R3PACK

REDUCE, REUSE, RETHINK PACKAGING

WP3.1- Selection of suitable packaging for reuse for each product type

Work package: WP3 – REUSE: towards industrial, economical and environmental optimisation
Task: 3.1 - Selection of standardized packaging and recyclability assessment
Deliverable: 3.1 – Selection of suitable packaging for reuse for each product type

Dissemination level: Public deliverable
Issue date: M7
Lead beneficiary: (RE)SET

Funded by the European Union

This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No 101060806.

DOCUMENT INFORMATION

HISTORY OF CHANGES		
Version	**Publication date**	**Changes**
1.0	29.12.2022	1st version

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DOCUMENT DISTRIBUTION		
Issue	**Date**	**Distributed to**
	31.12.2022	European Commission (PUBLIC)

VERIFICATION AND APPROVAL		
	Date	**Distributed to**
Approval Final Deliverable by (RE)SET	29.12.2022	Antoine Covillers

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GLOSSARY

ENABLERS: member of R3PACK's project that support the project with an expertise (flux modelisation, food safety, etc) that facilitate the collaborative work.

FOOD PRODUCERS: member of R3PACK's project that provide food product to the market, either by having production plant (industrials) or by conditioning food at the point of sale (retailers).

IN-SHOP PRODUCTS: food products conditioned in the shop by a storekeeper or in the shop back room and sold in self-service.

PACKAGING COMBINATION: a combination refers to the association of one packaging format with one material with one capacity and with one closing system among the potential possibilities.

PBT: polybuthylene terephtalate

PET: polyethylene terephtalate

PP: polypropylene

REUSE: one of the two project pillars – it consists in supporting the uptake of economic, industrial and environmental optimised reuse schemes. This implies packaging standardization across food producers, normalization of food safety & washing methods frameworks, logistics optimization, maximization of return rate through social innovation practices, etc.

SOURCING: phase of the project during which (RE)SET and partners look for packaging available on the market that answer the selected product constraints. The packaging found are then gathered in a database.

TRITAN: a copolyester of interest for reusable packaging

INTRODUCTION

Within the work package 3, the task 3.1 aims at making a **selection of reusable packaging options relevant for the food product types covered by R3PACK:** prepared salads, unprocessed fruits and vegetables, in-shop products, butter, cheese, yoghurt, savoury biscuits, chips, soups, milk and juices. Today, most of these food categories are not covered by reuse systems in Europe.

In order to be economically and environmentally viable and scalable, reuse systems call for more harmonization across their value chain and logistics model. At industrial scale for instance, identifying the product types that have similar needs is essential to allow mutualization of reusable packaging for a wider product group (e.g. milk and juice bottles), which supports the standardization of packaging.

The exercise is complex as it requires the food producers and retailers to take a cross-industry perspective. As the packaging will possibly contain a different product at each rotation, it is important to keep in mind the implications for the packaging in terms of alteration, use, logistics. Nonetheless, it is a key lever to expand reuse in the food sector.

The deliverable details the adopted approach and methodology, as well as the choices made within R3PACK's consortium. For everyone's sake and the development of reuse at the European scale, the deliverable will be made public.

The document is divided into three main parts:

I / The first part presents the **used methodology** for designing the packaging options list

II / The second part provides more details on the **material characteristics,** their advantages and limits to be used as reusable packaging

III / The third part gives an overview of the **packaging selection's next steps** with regards to the following reuse demonstration phase

DISCLAIMER

The deliverable 3.1 gives an overview of the methodology used by R3PACK to select reusable packaging for the demonstrator and the potential reusable packaging existing today on the market.

- The work done in this task is not entirely new, it builds up on several previous works on reuse standards.
- The different rounds of individual choices and collective alignment is one methodology, but it is not the only one.
- The selection list of reusable packaging is non-exhaustive and remains, to date, only potential options. Tests in terms of food safety, industrial compatibility, etc, need to be done before the launch of the pilot phase to validate their use in real life cases.
- Materials, formats, closing systems are perfectible and will have to evolve to obtain the best fit in terms of meeting food products requirements in the context of reuse scheme.
- Even if packaging are intended to be reused and not thrown away after one use, recyclability of the material remains important. However, some resins in development appear promising but do not yet have recycling facility as the flux is too small.

Then on the choice of materials, three strategies were considered:

- Common plastic resins such as PET, PP, with existing recycling infrastructure but which reusability remains to be validated.
- Uncommon plastic resins, without recycling infrastructure but which properties (strength, temperature resistance, etc) are valuable for reuse. Among them, PBT and Tritan seem to be the most promising, notably for R3PACK's experiment.
- Common materials such as glass and stainless steel, well known in the food sector.

INVOLVED PARTNERS

FOOD PRODUCERS

ALTHO

Sodiaal candia* Yoplait EntreMont

europe snacks

Floréale UNE ENTREPRISE DU GROUPE AGRIAL

Laiterie de Saint Denis de l'Hôtel

Schreiber

Carrefour**

U**

ENABLERS

SGS

Alma Mater Studiorum Università di Bologna A.D. 1088

**NB: Candia is R3PACK's official signatory member. However it is part of a larger group, Sodiaal, therefore the selection of packaged products to be considered within the project will be extended to the affiliated brands Yoplait and EntreMont*
***NB: Carrefour & Système U are involved in WP3.1 as food producers. In fact they are the "producer" of the in-shop products (cold cuts, cheese, delicatessen, etc) sold in their stores.*

FOOD PRODUCTS CONCERNED

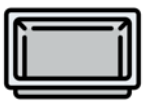
DEPRIORITIZED*

BAGGED SALADS

BUTTER

CHEESE

CHIPS



IN-SHOP PRODUCTS

JUICES

MILK

PREPARED SALADS

SAVORY BISCUITS

SOUPS

PREPARED/MASHED FRUITS & VEGETABLES

YOGHURT & SOUR CREAM

NB: To date, bagged salads & butter have been excluded from reuse demonstrator. The explanation may be found in WP2.1 deliverable in part 3 "Feasability assessment per food category".

I / STANDARDIZED PACKAGING SELECTION

Funded by the European Union

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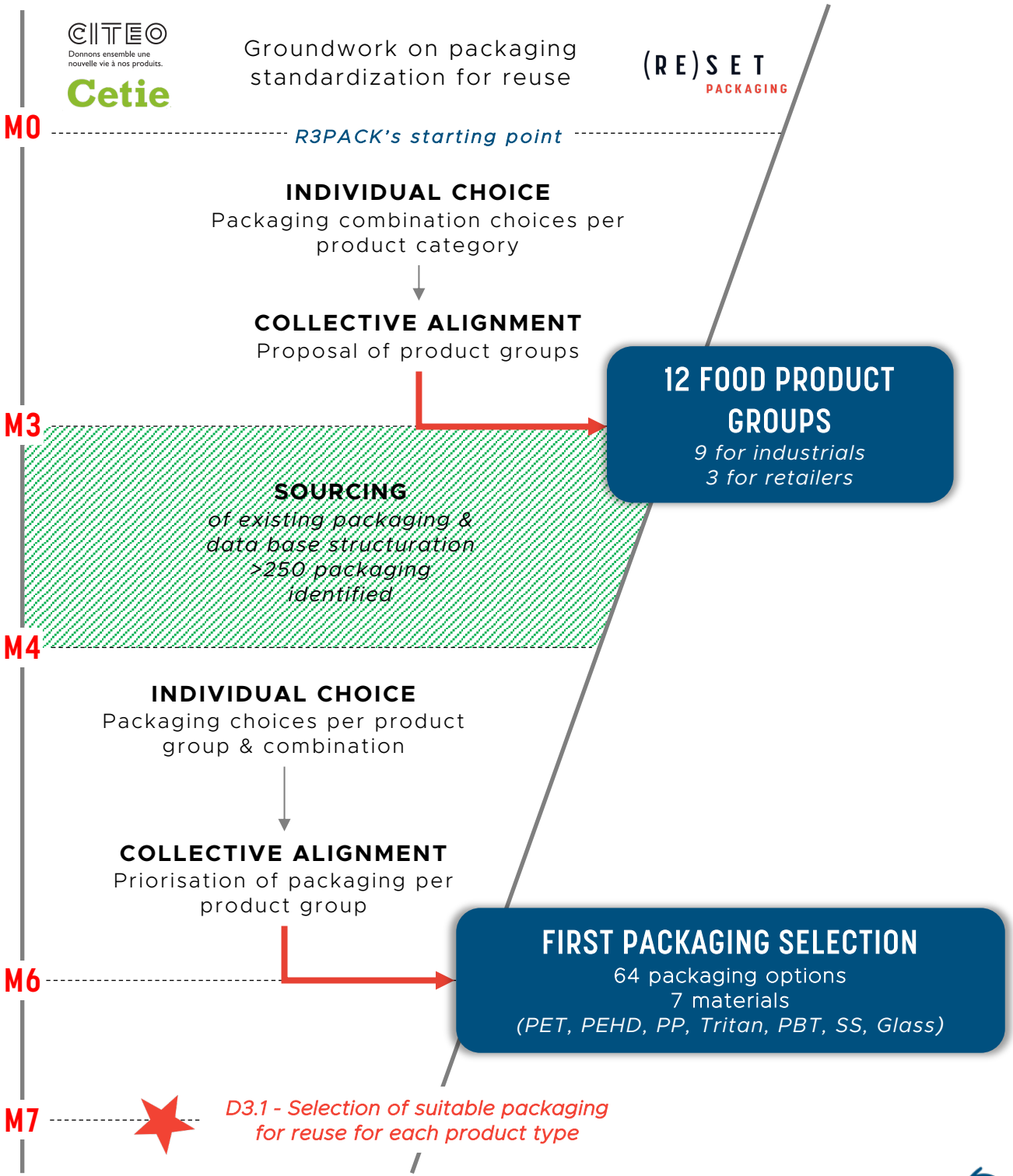
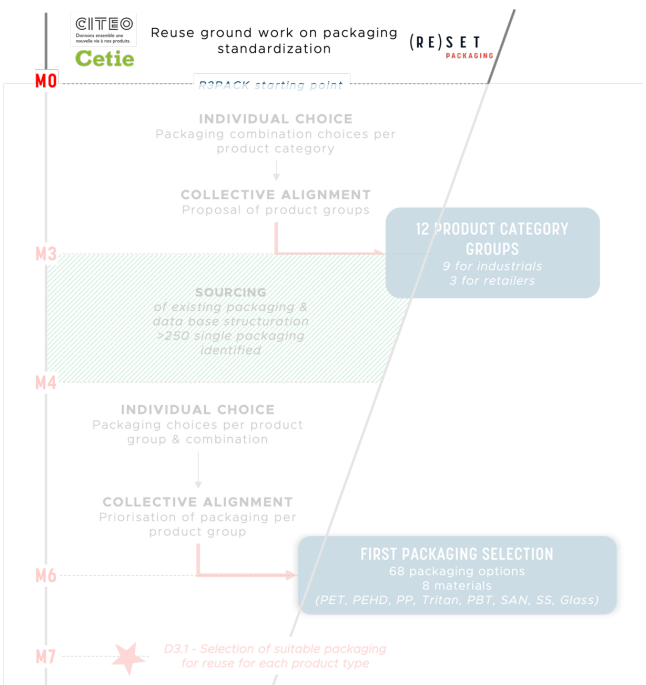
METHODOLOGY OVERVIEW

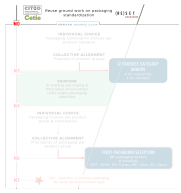


R3PACK

#1

GROUNDWORK





WHY & WHERE DO THE STANDARDS COME FROM?

Reusable packaging for food products is a promising solution to reduce the impact of plastic packaging on the planet. Many experiments are being devised and tested, particularly in France but also across other European countries. Thanks to these, the conditions for reuse scheme success are emerging. Among the levers, the **definition of standard packaging** ranges appears to be crucial. Standardization has been pushed in France by the anti-waste law for a circular economy (AGEC) which asked the companies responsible for household waste management (as per the EPR – extended producer responsibility) to define, no later than January 1st, 2022 "standard ranges of reusable packaging for catering, fresh products and beverages sectors".

What are the benefits of using standard reusable packaging?

It has environmental and economic advantages by:

- Allowing the mutualization of packaging across industrials leading to the **optimization of the return rate** and sorting, washing and logistical processes
- Creating a complete **territorial network**
- Facilitating access for all food producers/marketers to a range of packaging adapted to reuse, even those who do not have the means to get started
- Making **reuse simpler and more understandable for consumers**, whose return of packaging after use of products is essential

CITEO
Donnons ensemble une nouvelle vie à nos produits.

