	/	/
2.1	PET Lid	1	4	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/
2.2	PET Bowl	1	8	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

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- **SUBSTITUTION - TABLE (B2), PP-M LCI, – Prepared Salad, Cardboard Tray**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which therefore were not included

Tab B2. PP-M LCI, PRODUCT 02-s – Prepared Salad, Cardboard Tray

TABLE B2				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
2-s	Cardboard Tray	1	4,604					
2.1-s	PET foil Lid	1	0,004	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
2.2-s	Cardboard cup	1	0,92	Coating		Rod Coating		
2.3-s	Cardboard cup	1	3,68	Cardboard				

PRODUCT 03

- **STATE-OF-THE-ART - TABLE A3, PP-M LCI, – Sour cream, Cup**

  Assumptions and limitations: the sealing process for components 3.2 and 3.3 and the closing process for components 3.1 and 3.3 have been omitted due to the lack of specific information retrieved in the data collection and suitable Ecoinvent datasets. The manufacturing process for the monolayer Aluminum Lid (3.2) was not declared, thus, sheet rolling was assumed as the most suitable option. Furthermore, no information has been provided regarding eventual printing processes and related ink, which therefore were not included in the analysis.

Tab A3. PP-M LCI, PRODUCT 03 – Sour cream, Cup

TABLE A3				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
3	Cup	1	6,18	/	/	Inline closing and sealing	/	/
3.1	PET Overcap	1	1,525	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

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3.2	Aluminum Lid	1	0,405	Aluminum	Aluminium alloy, AlMg3 {GLO}| market for | Cut-off, U	Sheet rolling	Sheet rolling, aluminium {RER}| processing | Cut-off, U	• Water, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
3.3	PP Bowl	1	4,25	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

- **SUBSTITUTION - TABLE (B3), PP-M LCI, – Sour cream, Paper Cup**

  Assumption and limitations: in data collection, the dimensions as well as lid and overcap are assumed to be the same as state-of-the-art product 03.

  The sealing process for components 3.2-s and 3.3-s and the closing process for components 3.1-s and 3.3-s have been omitted due to the lack of specific information retrieved in the data collection and suitable Ecoinvent datasets. The manufacturing process for the monolayer Aluminum Lid (3.2-s) was not declared, thus, sheet rolling was assumed as the most suitable option. Furthermore, no information has been provided regarding possible printing processes and related ink, which therefore were not included in the analysis.

Tab B3. PP-M LCI, PRODUCT 03-s – Sour cream, Paper Cup

TABLE B3				**PRE-PROCESSING**		**MANUFACTURING**		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
3-s	Cup	1	4,95	/	/	/	/	/
3.1-s	PET Overcap	1	1,525	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/
3.2-s	Aluminum Lid	1	0,405	Aluminum	Aluminium alloy, AlMg3 {GLO}| market for | Cut-off, U	Sheet rolling	Sheet rolling, aluminium {RER}| processing | Cut-off, U	• Water, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
3.3-s	Paper based cup	1						
3.4-s	Cup layer 1	1	0,37	HDPE	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}|

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								market for | Cut-off, U
3.5-s	Cup layer 2	1	2,44	Paper/ Cardboard		Pulping, bleaching, calenderin g		
3.6-s	Cup layer 3	1	0,21	LDPE	Polyethylen e terephthalat e, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

PRODUCT 04

- **STATE-OF-THE-ART - TABLE A4, PP-M LCI, – Greek yoghurt, Cup**

  Assumptions and limitations: the sealing process for components 4.2 and 4.3 and the closing process for components 4.1 and 4.3 have been omitted due to the lack of specific information retrieved in the data collection and suitable Ecoinvent datasets. The manufacturing process for the monolayer Aluminum Lid (4.2) was not declared, thus, sheet rolling was assumed as the most suitable option. Furthermore, no information has been provided regarding eventual printing processes and related ink, which therefore were not included in the analysis.

Tab A4. PP-M LCI, PRODUCT 04 – Greek yoghurt, Cup

TABLE A4				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
4	Cup	1	4,5	/	/	Inline closing and sealing	/	/
4.1	PET Overcap	1	1,111	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoformin g	Extrusion of plastic sheets and thermoformin g, inline {FR}| processing | Cut-off, U	/
4.2	Aluminum Lid	1	0,278	Aluminu m	Aluminum alloy, AlMg3 {GLO}| market for | Cut-off, U	Sheet rolling	Sheet rolling, aluminum {RER}| processing | Cut-off, U	• Water, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

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4.3	PP Bowl	1	3,111	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

- **SUBSTITUTION - TABLE (B4), PP-M LCI, – Greek yoghurt, Paper Cup**

  Note: Only few details for this product from data collection.

Tab B4. PP-M LCI, PRODUCT 04-s – Greek yoghurt, Paper Cup

TABLE B4				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
4-s	Cup	1	5,37	/	/	Thermoforming		
4.1-s	Moulded pulp	1	5					
4.2-s	PE film	1	0,37	PE	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

PRODUCT 05

- **STATE-OF-THE-ART - TABLE A5, PP-M LCI, – Pork chop, Wrapped Tray**

  Note: for the "In-shop products" food category, a specific EPS tray was not supplied by the partners, therefore a suitable one for the reference product (2 pork chops) was selected by the authors. Specifically, the product is made up of an expanded polystyrene tray and a PVC film.

  Assumptions and limitations: the wrapping process (manual or automatic) has been omitted as considered negligible and due to the absence of suitable Ecoinvent datasets.

Tab A5. PP-M LCI, PRODUCT 05 – Pork chop, Wrapped Tray

TABLE A5				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
5	Wrapped Tray	1	2,76	/	/	Wrapping	/	/

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5.1	PVC Wrapping Film	1	0,58	PVC	Polyvinylchloride, suspension polymerised {RER}| polyvinylchloride production, suspension polymerisation | Cut-off, U	Bubble extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
5.2	PSE Tray	1	2,18	EPS	Polystyrene, expandable {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/
						Foaming	Polymer foaming {RER}| processing | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **SUBSTITUTION - TABLE (B5), PP-M LCI, – Pork chop, Cellulose tray**

  Note: No info about the lid/wrapping film.

Tab B5. PP-M LCI, PRODUCT 05-s – Pork chop, Cellulose tray

TABLE B5				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
5-s	Cellulose tray	1	3,02	/	/	Thermoforming	/	/
5.1-s	Wet molded cellulose	1	2,9					
5.2-s	Biofilm	1	0,12	cellulosic emulsion + modified starch		Rod Coating		

PRODUCT 06

- **STATE-OF-THE-ART - TABLE A6, PP-M LCI, – Florette Mache, OPP Film**

  Assumptions and limitations: The laminating process (6.2) has been modified changing the typology of adhesive (Polyurethane adhesive instead of acrylic binder as specificated in data collection). The printing process has been omitted due to the absence of suitable Ecoinvent datasets, only the date of ink has been considered.

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Tab A6. PP-M LCI, PRODUCT 06 – Florette Mache, OPP Film

TABLE A6				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
6	Bag	1	4,464	/	/	/		/
6.1	OPP Film	1	0,128	Ink	Printing ink, offset, without solvent, in 47% solution state {RER}|	Printing Ink	/	/
6.2	OPP Film	1	0,256	Adhesive	Polyurethane adhesive {GLO}| market for polyurethane adhesive | Cut-off, U	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	• Electricity, medium voltage {FR}| market for | Cut-off, U
6.3	PP Foil	1	4,08	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **SUBSTITUTION - TABLE (B6), PP-M LCI, – Florette Mache, Paper/PE bag**

  Assumptions and limitations: The bag dimensions and the amount of adhesive and ink are assumed as the same as plastics products

  For the Paper/PE bag (6.1-s), a dataset has been used to produce an "average European paper sack", which is a hybrid mix of all types of multiwall paper sacks in Europe. It mixes brown (unbleached) and white (bleached) sack kraft paper, LDPE and HDPE plastic liners and different kinds of glues, all in one.

Tab B6. PP-M LCI, PRODUCT 06-s – Florette Mache, Paper/PE bag

TABLE B6				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
6-s	Bag	1	/	/	/	/	/	/
6.1-s	Paper & PE bag	1	10,24				Paper sack {RER}| paper sack production | Cut-off, U	• Variation amount paper, PE and ink • Electricity, medium voltage {FR}| market for | Cut-off, U

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PRODUCT 07

- **STATE-OF-THE-ART - TABLE A7, PP-M LCI, – Butter, Aluminum & OPP Film**

  Assumptions and limitations: The manufacturing process for the layer Aluminum Lid (7.2) was not declared, thus, sheet rolling was assumed as the most suitable option.

Tab A7. PP-M LCI, PRODUCT 07 – Butter, Aluminum & OPP Film

TABLE A7				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
7	Aluminum & OPP Film	1	0,78	/	/	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	• Electricity, medium voltage {FR}| market for | Cut-off, U
7.1	OPP Film	1	0,512	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
7.2	Aluminum Lid	1	0,268	Aluminum	Aluminium alloy, AlMg3 {GLO}| market for | Cut-off, U	Sheet rolling	Sheet rolling, aluminium {RER}| processing | Cut-off, U	• Water, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **SUBSTITUTION - TABLE (B7), PP-M LCI, – Butter, Aluminium & Paper Film**

  Assumptions and limitations: The dimensions and grammage are assumed.

Tab B7. PP-M LCI, PRODUCT 07-s – Butter, Aluminum & Paper Film

TABLE B7				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
7-s	Aluminum & Paper film	1	1,32	/	/	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	Electricity, medium voltage {FR}| market for | Cut-off, U
7.1-s	Printable top-coating	1	0,0528			Blade coating		
7.2-s	Greaseproof base paper	1	1,232					

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7.3-s	Aluminum	1	0,0016	Aluminum	Aluminum alloy, AlMg3 {GLO}| market for | Cut-off, U	Vacuum metallization		
7.4-s	Pre-coating	1	0,0352			Blade coating		

PRODUCT 08

- **STATE-OF-THE-ART - TABLE A8, PP-M LCI, – Grated cheese, OPA & LDPE Film**

  Assumptions and limitations: The printing process has been omitted due to the absence of suitable Ecoinvent datasets, only the date of ink has been considered.

Tab A8. PP-M LCI, PRODUCT 08 – Grated cheese, OPA & LDPE Film

TABLE A8				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
8	Grated Cheese Bag	1	2,811	/	/	/		/
8.1	OPA & LDPE Film	1	0,0611	Ink	Printing ink, offset, without solvent, in 47% solution state {RER}|	Printing Ink	/	/
8.2	Complexing Film	1	0,0833	Adhesive	Acrylic binder, with water, in 54% solution state {RER} | Cut-off, U	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	• Electricity, medium voltage {FR}| market for | Cut-off, U
8.3	LDPE Foil	1	1,944	LDPE	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
8.4	OPA Foil	1	0,722	PA	Nylon 6 {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **SUBSTITUTION - TABLE (B8), PP-M LCI, – Grated cheese, Paper bag**

  Assumptions and limitations: The dimensions are assumed to be the same as plastic products. The amount of aluminum nanolayer is an assumption of the grammage; amount of ink is assumed as the same as plastic product.

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Tab B8. PP-M LCI, PRODUCT 08-s – Grated cheese, Paper bag

TABLE B8				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
8-s	Grated Cheese Paper Bag	1	3,7	/	/	/	/	/
8.1-s	Paper & Aluminum bag	1	0,083	Ink	Printing ink, offset, without solvent, in 47% solution state {RER}	Gravure printing		
8.2-s	Top-coating	1	0,128			Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	Electricity, medium voltage {FR}| market for | Cut-off, U
8.3-s	Aluminum Nanolayer	1	0,0044	Aluminum		Vacuum metallization		
8.4-s	Coating 1	1	1,32			Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	• Electricity, medium voltage {FR}| market for | Cut-off, U
8.5-s	Paper	1	3,4					

PRODUCT 09

- **STATE-OF-THE-ART - TABLE A9, PP-M LCI, – Peanut curl, OPP Film**

  Assumptions and limitations: The metallization process for OPP film (9.2) has been omitted due to the lack of specific information retrieved in the data collection (type of process). The printing process has been omitted due to the absence of suitable Ecoinvent datasets, only the date of ink has been considered.

Tab A9. PP-M LCI, PRODUCT 09 – Peanut curl, OPP Film

TABLE A9				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
9	Bag	1	4,456	/	/	/		/

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9.1	OPP Film	1	0,3312	Ink	Printing ink, offset, without solvent, in 47% solution state {RER}|	Printing Ink	/	/
9.2	OPP Film	1	0,2368	Adhesive	Acrylic binder, with water, in 54% solution state {RER} | Cut-off, U	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	Electricity, medium voltage {FR}| market for | Cut-off, U
9.3	PP Foil	1	3,888	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **SUBSTITUTION - TABLE (B9), PP-M LCI, – Peanut curl, Paper & PP bag**

  Assumptions and limitations: The dimensions are assumed as the same as plastics products

  For the Paper/PP bag (9.2-s), a dataset has been used to produce an "average European paper sack", which is a hybrid mix of all types of multiwall paper sacks in Europe. It mixes brown (unbleached) and white (bleached) sack kraft paper, LDPE and HDPE plastic liners and different kinds of glues, all in one.

Tab B9. PP-M LCI, PRODUCT 09-s – Peanut curl, Paper & PP bag

TABLE B9				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
9-s	Bag	1	4,8	/	/	/	/	/
9.1-s	Printing	1	0,1	Varnish				
9.2-s	Paper & PP Bag	1	4,7				Paper sack {RER}| paper sack production | Cut-off, U	•Variation amount paper and PP • Change in dataset of PE with PP • Electricity, medium voltage {FR}| market for | Cut-off, U

PRODUCT 10

- **STATE-OF-THE-ART - TABLE A10, PP-M LCI, – Savory biscuits, OPP & Cardboard**

  Assumptions and limitations: The metallization process for OPP film (10.2) has been omitted due to the lack of specific information retrieved in the data collection (type of process).

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For the Cardboard box (10.1), a dataset has been used for production of a Folding boxboard carton that have not specific data on recycled cardboard.

Tab A10. PP-M LCI, PRODUCT 10 – Savory biscuits, OPP & Cardboard

TABLE A10				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
10	Savory Biscuit	1	25,75	/	/	/		/
10.1	Cardboard Box	1	24			Flat cut	Folding boxboard carton production {RER}| production | Cut-off, U	• Variation amount of Varnish and Ink • Electricity, medium voltage {FR}| market for | Cut-off, U
10.2	OPP Film	1	0,15	Adhesive	Acrylic binder, with water, in 54% solution state {RER} | Cut-off, U	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	• Electricity, medium voltage {FR}| market for | Cut-off, U
10.3	PP Foil	1	1,6	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **SUBSTITUTION - TABLE (B10), PP-M LCI, – Savory biscuits, Paper&PP bag & Cardboard**

  Assumptions and limitations: The bag dimensions are assumed as the same as plastics products**.**

  For the Cardboard box (10.1-s), a dataset has been used for production of a Folding boxboard carton that has not specific data on recycled cardboard.

  For the Paper/PP bag (10.2-s), a dataset has been used to produce an "average European paper sack", which is a hybrid mix of all types of multiwall paper sacks in Europe. It mixes brown (unbleached) and white (bleached) sack kraft paper, LDPE and HDPE plastic liners and different kinds of glues, all in one.

Tab B10. PP-M LCI, PRODUCT 10-s – Savory biscuits, Paper&PP bag & Cardboard

TABLE B10				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
10-s	Savory biscuit box	1	27,32	/	/	/	/	/

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10.1-s	Cardboard box	1	24	Recycled paper		Flat cut	Folding boxboard carton production {RER}| production | Cut-off, U	• Variation amount of Varnish and Ink • Electricity, medium voltage {FR}| market for | Cut-off, U
10.2-s	Paper/PP Bag	1	3,32	/	/	Coextrusion	Paper sack {RER}| paper sack production | Cut-off, U	• Variation amount paper and PP • Change in dataset of PE with PP • Electricity, medium voltage {FR}| market for | Cut-off, U

TRANSPORTS

The inventory data for the transport phase was derived from the modeling and optimization work done by the project partner **UniBo** and presented within WP3. It was chosen to employ distribution data from the work on reuse to maintain homogeneity among methodological choices. The data were then considered up to the consumer distribution stage.

Tab 5. Distribution distances for state-of-the-art and substitution products

EAN	PRODUCT	PRODUCER	PRODUCER TO FILLER [KM]	PACKAGER TO DISTRIBUTION CENTER [KM]
EAN_01	Prepared salad and cut vegetable	LSDH	43	114
EAN_02	Prepared salad and cut vegetable	SODEBO	43	498
EAN_03	Prepared salad and cut vegetable	FLOREALE	43	163
EAN_04	Fromage blanc and fresh cream 500 g	YOPLAIT	168	274
EAN_05	Fromage blanc and fresh cream 500 g	SCHREIBER	168	516
EAN_06	Fromage blanc and fresh cream 500 g	EURIAL	168	235
EAN_08	Peanut curl MDD U_3256225135424	ALTHO	236	310
EAN_09	Bret's_3497917003793	ALTHO	236	321
EAN_10	Mix party_3256225109531	EUROPESNACKS	63	459
EAN_11	Orange Juice_3256225036004	LSDH	378	135
EAN_12	Biscuits Mini GF choco_3256225130955	BISCUITSBOUVARDS	63	173

END-OF-LIFE LCI

Regarding the LCI of the end-of-life phase, a dedicated waste scenario has been defined for each material. For state-of-the-art each waste scenario is composed of the different waste treatments i.e. recycling, incineration and landfill. The percentage of wasted material destined for each waste treatment was defined on the basis of data relating to waste management in the French context; the sources are indicated in the "data source" column (Tab. 6). Furthermore, the table below shows the process with which each waste treatment is modelled in Ecoinvent. The specific waste scenario for each product consists of *(i)* a single waste process if the product is mono-material, or of *(ii)* the combination of two or more waste processes if the product is

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made up of components in different materials. In the latter case, the percentages of material destined for each waste process are defined on the basis of weight percentage of each material on the packaging composition.