In 2021, CITEO, responsible for the management of consumers' packaging waste end of life in France, has initiated a working group around **reusable standard packaging for fresh products, catering and beverage sectors**. It has onboarded food industrials and existing reuse operators to define the packaging combination that could answer product and industrial constraints and be used in reuse schemes, at least at national scale. This collaborative work coordinated by (RE)SET took place in three steps:

1. circular analysis to write the first reusable packaging specifications,
2. definition of packaging ranges design
3. rapid testing to validate the use and relevance of identified options and make recommendations

What is a combination?

A packaging combination refers to four parameters: format, capacity, material, closing system.

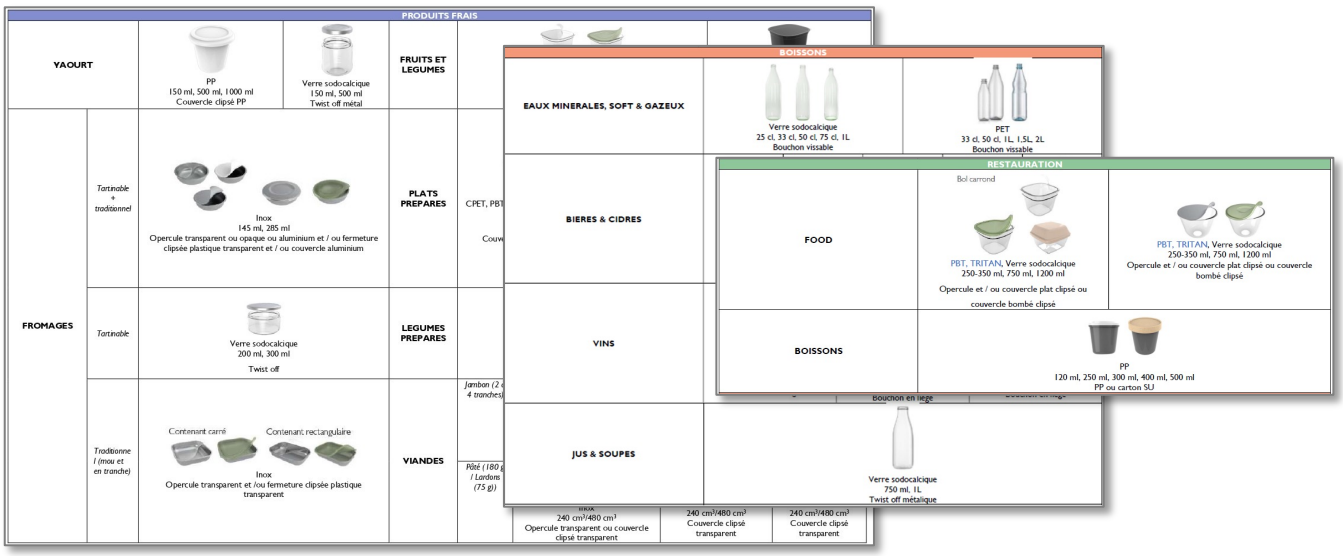
R3PACK

WHY & WHERE DO THE STANDARDS COME FROM?

CITEO

Donnons ensemble une nouvelle vie à nos produits.

Study results have led to different reusable packaging ranges for the three concerned sectors (fresh products, beverages and catering).



These are the starting point of the creation of standard reusable packaging. The feasibility and compliance of the future standards need to be operationally and organizationally demonstrated (food safety, physical integrity, functionality in reuse scenario and optimized model).

Cetie

Cetie, is the International Technical Center for Bottling and related Packaging, it gathers the main experts of the glass and PET packaging industry. It has a similar objective as Citeo, to **make large-scale reuse possible in France**. Cetie has announced in 2022 the creation of a working group focused on "*Reuse of containers designed for food and beverages*". The group gathers marketers, fillers, federations, glass manufacturers, washers, inspection machine and corks and caps manufacturers, the State-organisations ADEME and CITEO.

From a note dated November 11th, 2022, they have brainstormed on the characteristics needed for a reusable container. Indeed, even if those start to be well known for glass bottles, we still have little knowledge about the specifications for jars and other types of food containers.

WHY & WHERE DO THE STANDARDS COME FROM?

Cetie

Several criteria have been raised by the glass manufacturer Owens Illinois to determine whether or not a jar is reusable: **minimum thickness** of the body and the bearing surface, **minimum radius** inside the base and **performance tests**.

The performance tests consist of thermal shock, impact test and top load after a 100 minutes simulation in the bottling line.

The complete protocol should be refined with boundary values and recommendations on design aspects (shape of contact zones, shoulder shape, protection of the finish).

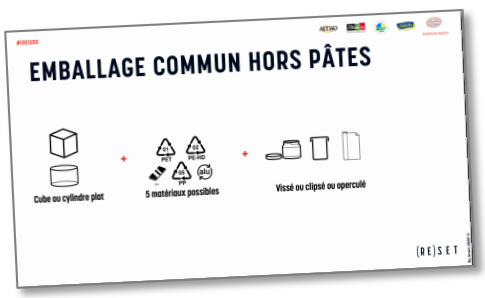
The same group has also worked on the **washing part of reuse scheme**, asking what the microbiological contamination and allergens acceptable limits are. As washers will generally be outsourced, it's important to certify they meet industrial specifications. The first discussions concluded the following:

- No need to require zero microbiological contamination as it is not the case for single-use packaging either
- Allergens subject is more complex and requires more precautions to limit condensation

The objective of Cetie's guides and recommendations is to **help the sector to reach harmonisation on the essential aspects** and to offer consumers safe, reliable and sustainable solutions.

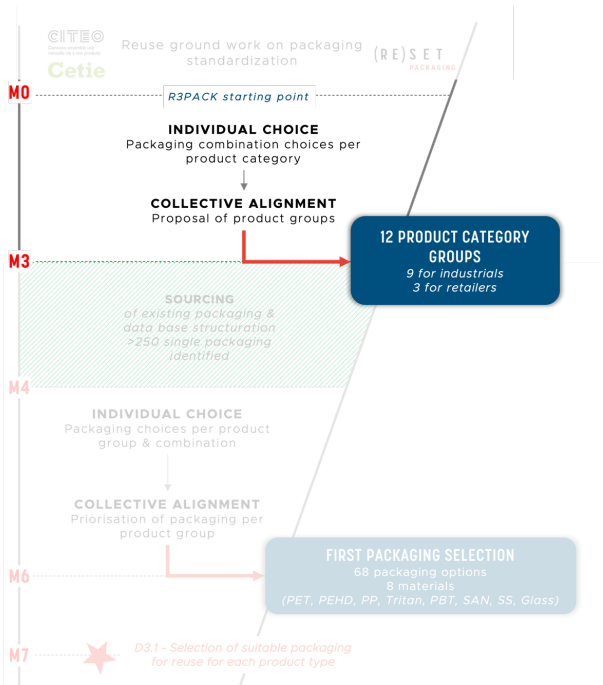
(RE)SET PACKAGING

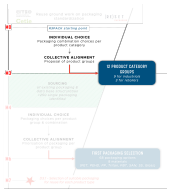
With its historical consortium, (RE)SET has engaged first discussions between industrials on standardized packaging. Coming from different food sectors (chips, yoghurt, snacking salads, cheese, etc) they have started to think about **common packaging combinations** that could meet the constraints of several of their products. This work was the basis of R3PACK's task 3.1. In fact, the industrials were made aware of the standardization concept, thus facilitating alignment.



#2

PRODUCT GROUP ALIGNMENT

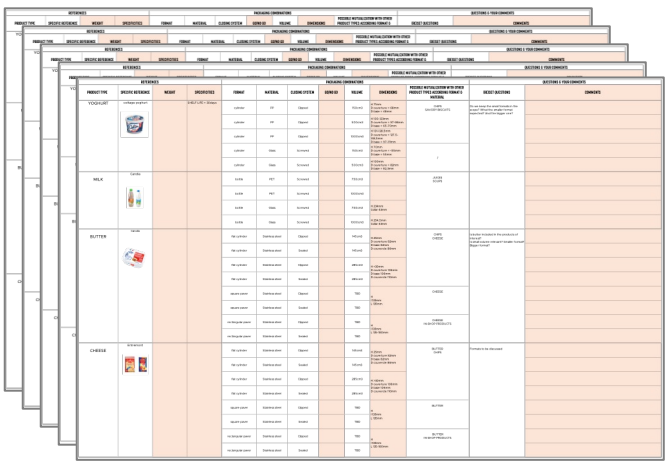




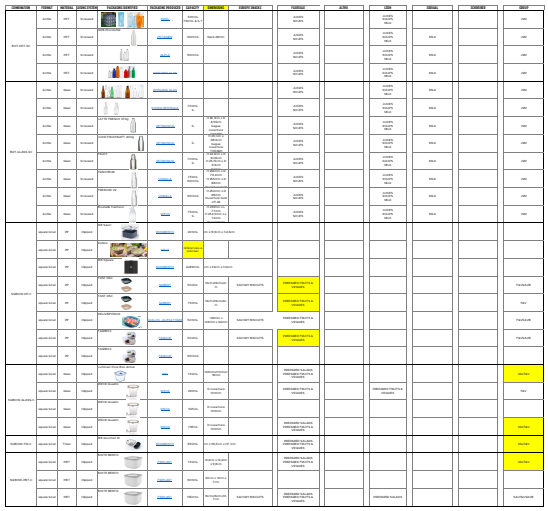
GROUP FORMATION PROCESS

Based on the different studies and work that have been initiated by CITEO, Cetie and (RE)SET Packaging on reusable packaging standardization, R3PACK has started task 3.1 by **forming product groups**.

First, a **list of possible packaging combinations per product category** has been sent **individually** to each industrial and retailer. For each combination, the partner was able to give a go or no go and to provide qualitative details on the constraints of the product-packaging couple such as the need of transparency.

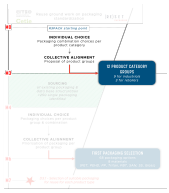


INDUSTRIAL MATRIX COMPILING POSSIBLE PACKAGING COMBINATION PER PRODUCT CATEGORY



COMPILATION OF INDIVIDUAL CHOICE TO GET A MULTI-INDUSTRY VISION

After this individual choice step, (RE)SET has compiled the answers and **structured the product groups based on answers' similarities**. At this stage ten industrial product groups and five retailer in-shop product groups have been identified. There are presented in the following pages. Each product group has a specific set of packaging combinations.



INDUSTRIAL PRODUCT GROUPS

1-SMALL SIZE PLASTIC PACKAGING
250-350mL

*

2-MEDIUM SIZE PREPARED FRUITS & VEGETABLES
650-750mL

3-BIG SIZE NON-LIQUID PRODUCTS
1200mL

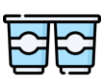
4-MEDIUM SIZE DAIRY PRODUCTS
500-600mL

5-BIG SIZE PLASTIC « BUCKET »
≈ 1000mL

6-EXTREME BIG SIZE SALTY SNACKS
>2000mL

7-GLASS BOWL & PAVER
1200mL

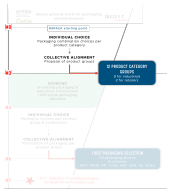
8-GLASS JAR*
1000mL



9-LIQUID PRODUCTS
1000mL

10-STAINLESS STEEL PAVER & BOWL
300mL - 500mL - ≈ 1000mL

**small size sour cream (in group 1) & big glass yoghurt (group 8) have been deprioritized by industrials*

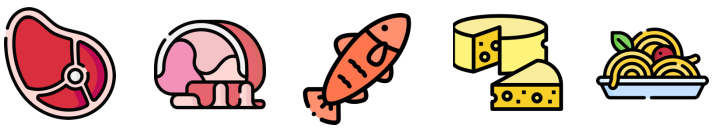


RETAILER IN-SHOP PRPDUCT GROUPS

In-shop products are food products **conditioned in the shop** by a storekeeper or in the shop back room and sold in self-service. At first, it has been decided to make different groups for in-shop products as they may not use the same distribution channels and logistics compared to industrial products. Nonetheless, in a second time, when final packaging will be selected, we could observe packaging overlaps between industrials and retailers and then think of potential mutualization.

1-MEAT, COLD CUTS, FISH, CHEESE & CATERED MEALS

≈650mL, ≈1500mL, ≈2500mL, >3000mL



2-FOCUS ROASTED CHICKEN*

>5000mL

3-PRE-CUT FRUITS & VEGETABLES

200-300mL & 400-500mL

4-JUICES

500mL

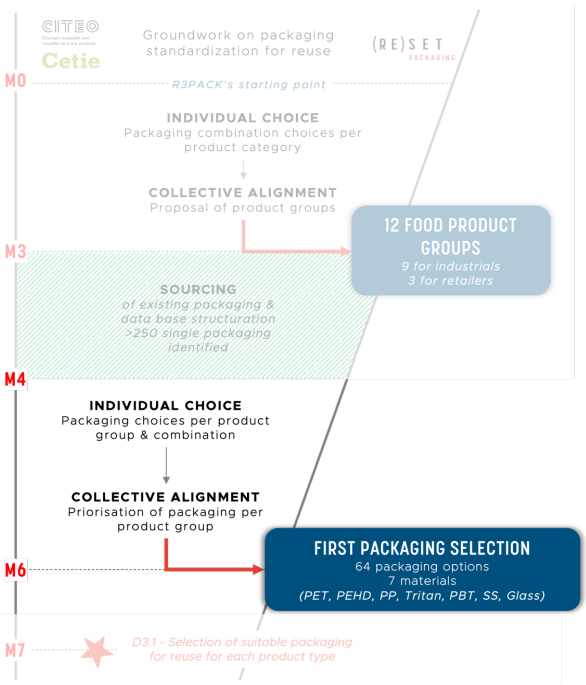
5-BAKERY & PASTRY

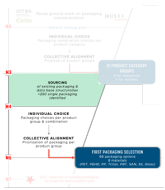
1500, 2500mL

**roasted chicken has been deprioritized by retailers*

#3

SOURCING & PACKAGING CHOICE





SOURCING

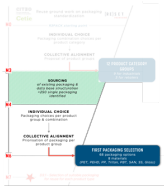
Following the first step of choosing the packaging combinations per product category and setting up the product groups, (RE)SET started a **sourcing phase of packaging that meet industrial and retailer criteria**.

This sourcing is based on packaging **currently available** on the market, either already declared reusable or which reusability would be interesting to explore. In any case, **all selected packaging are food safe**.

Then, a base of **500+** single packaging references from about fifty different producers (mainly European ones) has been structured. The list is not exhaustive.

COMBINATION	FORMA	MATE	CLOS SYST	PACKAGING IDENTIFIED	PACKAGING PRODUCE	CAPACITY	DIMENSIONS	SPECIFITIES
RBOW-SS-C	round bowl	Stainless steel	Clipped	BOL	TIFFIN	700mL	D 12cm x 6,5cm	
	round bowl	Stainless steel	Clipped	BOL	TIFFIN	1,1L	D 14cm x 8,5cm	
	round bowl	Stainless steel	Clipped	ASSIETTE	TIFFIN	1100mL	D180mm x h50mm	compartments possibilities
	round bowl	Stainless steel	Clipped	MUOVO	GEEU	2500mL	D200mm x h132mm	Internal graduation Dishwasher safe Silicon watertight lid
RBOW-SS-S	round bowl	Stainless steel	Sealed					
RBOW-PBT-C	round bowl	PBT	Clipped	R'box small box	FIBPLAST	300/360mL	Dbas 50mm x Dhaut135mm x h : 50mm	plus 20% glass fiber Microwave, dishwasher & freezer safe BPA free stackable 65g
	round bowl	PBT	Clipped	R'box medium box	FIBPLAST	850/1000mL	Dbas 120mm x Dhaut 195mm x h 54mm	plus 20% glass fiber Microwave, dishwasher & freezer safe BPA free stackable 130g
	round bowl	PBT	Clipped	R'box large box	FIBPLAST	1150/1300mL	Dbas 120mm x Dhaut 195mm x h 67mm	plus 20% glass fiber Microwave, dishwasher & freezer safe BPA free stackable 150g
	round bowl	PBT	Clipped	BOWL	ECOBOX	500mL		Ornamin producer Microwave & freezer safe
	round bowl	PBT	Clipped	BOWL	ECOBOX	1000mL		Ornamin producer Microwave, dihwasher & freezer safe
	round bowl	PBT	Clipped	BOX 1S	RECIRCLE	600mL	D170mm x h TBC	Glass fibers added BPA free PP lid Tight closing
	round bowl	PBT	Clipped	BOX 1M	RECIRCLE	1200mL	D195mm x hTBC	Glass fibers added BPA free PP lid Tight closing
	round bowl	PBT	Clipped	BOX MENU	RECIRCLE	900mL	D240mm x hTBC	Glass fibers added BPA free PP lid Tight closing
	round bowl	PBT	Clipped	BOX PIZZA	RECIRCLE		D320mm	Glass fibers added BPA free PP lid Tight closing

PACKAGING DATA BASE



PACKAGING OPTIONS

From the packaging database and the alignment done previously, **each packaging has been associated to a product group or not.**

This packaging didn't meet any product group requirement, thus it has not been proposed

RECPAV-PP-C	rectangular paver	PP	Clipped	DELIVERIPACK		LIN - ALPHA F	950mL	L232mm x l172mm x h60mm		
	rectangular paver	PP	Clipped	PRESTIPACK		LIN - ALPHA F	600mL	L160mm x l130mm x h55mm		2

This packaging has been proposed to product group 2

Industrials and retailers have then received **individual presentations** including the product groups in which they are included as well as **specific packaging proposals for each of their couple** "*product group X packaging combination*".

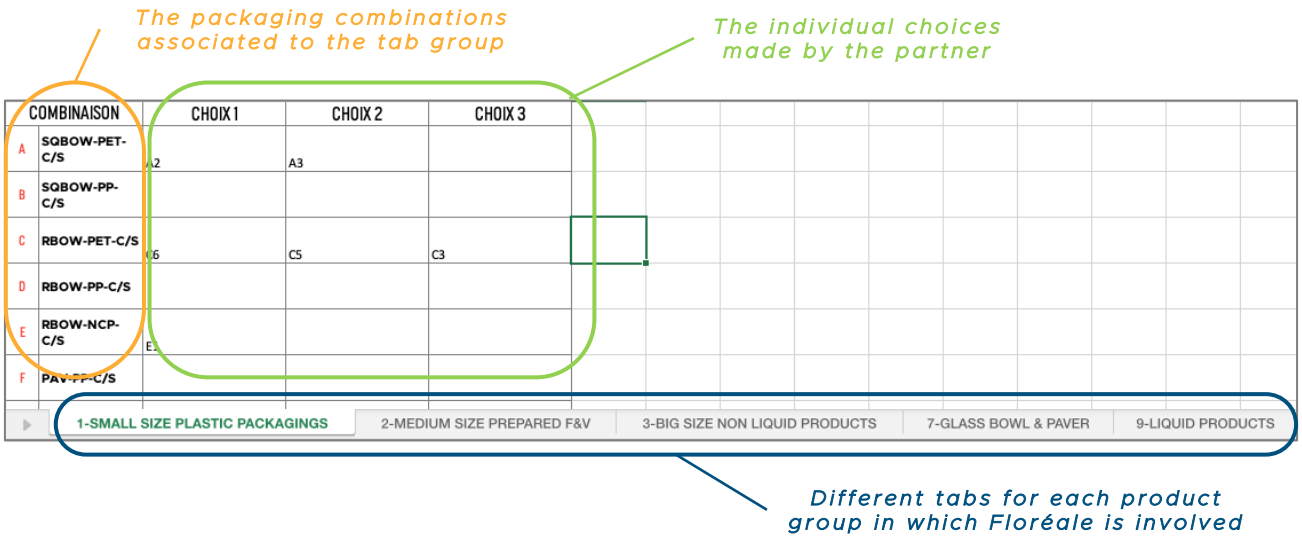
Below is an example of packaging propositions for the **industrial group 1*** and the combination "*square bowl X 250-350mL X material PP X clipped/sealed*". It has been sent to Floréale, LSDH, Sodiaal and Schreiber.

**In the end, the group 1 encompasses only prepared fruits and vegetables produced by Floréale and LSDH, small size sour cream having been deprioritized.*

INDIVIDUAL CHOICE & COLLECTIVE ALIGNMENT

Industrials and retailers individually completed a **choice matrix** for each product group by filling in a maximum of three packaging choices with the code given on the presentation.

Below is the matrix that has been filled by Floréale.



Based on all the individual choices, a **workshop in sub-groups** was organised to **align the partners of a same product group on final selection options.** Maximum five options were kept with the aim to meet the products constraints while accepting some compromises. In fact, industrials know that for now, the perfect reusable packaging, exactly equivalent to the current single-use one does not exist.

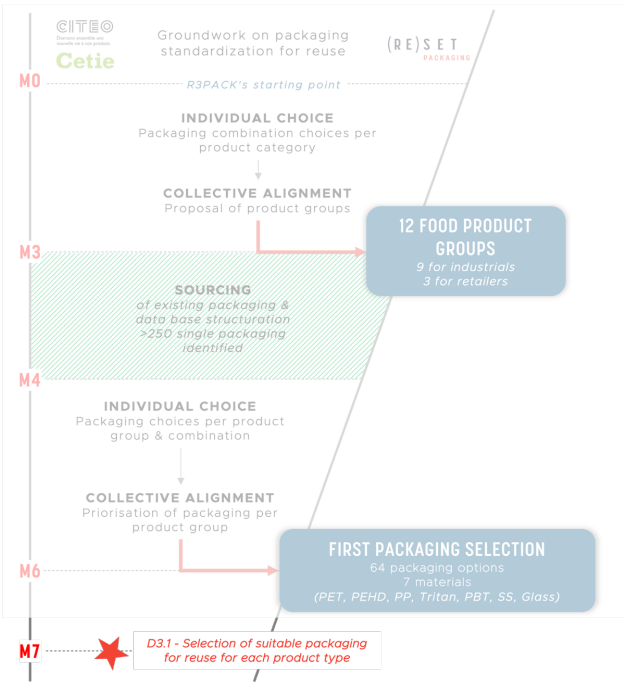
The **selected options** per each product group are then presented in the next section.

For each product, the first page presents the group with the **product references**, the targeted **volume** and the **food producers**.

Then per product group the **options are listed per material**.

#4

TO DATE SELECTION



1-SMALL SIZE PLASTIC PACKAGING

PREPARED FRUITS & VEGETABLES

Specific volume: **250-350mL**

FOOD PRODUCER	Floréale – UNE ENTREPRISE DU GROUPE AGRIAL	LAITERIE DE SAINT DENIS DE L'HOTEL
REFERENCES		

1-SMALL SIZE PLASTIC PACKAGING

PREPARED FRUITS & VEGETABLES - PET

INDUSTRIALS

MATERIAL

PET

SPECIFIC VOLUME

250-350mL

		
Packaging producer / *brand*	ALLINPACKAGING *Pot PET rond*	GUILLIN - ALPHA FORM *Crudipack (thicker prototype)*
Dimension	D63,7mm x h96,5mm Douverture 63mm	L160mm x l160mm x h45mm
Precise volume claimed	250mL	370mL
Material	PET	PET
Closing system	Screwed	Clipped

1-SMALL SIZE PLASTIC PACKAGING

PREPARED FRUITS & VEGETABLES - PP

INDUSTRIALS

MATERIAL
PP

SPECIFIC VOLUME
250-350mL

			
Packaging producer / *brand*	GUILLIN - ALPHA FORM *Prestipack*	BERRY SUPERFOS *UniPak Round 3*	BERRY SUPERFOS *Superlock 95*
Dimension	D128mm x h50mm	D117,9mm x h52,6mm	Dtop91,5mm x Dbottom 70,9mm x h70mm
Precise volume claimed	350mL	360mL	315mL
Material	PP	PP	PP
Closing system	Clipped	Clipped	Clipped/sealed

1-SMALL SIZE PLASTIC PACKAGING

PREPARED FRUITS & VEGETABLES - NCP

INDUSTRIALS

MATERIAL

NCP

SPECIFIC VOLUME

250-350mL

			
Packaging producer / *brand*	FIRPLAST *R'box*	MONBENTO *MB delight*	FIRPLAST *R'box small box*
Dimension	D135mm x h50mm	D70mm x h83mm	Dbas 50mm x Dhaut 135mm x h 50mm
Precise volume claimed	300mL	200mL	300/360mL
Material	PBT + *20% glass fibers*	Tritan (+ PP lid)	Tritan
Closing system	Clipped	Clipped	Clipped