Tab 6. End-of-life LCI

		TABLE 6				END OF LIFE	
		WASTE TYPE	MATERIAL % PER WASTE TREATMENT	DATA DESCRIPTION	DATA SOURCE	WASTE TREATMENT	NOTES
Waste scenario	**Waste process**	PA	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PA Recycling	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PA Incineration	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PA Landfill	
	Waste process	PET	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PET Recycling	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PET Incineration	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PET Landfill	
	Waste process	PP	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PP Recycling	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PP Incineration	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PP Landfill	
	Waste process	PVC	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PVC Recycling	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PVC Incineration	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PVC Landfill	
	Waste process	EPS	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	EPS Recycling	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	EPS Incineration	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	EPS Landfill	dataset s for PS
	Waste process	Aluminu m	58	France post-consumer aluminium packaging waste treatment	Citeo Adelphe, 2021	Aluminum Recycling	
			42	France MSW treatment	Eurostat, 2018	Municipal Waste (62% Incineration + 38% Landfill	
	Waste process	Aluminu m & OPP	100	France MSW treatment	Eurostat, 2018	Municipal Waste	

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	Waste process	Cardboard	72	France post-consumer cardboard packaging waste treatment	Citeo Adelphe, 2021	Paper Recycling	
			28	France MSW treatment	Eurostat 2018	Municipal Waste	

For the substitution product, end-of-life data were also collected : all products are recyclable, and some are also compostable (Table 7).

Tab 7. End-of-life LCI

PRODUCT	RECYCLING	COMPOSTING
ID 01-s	n.a.	n.a.
ID 02-s	Y	Y (only the bowl without the lid)
ID 03-s	Y (If the overcap is separated from the cup during sorting)	N
ID 04-s	Y	N
ID 05-s	Y	Y (only the tray)
ID 06-s	Y	N
ID 07-s	Y	N
ID 08-s	Y	N
ID 09-s	Y	N
ID 10-s	Y	N

MATERIALS RECOVERY MODELLING CHOICES: CFF APPLICATION

In order to calculate credits and impacts connected to recycling and energy recovery in the PEF Method, the use of the Circular Footprint Formula (CFF) is prescribed[2]. CFF is composed of three parts corresponding, respectively, to material, energy and disposal (Fig. 2).

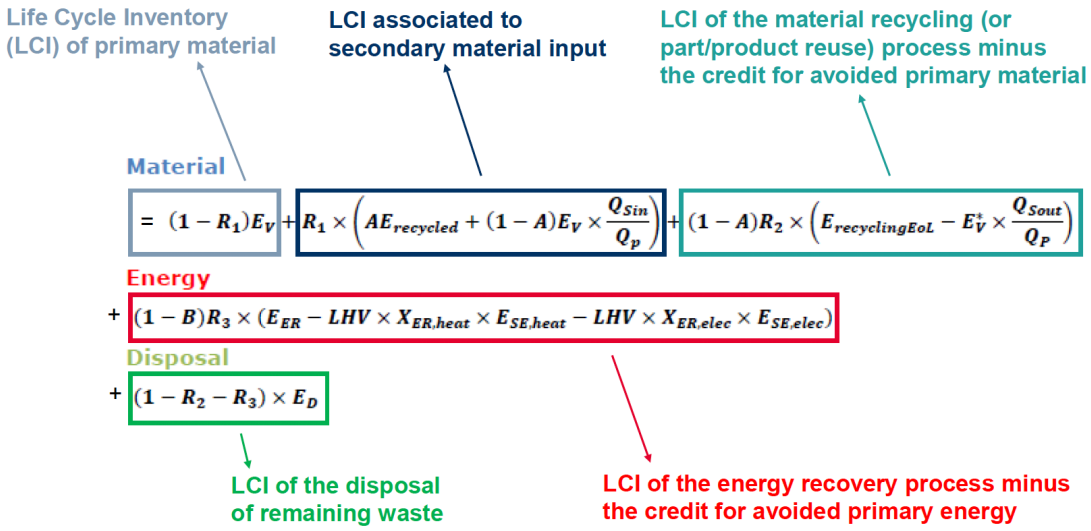

Figure 2: Circular Footprint Formula (CFF)

[2] Zampori, L. and Pant, R., Suggestions for updating the Product Environmental Footprint (PEF) method, EUR 29682 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76- 00654-1, doi:10.2760/424613, JRC11595. § 4.4.8.1 The Circular Footprint Formula (CFF)

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The CFF allows the connection with subsequent and preceding life cycles via debiting (Fig. 4, left) and crediting (Fig. 4, right) which in the cut-off approach, are not considered[3].

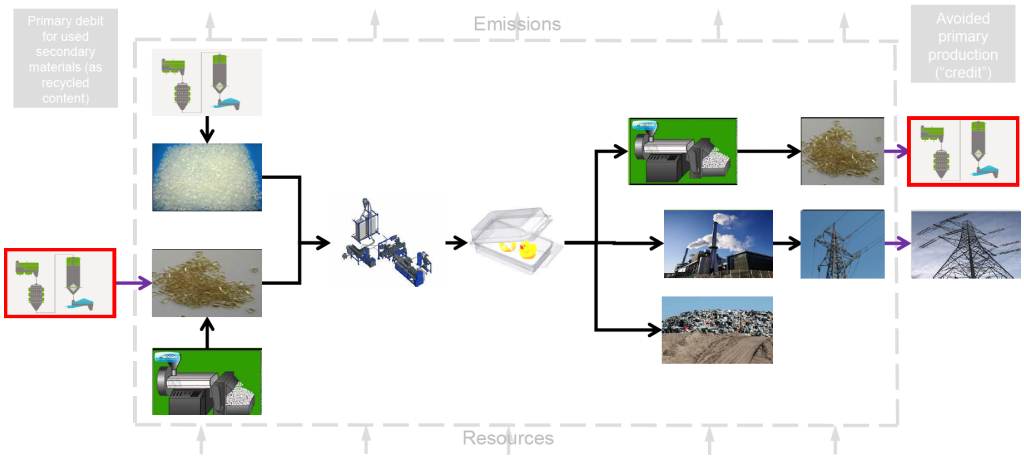

Figure 3: CFF debiting (left) and crediting (right)

Circular Footprint Formula will be implemented in the following deliverable thanks to the recent release of the new EF 3.1 database[4] containing the needed datasets for the calculation in SimaPro.

This deliverable compiles a list of datasets and parameters that will be implemented in the formula. The selected datasets come from the ecoinvent Cut-Off database, ensuring compliance with the current restrictions on publishing EF dataset assessment results.

The list of parameters has been divided in two macro-groups: the first one is related to the materials (Tab.8) and the second to the end-of-life treatments (Tab. 9).

For materials whose recycled content is known, relevant parameters were collected to describe the benefits given by their use. For all other materials, not knowing their composition and not being able to refer to national average values, following PEF guidance, they were considered to be composed of 100 percent virgin material, thus collapsing the first section of the formula.

3 Wolf, M. A., The Circular Footprint Formula (CFF) and its practical application training. Environmental Footprint (EF) transition phase, 2019. Webinar available in: https://ec.europa.eu/environment/eussd/videos/2019-10-08%2016.01%20The%20Circular%20Footprint%20Formula.mp4

4 Environmental Footprint database 3.1: https://simapro.com/products/environmental-footprint-database/

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Tab 8. CFF parameters - materials

MATERIAL	PARAMETER	VALUE
RPET	Erecycled	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| market for polyethylene terephthalate, granulate, amorphous, recycled | Cut-off, U
	Ev	Polyethylene terephthalate, granulate, amorphous {Europe without Switzerland}| polyethylene terephthalate, granulate, amorphous, recycled to generic market for amorphous PET granulate | Cut-off, U
	A	0,5
	Qsin/QP	0,9
	R1	0,5
COLOURLESS GLASS	Erecycled	Packaging glass, green {RER w/o CH+DE}| packaging glass production, green | Cut-off, U
	Ev	Packaging glass, white {RER w/o CH+DE}| packaging glass production, white | Cut-off, U
	A	0,2
	Qsin/QP	1
	R1	0,4
GREEN GLASS	Erecycled	Packaging glass, brown {RER w/o CH+DE}| packaging glass production, brown | Cut-off, U
	Ev	Packaging glass, white {RER w/o CH+DE}| packaging glass production, white | Cut-off, U
	A	0,2
	Qsin/QP	1
	R1	0,8

End-of-life parameters for all materials were collected and modeled in order to implement the CFF. Parameters R2, R3 and D (given by 1-R2-R3) were derived from the research on EoL paragraph.

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Tab 9. CFF parameters - end-of-life processes

MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
PET	PET Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polyethylene terephthalate, granulate, bottle grade {CH}| polyethylene terephthalate, granulate, bottle grade, recycled to generic market for bottle grade PET granulate | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| market for polyethylene terephthalate, granulate, amorphous, recycled | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C, PET mechanical recycling
	PET Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
	PET Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, municipal incineration | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		LHV	23,6	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatola in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatola in cartone ondulato"
		B	0	ANNEX C
ALUMINIUM FOIL	ALUMINIUM FOIL Recycle	R_2	0,58	Citeo Adelphe, 2021
		E*v	Aluminium alloy, AlMg3 {GLO}| market for aluminium alloy, AlMg3 | Cut-off, U	
		$E_{recyclingEoL}$	Aluminium scrap, post-consumer {GLO}| market for aluminium scrap, post-consumer | Cut-off, U	
		A	0,2	ANNEX C
		Q_{Sout}/Qp	1	ANNEX C
	ALUMINIUM FOIL Disposal	D	0,42	Eurostat, 2018
		Ed	Waste aluminium {RoW}| treatment of waste aluminium, sanitary landfill | Cut-off, U	
	ALUMINIUM FOIL Energy Recovery	R_3	0	
		E_{ER}	-	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		LHV	0	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatola in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatola in cartone ondulato"
		B	0	ANNEX C
PP	PP Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polypropylene, granulate {RER}| production | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{recyclingEoL}$	Polyethylene, high density, granulate, recycled {Europe without Switzerland}| polyethylene production, high density, granulate, recycled | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C
	PP Disposal	D	0,39	Plastics Europe, 2022
		Ed	Waste polypropylene {CH}| treatment of, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
	PP Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polypropylene {CH}| treatment of, municipal incineration | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		LHV	44,3	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatola in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatola in cartone ondulato"
		B	0	ANNEX C

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MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
PVC	PVC Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polyvinylchloride, suspension polymerised {GLO}| market for polyvinylchloride, suspension polymerised | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| polyethylene terephthalate production, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	PVC Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polyvinylchloride {CH}| treatment of, sanitary landfill | Cut-off, U	
	PVC Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polyvinylchloride {CH}| treatment of, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	17,95	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
EPS	EPS Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polystyrene, expandable {RoW}| polystyrene production, expandable | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| polyethylene terephthalate production, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C
	EPS Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polystyrene {CH}| treatment of, sanitary landfill | Cut-off, U	
	EPS Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste expanded polystyrene {CH}| treatment of, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	41,1	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
LDPE	LDPE Recycle	R_2	0,29	Plastics Europe, 2022
		E*v	Polyethylene, low density, granulate {RER}| production | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{recyclingEoL}$	Polyethylene, high density, granulate, recycled {Europe without Switzerland}| polyethylene production, high density, granulate, recycled | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	LDPE Disposal	D	0,39	Plastics Europe, 2022
		Ed	Waste polyethylene {CH}| treatment of, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
	LDPE Energy Recovery	R_3	0,32	Plastics Europe, 2022
		E_{ER}	Waste polyethylene {CH}| treatment of, municipal incineration | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	42,27	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		XER,elec	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C

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MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
PA	PA Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Nylon 6{RER}| market for nylon 6 | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| polyethylene terephthalate production, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	PA Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste plastic, mixture {CH}| treatment of waste plastic, mixture, sanitary landfill | Cut-off, U	
	PA Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste plastic, mixture {CH}| treatment of waste plastic, mixture, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	30,85	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
HDPE	HDPE Recycle	R_2	0,29	Plastics Europe, 2022
		E*v	Polyethylene, low density, granulate {RER}| production | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene, high density, granulate, recycled {Europe without Switzerland}| polyethylene production, high density, granulate, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	HDPE Disposal	D	0,39	Plastics Europe, 2022
		Ed	Waste polyethylene {CH}| treatment of, sanitary landfill | Cut-off, U	
	HDPE Energy Recovery	R_3	0,32	Plastics Europe, 2022
		E_{ER}	Waste polyethylene {CH}| treatment of, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	42,27	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
RPET	RPET Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polyethylene terephthalate, granulate, bottle grade {CH}| polyethylene terephthalate, granulate, bottle grade, recycled to generic market for bottle grade PET granulate | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| market for polyethylene terephthalate, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C
	RPET Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, sanitary landfill | Cut-off, U	
	RPET Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	23,6	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C

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MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
CARDBOARD	CARDBOARD Recycle	R_2	0,75	RCP Made Green in Italy "Pere"
		E*v	Sulfate pulp, unbleached {RER}| sulfate pulp production, from softwood, unbleached | Cut-off, U	RCP Made Green in Italy "Pere"
		$E_{recyclingEoL}$	Waste paper, sorted {Europe without Switzerland}| treatment of waste paper, unsorted, sorting | Cut-off, U	RCP Made Green in Italy "Pere"
		A	0,2	Annex C
		Q_{Sout}/Qp	0,85	Annex C
	CARDBOARD Disposal	D	0,14	
		Ed	Waste paperboard {CH}| treatment of, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Pere"
	CARDBOARD Energy Recovery	R_3	0,11	RCP Made Green in Italy "Pere"
		E_{ER}	Waste paperboard {CH}| treatment of, municipal incineration | Cut-off, U	RCP Made Green in Italy "Pere"
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	19,7	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
COLOURLESS GLASS	COLOURLESS GLASS Recycle	R_2	0,4	
		E*v	Packaging glass, white {GLO}| market for packaging glass, white | Cut-off, U	
		$E_{recyclingEoL}$	Packaging glass, brown {GLO}| market for packaging glass, brown | Cut-off, U	
		A	0,2	ANNEX C
		Q_{Sout}/Qp	1	ANNEX C
	COLOURLESS GLASS Disposal	D	0,6	
		Ed	Waste glass {GLO}| treatment of waste glass, sanitary landfill | Cut-off, U	
	COLOURLESS GLASS Energy Recovery	R_3	0	
		E_{ER}	-	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	0	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
GREEN GLASS	GREEN GLASS Recycle	R_2	0,66	
		E*v	Packaging glass, green {GLO}| market for packaging glass, green | Cut-off, U	
		$E_{recyclingEoL}$	Packaging glass, brown {GLO}| market for packaging glass, brown | Cut-off, U	
		A	0,2	ANNEX C
		Q_{Sout}/Qp	1	ANNEX C
	GREEN GLASS Disposal	D	0,34	
		Ed	Waste glass {GLO}| treatment of waste glass, sanitary landfill | Cut-off, U	
	GREEN GLASS Energy Recovery	R_3	0	
		E_{ER}	-	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	0	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C

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3. PART B: REUSE

In the current phase of the project, WP3 activities are in the demonstration stage for reusable packaging solutions. The data collection phase has retrieved data for reusable packaging selected as replacements for disposable systems. Table 10 presents both the single-use products initially identified and assessed in D6.1B and the reusable alternatives introduced. As previously mentioned, updated state-of-the-art analyses will be conducted in order to prepare the products for the incoming comparative analysis (D6.3). Six new reusable products have been added (15-r, 16-r,17-r, 18-r, 19-r, 20-r) and their state-of-the-art will be represented by the same products, but modeled within single-use systems.