R3PACK

2-MEDIUM SIZE PREPARED FRUITS & VEGETABLES

PREPARED FRUITS & VEGETABLES

Specific volume: **650-750mL**

FOOD PRODUCER	Floréale – UNE ENTREPRISE DU GROUPE AGRIAL
REFERENCES	

2-MEDIUM SIZE PREPARED FRUITS & VEGETABLES

PREPARED FRUITS & VEGETABLES - PET

/!\ only fruits

INDUSTRIALS

Floréale

MATERIAL

PET

SPECIFIC VOLUME

650-750mL

			
Packaging producer / *brand*	KNAUF INDUSTRIES *Kary fresh*	GUILLIN - ALPHA FORM *Freshipack*	GUILLIN - ALPHA FORM *Sekipack*
Dimension	L170mm x l130mm x h55mm	L135mm x l135mm x h80mm	D175mm x h95mm
Precise volume claimed	750mL	750mL	750mL
Material	PET	PET	PET
Closing system	Clipped	Clipped	Clipped

2-MEDIUM SIZE PREPARED FRUITS & VEGETABLES

PREPARED FRUITS & VEGETABLES - PP

INDUSTRIALS

MATERIAL
PP

SPECIFIC VOLUME
650-750mL

				
Packaging producer / *brand*	SABERT *Fast Pac*	PKG FOODS *Square bowl*	*REUSABOL* *Big one*	SABERT *Fast Pac*
Dimension	L160mm x l160mm x h60mm	L160mm x l160mm x H60mm	TBC	L230mm x l170mm x h40mm
Precise volume claimed	750mL	750mL	750mL	600mL
Material	PP	PP	PP	PP
Closing system	Clipped	Clipped	Clipped	Clipped

/!\ only purées

2-MEDIUM SIZE PREPARED FRUITS & VEGETABLES

PREPARED FRUITS & VEGETABLES - GLASS

INDUSTRIALS

Floréale

MATERIAL

GLASS

SPECIFIC VOLUME

650-750mL

					
Packaging producer / *brand*	ARC *Luminarc Pure Box Active*	BORMIOLI ROCCO *Frigoverre evolution square tall*	ARC *Luminarc salad bowl*	*ARC* *Luminarc Keep'n Box*	DURALEX *Freshbox square*
Dimension	L111mm x l118mm x h122mm	L120mm x l120mm x h110mm	D140mm x h62mm	149mmx149mmx59mm	L140mm x l140mm x h58mm
Precise volume claimed	750mL	754mL	TBC	760mL	610mL
Material	Glass (weight TBC)	Glass (weight TBC)	Glass (334g)	Glass (490g)	Glass (346g)
Closing system	Clipped	Clipped	Clipped	Clipped	Clipped

R3PACK

3-BIG SIZE NON LIQUID PRODUCTS

SNACKING SALADS & SAVORY BISCUITS

Specific volume: **1200mL**

FOOD PRODUCER	Florédale – UNE ENTREPRISE DU GROUPE AORIAL	LAITERIE DE SAINT DENIS DE L'HOTEL	europe snacks	
REFERENCES				

3-BIG SIZE NON LIQUID PRODUCTS

SNACKING SALADS & SAVORY BISCUITS- PET

INDUSTRIALS

MATERIAL

PET

SPECIFIC VOLUME

1200mL

		
Packaging producer / *brand*	GUILLIN - ALPHA FORM *Multipack*	PETAINER *Straight cylindrical*
Dimension	L192mm x l160mm x h55mm	D114mm x h161mm Dtop 110mm
Precise volume claimed	1000mL	1250mL
Material	PET /!\ only salads	PETclear /!\ only biscuits
Closing system	Clipped	Screwed

3-BIG SIZE NON LIQUID PRODUCTS

SNACKING SALADS & SAVORY BISCUITS- PP

INDUSTRIALS

MATERIAL

PP

SPECIFIC VOLUME

1200mL

		
Packaging producer / *brand*	BERRY SUPERFOS *Unipak square 1*	GUILLIN – ALPHA FORM *Alphacell*
Dimension	L128,5mm x l128,5mm x h108,3mm	L227mm x l77mm x h50mm
Precise volume claimed	1150mL	1510mL
Material	PP	PP
Closing system	Clipped	Sealed

R3PACK

3-BIG SIZE NON LIQUID PRODUCTS

SNACKING SALADS & SAVORY BISCUITS- NCP

INDUSTRIALS

MATERIAL

NCP

SPECIFIC VOLUME

1200mL

		
Packaging producer / *brand*	MONBENTO *MB jar*	FIRPLAST *R'box medium box*
Dimension	D 118mm x h 120mm PP lid - D 124mm	Dbas 120mm x Dhaut 195mm x h 54mm
Precise volume claimed	1000mL	1000mL
Material	Tritan	Tritan
Closing system	Clipped	Clipped

R3PACK

4-MEDIUM SIZE DAIRY PRODUCTS

YOGHURT & SOUR CREAM

Specific volume: **500mL**

FOOD PRODUCER	candia yoplait	Schreiber
REFERENCES		

4-MEDIUM SIZE DAIRY PRODUCTS

YOGHURT & SOUR CREAM - PP

INDUSTRIALS

candia yoplait Schreiber

MATERIAL

PP

SPECIFIC VOLUME

500mL

			
Packaging producer / *brand*	REUSABOL *Small one*	JOKEY *Jetb 550*	BERRY SUPERFOS *UniPak round 2*
Dimension	TBC	Dtop118mm x h80mm	D118,2mm x h79,4mm
Precise volume claimed	500mL	550mL	565mL
Material	PP	PP	PP
Closing system	Clipped	Clipped	Clipped

R3PACK

4-MEDIUM SIZE DAIRY PRODUCTS

YOGHURT & SOUR CREAM - NCP

INDUSTRIALS

candia yoplait Schreiber

MATERIAL

NCP

SPECIFIC VOLUME

500mL

	
Packaging producer / *brand*	REUSABOL *Bowl*
Dimension	TBC
Precise volume claimed	500mL
Material	PBT
Closing system	Clipped

R3PACK

4-MEDIUM SIZE DAIRY PRODUCTS

YOGHURT & SOUR CREAM - GLASS

INDUSTRIALS

candia yoplait Schreiber

MATERIAL

GLASS

SPECIFIC VOLUME

500mL

		
Packaging producer / *brand*	BORMIOLI ROCCO *Frigoverre evolution round*	TICORBRAUN *Glass straight side jar 82-2040*
Dimension	D140mm x h65mm	D84,5mm x h107,95mm Dtop82mm
Precise volume claimed	510mL	473mL
Material	Glass	Glass
Closing system	Clipped	Screwed

5-BIG SIZE PLASTIC BUCKET

YOGHURT & SAVORY BISCUITS

Specific volume: **1000mL**

FOOD PRODUCER	candia yoplait	Schreiber	europe snacks
REFERENCES			

5-BIG SIZE PLASTIC BUCKET

YOGHURT, SOUR CREAM & SAVORY BISCUITS - PET

INDUSTRIALS

candia Yoplait · Schreiber · europe snacks

MATERIAL

PET

SPECIFIC VOLUME

1000mL

	
Packaging producer / *brand*	PETAINER *Straight cylindrical*
Dimension	D114mm x h161mm Dtop110mm
Precise volume claimed	1250mL
Material	PET (clear version)
Closing system	Screwed

R3PACK

5-BIG SIZE PLASTIC BUCKET

YOGHURT, SOUR CREAM & SAVORY BISCUITS - PP

INDUSTRIALS

candia yoplait Schreiber europe snacks

MATERIAL

PP

SPECIFIC VOLUME

1000mL

			
Packaging producer / *brand*	GUILLIN - ALPHA FORM *Tusipack*	JOKEY *Jetb 10*	MEPAL *Multi-fonction bol Cirqula high*
Dimension	D115mm x h153mm	Dbottom124mm x Dtop146mm x h92mm	Dbottom169mm x Dtop159mm x h100mm
Precise volume claimed	1000mL	1090mL (V ISO)	1000mL
Material	PP	PP	PP
Closing system	Clipped	Clipped	Clipped

R3PACK

5-BIG SIZE PLASTIC BUCKET

YOGHURT, SOUR CREAM & SAVORY BISCUITS - NCP

INDUSTRIALS

candia Yoplait Schreiber europe snacks

MATERIAL

NCP

SPECIFIC VOLUME

1000mL

		
Packaging producer / *brand*	ECOBOX *Bowl*	MONBENTO *MB jar*
Dimension	TBC	D 118mm x h 120mm PP lid - D 124mm
Precise volume claimed	1000mL	1000mL
Material	PBT	Tritan
Closing system	Clipped	Clipped

R3PACK

6-EXTREME BIG SIZE SALTY SNACKS

CHIPS & SAVORY BISCUITS

Specific volume: **>2000mL**

FOOD PRODUCER	ALTHO	europe snacks
REFERENCES		

6-EXTREME BIG SIZE SALTY SNACKS

CHIPS & SAVORY BISCUITS - PP

INDUSTRIALS

ALTHO europe snacks

MATERIAL

PP

SPECIFIC VOLUME

>2000mL

		
Packaging producer / *brand*	JOKEY *Jet 23*	BERRY SUPERFOS *UniPak Round*
Dimension	Dtop 175mm x h131,7mm	D170mm x h153mm
Precise volume claimed	2300mL	2300mL
Material	PP	PP
Closing system	Clipped	Clipped

R3PACK

6-EXTREME BIG SIZE SALTY SNACKS

CHIPS & SAVORY BISCUITS - SS

INDUSTRIALS

ALTHO europe snacks

MATERIAL

SS

SPECIFIC VOLUME

>2000mL

	
Packaging producer / *brand*	GEFU *Muovo*
Dimension	D200mm x h132mm
Precise volume claimed	2500mL
Material	Stainless steel
Closing system	Clipped

R3PACK

7-GLASS BOWL & PAVER

SNACKING SALADS

Specific volume: **1200mL**

FOOD PRODUCER	Floréale – UNE ENTREPRISE DU GROUPE AGRIAL	LAITERIE DE SAINT DENIS DE L'HOTEL
REFERENCES		

7-GLASS BOWL & PAVER

SNACKING SALADS- GLASS

INDUSTRIALS

MATERIAL

GLASS

SPECIFIC VOLUME

1200mL

		
Packaging producer / *brand*	ARC *Luminarc Keep'n box*	DURALEX *Fresh box square*
Dimension	D170mm x h83mm	L170mm x l170mm x h68mm
Precise volume claimed	1000mL (TBC)	1150mL
Material	Glass	glass
Closing system	Clipped	clipped

9-LIQUID PRODUCTS

SOUPS, JUICES, MILK

Specific volume: **1000mL**

FOOD PRODUCER	Floréale – UNE ENTREPRISE DU GROUPE AGRIAL	LAITERIE DE SAINT DENIS DE L'HOTEL	candia
REFERENCES			

9-LIQUID PRODUCTS

SOUPS, JUICES, MILK - PET

INDUSTRIALS

MATERIAL

PET

SPECIFIC VOLUME

1000mL

			
Packaging producer / *brand*	PETAINER *Plastic 38mm bottle*	FRAPAK *Milk bottle*	*Square bottle*
Dimension	D82mm x h240,5mm Neck 38mm	Neck 28mm	h231mm Neck 40mm
Precise volume claimed	1000mL	1000mL	1000mL
Material	PET	PET	PEHD
Closing system	screwed	screwed	screwed

9-LIQUID PRODUCTS

SOUPS, JUICES, MILK - GLASS

INDUSTRIALS

MATERIAL

GLASS

SPECIFIC VOLUME

1000mL

	
Packaging producer / *brand*	LE PARFAIT *Bouteille Fraîcheur*
Dimension	h260mm Neck TO48mm
Precise volume claimed	1000mL
Material	glass
Closing system	screwed

10-STAINLESS STEEL PAVER & BOWL

CHEESE

Specific volume: **300mL - 500mL - 1000mL**

FOOD PRODUCER	candia EntreMont
REFERENCES	  

10-STAINLESS STEEL PAVER & BOWL

CHEESE - SS

INDUSTRIALS

candia EntreMont

MATERIAL

SS

SPECIFIC VOLUME

300-500-1000mL

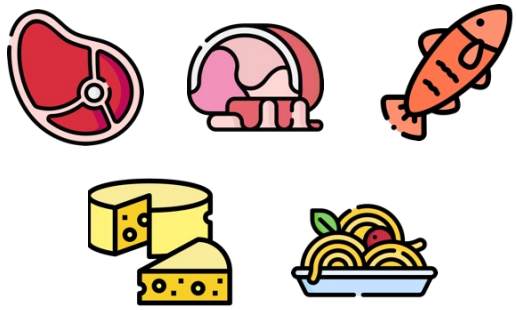
				
Packaging producer / *brand*	CUITISAN *Food box rectangle*	BERNY/GUELT *Small box*	TIFFIN *Bol*	CUITISAN *Food box round*
Dimension	L100mm x l50mm x h50mm	L185mm x l142mm x h30mm	D140mm x h85mm	D110mm x h90mm
Precise volume claimed	300mL	450mL	1100mL	920mL
Material	Stainless steel	Stainless steel	Stainless steel	Stainless steel
Closing system	Clipped	Sealed	Clipped	Clipped

R3PACK

RETAILER IN-SHOP PRODUCTS

MEAT, COLD CUTS, FISH, CHEESE & CATERED MEALS

Specific volume: **650mL – 1500mL - 2500mL - >3000ml**

RETAILERS	Carrefour
REFERENCES	

RETAILER IN-SHOP PRODUCTS

MEAT, COLD CUTS, FISH, CHEESE & CATERED MEALS - PP

INDUSTRIALS

Carrefour

MATERIAL

PP

SPECIFIC VOLUME

650mL – 1500mL - 2500mL - >3000mL

					
Packaging producer / *brand*	IRIS *Airtight plate*	GUILLIN - ALPHA FORM *Prestipack*	SABERT *Fast Pac*	GUILLIN - ALPHA FORM *Alphacel rectangular*	KNAUF INDUSTRIES *Buster'bak*
Dimension	L220mm x l160mm x h40mm	L160mm x l130mm x h55mm	L280mm x l200mm x h40mm	L227mm x l77mm x h85mm	L343mm x l151mm x h131mm
Precise volume claimed	600mL	600mL	1350mL	2460mL	5000mL
Material	PP	PP	PP	PP	PP
Closing system	Clipped	Clipped	Clipped	Sealed (1 time)	Clipped

R3PACK

RETAILER IN-SHOP PRODUCTS

MEAT, COLD CUTS, FISH, CHEESE & CATERED MEALS - SS

INDUSTRIALS

Carrefour

MATERIAL

SS

SPECIFIC VOLUME

650mL – 1500mL - 2500mL - >3000mL

					
Packaging producer / *brand*	BERNY	BERNY	CUITISAN *Rectangle box*	CUITISAN *Rectangle box*	CUITISAN *Rectangle box*
Dimension	TBC	L284mm x l185mm x h30mm	L120mm x l70mm x h55mm	L210mm x l140mm x h70mm	L180mm x l110mm x h95mm
Precise volume claimed	Upcoming new volume? (existing 450mL)	1000mL	580mL	1900mL	2800mL
Material	SS	SS	Stainless steel	Stainless steel	Stainless steel
Closing system	Wrapped	Wrapped	Clipped	Clipped	Clipped

RETAILER IN-SHOP PRODUCTS

MEAT, COLD CUTS, FISH, CHEESE & CATERED MEALS - SS

INDUSTRIALS

Carrefour

MATERIAL

GLASS

SPECIFIC VOLUME

650mL – 1500mL - 2500mL - >3000mL

		
Packaging producer / *brand*	ARC *Arcoroc Food Box*	ARC *Luminarc keep'n box square*
Dimension	L179mm x l133mm x h60mm	L180mm x l176mm x h65mm
Precise volume claimed	820mL	1220mL
Material	Glass	glass
Closing system	Clipped	clipped

R3PACK

RETAILER IN-SHOP PRODUCTS

PRE-CUT FRUITS & VEGETABLES

Specific volume: **300mL – 500mL**

RETAILERS	Carrefour
REFERENCES	

RETAILER IN-SHOP PRODUCTS

PRE-CUT FRUITS & VEGETABLES - PP

INDUSTRIALS

Carrefour

MATERIAL

PP

SPECIFIC VOLUME

300mL – 500mL

					
Packaging producer / *brand*	SABERT *Fast Pac*	BERRY SUPERFOS *Thor Round*	SABERT *Fast Pac*	REUZ IMPACT GROUP *Kiobox*	BERRY SUPERFOS *Thor Round*
Dimension	D130mm x h50mm	D99mm x height TBC	D130mm x h70mm	TBC	D99mm x height TBC
Precise volume claimed	375mL	280mL	500mL	468mL	480mL
Material	PP	PP	PP	PP & (PP + composite)	PP
Closing system	Clipped	Clipped	Clipped	Clipped	Clipped

R3PACK

RETAILER IN-SHOP PRODUCTS

FRESH JUICES

Specific volume: **500mL**

RETAILERS	Carrefour
REFERENCES	

RETAILER IN-SHOP PRODUCTS

FRESH JUICES - PET

INDUSTRIALS

Carrefour

MATERIAL

PET

SPECIFIC VOLUME

500mL

	
Packaging producer / *brand*	ALPLA *Juice bottle*
Dimension	TBC – Neck Fl38mm 2-start
Precise volume claimed	500mL
Material	PET
Closing system	Screwed

R3PACK

RETAILER IN-SHOP PRODUCTS

BAKERY

Specific volume: **2500mL**

RETAILERS	Carrefour, U
REFERENCES	

RETAILERS IN-SHOP PRODUCTS

BAKERY- PP

INDUSTRIALS

Carrefour

MATERIAL

PP

SPECIFIC VOLUME

2500mL

		
Packaging producer / *brand*	KNAUF INDUSTRIES *Buster'bak*	GUILLIN - ALPHA FORM *Alphacel rectangular*
Dimension	L171,3mm x l147,3mm x h138,7mm	L227mm x l77mm x h85mm
Precise volume claimed	2500mL	2460mL
Material	PP	PP
Closing system	Clipped	Sealed (1 time)

R3PACK

RETAILER IN-SHOP PRODUCTS

BAKERY- SS

INDUSTRIALS

Carrefour

MATERIAL

SS

SPECIFIC VOLUME

2500mL

	
Packaging producer / *brand*	CUITISAN *Rectangle box*
Dimension	L180mm x l110mm x h95mm
Precise volume claimed	2800mL
Material	Stainless steel
Closing system	Clipped

II / PACKAGING MATERIAL ASSESSMENT

Funded by the European Union

This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No 101060806.

#1

PLASTICS

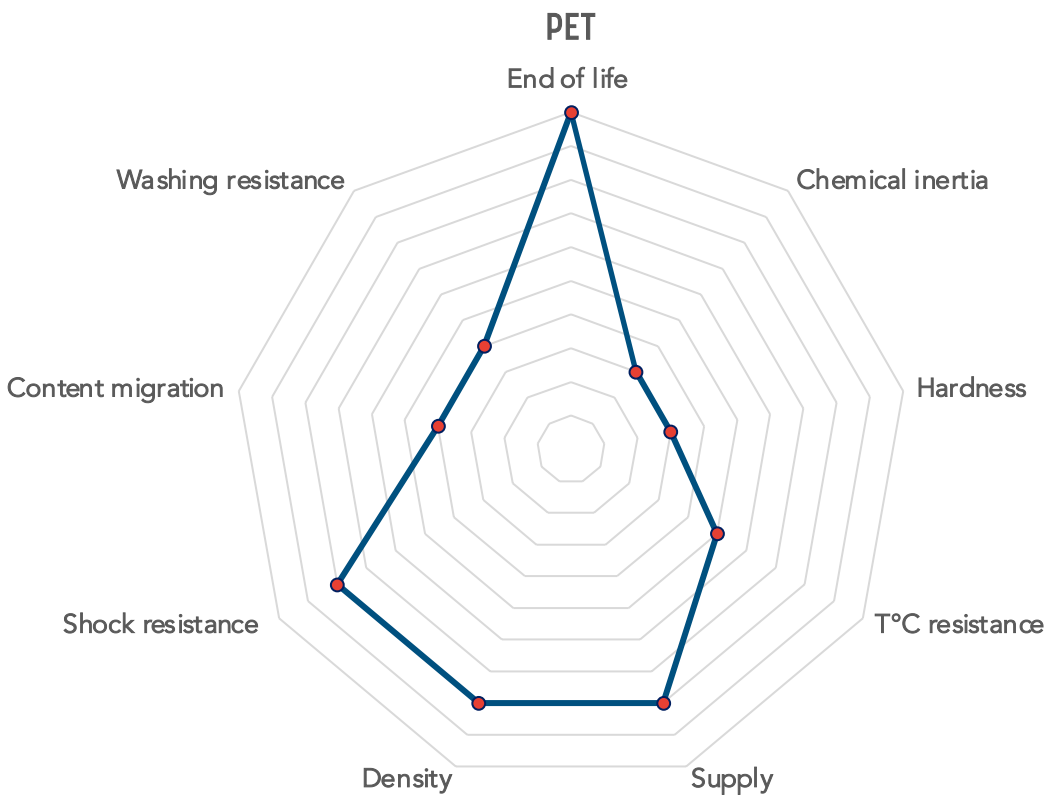
PLASTIC OVERVIEW

CONVENTIONAL PLASTICS

Plastics are a wide range of **synthetic or semi-synthetic materials** that use polymers as a main ingredient. Three common plastic resins have been kept in the selection of potential reusable packaging: Polyethylene terephthalate (PET), Polypropylene (PP) and Polyethylene (HDPE). There are the **most extensive and well-known resins**, but have different advantages and limits.

All are declared **food safe** (for single use) and are made from **petroleum resources**. Nevertheless, SGS tests will verify the chemical inertia of the raw material in the context of reuse scenarios and multiple uses.

PET has a long history as single-use container material. The main advantage lies in its high **recyclability property**. The recycling facilities are in place and the deposit is rather well captured. **Mechanically recycled clear PET has been declared food contact**, thus from PET food packaging, new PET food packaging can be manufactured. However, PET is **sensitive to high temperature and abrasion**, which questions its ability to endure a reuse loop. This point needs to be validated by SGS tests. Nevertheless, to increase the chances of success of PET, a thicker prototype than the "common" one will be tested.

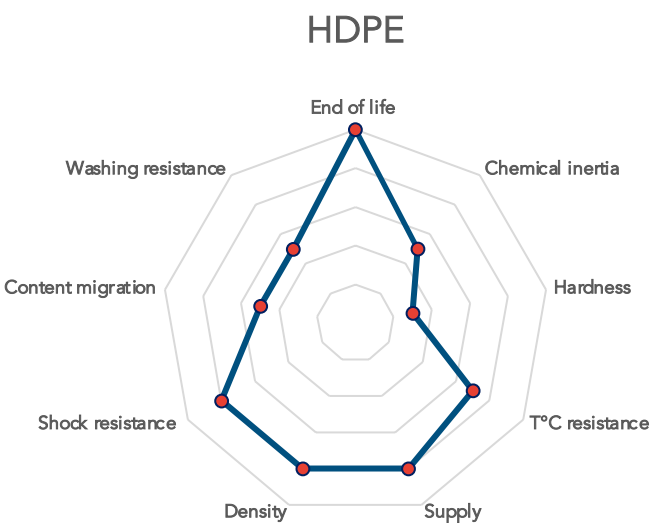


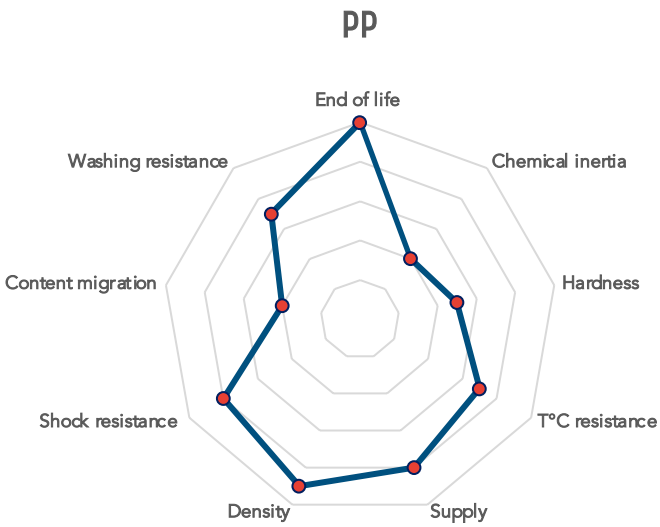
PLASTIC OVERVIEW

CONVENTIONAL PLASTICS

HDPE is a derivative of PE family. Its **opacity and rigidity** are the properties of interest for reusable packaging and particularly bottles. Indeed, it protects the content from UV.