Tab 10. Product selected for REUSE

STATE OF THE ART (REUSE)			REUSE PACKAGING		
Food category: Prepared fruits					
Product: Florette Shaker Ananas					
	**Format**	Preformed PET Shaker, thin PET foil lid		**Format**	PP Tray + PP lid
	Food weight	400 ml		**Food weight**	1261 ml - 250 gr
	Company	Floréale		**Company**	Floréale (Agrial)
	LCA ID	01		**LCA ID**	01-r
Food category: Prepared salad					
Product: Salad MDD					
	**Format**	PET Tray		**Format**	PP Tray + PP lid
	Food weight	250 g		**Food weight**	1261 ml - 250 gr
	Company	LSDH		**Company**	LSDH/ Sodebo / Floreale
	LCA ID	02		**LCA ID**	02-r
Food category: Sour cream					
Food category: Yoghurt					
	**Format**	PP Cup		**Format**	PP pot + PP lid
	Food weight	200 g		**Food weight**	500 gr
	Company	Yoplait		**Company**	Yoplait/Eurial/ Schreiber
	LCA ID	03		**LCA ID**	03-r
Food category: Yoghurt					
Product: GreekYoghurt					
	**Format**	PP Cup		**Format**	PP pot + PP lid
	Food weight	450 g		**Food weight**	500 gr
	Company	Yoplait		**Company**	Yoplait /Eurial/ Schreiber
	LCA ID	04		**LCA ID**	04-r
Food category: In-shop product					
Product: Pork chop					
	**Format**	EPS Tray		**Format**	PP Salad Tray
	Food weight	500 g		**Food weight**	500g (tbd)
	Company	(none)		**Company**	System U & Carrefour
	LCA ID	05		**LCA ID**	05-r

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Food category: Chips **Product: Peanutes curl**					
	**Format**	OPP Film		**Format**	PP Bucket 3,5L
	Food weight	125 g		**Food weight**	250 gr - 3500 ml
	Company	Altho		**Company**	Altho
	LCA ID	09		**LCA ID**	09-r
Food category: Savory biscuits **Product: Mix party savory biscuits**					
	**Format**	OPP Sachet & Cardboard		**Format**	PP Bucket 1L
	Food weight	85- 105 g		**Food weight**	100 gr
	Company	Europe Snacks		**Company**	Europe Snacks
	LCA ID	10		**LCA ID**	10-r1
Food category: Savory biscuits **Product: Mix party**					
	**Format**	OPP Sachet & Cardboard		**Format**	PP Bucket 2L
	Food weight	85- 105 g		**Food weight**	200 gr
	Company	Europe Snacks		**Company**	Europe Snacks
	LCA ID	10		**LCA ID**	10-r2
Food category: Juice **Product: Orange Juice**					
	**Format**	Clear Bottle with 50% recycled		**Format**	Glass bottle 1L
	Food weight	1 l		**Food weight**	1 l
	Company	LSDH		**Company**	LSDH
	LCA ID	11		**LCA ID**	11-r
Food category: Milk **Product: UHT milk**					
	**Format**	PET opaque Bottle		**Format**	Glass bottle 1L
	Food weight	1 l		**Food weight**	1 l
	Company	LSDH		**Company**	LSDH
	LCA ID	12		**LCA ID**	12-r
Food category: Milk **Product: UHT milk**					
	**Format**	PEHD Bottle		**Format**	Glass bottle 1L
	Food weight	1 l		**Food weight**	1 l
	Company	Sodiaal		**Company**	Sodiaal
	LCA ID	13		**LCA ID**	13-r

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Food category: Savory biscuits **Product: Minis GF Choco**					
	**Format**	cardboard box + flowpacks		**Format**	PP Bucket 1L
	Food weight	168 g		**Food weight**	350g
	Company	Biscuit bouvard		**Company**	Biscuit bouvard
	LCA ID	14		**LCA ID**	14-r
Food category: Yoghurts **Product: Fromage blanc 2 kg**					
				**Format**	PP Bucket 2L
				Food weight	2 kg
				Company	Rians
				LCA ID	15-r
Food category: Boissons **Product: Syrup**					
				**Format**	Clear glass bottle with PEHD Closure
				Food weight	700 ml
				Company	Monin
				LCA ID	16-r
Food category: Condiments **Product: Mayonnaise**					
				**Format**	Clear glass jar with metallize closure
				Food weight	475 g
				Company	Lesieur
				LCA ID	17-r
Food category: Oil **Product: Olive Oil**					
				**Format**	Glass bottle with PEHD closure
				Food weight	250 ml
				Company	Lesieur
				LCA ID	18-r
Food category: Boissons **Product: Sweet/brut cider**					
				**Format**	Glass bottle with corp and metal lid
				Food weight	750 ml
				Company	Eclor
				LCA ID	19-r

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Food category: Boissons Product: Lemonade		
	Format	Glass bottle
	Food weight	750 ml
	Company	Source de Soulzmatt
	LCA ID	20-r

As shown in Table 10, many of the selected packaging options have undergone size increases to accommodate the logistical needs of reuse systems. For example, yogurt containers have shifted from 200g to 500g, and chip bags from 125g to 600g. These changes raise potential implications for the environmental analysis.

Since the objective of the study is to compare single-use packaging with reusable packaging, any variables that differ between the two systems add complexity to the analysis and introduce further implications. Some of these key variables are:

- **Consumer habits**: Changes in packaging size may influence purchasing patterns and consumption behavior. Larger packaging could lead to alterations in buying frequency or product usage, complicating a direct comparison with single-use packaging.
- **Food waste**: The impact of larger packaging on food waste is another critical variable. With increased portion sizes, the potential for waste may differ significantly between reusable and single-use systems, affecting the overall sustainability assessment.
- **Acceptability of larger formats**: Consumer acceptance of larger packaging formats presents an additional challenge. The factors influencing their willingness to adopt or reject these new sizes—such as convenience, storage space, or perceived value—can introduce variations that make it harder to draw direct conclusions between the two types of packaging.

However, the data have been processed with the best possible compromises, and these potential implications, which were addressed within WP2, will not be factored into the final analysis. These variables must be considered as primary implications and limitations of the study. The methodology has aimed to mitigate their impact to ensure a more straightforward comparison between the state-of-the-art and reusable packaging. As a result, these differences will be acknowledged but excluded from the core analysis to maintain clarity and focus on the primary objectives of the study.

3.1 GOAL OF THE STUDIES

The goal of this comparative LCA study is to identify the break-even point, defined as the moment when the reuse system begins to generate net environmental benefits compared to disposable systems. The study evaluates two packaging solutions: state-of-the-art disposable packaging and reusable packaging across multiple cycles.

This analysis is part of the R3PACK project, specifically Task 6.3 (Part B), which aims to assess the environmental impacts and identify potential improvements through reuse strategies defined in WP3. The target audience consists of WP3 partner contributors, while R3PACK serves as the commissioning body.

The figure below illustrates the relationship between environmental impact and the number of uses for two packaging systems: a single-use system (represented by the dashed blue line) and a reusable system (represented by the orange curve). The break-even point, marked with a red "X", indicates the point where the reusable system begins to generate net environmental benefits compared to the single-use system. As shown, with each additional use, the environmental impact of the reusable system decreases

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until it flattens, signifying convergence in the long-term impact.

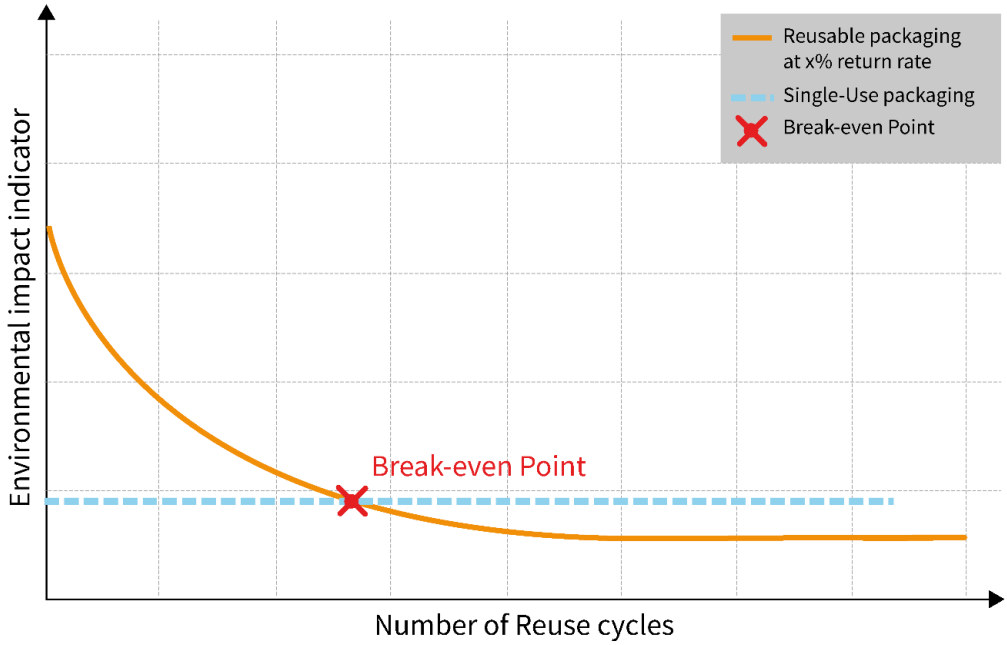

Figure 4: Break-even Point definition

The objective is to evaluate the performance of both systems at the break-even point and, if relevant, at different cycle numbers, especially when the environmental impact curve of the reuse system flattens (convergence).

The data about the return rate has been taken from the projects outputs of WP2 and WP3. In particular, in *D3.4: Decision-support model for reuse logistic network design (pag.36)*, states that consumer return behaviour showed a 60% likelihood of returning packaging to stores, 8% in residential districts, and 32% not returning it at all. Additionally, a 5% scrap rate was applied to account for packaging losses due to breakage and wear.

Following is presented the calculation for the **64.6% return rate:**

- **Total Collection (Theoretical Return Rate):**
  - Probability of returning to stores: 60%
  - Probability of returning in residential districts: 8%
  - Initial total: 60% + 8% = 68%
- **Losses Due to Scrap:**
  - The scrap rate, accounting for breakage and wear, was estimated at 5%.
- **Effective Return Rate:**

  By applying the scrap rate to the theoretical rate:

  Effective Return Rate=68%×(1−0.05)=68%×0.95=64.6%

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If with the assumption of a return rate based on 64.6%, a break-even point will not be found, sensitivity analyses will be conducted to determine the ideal return rate required to achieve it. This analysis consists in variating the initial assumption—either increasing or decreasing the return rate—aiming to identify the specific rate at which the break-even point is reached. This process will help explore a range of outcomes, assessed qualitatively.

The impact evaluation follows the Life Cycle Assessment (LCA) methodology, in compliance with ISO 14040 and 14044 standards, and is performed using SimaPro software (PRé Sustainability). The environmental indicators and datasets align with the Product Environmental Footprint (PEF) methodology, as recommended by the European Commission in Recommendation 2021/2279. Due to the transitional phase of the Environmental Footprint (EF) framework and the absence of finalized PEFCRs for packaging products, the study transparently declares all limitations, assumptions, and deviations from the PEF methodology throughout the report.

3.2 SCOPE OF THE STUDIES

a. Functional Unit and reference flow

During the inventory data acquisition phase, it became evident that, in some cases, the capacity of the packaging changed compared to the packaging considered in the state-of-the-art analyses.

This change of size implies that, in these cases, the functions of the two containers are not completely comparable. A package made to carry a large amount of food does not fulfill the same function as a smaller size package. It often happens, for example, that the two food quantities are sold to a different target audience.

It was therefore chosen to go for a variation of the Functional Unit by introducing a fixed amount of food contained. In this way it is possible to fix a parameter on which to base the comparison and ensure greater homogeneity between the data and between the results of the analyses, making it easier for the reader to understand.

The Functional Unit of the analyzed system is defined as follow: “The packaging required to contain, protect, and preserve 100 grams of food over the duration of the expected shelf life, to ensure food safety, quality, and integrity throughout the distribution chain”.

Tab 11. Functional Unit aspects

ASPECT	DESCRIPTION
i) Functions or services provided (What)	Contain, preserve, protect food, and provide information about the product content defined in the "Food category" item in Table 10 (e.g. prepared fruits) throughout the distribution chain.
ii) Extent of the function (How much)	The quantity of product to be packaged is 100 grams.
iii) Expected level of quality (What quality)	Guarantee food safety performance and shelf-life
iv) Duration/lifetime of the product (For how long)	Equal to the food’s expected shelf-life.
Reference Flow	The mass of packaging material (single-use or allocated for reuse cycles) required to deliver 100 grams of food.

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A density of 1 g/cm^3 was assumed for liquid products to simplify calculations and enhance the clarity of inventory proportioning steps. This approximation aids in streamlining the process. The table below provides average density values for liquid products, as reported in literature.

Tab 12. Density of the liquids involved

PRODUCT	DENSITY (g/ml)	SOURCE
Milk	1,030- 1,036	FAO/INFOODS Density Database version 1.0 (July 2011)[5]
Olive Oil	0,918	
Lemonade	1,020	
Cyder	1,007-1,017	
Fruit Syrup	1,280-1,340	
Orange Juice	1,060	

3.3 SYSTEM BOUNDARY

In order to provide an adequate comparison with single use packaging, coherent with the Functional Unit selected, the modelisation of the Life Cycle of reusable packaging has been set considering the following macro-phases: raw material acquisition and pre-processing, manufacturing, distribution stage, use stage and end-of-life.

The lifecycle of reusable packaging requires that, after they are produced, they support several reuse cycles, the number of which (abbreviated hereafter as N) determines the lifecycle duration. The reuse rate is the number of times a material is used at the factory. Consequently, the packaging undergo the phases of filling, distribution, use, washing and recovery N times. Visually, this can be represented as a fundamentally circular diagram, where a series of life phases are repeated N times, while the production and end-of-life phases are, inherently, unique.

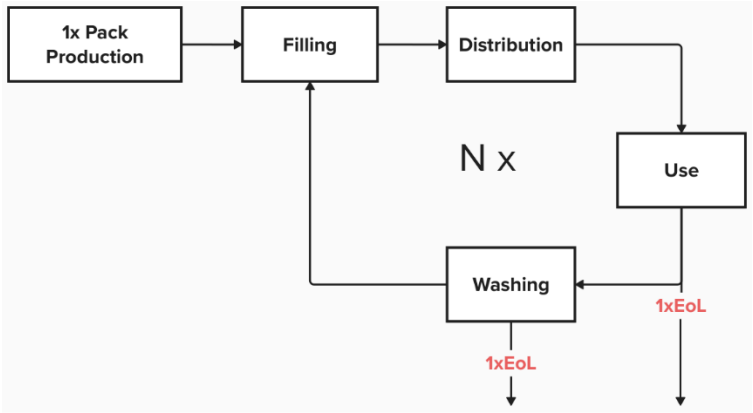

Figure 5: modelisation of the Life Cycle of reusable packaging

If a life cycle analysis of this type were carried out, considering the phases that repeat N times, it would be possible to obtain the cumulative values of the environmental impacts of the bottle throughout its entire life cycle.

[5] https://www.fao.org/fileadmin/templates/food_composition/documents/upload/Density_databse_v1_final.pdf

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Since in the case of single use packaging the life cycle ends after the consumption of the goods by the customer, while in the case of the reusable packaging the life cycle can proceed for several cycles of use, to provide an effective comparison between the two, it has been chosen to assess the impacts of the single cycle of distribution.

This implies that the life cycle scheme for reusable components has to consider one time the phases that repeats during the lifecycle and to distribute the other stages that occur just once on the number of phases.

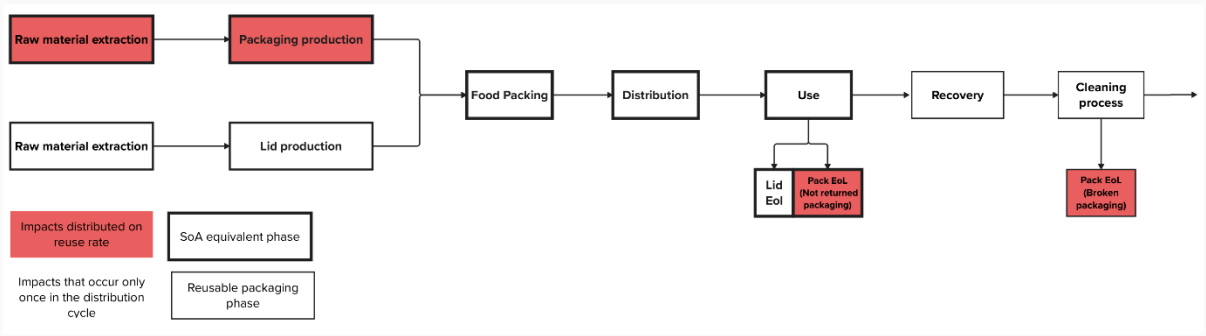

Figure 6: Expanded modelisation of the Life Cycle of reusable packaging

All the processes attributed to the packaging are listed in the Life Cycle Inventory (LCI) divided by life cycle stages. Here below, a list of the processes considered for each stage is provided, with a specific description of the modelling choices.

Packaging raw materials acquisition and pre-processing: this life cycle stage begins when resources are extracted from nature and ends when product components enter the packaging production plant. In particular, it includes the pre-processing of material inputs. According to PEF method, the raw materials consumption shall be calculated dividing the actual weight of the packaging by the number of times the packaging is reused. In this way, the impacts coming from the extraction of resources are distributed over the reuse rate. The transportation related to the acquisition of raw materials is partly modelled by ecoinvent market processes datasets.

Packaging manufacturing: the production stage begins when the raw materials enter the production site and ends when the packaging components leave the production facility. The transportation related to the acquisition of raw materials is partly modelled by ecoinvent market processes datasets.

Packaging transport from packaging manufacturer to the product factory: according to PEF method, this transport impact shall be calculated, as all phases that are unique during the lifecycle, by dividing the one-way trip impact by the number of times the packaging is reused.

Filling stage: in this phase the packaging is filled with food and all the other accessory components, as the single use lids, are added to the assembly.

Distribution to final user: this transport stage has been modelled considering the one way trip from the filling plant to the user house.

Use stage: in this phase, it is assumed that users dispose of the single-use lids, while a fraction of the containers are retained by customers and eventually reach end-of-life. This fraction represents the likelihood that some packaging will be removed from the reuse scheme by customers and is object of sensitivity analysis.

Recovery: empty packaging are recovered by using Reverse Vending Machines, placed in stores or in district.

Transport to washing centers: empty packaging are then transferred to the washing center, where they are inspected and cleaned.

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Washing process: in this stage, packaging are cleaned and regenerated for further reuses. the fraction that is damaged due to previous uses is sent off to end of life.

Loss rate modeling: in life cycle modeling, two points were identified where packaging output flows are concentrated, within the use and withing the washing phases. In contrast, at each reuse cycle, packaging that is lost is reintegrated by feeding new packaging into the stream.

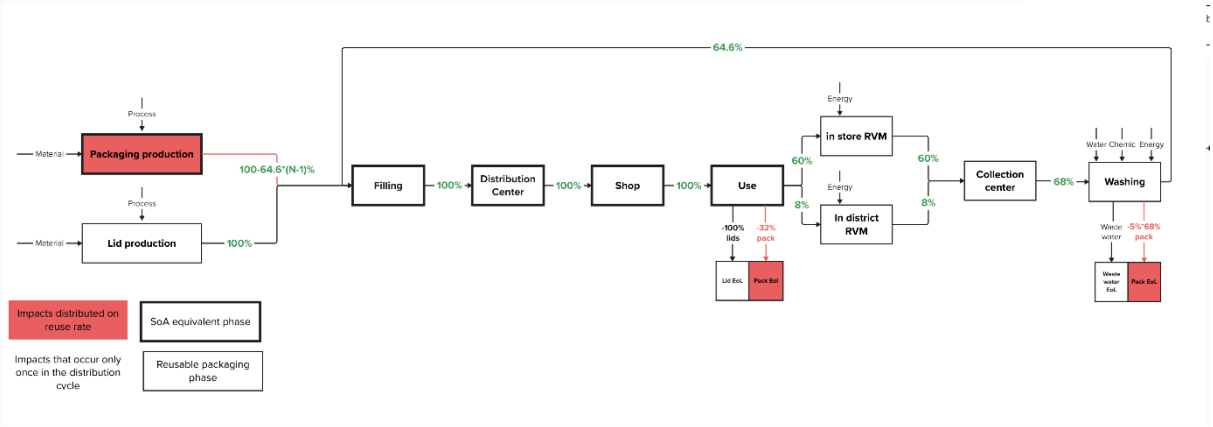

Figure 7: Loss rate modeling

This results in more accurate modeling of reuse rates, taking into account loss rates and the different amortizations of packaging based on different reuse numbers.

As reuse cycles increase, the virtual composition of containers varies, with containers having experienced different numbers of reuses.

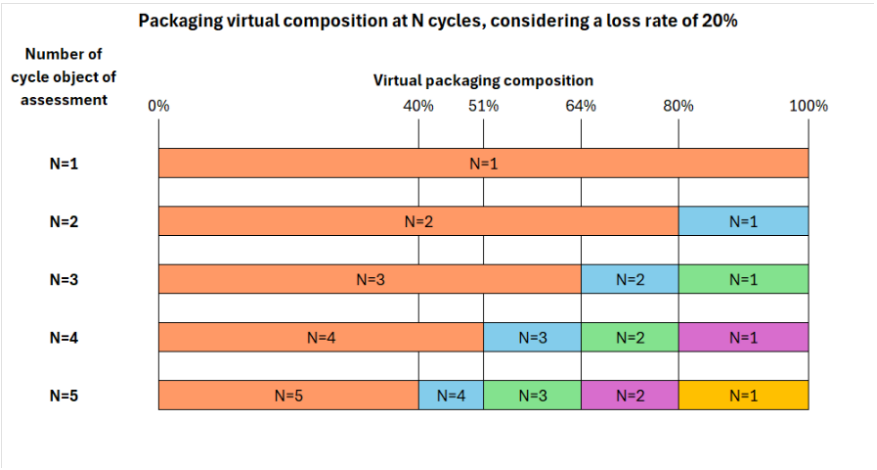

Figure 8: Virtual composition of containers

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To accurately describe the virtual mass of the containers, taking into account the different allocations of reuse cycles for progressively reintegrated containers, the following function has been defined:

$$m(n) = \frac{(1-q)^n}{n+1} + q\sum_{k+1}^{n-1}\frac{(1-q)^k}{k+1}$$

where $m(n)$ represents the virtual composition of the packaging, at n number of cycles, q the percentage of containers loss at every reuse cycles and k denotes each intermediate cycle from 1 to n-1.

The behavior described by this formula can be rearranged as follows:

$$m(n) = \frac{m}{n}(1-q)^{n-1} + q\sum_{n-2}^{n}\frac{m}{n-1}(1-q)^{n-2}$$

where m is the mass of the packaging, n the number of cycles of the most used packaging in use and q the percentage of container loss at every reuse cycles.

The formula can be described by splitting it in two sections. The first element, represented by the function $\frac{m}{n}(1-q)^{n-1}$ describes the allocation of the containers that are in use since the first cycle. Their mass is then allocated on the number of reuses, taking into account the fact that at each cycle, a percentage of them is sent to end of life. The remaining ones, sustain several reuse cycles.

The second element in the formula, represented by the summatory function $q\sum_{n-2}^{n}\frac{m}{n-1}(1-q)^{n-2}$ describes how the novel packaging that are immitted to reintegrate the losses, sustain a lower number of reuses then the original ones. At the same time, the population of reintegrated packaging that have sustained a higher number of reuse cycles, decreases with the increasing of rotations.

The behavior described by this formula has been employed to model the virtual composition of the mass of reusable packaging as the number of reuses changes. In particular, this formula has been used to allocate the mass on the number of reuses for the phases of raw materials acquisition and preprocessing, production, transport to filling plant and end of life stages for reusable packaging.

As an example of the application of the model, considering a packaging with mass of 100g, a return rate of 68% of the original packaging and a breakage rate of 5% (see §3.1 Goal of the study) of the remaining one, it is possible to obtain the following values for the mass across the variation of the number of cycles:

Tab 13. Example of virtual composition of containers

NUMBER OF CYCLES	VIRTUAL MASS
1	100,00
2	67,70
3	60,74
4	58,50
5	57,63
6	57,25
7	57,08
8	57,00
9	56,95
10	56,93
11	56,92
12	56,91

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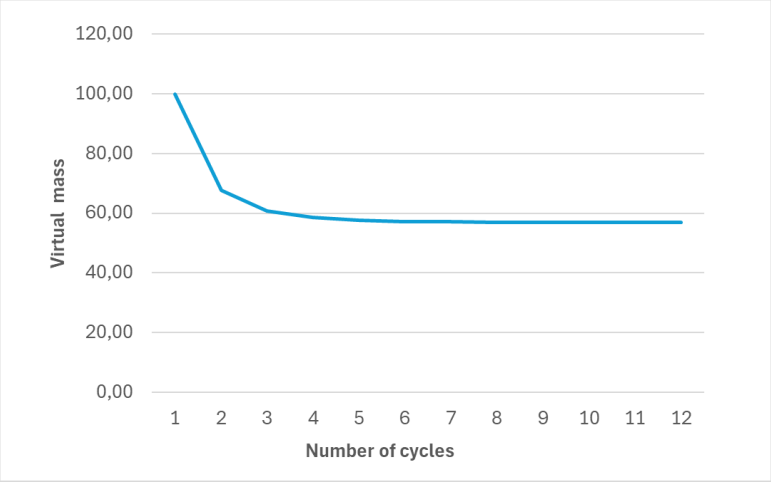

Figure 9: Example of virtual composition of containers

Loss and breakage rate: in the life cycle model, packaging is lost during the use phase when customers do not return it to the RVM, and when containers are deemed unfit for further reuse cycles during the washing process. Due to the absence of real data from the demonstration project, a reference base scenario, coherent with the one described in the WP3.4 work, has been selected. In particular, it has been considered a likelihood of not returning the containers of 32% and a breakage rate of 5%.

Transport modelling: transport distances used in the model were sourced from WP3. Specifically, precise transport distances between the different stages were determined accounting for variations in the system at the variation of return and breakage rates.

3.4 ENVIRONMENTAL FOOTPRINT IMPACT CATEGORIES

LCA results are presented through various environmental impact categories. For the impact assessment, all the 16 EF (Environmental Footprint) impact categories shown in Table 14 are considered together with an all-encompassing value expressed in Pt obtained by weighting the different categories through appropriate factors. In the interpretation phase, only the most relevant impact categories are considered. Table 14 shows the list of all the EF 3.1 impact categories, and related indicators and units are provided[6].

Tab14. impact categories and related indicators and units.

Impact category	Indicator	Unit	LCIA method
Acidification	Accumulated Exceedance (AE)	mol H+ eq	Accumulated Exceedance
Climate change	Radiative forcing as Global Warming Potential (GWP100)	kg CO2 eq	Baseline model of 100 years of the IPCC (based on IPCC 2013)
Ecotoxicity, freshwater	Comparative Toxic Unit for ecosystems (CTUe)	CTUe	USEtox model

[6] Zampori, L. and Pant, R., Suggestions for updating the Product Environmental Footprint (PEF) method, EUR 29682 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76- 00654-1, doi:10.2760/424613, JRC11595. § 3.2.3 Environmental Footprint impact categories, Tab. 2

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Eutrophication, marine	Fraction of nutrients reaching marine end compartment (N)	Kg N eq	EUTREND model
Eutrophication, freshwater	Fraction of nutrients reaching freshwater end compartment (P)	Kg P eq	EUTREND model
Eutrophication, terristrial	Accumulated Exceedance (AE)	mol N eq	Accumulated Exceedance
Human toxicity, cancer	Comparative Toxic Unit for humans (CTUh)	CTUh	USEtox model
Human toxicity, non-cancer	Comparative Toxic Unit for humans (CTUh)	CTUh	USEtox model
Ionising radiation	Human exposure efficiency relative to U235	KBq U-235 eq	Human health effect model
Land use	Soil quality index	Dimensionless (pt)	Soil quality index based on LANCA (ECJRC)
Ozone depletion	Ozone Depletion Potential (ODP)	kg CFC-11 eq	Steady-state ODPs as in (WMO 1999)
Particulate matter	Impact on human health	disease inc.	PM method recomended by UNEP
Photochemical ozone formation	Tropospheric ozone concentration increase	kg NMVOC eq	LOTOS-EUROS model as implemented in ReCiPe 2008
Resource use, fossils	Abiotic resource depletion – fossil fuels (ADP-fossil)	MJ	CML 2002
Resource use, minerals and metals	Abiotic resource depletion (ADP ultimate reserves)	kg Sb eq	CML 2002
Water use	User deprivation potential (deprivation-weighted water consumption)	m3 depriv.	Available WAter REmaining (AWARE)

3.5 DATA COLLECTION AND QUALITY

a. Data collection

In accordance with the WP3 timeline, the data collection phase was conducted in a structured manner, though the availability of certain detailed data was limited. This limitation aligns with the general scarcity of information identified during the state-of-the-art data collection (D6.1b). The primary focus of data gathering was on core packaging characteristics, which are summarized in the accompanying table sent to (RE)SET .

Initial data collection centered on key parameters, including the description of single-use and reusable packaging, specific food category, product selection for demonstrator purposes, packaging capacity (in ml), global weight (in grams), product weight, packaging weight, and process technology. Detailed material information was also documented, covering the main packaging body material and accessory elements (such as caps, labels, and other components). For each accessory component, we noted whether it is disposable or reusable in line with the container's reuse cycle.

Beyond these core parameters, additional data requests were addressed. As a starting point, transportation distances have been provided by the UniBo team through the calculation of a median for each transportation phase, with specific focus on refrigerated trucks for certain product references.

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The washing process was another key area, where primary data on water and detergent consumption, energy usage, and process efficiency were collected for glass bottles. More detailed data on the washing process for other types of packaging remains pending.

To enhance the sustainability analysis, technical specifications for the Reverse Vending Machines (RVMs) in use were requested, including details on energy consumption, machine weight, material composition, and efficiency. Information on the daily processing capacity of these machines was gathered to estimate energy allocation per packaging unit. The targeted frequency for emptying the RVMs has been established as once per month, although further details on machine fill-up rates are needed, as usage rates depend on user behavior.

The following table summarizes the data collection activity:

Tab 15. Data collection activity description

CATEGORY	DETAILS REQUIRED	INFORMATION COLLECTED	DATA SOURCE
Packaging Description	Description of single-use and reusable packaging	Initial data collected, details provided for demonstrators	**Primary data** from (RE)SET
Packaging Capacity	Capacity in ml	Collected, pending specific packaging types	**Primary data** from (RE)SET
Weights	Global weight, weight of product, weight of packaging	Data collected	**Primary data** from (RE)SET
Process Technology	Technology used for packaging manufacturing	General information provided, specific manufacturing inputs taken from Ecoinvent database	**Primary data** from (RE)SET, secondary dataset from Ecoinvent database.
Packaging Composition	Main packaging body material, components, and whether components are disposable or reusable	General components material recorded; accessory elements' reuse/disposal noted	**Primary data** from (RE)SET, specific material composition taken from Ecoinvent database
Transportation Details	Distances between operational stages of life cycle	Collected for specific transportation stages based on EAN codes	**Primary data** processed data from UniBo
Washing Process	Water and detergent usage, energy consumption, process efficiency	Primary data available for glass bottles	**Primary data** from (RE)SET
Reverse Vending Machine (RVM)	Technical datasheet with energy consumption, machine weight, material, and efficiency	Information on RVMs collected	**Primary data** from (RE)SET
Efficiency	Efficiency data for washing and RVM processes (number of pieces processed and time to fill machine)	Initial data provided; pending specific usage rates	**Primary data** from (RE)SET
End of Life	Share and treatment process characteristics	French specific data gathered	Secondary data from statistics, process datasets from Ecoinvent

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b. Data quality

To support the initiation of Life Cycle Assessment (LCA) studies, the quality and consistency of the collected data are essential. The primary and secondary data sources are presented in Table 15.

In particular, for primary data, packaging characteristics, weights, materials, and process details—were provided by (RE)SET, while processed transportation data, including EAN codes were sourced from UniBo.

Temporal Representativeness: given the ongoing process of demonstration and active data collection from the partners, the majority of primary data collected pertains to the current operational context. Secondary Data have been derived from the latest available datasets in Ecoinvent, ensuring compatibility with modern industry standards.

Geographical Representativeness: primary data focuses on specific operational sites and logistical routes, offering a precise geographical scope. For what concerns secondary data, processes and materials-related Ecoinvent datasets have been aligned to the French Energy Mix; while for End-of-Life rates (percentage of recycling, landfill, and incineration) reference data have been taken from French data.

Technological Representativeness: Primary data directly reflects washing, and RVM processes, ensuring high relevance. Secondary Data about material composition, process technologies and EoL management that are consistent with industry averages.

Completeness: primary data covers all major life cycle stages complemented by secondary data of materials and processes specificity and EoL processes.

Methodological Consistency: the combination of primary and secondary data follows a harmonized methodology, ensuring alignment with the PEF framework. For the remaining data needs, the decision is to rely on data retrieved from databases available in SimaPro, specifically the Ecoinvent database, to ensure a robust and comprehensive foundation for LCA assessments.

It is also worth noting that the quality of the data collected for reuse is aligned with the data obtained for the state of the art, ensuring that these studies remain comparable. Despite these challenges, the data collected so far, supplemented by SimaPro, provides a solid foundation for preliminary LCA studies, with further refinements expected to enhance the accuracy and reliability of the assessments.

The data collection and the study aim have been aligned with UniBo's WP3 study thanks to a strict collaboration to maintain coherence with the broader project objectives.

The retrieved data from partners are reported in Annex 2 at the end of this document.

3.6 LCI – LIFE CYCLE INVENTORY

In this paragraph, the inventory tables are provided and organized to keep the various phases of the packaging life cycle separate as described in the system boundary diagram.

PRE-PROCESSING AND MANUFACTURING LCI

Below, for each product, a table describing the pre-processing (PP) and manufacturing (M) processes of the packaging is provided. The inventory is structured as a bill of materials: each component that makes the product up is associated with a position number that reflects the structure of the assemblies; quantity and weight in grams are indicated for each component/assembly.

Regarding pre-processing, the material (as declared by the company in the data collection form) is indicated for each layer, together with the corresponding raw material selected in SimaPro. With respect to manufacturing, a description of the processes used and an indication of the corresponding processes in SimaPro is

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provided. If the original datasets have been modified to adapt them to the French context by selecting, for example, energy data related to this geographical area, all the modifications made are reported in a dedicated column.

In correspondence with each table, any limitations and assumptions made during the compilation of the inventory are reported.