PP resin is more and more widespread in the container applications. It is known for its **superior thickness and better resistance to heat**. Thus, it appears to be a good candidate for reusable packaging. However, some experiences showed a color migration from the food to the container. This point has then to be checked by SGS and industrial tests. PP is recyclable but, to date, the obtained recycled PP is not food contact.

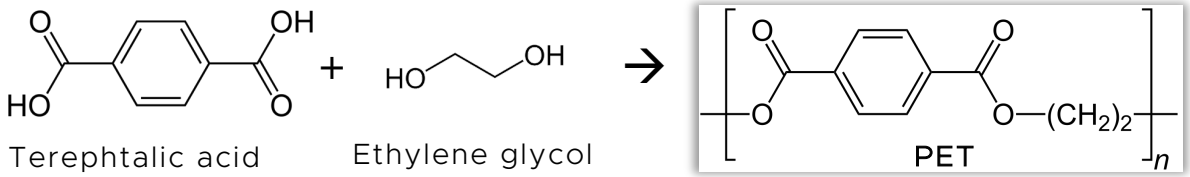




The three following pages precise the characteristics of each of these plastic.

PolyEthylene Terephtalate
PET

Polyethylene terephthalate belongs to the family of fossil origin polyester. Most common application include rigid and flexible packaging as it is very light weight. It notably finds use in food & cosmetics packaging, fabrics, films to molded parts of automotive, electronics, toys, kitchenware, etc. The annual production of PET reaches 26 million tons in 2020.



Terephtalic acid + Ethylene glycol → PET

PRODUCTION

1. Oil extraction*
2. Refining & steam cracking to get PET monomers
3. Polymerization (esterification under pressure at 280°C and polycondensation under vacuum at hight T°C)
4. Brutal cooling to obtain granules
5. Packaging manufacturing (moulding and thermoforming)

**1kg of PET requires 1,9kg of oil*

END-OF-LIFE & RECYCLABILITY

55% collection rate*
26% recycling rate*
(**57%** for PET bottles)

High collection rate*
+50% recycling rate* all plastics (**92%** for PET bottles)

Today, PET is the only mechanically recycled resin certified as suitable for food contact after recycling. In this process, some disruptors have been identified such as carbon black, coloured PET, labels and adhesives, etc.
As recycled PET is highly sought after, it is now more expensive than virgin PET.

01 PET

→ *1kg of recycled PET saves 0,7kg of oil*

Finally, it's important to notice that chemical recycling is in development.

*statistics sources available in the bibliography

Advantages of PET for reusable packaging

- ✓ Transparency
- ✓ Mechanical resistance
- ✓ Lightness
- ✓ Durability
- ✓ Recyclability
- ✓ Recycled PET integration possibility while having food grade packaging

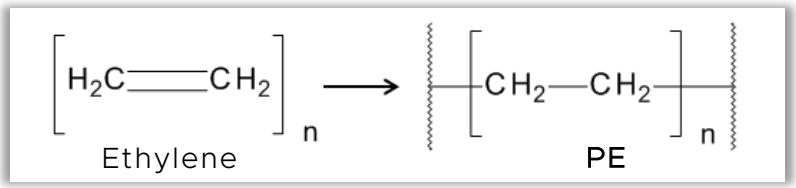
Limits of PET for reusable packaging

- x High temperature sensitivity
- x Use of non renewable resource

R3PACK

PolyEthylene High-Density HDPE

Polyethylene belongs to the family of polyolefin resins made from the polymerization of ethylene. PE is the most widely used polymer in the world – in 2021 the production capacity reached 130,5 million tons per year. As it's a very versatile polymer, many kinds of PE are known, according to its density there are three main categories : low density (LDPE), high density (HDPE) and linear. Generally for rigid packaging applications, HDPE is the most used PE version. R3PACK focuses its interest on it.



PRODUCTION

1. Oil extraction
2. Refining & steam cracking to get ethylene in the gas form
3. Cationic polymerization* (specific for HDPE) – ethylene monomer in suspension with a halogen or chromium catalyst (65-100°C & 5-37bar)
4. Extrusion to obtain pellets
5. Packaging manufacturing (moulding and thermoforming)

**Or gas phase fluidized bed process*

END-OF-LIFE & RECYCLABILITY

67% collection rate* of HDPE bottle
53% recycling rate* of HDPE bottle

High collection rate*
+50% recycling rate* all plastics

Today, there are different ways of recycling PE: mechanical, thermomechanical, chemical – the first being the most common. However, the resulting PE is not suitable for food contact. Its chemical structure makes decontamination complex. The recycling outlets are thus of low added value (garbage bags, pipes, etc). Nevertheless, it's possible to find recycled PE in food contact application, it's obtained from recycling a pure milk bottles stream.

→ *Using recycled HDPE saves 89% energy*

02 PE-HD

*statistics sources available in the bibliography

Advantages of HDPE for reusable packaging

- ✓ Opacity – UV resistance
- ✓ Recyclability
- ✓ High impact and corrosion resistance
- ✓ High melting point
- ✓ Lightness

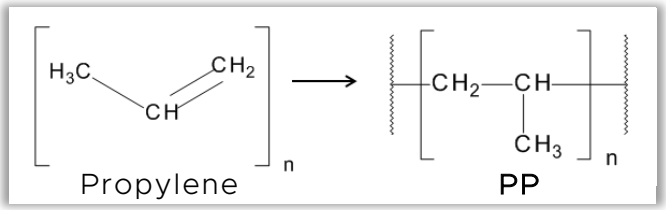
Limits of HDPE for reusable packaging

- X Recycled PE non food contact (within the current legislative framework and recycling infrastructure)
- X Use of non renewable resource

R3PACK

Polypropylene PP

Polypropylene belongs to the family of polyolefin resins and is built up by the polymerization of propylene. PP is the second-most widely produced commodity plastic. The size of PP market has been estimated at over eighty million tons by 2021. PP is mainly used for injection molding leading to rigid applications notably cosmetic and food packaging (box, bottle, tube). Nevertheless, PP can be found in flexible form, especially for bags.



PRODUCTION

1. Oil extraction
2. Refining & steam cracking to get ethylene in the gas form
3. A) “Spheripol” or “Hypol” polymerization in liquid phase at 60-80°C /
   B) “Unipol” polymerization in gaseous phase at 90-100°C and 3-5MPa.
4. Extrusion to obtain pellets
5. Packaging manufacturing (moulding and thermoforming)

END-OF-LIFE & RECYCLABILITY

High collection rate* (all plastics)
30% recycling rate* (all plastics)

High collection rate*
+50% recycling rate* (all plastics)

Currently, rigid PP packaging has an effective mechanical recycling channel. However, as PE, the resulting PP is not suitable for food contact. Its chemical structure makes decontamination complex. The recycling outlets are thus of low added value (plumbing tubes, technical parts of automotive products, etc).

→ *1 ton of recycled PP saves up to 830L of oil*

05 PP

*statistics sources available in the bibliography

Advantages of PP for reusable packaging

- ✓ Toughness
- ✓ Light weight
- ✓ Heat resistance
- ✓ Recyclable
- ✓ Chemical inertia

Limits of PP for reusable packaging

- x Use of non renewable resource
- x Colored by pigmented foods (to be verified)

R3PACK

PLASTIC OVERVIEW

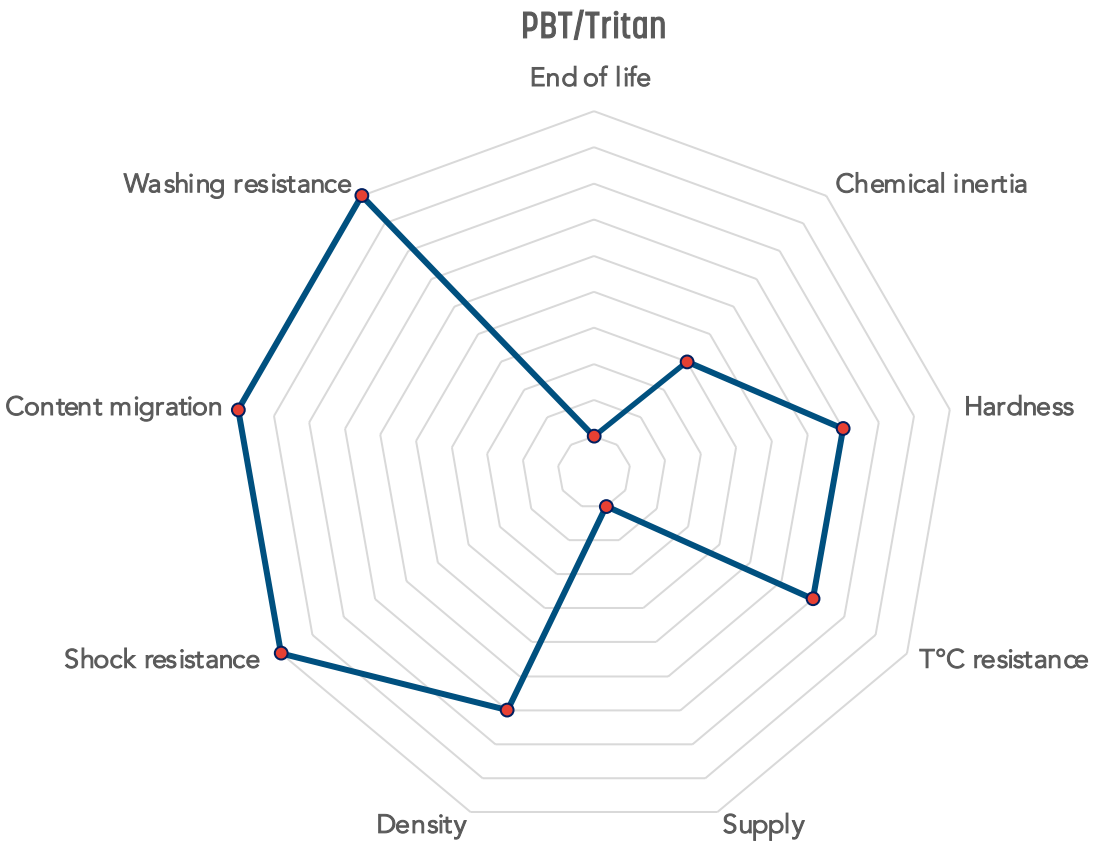
NON CONVENTIONAL PLASTICS

To the three first “common” plastic resins, it has been decided to add two “non-conventional plastics”: the co-polyester Tritan and Polybutylene terephthalate (PBT).

These two material combine the desired advantages of **lightness, transparency, high temperature and impact resistance**. However, their end-of-life remains problematic. In fact, to date there are no recycling infrastructures in France or Belgium and material pools are still too small to justify their development.

As Tritan or PBT containers resemble traditional plastic packaging, they could end up in the classic plastic flow and thus become a disruptor of recycling. This point is taken into account within R3PACK thanks to work that will be done on communication and consumer awareness-raising.

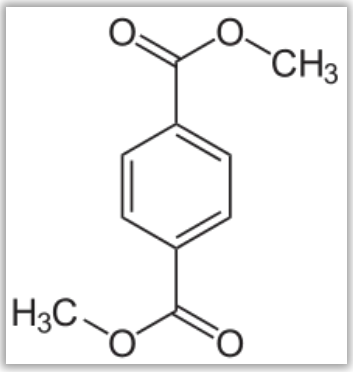
Moreover, a point of attention is raised on the supply of raw material, notably for Tritan as it is a proprietary resin.



The two following pages precise the characteristics of each of these plastic.

Co-polyesters
TRITAN

Tritan is the name of the brand commercialized by Eastman Chemical. Tritan material is a transparent amorphous thermoplastic of the co-polyester family. It is made from three monomers. Some formulations contain no additives while others do, such as anti-UV, antistatic agents, etc. Since it's launch in 2007, Eastman Tritan has spread to a variety of markets – reusable bottle, infant care, food and beverages packaging, small appliance and houseware.



PRODUCTION

As Tritan is a proprietary resin, the manufacturing process of the raw material is still secret. However, the manufacturing of Tritan finished goods is similar to an injection blow moulding process common to several plastic resins.