PRODUCT 01

- **STATE OF THE ART - TABLE (E1), PP-M LCI, – Florette Shaker, PET Cup**

  Assumptions and limitations: the heat sealing process for components 1.1 and 1.2 has been omitted due to the lack of specific information retrieved in the data collection and suitable Ecoinvent datasets. Furthermore, no information has been provided regarding eventual printing processes and related ink, which therefore were not included in the analysis.

Tab E1. PP-M LCI, PRODUCT 01 – Florette Shaker, PET Cup

TABLE E1				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
1	PET Cup	1	5,391	/	/	Heat sealing	/	/
1.1	PET Foil Lid	1	0,348	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}| market for | Cut-off, U
1.2	PET Shaker	1	5,043	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

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- **REUSE - TABLE F1, PP-M LCI,– Florette Shaker, PP Tray + Lid**

Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks, or other labels, which were therefore not included in the analysis.

Tab F1. PP-M LCI, PRODUCT 01-r – Florette Shaker, PET Cup

TABLE F1				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
1-r	PET Cup	1	18,44	/	/	/	/	/
1.1-r	PP Lid	1	0,8	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
1.2-r	PP Tray	1	17,640	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

PRODUCT 02

- **STATE OF THE ART - TABLE E2, PP-M LCI, – Salad MDD, PET Tray**

Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks, or other labels, which were therefore not included in the analysis.

Tab E2. PP-M LCI, PRODUCT 02 – Salad MDD, PET Tray

TABLE E2				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
2	PET Tray	1	12	/	/	Inline manual closing	/	/
2.1	PET Lid	1	4	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

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2.2	PET Bowl	1	8	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

- **REUSE - TABLE F2, PP-M LCI, – Prepared Salad Tray 261 mL**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which were therefore not included

Tab F2. PP-M LCI, PRODUCT 02-r – Prepared Salad Tray 261 mL

TABLE F2				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
2-r	PET Cup	1	18,44	/	/	/	/	/
2.1-r	PP Lid	1	0,8	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
2.2-r	PP Tray	1	17,640	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

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PRODUCT 03

- **STATE OF THE ART - TABLE E3, PP-M LCI, – Sour cream, Cup**

  Assumptions and limitations: the sealing process for components 3.2 and 3.3 and the closing process for components 3.1 and 3.3 have been omitted due to the lack of specific information retrieved in the data collection and suitable Ecoinvent datasets. The manufacturing process for the monolayer Aluminium Lid (3.2) was not declared, thus, sheet rolling was assumed as the most suitable option. Furthermore, no information has been provided regarding eventual printing processes and related inks, which were therefore not included in the analysis.

Tab E3. PP-M LCI, PRODUCT 03 – Sour cream, Cup

TABLE E3				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
3	Cup	1	6,18	/	/	Inline closing and sealing	/	/
3.1	PET Overcap	1	1,525	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/
3.2	Aluminium Lid	1	0,405	Aluminium	Aluminium alloy, AlMg3 {GLO}| market for | Cut-off, U	Sheet rolling	Sheet rolling, aluminium {RER}| processing | Cut-off, U	• Water, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
3.3	PP Bowl	1	4,25	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusiion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

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- **REUSE - TABLE F3, PP-M LCI, – Sour cream PP Bucket + Lid**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which were therefore not included in the analysis.

Tab F3. PP-M LCI, PRODUCT 03-r – Sour cream PP Bucket + Lid

TABLE F3				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
3-r	PET Bucket + Lid	1	4,58	/	/	/	/	/
3.1-r	PP Lid	1	1,12	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
3.2-r	PP Bucket	1	3,46	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

PRODUCT 04

- **STATE OF THE ART TABLE E4, PP-M LCI – Greek yoghurt, Cup**

  Assumptions and limitations: the sealing process for components 4.2 and 4.3 and the closing process for components 4.1 and 4.3 have been omitted due to the lack of specific information retrieved in the data collection and suitable Ecoinvent datasets. The manufacturing process for the monolayer Aluminium Lid (4.2) was not declared, thus, sheet rolling was assumed as the most suitable option. Furthermore, no information has been provided regarding eventual printing processes and related inks, which were therefore not included in the analysis.

Tab E4. PP-M LCI, PRODUCT 04 – Greek yoghurt, Cup

TABLE E4				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
4	Cup	1	4,5	/	/	Inline closing and sealing	/	/

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4.1	PET Overcap	1	1,111	PET	Polyethylene terephthalate, granulate, amorphous {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/
4.2	Aluminium Lid	1	0,278	Aluminium	Aluminium alloy, AlMg3 {GLO}| market for | Cut-off, U	Sheet rolling	Sheet rolling, aluminium {RER}| processing | Cut-off, U	• Water, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
4.3	PP Bowl	1	3,111	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

- **REUSE - TABLE F4, PP-M LCI, – Greek yoghurt, PP Cup + Lid**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which were therefore not included in the analysis.

Tab F4. PP-M LCI, PRODUCT 04-r – Greek yoghurt, PP Cup + Lid

TABLE F4				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
4-r	PET Bucket + Lid	1	4,58	/	/	/	/	/
4.1-r	PP Lid	1	1,12	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
4.2-r	PP Bucket	1	3,46	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

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PRODUCT 05

- **STATE OF ART - TABLE E5, PP-M LCI, – Pork chop, Wrapped Tray**

  Note: for the "In-shop products" food category a specific EPS tray was not supplied by the partners, therefore a suitable one for the reference product (2 pork chops) was selected by the authors. Specifically, the product consists of an expanded polystyrene tray and a PVC film.

  Assumptions and limitations: the wrapping process (manual or automatic) has been omitted as considered negligible and due to the absence of suitable Ecoinvent datasets.

Tab E5. PP-M LCI, PRODUCT 05 – Pork chop, Wrapped Tray

TABLE E5				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
5	Wrapped Tray	1	2,76	/	/	Wrapping	/	/
5.1	PVC Wrapping Film	1	0,58	PVC	Polyvinylchloride, suspension polymerised {RER}| polyvinylchloride production, suspension polymerisation | Cut-off, U	Bubble extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
5.2	PSE Tray	1	2,18	EPS	Polystyrene, expandable {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/
						Foaming	Polymer foaming {RER}| processing | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **REUSE - TABLE (F5), PP-M LCI, – PP Tray + Lid**

Tab E5. PP-M LCI, PRODUCT 05-r– Pork chop, PP Tray + Lid

TABLE F5				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
5-r	Wrapped Tray	1	8,4	/	/	/	/	/

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5.1-r	Tray	1	8	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
5.2-r	Lid	1	0,4	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic sheets and thermoforming	Extrusion of plastic sheets and thermoforming, inline {FR}| processing | Cut-off, U	/

PRODUCT 09

- **STATE OF ART - TABLE E9, PP-M LCI, – Peanut curl, OPP Film**

  Assumptions and limitations: The Metallization process for OPP film (9.2) has been omitted due to the lack of specific information retrieved in the data collection (type of metal and type of process). The printing process has been omitted due to the absence of suitable Ecoinvent datasets, only the dataset of ink has been considered.

Tab E9. PP-M LCI, PRODUCT 09 – Peanut curl, OPP Film

TABLE E9				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
9	Bag	1	4,456	/	/	/		/
9.1	OPP Film	1	0,3312	Ink	Printing ink, offset, without solvent, in 47% solution state {RER}|	Printing Ink	/	/
9.2	OPP Film	1	0,2368	Adhesive	Acrylic binder, with water, in 54% solution state {RER} | Cut-off, U	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	• Electricity, medium voltage {FR}| market for | Cut-off, U
9.3	PP Foil	1	3,888	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

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- **REUSE - TABLE F9, PP-M LCI, – Chips PP Bucket + Lid**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which were therefore not included in the analysis.

Tab F9. PP-M LCI, PRODUCT 09-r – Chips PP Bucket + Lid

TABLE F9				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
9-r	PET Cup	1	56,32	/	/	/	/	/
9.1-r	PP Clip Lid	1	13,12	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
9.2-r	PP Bucket	1	43,2	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

PRODUCT 10

- **STATE OF ART - TABLE E10, PP-M LCI, – Savory biscuits, OPP & Cardboard**

  Assumptions and limitations: The metallization process for OPP film (10.2) has been omitted due to the lack of specific information retrieved in the data collection (type of metal and type of process).

  For the Cardboard box (10.1), a dataset for the production of a folding boxboard carton has been used, which does not contain specific data on recycled cardboard.

Tab E10. PP-M LCI, PRODUCT 10 – Savory biscuits, OPP & Cardboard

TABLE E10				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
10	Savory Biscuit	1	25,75	/	/	/		/
10.1	Cardboard Box	1	24			Flat cut	Folding boxboard carton production {RER}| production | Cut-off, U	• Variation amount of Varnish and Ink • Electricity, medium voltage {FR}| market for | Cut-off, U
10.2	OPP Film	1	0,15	Adhesive	Acrylic binder, with water, in 54% solution state {RER} | Cut-off, U	Lamination	Laminating service, foil, with acrylic binder {RER}| processing | Cut-off, U	• Electricity, medium voltage {FR}| market for | Cut-off, U

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10.3	PP Foil	1	1,6	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **REUSE - TABLE F10, PP-M LCI – Savory Biscuits PP Bucket 1L + Lid**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which were therefore not included in the analysis.

Tab F10 PP-M LCI, PRODUCT 10-r1 – Savory biscuits PP Bucket 1L + Lid

TABLE F10				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
10-r1	PET Cup	1	46,7	/	/	/	/	/
10.1-r1	PP Clip Lid	1	9,7	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
10.2-r1	PP Bucket	1	37	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

- **REUSE - TABLE G10, PP-M LCI – Savory Biscuits PP Bucket 2L + Lid**

  Assumptions and limitations: no information has been provided regarding eventual printing processes and related inks or other labels, which were therefore not included in the analysis.

Tab G10.1 PP-M LCI, PRODUCT 10-r2 – Savory biscuits PP Bucket 2L + Lid

TABLE G10				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
10-r2	PET Cup	1	27,3	/	/	/	/	/
10.1-r2	PP Clip Lid	1	8,8	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

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10.2-r2	PP Bucket	1	18,5	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

PRODUCT 11

- **STATE OF ART - TABLE E11, PP-M LCI, – Orange Juice- PET Clear Bottle**

  Assumptions and limitations: Printing processes and inks on OPP label: omitted due to the lack of specific information retrieved in the data collection.

Tab E11. PP-M LCI, PRODUCT 11 – Orange Juice- PET Clear Bottle

TABLE E11				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
11	Clear bottle	1	3,2	/	/	Capping	/	/
11.1	HDPE Cap	1	0.3	HDPE	Polyethylene, high density, granulate {RER}| polyethylene production, high density, granulate | Cut-off, U	Injection moulding	Injection moulding {RER}| injection moulding | Cut-off, U	• Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}| market for | Cut-off, U
11.2	OPP Foil	1	0.1	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; •Electricity, medium voltage {FR}| market for | Cut-off, U
11.3	PET Bottle	1	1,4	PET	Polyethylene terephthalate, granulate, bottle grade {RER}| polyethylene terephthalate production, granulate, bottle grade | Cut-off, U	Stretch blow moulding	Stretch blow moulding {RER}| stretch blow moulding | Cut-off, U	• Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}| market for | Cut-off, U
			1,4	rPET	rPET CIRCULAR FOOTPRINT FORMULA DATASET	Injection moulding	Injection moulding {RER}| injection moulding | Cut-off, U	Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}| market for | Cut-off, U

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- **REUSE - TABLE F11, PP-M LCI, – Orange Juice- Glass Bottle 1l**

Assumptions and limitations: Because there is no dataset within the ecoinvent database describing the blow molding process for glass, it was modeled considering the blow molding process used for plastics. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection.

Tab F11. PP-M LCI, PRODUCT 11-r – Orange Juice- Glass Bottle 1l

TABLE F11				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
11-r	PET Cup	1	38	/	/	/	/	/
11.1-r	Twist-off capsule	1	0,5	Metal	Tin plated chromium steel sheet, 2 mm {RER}| tin plated chromium steel sheet production, 2 mm | Cut-off, U	Sheet rolling	Sheet rolling, chromium steel {RER}| sheet rolling, chromium steel | Cut-off, U	/
11.2-r	Glass Bottle	1	37,5	GLASS	White Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/

PRODUCT 12

- **STATE OF ART - TABLE E12, PP-M LCI, – UHT Milk – PET Opaque Bottle**

Assumptions and limitations: Printing processes and inks on OPP label: omitted due to the lack of specific information retrieved in the data collection.

Tab E12. PP-M LCI, PRODUCT 12 – UHT Milk – PET Opaque Bottle

TABLE E12				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
12	Opaque bottle	1	2,8	/	/	Capping	/	/
12.1	HDPE Cap	1	0,3	HDPE	Polyethylene, high density, granulate {RER}| polyethylene production, high density, granulate | Cut-off, U	Injection moulding	Injection moulding {RER}| injection moulding | Cut-off, U	• Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}|

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								market for | Cut-off, U
12.2	OPP Foil	1	0,1	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}| market for | Cut-off, U
12.3	PET Bottle	1	1,2	PET	Polyethylene terephthalate, granulate, bottle grade {RER}| polyethylene terephthalate production, granulate, bottle grade | Cut-off, U	Stretch blow moulding	Stretch blow moulding {RER}| stretch blow moulding | Cut-off, U	• Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}| market for | Cut-off, U
			1,2	rPET	rPET CIRCULAR FOOTPRINT FORMULA DATASET	Injection moulding	Injection moulding {RER}| injection moulding | Cut-off, U	• Water, cooling, unspecified natural origin, FR; Electricity, medium voltage {FR}| market for | Cut-off, U

- **REUSE - TABLE F12, PP-M LCI, – UHT Milk – White Glass bottle**

Assumptions and limitations: Because there is no dataset within the ecoinvent database describing the blow molding process for glass, it was modeled considering the blow molding process used for plastics. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection.

Tab F12. PP-M LCI, PRODUCT 12-r – UHT Milk – White Glass bottle

TABLE F12				**PRE-PROCESSING**		**MANUFACTURING**		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
12-r	PET Cup	1	36,5	/	/	/	/	/
12.1-r	Twist-off capsule	1	0,5	Metal	Tin plated chromium steel sheet, 2 mm {RER}| tin plated chromium steel sheet production, 2 mm | Cut-off, U	Sheet rolling	Sheet rolling, chromium steel {RER}| sheet rolling, chromium steel | Cut-off, U	/

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12.2-r	Glass Bottle	1	36	GLASS	White Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/

PRODUCT 13

- **STATE OF ART - TABLE E13, PP-M LCI, – UHT Milk – PEHD Bottle**

  Assumptions and limitations: Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection

Tab E13. PP-M LCI, PRODUCT 13 – UHT Milk – PEHD Bottle

TABLE E13				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
13	HDPE bottle	1	3,57	/	/	Capping		/
13.1	HDPE Cap	1	0,27	HDPE	Polyethylene, high density, granulate {RER}| polyethylene production, high density, granulate | Cut-off, U	Injection moulding	Injection moulding {RER}| injection moulding | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
13.2	Bottle	1	3,3	HDPE	Polyethylene, high density, granulate {RER}| polyethylene production, high density, granulate | Cut-off, U	Stretch blow moulding	Stretch blow moulding {RER}| stretch blow moulding | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U
						Co-extrusion	Extrusion, co-extrusion {FR}| extrusion, co-extrusion of plastic sheets | Cut-off, U	/

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- **REUSE - TABLE F13, PP-M LCI, – UHT Milk – Glass Bottle**

  Assumptions and limitations: Because there is no dataset within the ecoinvent database describing the blow molding process for glass, it was modeled considering the blow molding process used for plastics. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection.

Tab F13. PP-M LCI, PRODUCT 13-r – UHT Milk – Glass Bottle

TABLE F13				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
13-r	PET Cup	1	36,5	/	/	/	/	/
13.1-r	Twist-off capsule	1	0,5	Metal	Tin plated chromium steel sheet, 2 mm {RER}| tin plated chromium steel sheet Rproduction, 2 mm | Cut-off, U	Sheet rolling	Sheet rolling, chromium steel {RER}| sheet rolling, chromium steel | Cut-off, U	/
13.2-r	Glass Bottle	1	36	GLASS	White Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/

PRODUCT 14

- **STATE OF ART - TABLE E14, PP-M LCI, – Savory biscuits, BOPP & Cardboard**

  Assumptions and limitations: Dataset for production of a Folding boxboard carton haven't specific data on recycled cardboard. The Coating process has been omitted due to the lack of specific information retrieved in the data collection. The Printing process has been omitted due to the absence of suitable Ecoinvent datasets.

Tab E14. PP-M LCI, PRODUCT 14- Savory biscuits, BOPP & Cardboard

TABLE E14				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
14	Savory Biscuit	1	17,85	/	/	/	/	/
14.1	Cardboard Box	1	16,07		/	Flat cut	Folding boxboard carton production {RER}| production | Cut-off, U	• Variation amount of Varnish and Ink • Electricity, medium voltage {FR}| market for | Cut-off, U

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14.2	BOPP Foil	1	1,78	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Extrusion of plastic film	Extrusion, plastic film {RER}| extrusion, plastic film | Cut-off, U	• Water, cooling, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

- **REUSE - TABLE F14, PP-M LCI, – Savory biscuits – PP Bucket + Lid**

  Assumptions and limitations: Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection

Tab F14. PP-M LCI, PRODUCT 14-r- Savory biscuits, PP Bucket + Lid

TABLE F14				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
14-r	PET Cup	1	13,342	/	/	/	/	/
14.1-r	Clip lid	1	2,771	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
14.2-r	Bucket	1	10,571	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

PRODUCT 15

- **STATE OF ART & REUSE - TABLE E15, PP-M LCI, – Fromage Blanc – PP Bucket + Lid**

  Assumptions and limitations: This product was not listed within the state of the art analysis and was added during the preparation of this report. The environmental impact analysis will be performed by comparing environmental impacts as the number of cycles of use changes. Therefore, the table with the inventory data for the state of the art and that for the reuse phases coincide. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection.

Tab E15. PP-M LCI, PRODUCT 15 – Fromage Blanc – PP Bucket + Lid

TABLE E15				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
15	Fromage Blanc	1	4,425	/	/	/	/	/

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15.1	PP Bucket 2L	1	3,545	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/
15.2	Clip lid	1	0,88	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

PRODUCT 16

- **STATE OF ART & REUSE - TABLE E16, PP-M LCI, – Syrup – Glass Bottle**

Assumptions and limitations: This product was not listed within the state of the art analysis and was added during the preparation of this report. The environmental impact analysis will be performed by comparing environmental impacts as the number of cycles of use changes. Therefore, the table with the inventory data for the state of the art and that for the reuse phases coincide. Because there is no dataset within the ecoinvent database describing the blow molding process for glass, it was modeled considering the blow molding process used for plastics. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection.

Tab E16. PP-M LCI, PRODUCT 16 – Syrup – Glass Bottle

TABLE E16				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
16	Syrup	1	105,525	/	/	/	/	/
16.1	Glass bottle 70cl	1	105,023	GLASS	White Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/
16.2	Clip lid	1	0,502	PEHD		Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

PRODUCT 17

- **STATE OF ART & REUSE - TABLE E17, PP-M LCI, – Mayonnaise – Glass Jar + Lid**

Assumptions and limitations: This product was not listed within the state of the art analysis and was added during the preparation of this report. The environmental impact analysis will be performed by comparing environmental impacts as the number of cycles of use changes. Therefore, the table with the inventory data for the state of the art and that for the reuse phases coincide. Because there is no dataset within the ecoinvent database describing the blow moulding process for glass, it was modeled considering the blow moulding process used for plastics. Label material, printing processes and inks have been omitted due to the lack of

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specific information retrieved in the data collection.

Tab E17. PP-M LCI, PRODUCT 17 – Mayonnaise – Glass Jar + Lid

TABLE E17				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
17	Mayonnaise	1	99,498	/	/	/	/	/
17.1	Glass Jar	1	96,234	GLASS	White Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/
17.2	Twist-off Lid	1	3,264	Tin plated steel	Tin plated chromium steel sheet, 2 mm {RER}| tin plated chromium steel sheet production, 2 mm | Cut-off, U	Sheet rolling	Sheet rolling, chromium steel {RER}| sheet rolling, chromium steel | Cut-off, U	/

PRODUCT 18

- **STATE OF ART & REUSE - TABLE E18, PP-M LCI, – Olive Oil – Glass bottle**

Assumptions and limitations: This product was not listed within the state of the art analysis and was added during the preparation of this report. The environmental impact analysis will be performed by comparing environmental impacts as the number of cycles of use changes. Therefore, the table with the inventory data for the state of the art and that for the reuse phases coincide. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection.

Tab E18. PP-M LCI, PRODUCT 18 – Olive Oil – Glass bottle

TABLE E18				PRE-PROCESSING		MANUFACTURING		
ID	Description	Quantity	Weight per 100g of product [g]	Material	Material (Ecoinvent dataset)	Processing	Processing (Original Ecoinvent dataset)	Processing variations (available FR datasets)
18	Olive oil	1	69,2	/	/	/	/	/
18.1	Glass Bottle	1	64	GLASS	White Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/
18.2	Clip lid	1	2	Aluminium	Aluminium alloy, AlMg3 {GLO}| market for | Cut-off, U	Sheet rolling	Sheet rolling, aluminium {RER}| processing | Cut-off, U	• Water, unspecified natural origin, FR; • Electricity, medium voltage {FR}| market for | Cut-off, U

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18.3	Pourer	1	3,2	PP	Polypropylene, granulate {RER}| production | Cut-off, U	Injection moulding	Injection moulding {GLO}| market for injection moulding | Cut-off, U	/

PRODUCT 19

- **STATE OF ART & REUSE - TABLE E19, PP-M LCI, – Brut Cyder – Glass Bottle**

Assumptions and limitations: This product was not listed within the state of the art analysis and was added during the preparation of this report. The environmental impact analysis will be performed by comparing environmental impacts as the number of cycles of use changes. Therefore, the table with the inventory data for the state of the art and that for the reuse phases coincide. Because there is no dataset within the ecoinvent database describing the blow molding process for glass, it was modeled considering the blow molding process used for plastics. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection.

Tab E19. PP-M LCI, PRODUCT 19 – Brut Cyder – Glass Bottle

TABLE E19				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
19	Brut Cyder	1	76,249	/	/	/	/	/
19.1	Glass Bottle	1	74,667	Green Glass	Green Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/
19.2	Cork stopper	1	0,949	Cork	Cork, raw {RoW}| cork forestry | Cut-off, U	Shaping	Bark {Europe without Switzerland} | sawing, softwood | Cut-off, U	/
19.3	Metallic Wire	1	0,633	Steel	Steel, low-alloyed {Europe without Switzerland and Austria}| steel production, electric, low-alloyed | Cut-off, U	Wire Drawing	Wire drawing, steel {RER}| wire drawing, steel | Cut-off, U	/

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PRODUCT 20

- **STATE OF ART & REUSE - TABLE E19, PP-M LCI, – Lemonade – Glass Bottle**

Assumptions and limitations: This product was not listed within the state of the art analysis and was added during the preparation of this report. The environmental impact analysis will be performed by comparing environmental impacts as the number of cycles of use changes. Therefore, the table with the inventory data for the state of the art and that for the reuse phases coincide. Label material, printing processes and inks have been omitted due to the lack of specific information retrieved in the data collection. Information about the weight and manufacturing processes for the stopper and of the metallic wire have not yet been provided.

Tab E20. PP-M LCI, PRODUCT 20 – Lemonade – Glass Bottle

TABLE E20				PRE-PROCESSING		MANUFACTURING		
ID	**Description**	**Quantity**	**Weight per 100g of product [g]**	**Material**	**Material (Ecoinvent dataset)**	**Processing**	**Processing (Original Ecoinvent dataset)**	**Processing variations (available FR datasets)**
20	Brut Cyder	1	77,667	/	/	/	/	/
20.1	Glass Bottle	1	74,667	GLASS	White Glass Circular Footprint Formula Dataset	Blow Moulding	Blow moulding {GLO}| market for blow moulding | Cut-off, U	/
20.2	Plastic Stopper	1	1	Plastic	/	/	/	/
20.3	Metallic Wire	1	2	Metal	/	/	/	/

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TRANSPORTS

The inventory data for the transport phase was derived from the modeling and optimization work done by UniBo and presented within WP3.
It is important to emphasize how the transport optimization model defines the position of the various nodes based on return rate and scrap rate data. As these two parameters change, the distances to be considered between the different phases also change.
Consequently, the distance reported here was calculated considering a return rate of 70% and a scrap rate of 5%, which are closest to those indicated in WP3.4, namely a 64.6% return rate and a 5% scrap rate.
If case it will be necessary, a sensitivity analysis will be performed to include the variation in distances as return and recovery rates change.

Tab 16. Transport data for Reuse

EAN	PRODUCT	PRODUCER	RETURN RATE	SCRAP RATE	Producer to Filler [km]	Packager to Distribution center [km]	Distribution center to RVM [km]	RVM to sorter [km]	Sorter to Washer [km]
EAN_01	**prepared salad and cut vegetable**	LSDH	70%	5%	43	105	63	141	53
EAN_02	**prepared salad and cut vegetable**	SODEBO	70%	5%	43	490	63	141	53
EAN_03	**prepared salad and cut vegetable**	FLOREALE	70%	5%	43	163	63	141	53
EAN_04	**Fromage blanc and fresh cream 500 g**	YOPLAIT	70%	5%	168	273	63	161	50
EAN_05	**Fromage blanc and fresh cream 500 g**	SCHREIBER	70%	5%	168	515	63	161	50
EAN_06	**Fromage blanc and fresh cream 500 g**	EURIAL	70%	5%	168	250	63	161	50
EAN_08	**Peanut curl MDD U_3256225135424**	ALTHO	70%	5%	511	337	63	165	63
EAN_09	**Bret's_3497917003793**	ALTHO	70%	5%	511	337	63	165	63
EAN_10	**Mix party_3256225109531**	EUROPESNACKS	70%	5%	265	471	63	176	58
EAN_11	**Orange Juice_3256225036004**	LSDH	70%	5%	412	131	63	141	49
EAN_12	**Biscuits Mini GF choco_3256225130955**	BISCUITSBOUVARDS	70%	5%	265	168	63	176	58
EAN_13	**Fromage blanc 2 kg_3184670001707**	RIANS	70%	5%	251	415	63	152	63
EAN_14	**Sirup of Mint_3265261638813**	MONIN	70%	5%	281	398	63	146	50
EAN_15	**Sirup of grenadine_3265261638820**	MONIN	70%	5%	281	405	63	146	50
EAN_16	**mayonnaise_3265470135271**	LESIEUR	70%	5%	378	590	63	260	177

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EAN_17	**Olive Oil Puget_3265470135257**	LESIEUR	70%	5%	227	585	63	260	177
EAN_18	**Brut cider_3013060118711**	ECLOR	70%	5%	280	353	63	157	50
EAN_19	**Fruity cider_3013060118629**	ECLOR	70%	5%	280	350	63	157	50
EAN_21	**Prepared Salad**	FLORETTE	70%	5%	43	538	63	141	53

RECOVERY (RVM)

Inventory data has been collected regarding the process of collecting reusable containers in supermarkets. Specifically, data on energy consumption and the composition of collection machines have been gathered.

The impacts will then be allocated to the Functional Unit.

Tab 17. Data collection on RVM

REVERSE VENDING MACHINES			
Process	**Amount**	**Unit of measure**	**Notes**
Energy consumption	26	kWh/an	
Machine weight	170	kg	
Composition	>95% steel		Few plastics and some electronics
Capacity	350/400	pcs of packaging	Precise value depends on packaging size
Frequency to empty	1	x month	

WASHING (GLASS BOTTLES)

So far, information has only been collected regarding the washing process for products that use bottles as containers. At the time of writing this report, data collection is underway with partners to also describe other product types.
The inventory data will then be allocated to the Functional Unit.

Tab 18. Data of bottles washing process

BOTTLES WASHING PROCESS		
Process	**Amount**	**Unit of measure**
Water consumption	1	l/bottle
Rinse water consumption	0,25	l/bottle
Energy consumption	0,25	kWh/bottle
Chemicals	0,007	kg/bottle

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END-OF-LIFE LCI

Regarding the LCI of the end-of-life phase, a dedicated waste scenario has been defined for each material. Each waste scenario is composed of the different waste treatments i.e. recycling, incineration and landfill. The percentage of wasted material destined for each waste treatment was defined on the basis of data relating to waste management in the French context; the sources are indicated in the "data source" column (Tab.19). Furthermore, the table below shows the process with which each waste treatment is modelled in Ecoinvent. The specific waste scenario for each product consists of a single waste process if the product is mono-material, or of the combination of two or more waste processes if the product is made up of components in different materials; in the latter case, the percentages of material destined for each waste process are defined on the basis of weight percentage of each material on the packaging composition.

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Tab 19. END-OF-LIFE LCI

		Table B				End of Life		
		Waste type	Material % per waste treatement	Data description	Data source	Waste treatement	Waste treatment (SimaPro dataset)	Notes
Waste scenario	Waste process	PA	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PA Recycling	PA (waste treatment) {GLO}| recycling of PA| Cut-off, U	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PA Incineration	Waste plastic, mixture {CH}| treatment of waste plastic, mixture, municipal incineration | Cut-off, U	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PA Landfill	Waste plastic, mixture {CH}| treatment of waste plastic, mixture, sanitary landfill | Cut-off, U	
	Waste process	PET	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PET Recycling	PET (waste treatment) {GLO}| recycling of PET | Cut-off, U	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PET Incineration	Waste polyethylene terephthalate {CH}| treatment of waste polyethylene terephthalate, municipal incineration | Cut-off, U	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PET Landfill	Waste polyethylene terephthalate {CH}| treatment of waste polyethylene terephthalate, sanitary landfill | Cut-off, U	
	Waste process	PP	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PP Recycling	PP (waste treatment) {GLO}| recycling of PP | Cut-off, U	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PP Incineration	Waste polypropylene {CH}| treatment of, municipal incineration | Cut-off, U	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PP Landfill	Waste polypropylene {CH}| treatment of, sanitary landfill | Cut-off, U	
	Waste process	PVC	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PVC Recycling	PVC (waste treatment) {GLO}| recycling of PVC | Cut-off, U	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PVC Incineration	Waste polyvinylchloride {CH}| treatment of, municipal incineration | Cut-off, U	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	PVC Landfill	Waste polyvinylchloride {CH}| treatment of, sanitary landfill | Cut-off, U	
	Waste process	EPS	27	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	EPS Recycling	PS (waste treatment) {GLO}| recycling of PS | Cut-off, U	
			44	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	EPS Incineration	Waste expanded polystyrene {CH}| treatment of, municipal incineration | Cut-off, U	
			29	France post-consumer plastics packaging waste treatment	Plastics Europe, 2022	EPS Landfill	Waste polystyrene {CH}| treatment of, sanitary landfill | Cut-off, U	datasets for PS
	Waste process	Aluminium	58	France post-consumer aluminium packaging waste treatment	Citeo Adelphe, 2021	Aluminium Recycling	Aluminium (waste treatment) {GLO}| recycling of aluminium | Cut-off, U	
			42	France MSW treatment	Eurostat, 2018	Municipal Waste (62% Incineration + 38% Landfill	Municipal solid waste {FR}| market for municipal solid waste | Cut-off, U	
	Waste process	Aluminium&OPP	100	France MSW treatment	Eurostat, 2018	Municipal Waste	Municipal solid waste {FR}| Cut-off, U	
	Waste process	Cardboard	72	France post-consumer cardboard packaging waste treatment	Citeo Adelphe, 2021	Paper Recycling	Paper (waste treatment) {GLO}| recycling of paper | Cut-off, U	
			28	France MSW treatment	Eurostat, 2018	Municipal Waste	Waste paperboard {FR}| market for waste paperbord | Cut-off, U	

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MATERIALS RECOVERY MODELLING CHOICES: CFF APPLICATION

In order to calculate credits and impacts connected to recycling and energy recovery in the PEF Method, the use of the Circular Footprint Formula (CFF) is prescribed[7]. CFF is composed of three parts corresponding, respectively, to material, energy and disposal (Fig. 9).

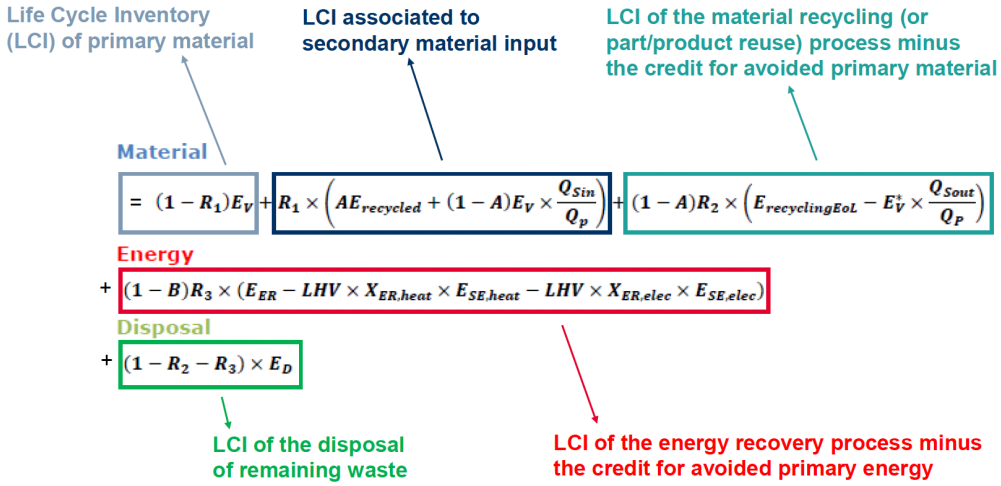

Figure 9: Circular Footprint Formula (CFF)

The CFF allows the connection with subsequent and preceding life cycles via debiting (Fig. 10, left) and crediting (Fig. 10, right) which in the cut-off approach, are not considered[8].