1. Drying, heating and injection to turn the raw material into a preform
2. The preform is blown into its final shape thanks to the wall of a blow mould (any shapes can be produced)
3. Checking final product based on customer's requirements.

END-OF-LIFE & RECYCLABILITY

To date, no collection/recycling of alternative plastics.

Currently, Tritan co-polyester can be recycled mechanically in a closed loop. It is therefore up to the supplier to take care of it. However, mechanically recycled Tritan is not certified food safe.
Nevertheless, Eastman has developed an advanced circular recycling technology – also known as molecular recycling – which breaks down plastic waste into basic components for reuse in manufacturing process.

The code 7 refers to other resins that are not defined by codes 1 to 6 (the most common resins).

7 OTHER

Advantages of Tritan for reusable packaging

- ✓ Clarity
- ✓ Chemical resistance
- ✓ Impact strength
- ✓ Fast drying time
- ✓ Scratch resistance

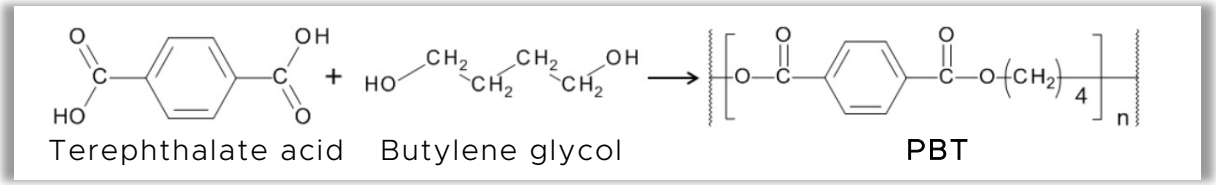
Limits of Tritan for reusable packaging

- x Use of non renewable resource
- x Non effectively recyclable at scale with current infrastructure & deposit volume
- x Material sovereignty (Eastman being the only raw material producer)

R3PACK

Polybutylene terephthalate
PBT

PBT belongs to the polyester family. It is produced by polycondensation of terephthalic acid or dimethyl terephthalate with 1,4-butanediol using calalysts and has similar properties and composition to PET.
PBT has gained commercial interest due to its wide range of applications ranging from automotive, electronics, medical, etc. Indeed, there are different ranges and grades of PBT – reinforced, filled, flame-retardant – all suitable for injection molding. This broad use of PBT is also shown by the numerous regulatory approvals held and notably the FDA approval for the nutrition and medical market.



PRODUCTION

1. Oil extraction
2. Refining & steam cracking to get PET monomers
3. Esterification
4. Brutal cooling to obtain granules
5. Packaging manufacturing (injection moulding and thermoforming)

END-OF-LIFE & RECYCLABILITY

To date, no collection/recycling of alternative plastics.

Currently, there is no infrastructure to recycle PBT. However, it seems that PBT may be chemically produced from recycled PET. Projects on chemical recycling methods are ongoing.

The code 7 refers to other resins that are not defined by codes 1 to 6 (the most common resins).

7 OTHER

Advantages of PBT for reusable packaging

- ✓ Toughness
- ✓ Stain resistance
- ✓ Low moisture absorption
- ✓ Fast drying time
- ✓ Mechanical strength
- ✓ UV resistance

Limits of PBT for reusable packaging

- x Use of non renewable resource
- x Non effectively recyclable at scale with current infrastructure & deposit volume
- x Often opaque/loaded with carbon black

R3PACK

#2

OTHER MATERIALS

OTHER MATERIALS OVERVIEW

GLASS & STAINLESS STEEL

Among other container materials, glass and stainless steel have been spotted as good candidates for reusable packaging.

First, they are **well-known in the food industry**.

Stainless steel has been used for years in the **catering industry** (gastro trays, serving dishes, etc).

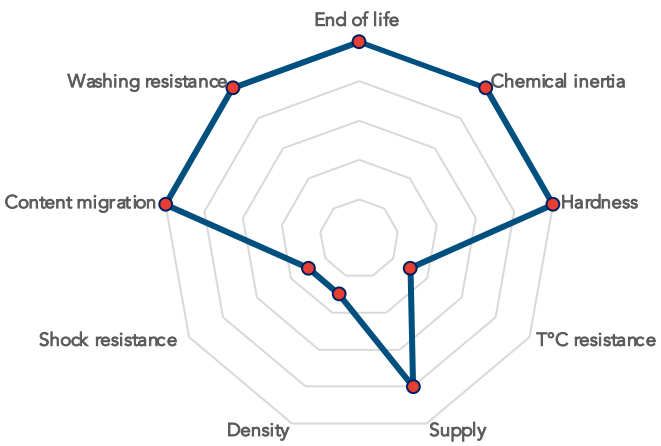
Glass has been used for decades particularly for **liquid products**, but is also beginning to be used for various grocery product lines. It has proven its **innocuity and recyclability.**

Both have proved their worth and are now widely proposed for reusable packaging ranges.

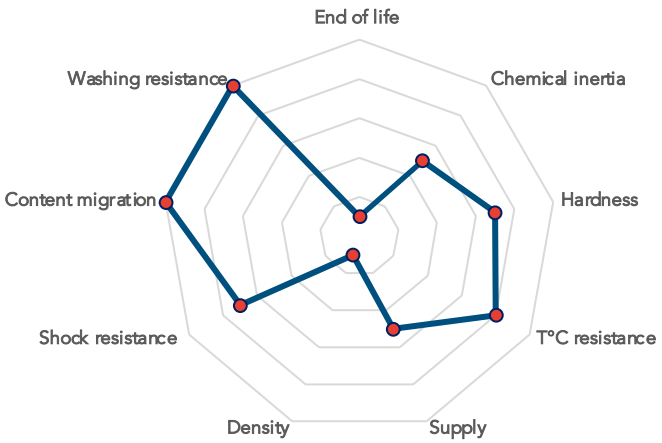
However, glass is heavy and easily breakable. This implies that many industrials do not use glass in their plants. Glass does not seem to be suitable with the major current production lines. A switch from plastic to glass packaging would imply big operational changes and the addition of safety systems to verify the absence of debris.

Stainless steel has also its limitations, especially in terms of manufacturing, as it is energy intensive, but also in terms of supply, cost and recyclability. Besides, it is an opaque material which does not meet the need for transparency of most of our industrials.

Soda-lime glass



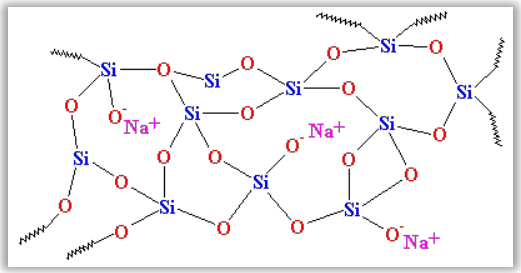
Stainless steel



The two following pages precise the characteristics of each of these material.

SODA-LIME GLASS

Glass belongs to the ceramic family. There are two main types of glass, borosiliciate and soda-lime. The latest is the one of interest for R3PACK's reusable packaging because it is recyclable in existing recycling flux. Moreover, soda–lime glass is relatively inexpensive, chemically stable, reasonably hard, and extremely workable. It accounts for about 90% of manufactured glass in two main applications: windows and containers. It's mainly composed of silica (70%) and to a lesser extent of sodium oxide, calcium oxide and aluminium oxide.



PRODUCTION

1. Mixing of the raw materials according to precise proportions
2. Melting of the composition at high temperature in a gas oven (24h at 1300°C to 1550°C)
3. Packaging manufacture by blowing in a specific mold
4. Annealing
5. Quality control: packaging with defects such as inclusions are discarded
6. Palletizing and covering

END-OF-LIFE & RECYCLABILITY

78% collection rate*
85% recycling rate*

96% collection rate*
97% recycling rate*

Glass packaging is collected separately from other household packaging, so it does not go to a sorting center but to a cullet processing center. Soda-lime glass can be recycled endlessly without loss of quality. The proportion of recycled cullet can reach 99%, but this will involve a change in tint. Indeed, the higher the proportion of cullet, the more the glass obtained is tinted with shades of green. Moreover, there are some recycling disruptors such as non-soda-lime, infusible and opaque glass, adhesive labels too.

→ *One ton of recycled glass avoids 500 kg of CO2*
→ *For 1kg of cullet used, 1.2kg of virgin materials are saved*

*statistics sources available in the bibliography

Advantages of glass for reusable packaging

- ✓ Clarity
- ✓ Chemical resistance and stability
- ✓ Safety
- ✓ Recyclability

Limits of glass for reusable packaging

- x Weight
- x Energy-intensive production process
- x Broken glass risk
- x Use of non renewable resource (sand and limestone)

R3PACK

Stainless Steel
SS

Stainless steel, like all types of steel, is not a single metal but an alloy that is a material made from two or more separate elements alloyed or "melted" together. What all steels have in common is that their major "ingredient" (alloying element) is the metal iron, to which a small amount of carbon has been added. The one key element they all share is a certain minimum percentage of chromium: 10,5%, chromium gives notably the corrosion resistance to the steels. Other elements such as carbon, other nonmetals and metals can be included in the SS composition to obtain specific properties. As indicated by its name "stainless steel", SS has rust-resisting property. However, other valuable characteristics make it a material of interest for many applications: cutlery, cookware, surgical instruments, appliances, vehicles, construction, storage tanks and containers!

PRODUCTION

1. Mixing of steel, scrap and chromium poured into a furnace
2. Heating to melting point
3. Passage into a refining furnace with oxygen and argan injection to eliminate impurities
4. Continuous casting in a mold to obtain a steel strip
5. Cutting into blocks called slab
6. Drawing of the blocks between rolls
7. Steel strips put in the form of coils

END-OF-LIFE & RECYCLABILITY

<50% collection rate* (from french people sorting gesture)
63% recycling rate* (all steel)

Collection and recycling rates non available

Stainless steel is a material that is currently not sorted during the collection of household packaging. Thus, in the sorting center, any stainless steel packaging will be disrupting: either in the steel stream (if magnetic stainless steel) or in the aluminium stream (if non-magnetic stainless steel). However, steel may be taken care of by specific players such as Recyco who works in collaboration with stainless steel producers (in particular APERAM) to collect and sort the material to be recycled. When it is done, recycling is made by fusion and the deposit comes largely from industry.

*statistics sources available in the bibliography

Advantages of SS for reusable packaging

- ✓ Corrosion resistance
- ✓ Cleanability
- ✓ Strength resistance
- ✓ Temperature resistance

Limits of SS for reusable packaging

- X Energy-intensive production process
- X Impact of fer and chrome extraction
- X Sovereignty (China produces 80% of worldwide SS)
- X Expensive
- X Opacity