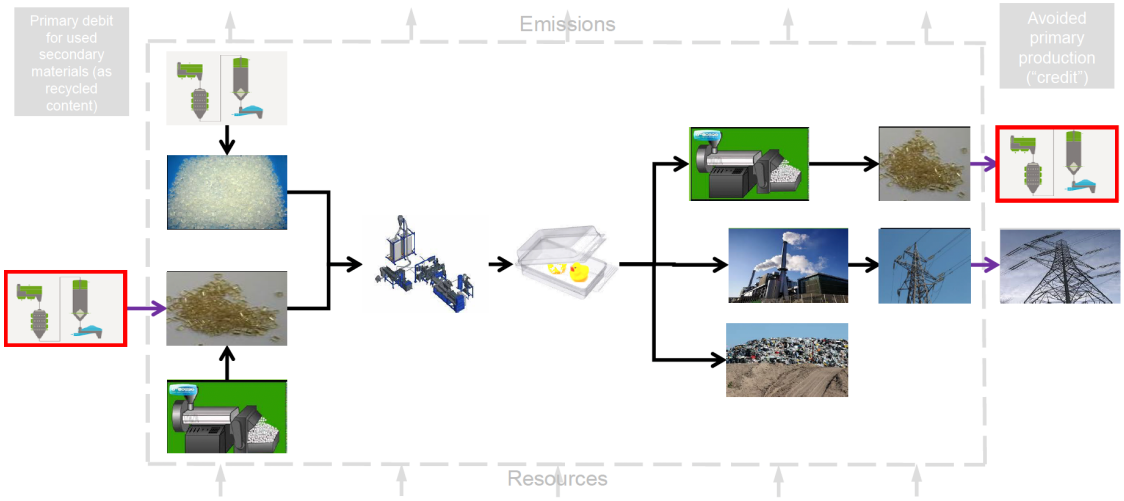

Figure 10: CFF debiting (left) and crediting (right)

7 Zampori, L. and Pant, R., Suggestions for updating the Product Environmental Footprint (PEF) method, EUR 29682 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76- 00654-1, doi:10.2760/424613, JRC11595. § 4.4.8.1 The Circular Footprint Formula (CFF)

8 Wolf, M. A., The Circular Footprint Formula (CFF) and its practical application training. Environmental Footprint (EF) transition phase, 2019. Webinar available in: https://ec.europa.eu/environment/eussd/videos/2019-10-08%2016.01%20The%20Circular%20Footprint%20Formula.mp4

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Circular Footprint Formula will be implemented in the following deliverable thanks to the recent release of the new EF 3.1 database[9] containing the needed datasets for the calculation in SimaPro.

This deliverable compiles a list of datasets and parameters that will be implemented in the formula. The selected datasets come from the ecoinvent Cut-Off database, ensuring compliance with the current restrictions on publishing EF dataset assessment results.

The list of parameters has been divided in two macro-groups: the first one is related to the materials and the second to the end-of-life treatments.

For materials whose recycled content is known, relevant parameters were collected to describe the benefits given by their use. For all other materials, not knowing their composition and not being able to refer to national average values, following PEF guidance, they were considered to be composed of 100 percent virgin material, thus collapsing the first section of the formula.

Tab 20. CFF parameters - materials

MATERIAL	PARAMETER	VALUE
RPET	Erecycled	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| market for polyethylene terephthalate, granulate, amorphous, recycled | Cut-off, U
	Ev	Polyethylene terephthalate, granulate, amorphous {Europe without Switzerland}| polyethylene terephthalate, granulate, amorphous, recycled to generic market for amorphous PET granulate | Cut-off, U
	A	0,5
	Qsin/QP	0,9
	R1	0,5
COLOURLESS GLASS	Erecycled	Packaging glass, green {RER w/o CH+DE}| packaging glass production, green | Cut-off, U
	Ev	Packaging glass, white {RER w/o CH+DE}| packaging glass production, white | Cut-off, U
	A	0,2
	Qsin/QP	1
	R1	0,4
GREEN GLASS	Erecycled	Packaging glass, brown {RER w/o CH+DE}| packaging glass production, brown | Cut-off, U
	Ev	Packaging glass, white {RER w/o CH+DE}| packaging glass production, white | Cut-off, U
	A	0,2
	Qsin/QP	1
	R1	0,8

End of life parameters for all materials were collected and modeled in order to implement the CFF. Parameters R2, R3 and D (given by 1-R2-R3) where derived from

[9] Environmental Footprint database 3.1: https://simapro.com/products/environmental-footprint-database/

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the research on EoL paragraph.

Tab 21. CFF parameters – End-of-life processes

MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
PET	PET Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polyethylene terephthalate, granulate, bottle grade {CH}| polyethylene terephthalate, granulate, bottle grade, recycled to generic market for bottle grade PET granulate | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| market for polyethylene terephthalate, granulate, amorphous, recycled | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C, PET mechanical recycling
	PET Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
	PET Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, municipal incineration | Cut-off, U	RCP Made Green in Italy "Gelato in vaschetta e multipack "
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		LHV	23,6	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatola in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatola in cartone ondulato"
		B	0	ANNEX C
ALUMINIUM FOIL	ALUMINIUM FOIL Recycle	R_2	0,58	Citeo Adelphe, 2021
		E*v	Aluminium alloy, AlMg3 {GLO}| market for aluminium alloy, AlMg3 | Cut-off, U	
		$E_{recyclingEoL}$	Aluminium scrap, post-consumer {GLO}| market for aluminium scrap, post-consumer | Cut-off, U	
		A	0,2	ANNEX C
		Q_{Sout}/Qp	1	ANNEX C
	ALUMINIUM FOIL Disposal	D	0,42	Eurostat, 2018
		Ed	Waste aluminium {RoW}| treatment of waste aluminium, sanitary landfill | Cut-off, U	
	ALUMINIUM FOIL Energy Recovery	R_3	0	
		E_{ER}	-	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		LHV	0	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatola in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatola in cartone ondulato"
		B	0	ANNEX C
PP	PP Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polypropylene, granulate {RER}| production | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{recyclingEoL}$	Polyethylene, high density, granulate, recycled {Europe without Switzerland}| polyethylene production, high density, granulate, recycled | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C
	PP Disposal	D	0,39	Plastics Europe, 2022
		Ed	Waste polypropylene {CH}| treatment of, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
	PP Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polypropylene {CH}| treatment of, municipal incineration | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatola in cartone ondulato"
		LHV	44,3	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatola in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatola in cartone ondulato"
		B	0	ANNEX C

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MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
PVC	PVC Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polyvinylchloride, suspension polymerised {GLO}| market for polyvinylchloride, suspension polymerised | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| polyethylene terephthalate production, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	PVC Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polyvinylchloride {CH}| treatment of, sanitary landfill | Cut-off, U	
	PVC Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polyvinylchloride {CH}| treatment of, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	17,95	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
EPS	EPS Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polystyrene, expandable {RoW}| polystyrene production, expandable | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| polyethylene terephthalate production, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C
	EPS Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polystyrene {CH}| treatment of, sanitary landfill | Cut-off, U	
	EPS Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste expanded polystyrene {CH}| treatment of, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	41,1	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
LDPE	LDPE Recycle	R_2	0,29	Plastics Europe, 2022
		E*v	Polyethylene, low density, granulate {RER}| production | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{recyclingEoL}$	Polyethylene, high density, granulate, recycled {Europe without Switzerland}| polyethylene production, high density, granulate, recycled | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	LDPE Disposal	D	0,39	Plastics Europe, 2022
		Ed	Waste polyethylene {CH}| treatment of, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
	LDPE Energy Recovery	R_3	0,32	Plastics Europe, 2022
		E_{ER}	Waste polyethylene {CH}| treatment of, municipal incineration | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	42,27	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		XER,elec	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C

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MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
PA	PA Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Nylon 6 {RER}| market for nylon 6 | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| polyethylene terephthalate production, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	PA Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste plastic, mixture {CH}| treatment of waste plastic, mixture, sanitary landfill | Cut-off, U	
	PA Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste plastic, mixture {CH}| treatment of waste plastic, mixture, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	30,85	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
HDPE	HDPE Recycle	R_2	0,29	Plastics Europe, 2022
		E*v	Polyethylene, low density, granulate {RER}| production | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene, high density, granulate, recycled {Europe without Switzerland}| polyethylene production, high density, granulate, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,75	ANNEX C
	HDPE Disposal	D	0,39	Plastics Europe, 2022
		Ed	Waste polyethylene {CH}| treatment of, sanitary landfill | Cut-off, U	
	HDPE Energy Recovery	R_3	0,32	Plastics Europe, 2022
		E_{ER}	Waste polyethylene {CH}| treatment of, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	42,27	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
RPET	RPET Recycle	R_2	0,27	Plastics Europe, 2022
		E*v	Polyethylene terephthalate, granulate, bottle grade {CH}| polyethylene terephthalate, granulate, bottle grade, recycled to generic market for bottle grade PET granulate | Cut-off, U	
		$E_{recyclingEoL}$	Polyethylene terephthalate, granulate, amorphous, recycled {Europe without Switzerland}| market for polyethylene terephthalate, granulate, amorphous, recycled | Cut-off, U	
		A	0,5	ANNEX C
		Q_{Sout}/Qp	0,9	ANNEX C
	RPET Disposal	D	0,29	Plastics Europe, 2022
		Ed	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, sanitary landfill | Cut-off, U	
	RPET Energy Recovery	R_3	0,44	Plastics Europe, 2022
		E_{ER}	Waste polyethylene terephtalate {Europe without Switzerland}| treatment of waste polyethylene terephtalate, municipal incineration | Cut-off, U	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	23,6	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C

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MATERIAL	PROCESS	PARAMETER	VALUE	SOURCE
CARDBOARD	CARDBOARD Recycle	R_2	0,75	RCP Made Green in Italy "Pere"
		E*v	Sulfate pulp, unbleached {RER}| sulfate pulp production, from softwood, unbleached | Cut-off, U	RCP Made Green in Italy "Pere"
		$E_{recyclingEoL}$	Waste paper, sorted {Europe without Switzerland}| treatment of waste paper, unsorted, sorting | Cut-off, U	RCP Made Green in Italy "Pere"
		A	0,2	Annex C
		Q_{Sout}/Qp	0,85	Annex C
	CARDBOARD Disposal	D	0,14	
		Ed	Waste paperboard {CH}| treatment of, sanitary landfill | Cut-off, U	RCP Made Green in Italy "Pere"
	CARDBOARD Energy Recovery	R_3	0,11	RCP Made Green in Italy "Pere"
		E_{ER}	Waste paperboard {CH}| treatment of, municipal incineration | Cut-off, U	RCP Made Green in Italy "Pere"
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	19,7	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
COLOURLESS GLASS	COLOURLESS GLASS Recycle	R_2	0,4	
		E*v	Packaging glass, white {GLO}| market for packaging glass, white | Cut-off, U	
		$E_{recyclingEoL}$	Packaging glass, brown {GLO}| market for packaging glass, brown | Cut-off, U	
		A	0,2	ANNEX C
		Q_{Sout}/Qp	1	ANNEX C
	COLOURLESS GLASS Disposal	D	0,6	
		Ed	Waste glass {GLO}| treatment of waste glass, sanitary landfill | Cut-off, U	
	COLOURLESS GLASS Energy Recovery	R_3	0	
		E_{ER}	-	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	0	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C
GREEN GLASS	GREEN GLASS Recycle	R_2	0,66	
		E*v	Packaging glass, green {GLO}| market for packaging glass, green | Cut-off, U	
		$E_{recyclingEoL}$	Packaging glass, brown {GLO}| market for packaging glass, brown | Cut-off, U	
		A	0,2	ANNEX C
		Q_{Sout}/Qp	1	ANNEX C
	GREEN GLASS Disposal	D	0,34	
		Ed	Waste glass {GLO}| treatment of waste glass, sanitary landfill | Cut-off, U	
	GREEN GLASS Energy Recovery	R_3	0	
		E_{ER}	-	
		$E_{SE,heat}$	Heat, central or small-scale, natural gas {RER}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		$E_{SE,elec}$	Electricity, high voltage {Europe without Switzerland}| market group for | Cut-off, U	RCP Made Green in Italy "Scatole in cartone ondulato"
		LHV	0	GRANTA CES
		$X_{ER,heat}$	0,31	RCP Made Green in Italy "Scatole in cartone ondulato"
		$X_{ER,elec}$	0,101	RCP Made Green in Italy "Scatole in cartone ondulato"
		B	0	ANNEX C

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4. ANNEXES

4.1. Annex I: Data collection substitution

PRODUCT 02-s – Prepared Salad, Cardboard Tray

STATE OF THE ART PRODUCT ID	ID 02 - Prepared salad
Name of the NEW product	Prepared salad
PACKAGING WEIGHT	11,51 g
CAPACITY (FOOD WEIGHT) - FORMAT	1300 mL
TECHNICAL DATASHEETS AVAILABI	NO

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Cardboard	225	9,2		
Layer 2	Coating	40	2,3	Rod Coating	
Layer 3					
Layer 4					
Layer 5					
PACKAGING LID					
Transparent lid	Polyethylene terephtalate foil		0,01	Extrusion	
ADHESIVE					
INK					
OVERPRINT VARNISH					
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		265,00	11,51		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	YES	Home compostable - Only the bowl
THERMOVALORIZATION	NO	
LANDFILL	NO	

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PRODUCT 03-s – Sour cream, Paper Cup

STATE OF THE ART PRODUCT ID	ID 03 - Yoghurt
Name of the NEW product	Sour cream
PACKAGING WEIGHT	9,9 g
CAPACITY (FOOD WEIGHT) - FORMAT	200g
TECHNICAL DATASHEETS AVAILABLE	YES

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Polyethylene	35	0,74	Extrusion	
Layer 2	Paper/Cardboard	230	4,88	Pulping, bleaching,	
Layer 3	Polyethylene	20	0,42	Extrusion	
Layer 4					
Layer 5					
PACKAGING LID					
Aluminium Lid	Aluminium		0,81		Assumptions : same as the state-of-the-art product
Overcap	Polyethylene Terephtalate		3,05	Thermoforming	
ADHESIVE					
INK					
OVERPRINT VARNISH					
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		285,00	9,90		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	seperated from the cup during sorting.
COMPOSTING	NO	
THERMOVALORIZATION	NO	
LANDFILL	NO	

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PRODUCT 04-s – Greek yoghurt, paper cup

STATE OF THE ART PRODUCT ID	ID 04 - Yoghurt
Name of the NEW product	Yoghurt
PACKAGING WEIGHT	10,74 g
CAPACITY (FOOD WEIGHT) - FORM	200 g
TECHNICAL DATASHEETS AVAILAB	YES

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Polyethylene	35	0,74	Extrusion	
Layer 2	Moulded pulp		10	Moulded Cellulose	
Layer 3					
Layer 4					
Layer 5					
Packaging lid					
ADHESIVE					
INK					
				In Mould printing	
OVERPRINT VARNISH					
varnish					
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		35,00	10,74		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	NO	
THERMOVALORIZATION	NO	
LANDFILL	no	

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PRODUCT 05-s – Pork chop, CelluloseTray

STATE OF THE ART PRODUCT ID	ID 05 - In-shop products
Name of the NEW product	In-Shop products
PACKAGING WEIGHT	15,1 g
CAPACITY (FOOD WEIGHT) - FORMA	500g
TECHNICAL DATASHEETS AVAILAB	NO

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	96% Wet molded cellulose		14,494	Moulded	
Layer 2	4% Biofilm (cellulosic emulsion + modified starch)		0,604	Rod coating	
Layer 3					
Layer 4					
Layer 5					
PACKAGING LID					
ADHESIVE					
INK					
OVERPRINT VARNISH					
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		0,00	15,10		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	YES	Only the tray
THERMOVALORIZATION	NO	
LANDFILL	NO	

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PRODUCT 06-s – Florrette Mache, Paper/PE bag,

STATE OF THE ART PRODUCT ID	ID 06 - Bagged salad	This pilot did not succeed because of the need of transparency for the consumer.
Name of the NEW product	Bagged salad	
PACKAGING WEIGHT	12,8 g	
CAPACITY (FOOD WEIGHT) - FORM	125g	
TECHNICAL DATASHEETS AVAILAB	YES	

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Bleached paper	70	11,2		
Layer 2	Polyethylene	7	1,12	Lamination	
Layer 3					
Layer 4					
Layer 5					
PACKAGING LID					
ADHESIVE					
Adhesive	Polyurethane adhesive	2	0,32		Assumptions: same as the state-of-the-art
INK					
Ink	Printing ink	1	0,16		Assumptions: same as the state-of-the-art
OVERPRINT VARNISH					
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		80,00	12,80		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	NO	
THERMOVALORIZATION	NO	
LANDFILL	NO	

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PRODUCT 07-s – Butter, Aluminium & Paper film

STATE OF THE ART PRODUCT ID	ID 07 - Butter
Name of the NEW product	**Butter**
PACKAGING WEIGHT	3,3 g
CAPACITY (FOOD WEIGHT) - FORMAT	250 g
TECHNICAL DATASHEETS AVAILABLE	YES

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Greaseproof base paper	70	3,08		
Layer 2	Pre-coating	2	0,088	Blade coating	
Layer 3	Aluminium	0,08	0,00352	Vacuum metallization	
Layer 4	Printable top-coating	3	0,132	Blade coating	
Layer 5					
PACKAGING LID					
ADHESIVE					
INK					
OVERPRINT VARNISH					
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		75,08	3,30		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	NO	
THERMOVALORIZATION	NO	
LANDFILL	NO	

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PRODUCT 08-s – Grated cheese,Paper bag

STATE OF THE ART PRODUCT ID	ID 08 - Cheese
Name of the NEW product	Cheese
PACKAGING WEIGHT	6,66 g
CAPACITY (FOOD WEIGHT) - FORMAT	180g
TECHNICAL DATASHEETS AVAILABLE	YES

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Paper	80	6,12		
Layer 2	Coating	2	0,15	Lamination	
Layer 3	Aluminium Nanolayer	0,1	0,008		grammage
Layer 4	Top-coating	3	0,23	Lamination	
Layer 5					
PACKAGING LID					
ADHESIVE					
INK					
Ink	Ink		0,15	Gravure printing	Assumptions : same the state-of-the-art product
OVERPRINT VARNISH					
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		85,10	6,66		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	NO	
THERMOVALORIZATION	NO	
LANDFILL	NO	

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PRODUCT 09-s – Peanut curl, Paper & PP bag

STATE OF THE ART PRODUCT ID	ID 09- Chips
Name of the NEW product	Chips
PACKAGING WEIGHT	5,99 g
CAPACITY (FOOD WEIGHT) - FORMA	125 g
TECHNICAL DATASHEETS AVAILAB	YES

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Paper	40	4,74		
Layer 2	Metallized Polypropylene	7	0,83	Coextrusion	
Layer 3					
Layer 4					
Layer 5					
PACKAGING LID					
ADHESIVE					
	Adhesive	2	0,237		
INK					
OVERPRINT VARNISH					
	Varnish printing	1,5	0,18		
ADDITIVES					
OTHERS					
TOTAL PACKAGING WEIGHT		50,50	5,99		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	NO	
THERMOVALORIZATION	NO	
LANDFILL	NO	

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PRODUCT 10-s – Savory biscuits, Paper & PP bag & Cardboard box

STATE OF THE ART PRODUCT ID	ID 10- Savory biscuits
Name of the NEW product	Savory biscuits
PACKAGING WEIGHT	27,55 g
CAPACITY (FOOD WEIGHT) - FORMAT	85-105g
TECHNICAL DATASHEETS AVAILABLE	NO

PRODUCT COMPOSITION

	Commercial name of the product (Material Data Sheet)	WEIGHT UNIT (g/mq)	WEIGHT UNIT (g)	Process technology	Notes
PACKAGING BODY					
Layer 1	Kraft paper	45	2,8755		
Layer 2	Metallized Polypropylene	7	0,4473	Coextrusion	
Layer 3					
Layer 4					
Layer 5					
PACKAGING LID					
ADHESIVE					
	Adhesive	2	0,1278		
INK					
OVERPRINT VARNISH					
	Varnish printing	1,5	0,09585		
ADDITIVES					
OTHERS					
Cardboard box	Cardboard 95% recycled	340	23,51		Assumptions : same as the state-of-the-art product
Cardboard box	Ink		0,11		
Cardboard box	Acrylic varnish		0,34		
Cardboard box	Glue		0,04		
TOTAL PACKAGING WEIGHT		395,50	27,55		
Packaging production technologies (Indicate the type of processes, e.g: extrusion, lamination, thermoforming, folding and cutting, printing, dyeing)					

END-OF-LIFE

Tipologia di smaltimento	yes/no	Note
RECYCLING	YES	
COMPOSTING	NO	
THERMOVALORIZATION	NO	
LANDFILL	NO	

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4.2. Annex II: Data collection reuse

PRODUCT 01-r

ID LCA	01-r	Picture
FOOD CATEGORY	Prepared fruits	
PRODUCT	Florette Shaker Ananas	
INDUSTRIALS	Floréale (Agrial)	
PACKAGING WEIGHT [g]	44,1	
LID WEIGHT [g]	2,0	
BODY+LID WEIGHT	46,1	
WEIGHT OF PRODUCT (G)	250	
PACK + PRODUCT WEIGHT (G)	296,1	
PACKAGING CAPACITY (ML)	1261	
PACKAGING BODY (MAJOR)	Tray	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Thermoforming	
PACKAGING COMPONENTS [All lids are considered disposable.]	Lid	
MATERIALS (Lid)	Rigid PP or PET	
SUPPLIER NAME	Knauf industries	

PRODUCT 02-r

ID LCA	02-r	
FOOD CATEGORY	Prepared salads	
PRODUCT	Prepared salad	
INDUSTRIALS	LSDH/ SODEBO / FLOREALE	
PACKAGING WEIGHT [g]	44,1	
LID WEIGHT [g]	2,0	
BODY+LID WEIGHT	46,1	Picture
WEIGHT OF PRODUCT (G)	250	
PACK + PRODUCT WEIGHT (G)	296,1	
PACKAGING CAPACITY (ML)	1261	
PACKAGING BODY (MAJOR)	Tray	
MORE DETAILS ABOUT THE PACKAGING BODY	Black colorant component detectable in sorting center	
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Thermoforming	
PACKAGING COMPONENTS [All lids are considered disposable.]	Lid	
MATERIALS (Lid)	Rigid PP or PET	
SUPPLIER NAME	Knauf industries	

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PRODUCT 03-r

ID LCA	03-r	Picture
FOOD CATEGORY	Yoghurt	
PRODUCT	Sour cream	
INDUSTRIALS	Yoplait	
PACKAGING WEIGHT [g]	17,3	
LID WEIGHT [g]	5,6	
BODY+LID WEIGHT	22,9	
WEIGHT OF PRODUCT (G)	500	
PACK + PRODUCT WEIGHT (G)	522,9	
PACKAGING CAPACITY (ML)	610	
PACKAGING BODY (MAJOR)	Bucket	
MORE DETAILS ABOUT THE PACKAGING BODY	White packaging	
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Injection	
PACKAGING COMPONENTS [All lids are considered disposable.]	Lid	
MATERIALS (Lid)	Rigid PP	
SUPPLIER NAME	Berry Superfos	

PRODUCT 04-r

ID LCA	04-r	Picture
FOOD CATEGORY	Yoghurt	
PRODUCT	Fromage blanc 500 g - greek yogurt	
INDUSTRIALS	Yoplait / Schreiber / Eurial	
PACKAGING WEIGHT [g]	17,3	
LID WEIGHT [g]	5,6	
BODY+LID WEIGHT	22,9	
WEIGHT OF PRODUCT (G)	500	
PACK + PRODUCT WEIGHT (G)	522,9	
PACKAGING CAPACITY (ML)	610	
PACKAGING BODY (MAJOR)	Bucket	
MORE DETAILS ABOUT THE PACKAGING BODY	White packaging	
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Injection	
PACKAGING COMPONENTS [All lids are considered disposable.]	Lid	
MATERIALS (Lid)	Rigid PP	
SUPPLIER NAME	Berry Superfos	

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PRODUCT 05-r

ID LCA	05-r	Picture
FOOD CATEGORY	In shop product	
PRODUCT	TBD	
INDUSTRIALS	System U & Carrefour	
PACKAGING WEIGHT [g]	40,0	
LID WEIGHT [g]	2,0	
BODY+LID WEIGHT	42,0	
WEIGHT OF PRODUCT (G)	500	
PACK + PRODUCT WEIGHT (G)	542,0	
PACKAGING CAPACITY (ML)	1355	
PACKAGING BODY (MAJOR)	Plastic tray	
MORE DETAILS ABOUT THE PACKAGING BODY	n.d.	
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Thermoforming	
PACKAGING COMPONENTS [All lids are considered disposable.]	Lid	
MATERIALS (Lid)	Rigid PP or PET	
SUPPLIER NAME	Knauf industries	

*Weight of the product to be confirmed

PRODUCT 09-r

ID LCA	09-r	Picture
FOOD CATEGORY	Chips	
PRODUCT	Peanut curl-Chips	
INDUSTRIALS	Altho	
PACKAGING WEIGHT [g]	108,0	
LID WEIGHT [g]	32,8	
BODY+LID WEIGHT	140,8	
WEIGHT OF PRODUCT (G)	250	
PACK + PRODUCT WEIGHT (G)	390,8	
PACKAGING CAPACITY (ML)	3500	
PACKAGING BODY (MAJOR)	Bucket	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Injection	
PACKAGING COMPONENTS [All lids are considered disposable.]	Clip lid	
MATERIALS (Lid)	Rigid PP	
SUPPLIER NAME	Berry Superfos	

PRODUCT 10-r1

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ID LCA	10-r1	Picture
FOOD CATEGORY	Savory biscuits	
PRODUCT	Mix party savory biscuits	
INDUSTRIALS	Europe Snacks	
PACKAGING WEIGHT [g]	37,0	
LID WEIGHT [g]	9,7	
BODY+LID WEIGHT	46,7	
WEIGHT OF PRODUCT (G)	100	
PACK + PRODUCT WEIGHT (G)	146,7	
PACKAGING CAPACITY (ML)	1000	
PACKAGING BODY (MAJOR)	Bucket	
MORE DETAILS ABOUT THE PACKAGING BODY	White packaging	
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Injection	
PACKAGING COMPONENTS [All lids are considered disposable.]	Clip lid	
MATERIALS (Lid)	Rigid PP	
SUPPLIER NAME	Berry Superfos	

PRODUCT 10-r2

ID LCA	10-r2	Picture
FOOD CATEGORY	Savory biscuits	
PRODUCT	Mix party	
INDUSTRIALS	Europe Snacks	
PACKAGING WEIGHT [g]	37,0	
LID WEIGHT [g]	17,6	
BODY+LID WEIGHT	54,6	
WEIGHT OF PRODUCT (G)	200	
PACK + PRODUCT WEIGHT (G)	254,6	
PACKAGING CAPACITY (ML)	1000	
PACKAGING BODY (MAJOR)	Bucket	
MORE DETAILS ABOUT THE PACKAGING BODY	White packaging	
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Injection	
PACKAGING COMPONENTS [All lids are considered disposable.]	Clip lid + sealed lid	
MATERIALS (Lid)	Rigid PP	
SUPPLIER NAME	Berry Superfos	

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PRODUCT 11-r

ID LCA	11-r	Picture
FOOD CATEGORY	Juice	
PRODUCT	Orange Juice	
INDUSTRIALS	LSDH	
PACKAGING WEIGHT [g]	375,0	
LID WEIGHT [g]	5,0	
BODY+LID WEIGHT	380,0	
WEIGHT OF PRODUCT (G)	1000	
PACK + PRODUCT WEIGHT (G)	1380,0	
PACKAGING CAPACITY (ML)	1000	
PACKAGING BODY (MAJOR)	Bottle	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	White Glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	Twist-off capsule	
MATERIALS (Lid)	metal	
SUPPLIER NAME	Vidrala	

PRODUCT 12-r

ID LCA	12-r	Picture
FOOD CATEGORY	Milk	
PRODUCT	UHT milk	
INDUSTRIALS	LSDH	
PACKAGING WEIGHT [g]	360,0	
LID WEIGHT [g]	5,0	
BODY+LID WEIGHT	365,0	
WEIGHT OF PRODUCT (G)	1000	
PACK + PRODUCT WEIGHT (G)	1365,0	
PACKAGING CAPACITY (ML)	1000	
PACKAGING BODY (MAJOR)	Bottle	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	White Glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	Twist-off capsule	
MATERIALS (Lid)	metal	
SUPPLIER NAME	Vidrala	

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PRODUCT 13-r

ID LCA	13-r	Picture
FOOD CATEGORY	Milk	
PRODUCT	UHT milk	
INDUSTRIALS	Sodiaal	
PACKAGING WEIGHT [g]	360,0	
LID WEIGHT [g]	5,0	
BODY+LID WEIGHT	365,0	
WEIGHT OF PRODUCT (G)	1000	
PACK + PRODUCT WEIGHT (G)	1365,0	
PACKAGING CAPACITY (ML)	1000	
PACKAGING BODY (MAJOR)	Bottle	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	White Glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	Twist-off capsule	
MATERIALS (Lid)	metal	
SUPPLIER NAME	Vidrala	

PRODUCT 14-r

ID LCA	14-r	Picture
FOOD CATEGORY	Savory biscuits	
PRODUCT	Biscuits Mini GF choco	
INDUSTRIALS	Biscuits Bouvards	
PACKAGING WEIGHT [g]	37,0	
LID WEIGHT [g]	9,7	
BODY+LID WEIGHT	46,7	
WEIGHT OF PRODUCT (G)	350	
PACK + PRODUCT WEIGHT (G)	396,7	
PACKAGING CAPACITY (ML)	1000	
PACKAGING BODY (MAJOR)	Bucket	
MORE DETAILS ABOUT THE PACKAGING BODY	White packaging	
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Injection	
PACKAGING COMPONENTS [All lids are considered disposable.]	Clip lid	
MATERIALS (Lid)	Rigid PP	
SUPPLIER NAME	Berry Superfos	

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PRODUCT 15-r

ID LCA	15_r	Picture
FOOD CATEGORY	Yoghurts	
PRODUCT	Fromage blanc 2 kg	
INDUSTRIALS	Rians	
PACKAGING WEIGHT [g]	70,9	
LID WEIGHT [g]	17,6	
BODY+LID WEIGHT	88,5	
WEIGHT OF PRODUCT (G)	2000	
PACK + PRODUCT WEIGHT (G)	2088,5	
PACKAGING CAPACITY (ML)	2300	
PACKAGING BODY (MAJOR)	Bucket	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	Rigid polypropylene	
PROCESS TECHNOLOGY	Injection	
PACKAGING COMPONENTS [All lids are considered disposable.]	Clip lid	
MATERIALS (Lid)	Rigid PP	
SUPPLIER NAME	BERRY	

PRODUCT 16-r

ID LCA	16_r	Picture
FOOD CATEGORY	Boissons	
PRODUCT	Syrup	
INDUSTRIALS	Monin	
PACKAGING WEIGHT [g]	460,0	
LID WEIGHT [g]	2,2	
BODY+LID WEIGHT	462,2	
WEIGHT OF PRODUCT (G)	438	
PACK + PRODUCT WEIGHT (G)	900,2	
PACKAGING CAPACITY (ML)	700	
PACKAGING BODY (MAJOR)	Bottle	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	White Glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	Clip lid	
MATERIALS (Lid)	injected PEHD	
SUPPLIER NAME	Veralia	

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PRODUCT 17-r

ID LCA	17_r	Picture
FOOD CATEGORY	Condiments	
PRODUCT	Mayonnaise	
INDUSTRIALS	Lesieur	
PACKAGING WEIGHT [g]	230,0	
LID WEIGHT [g]	7,8	
BODY+LID WEIGHT	237,8	
WEIGHT OF PRODUCT (G)	239	
PACK + PRODUCT WEIGHT (G)	476,8	
PACKAGING CAPACITY (ML)		
PACKAGING BODY (MAJOR)	Pot	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	White Glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	twist-off lid + label	
MATERIALS (Lid)	lid tin plated iron + paper label	
SUPPLIER NAME	Ardagh Group	

PRODUCT 18-r

ID LCA	18_r	Picture
FOOD CATEGORY	Oil	
PRODUCT	Olive Oil	
INDUSTRIALS	Lesieur	
PACKAGING WEIGHT [g]	160,0	
LID WEIGHT [g]	12,9	
BODY+LID WEIGHT	172,9	
WEIGHT OF PRODUCT (G)	250	
PACK + PRODUCT WEIGHT (G)	422,9	
PACKAGING CAPACITY (ML)	250	
PACKAGING BODY (MAJOR)	Bottle	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	White Glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	Clip lid + pourer	
MATERIALS (Lid)	Lid in aluminium + injected PP pourer	
SUPPLIER NAME	Veralia	

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PRODUCT 19-r

ID LCA	19_r	Picture
FOOD CATEGORY	Boissons	
PRODUCT	Sweet/brut cider	
INDUSTRIALS	Eclor	
PACKAGING WEIGHT [g]	540,0	
LID WEIGHT [g]	12,5 (7,5 cork, 5 wire)	
BODY+LID WEIGHT	552,5	
WEIGHT OF PRODUCT (G)	790	
PACK + PRODUCT WEIGHT (G)	1342,5	
PACKAGING CAPACITY (ML)	750	
PACKAGING BODY (MAJOR)	Bottle	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	Green glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	Lid	
MATERIALS (Lid)	Cork stopper, galvanised mild steel wire (95% zinc), tin plate	
SUPPLIER NAME	Veralia	

PRODUCT 20-r

ID LCA	20_r	Picture
FOOD CATEGORY	Boissons	
PRODUCT	Lemonade	
INDUSTRIALS	Source de Soulzmatt	
PACKAGING WEIGHT [g]	560,0	
LID WEIGHT [g]	25g with : 10g for the plastic part 15g for the metal part	
BODY+LID WEIGHT	585,0	
WEIGHT OF PRODUCT (G)	750	
PACK + PRODUCT WEIGHT (G)	1335,0	
PACKAGING CAPACITY (ML)	1000	
PACKAGING BODY (MAJOR)	Bottle	
MORE DETAILS ABOUT THE PACKAGING BODY		
MATERIAL (Body)	White Glass	
PROCESS TECHNOLOGY	Glass blowing	
PACKAGING COMPONENTS [All lids are considered disposable.]	meccanic closure	
MATERIALS (Lid)	Metal and plastic	
SUPPLIER NAME	TBD	

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