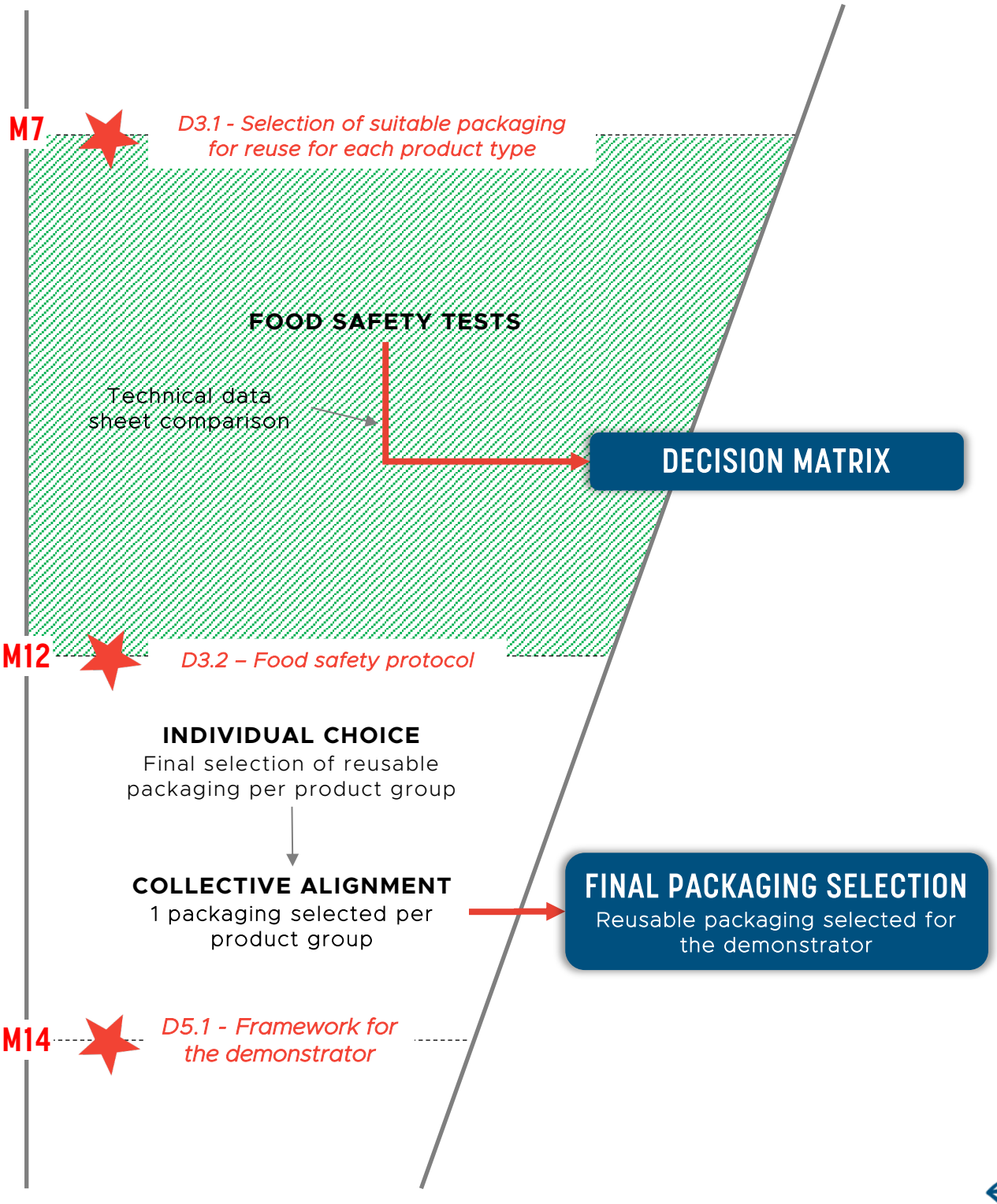
R3PACK

III / PACKAGING SELECTION – NEXT STEPS

Funded by the European Union

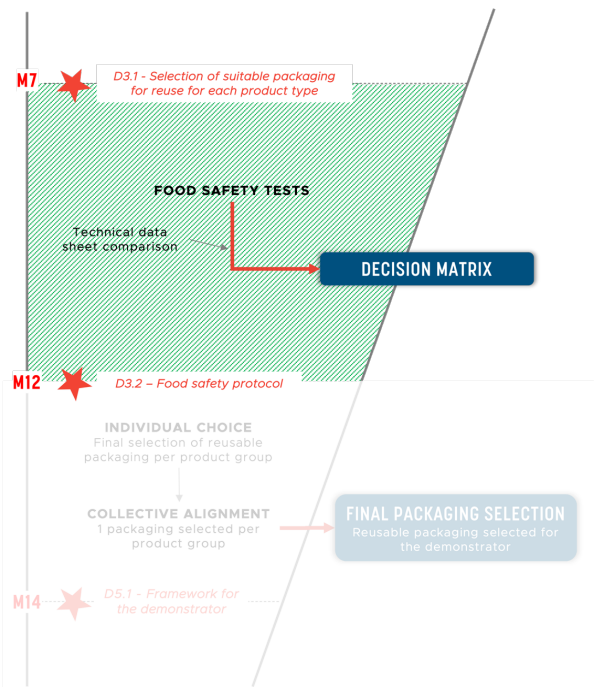
This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No 101060806.

NEXT STEPS OVERVIEW



#1

FOOD SAFETY TESTS



FOOD SAFETY PROTOCOL & RATIONALIZATION NEED

The task 3.2 called "*normalisation of food safety and washing protocols*" has the objective to **compensate the lack of reuse norm/standards** by determining a generic but reasonably **sensitive test protocol** in order to validate or not the **food safety** of a packaging in a **reuse scheme**.

In fact, currently the standard norm on food safety is not adapted to industrial reuse as it includes only three successive migration tests, thus only simulating three cycles, and does not take into account the uses and constraints arising throughout the reuse loop.

In this context, it seems **important to develop a more advanced protocol to give confidence** to all actors, from industrials to consumers. R3PACK's protocol, still under construction, will then verify:

- the **impact of washing** notably by high temperature
- the **health integrity** post-washing and with various products
- the packaging capacity to **resist to logistics and use** constraints

It will then go further compared to the current norm adding "**performance tests**". And, the protocol will test migration and performance over **5, 10 and 20 cycles**, which are realistic numbers of loops to have an economically and environmentally viable reuse system.

→ *R3PACK WP3.2 will write a **critical and reproductible** normative food safety reference for reusable packaging **(20 rotations)***

However, it is important to notice that the task does not aim to list and apply exhaustive tests on all packaging selected. Tests will be made with the first selection; on one hand to support SGS in their protocol structuration and potential iteration and on the other hand to **validate hypotheses on materials**, formats, etc.

Thus, as the **selection is wide** (64 options), the **human and economic resources and time are limited**, there was a **need to rationalize this list**. The challenge was then to choose a representative sample with the constraints mentioned.

THREE PARAMETERS ON WHICH TO RATIONALIZE

SGS has then prioritized the packaging selection taking into consideration three main parameters to get a **representative sample**.

1) The materials

Seven materials were included in the packaging selection made by industrials. The idea was to restrict this list to the **material with major risks and/or uncertainty**.

As discussed in the material assessment section, glass and stainless steel are widely used for reusable packaging. It has been decided to exclude these two materials and focus the tests on plastics. PBT has been excluded because of its opacity.

Among the plastic options, conventional and non-conventional, the most likely to be used and available reference was chosen per resin.

2) Products

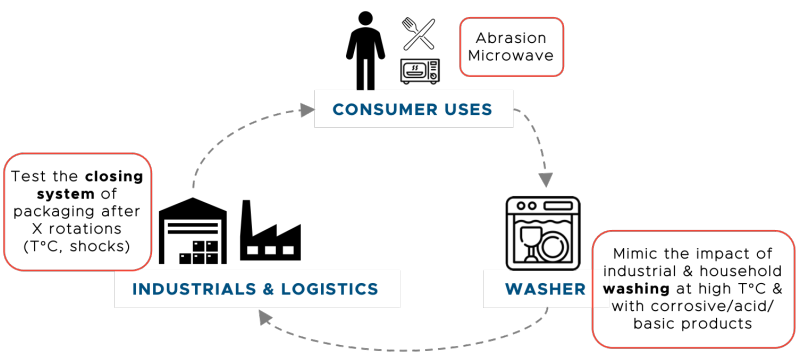
On products, there was the need to **decide which simulant(s)** will be used for the migration tests. As the aim of R3PACK is to mutualize packaging and to work with **cross-industry product groups**, we could not make compromises on the number of simulants applied. This implies **testing all simulants on all plastic resins**. The simulants comprise:

- Acetic acid 3% to mimic acid food
- Ethanol 50% to mimic dairy products
- Ethanol 95% and isooctane to mimic fatty products

3) Performance tests

The constraints applied on the packaging may be numerous throughout its "reuse life", especially at the industrial, transport, consumer and washer levels. To overcome these potential damages, the protocol secured the packaging resistance by **mimicking the stresses**: abrasion, heat, washing, shocks, etc.

The illustration on the right shows the **nodes where stresses on packaging arise in a reuse scheme and the tests associated** to anticipate the reaction of the packaging. Nevertheless, the tests may differ according to the packaging common uses and the intrinsic characteristics of the material.



→ Bottle and PET packaging won't endure the microwave test; the first because bottles are not intended to be put in a microwave and the second due to its temperature sensitivity. For the latter, if PET material appears to be suitable for reuse, communication will be labelled on future reusable PET packaging.

THE PACKAGING TESTED

After having gone through the rationalization process for the packaging selection list, **two groups of packaging** were chosen to be tested.

The first group has the objective to validate or not the **material resistance** throughout the reuse scheme. It encompasses six packaging of **all formats and all types of plastic resins** (PET, PEHD, PP and Tritan). These packages will be subjected to the **entire protocol** including **migration and performance tests** on 0, 5, 10 and 20 cycles. If at any time, one packaging is too deteriorated to pursue the test, then it will be excluded from the protocol and we will have an approximate idea of its life span in a reuse loop.

For reasons of time and resources, it was not possible to test more packaging with the whole protocol. However, it was **important to verify the closing system** of the references.

The second group comprises the **equivalent references** of the first group but in **larger sizes**. In fact, larger containers are more likely to deform due to heat, shocks, etc, and thus to deteriorate the closing system and the hermeticity of the container. The five packaging of the second group will be exposed **only to performance tests***.

GROUP 1 - SMALL SIZE PACKAGING

Food contact & performance tests* (washing, microwave, abrasion)

PEHD

PET 370mL

PP OPAQUE 468mL

PP TRANSPARENT 350mL

TRITAN 360mL

TRITAN 200mL

GROUP 2 - BIG SIZE PACKAGING

Only performance tests (washing, microwave, abrasion) to test clipability and hermeticity

PP OPAQUE 980mL

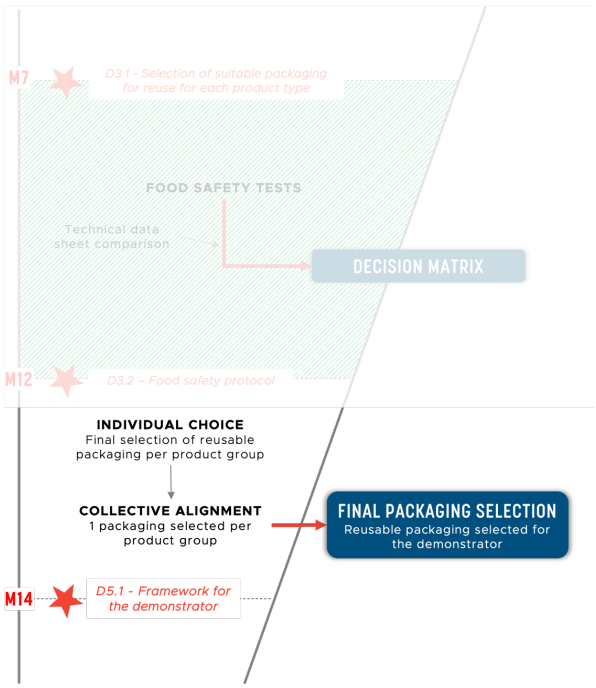
PP TRANSPARENT 2300mL 500mL

TRITAN 1000mL

*except for bottle and PET packaging, that will not endure microwave test because bottles won't be put in microwave and PET material is too sensitive to heat.

#2

FINAL SELECTION



DECISION MATRIX

With the results of SGS food safety tests on the eleven references, a decision matrix could be constructed. This matrix will be based on the information collected from the tests and on the parallels that can be drawn between the tested and non-tested references. **Technical data sheets** from packaging producers would help with the analysis.

The complete matrix will be sent to R3PACK's partners (food producers). And as it has been done in the previous steps of the packaging selection, **industrials and retailers will first chose individually** one packaging per product group. Then, a **workshop** will be organised to **align them collectively on the final selection** of reusable packaging that could be used during the demonstration phase.

CONCLUSION

Funded by the European Union

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CONCLUSION

The **collaborative work** done by industrials and retailers since six months allowed R3PACK to set up a **first list of reusable packaging options**.

This list is based first on Citeo, CETIE and (RE)SET Packaging ground work. Secondly, food product specifications and packaging requirements have been collected in order to build **product groups**.

In fact **mutualization** of packaging across different product categories is essential to find the economic and environmental balance of reuse schemes, facilitate consumer experience and scale up industrial reuse.

- The packaging selection is the result of several steps of **individual work followed by collective alignment**. This iterative process allowed everyone's voice to be heard while being aware of the need of common ground.
- The list comprises **64 unique references** of potential reusable packaging, currently available on the market but not specifically identified as reusable (to be tested).
- **Seven materials and seven formats** in various capacities have been spotted. At this stage, the preferred closing system for the demonstrator remains the "clipped" one as technology is not enough advanced to use repetitive thermoscellability in the short-term.

In the following months, **SGS will test a representative sample of the identified packaging and together with industrials and retailers, the packaging for the reuse demonstration phase will be chosen**. Then **industrial operational tests** will be done, iterations and compromises will probably be required before the launch of the experiment.

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