Final Report

PET Tray Recycling: Status quo, Challenges and Future Scenarios

Phase 1 – Initial Research

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List of abbreviations

AI	Artificial Intelligence
BHET	Bis(2-hydroxyethyl) terephthalate
BHETA	Bis(hydroxyethyl)terephthalate
BAT	Best Available Technology
DEG	Diethylene glycol
DfR	Design for Recycling
EG	Ethylene glycol
EVOH	Ethylene-vinyl alcohol copolymer
IV	Intrinsic Viscosity
LCA	Life Cycle Assessment
LSP	Liquid-State Polycondensation
LWP	Lightweight packaging (or packaging made from lightweight materials)
BEST	Best-before date
MHET	Mono-(2-hydroxyethyl)terephthalic acid
NIR	Near-infrared spectroscopy
PA	Polyamide
PCF	Product Carbon Footprint
PE	Polyethylene
PET	Polyethylene terephthalate
PP	Polypropylene
PPWR	Packaging and Packaging Waste Regulation
PROs	'Producer Responsibility Organisations', extended producer responsibility organisations
PS	Polystyrene
PVC	Polyvinyl chloride
PVDC	Polyvinylidene chloride
RaS	Recycled-at-Scale

RGB	Red, Green, Blue
rPET	recycled polyethylene terephthalate
SSP	Solid State Polymerisation solid-state polycondensation
TRL	Technology Readiness Level
VIS	Visible

1. Introduction

Over the past few decades, Polyethylene terephthalate (PET) has established itself as an important packaging material in the food and consumer goods sectors. Alongside PET bottles, PET trays in particular have become increasingly important. However, the recycling of PET trays poses a technical, economic and regulatory challenge due to the variety of materials used, their wide range of applications and their integration into existing collection and sorting systems.

In view of rising demands on plastics recycling and new European regulations – in particular those set out in Articles 6 and 7 of the European Packaging and Packaging Waste Regulation (PPWR) – there is a need for a reliable basis for the development and assessment of future recycling pathways for PET trays, which, as a specific format, offer considerable potential in terms of future recovery rates. Both established state of the art technologies as well as emerging new alternative processes will be examined in order to identify realistic prospects for large-scale recycling of this packaging format by 2035 and 2040 respectively.

The aim of this study is to develop and evaluate technical and economic future scenarios for PET tray recycling from a technical, economic and environmental perspective. To this end, the volume of PET trays in Germany and Europe, existing collection and sorting structures, and relevant recycling processes are analysed and assessed within a systemic framework. The study covers both mechanical recycling processes and alternative methods, examining their respective potential and limitations regarding high-quality material recovery.

Based on the results of the analysis, possible scenarios for PET tray recycling are discussed and assessed in terms of their feasibility. A special focus will cover the requirements for recycled materials and their potential applications, existing barriers along the value chain, and the regulatory and market-related framework conditions. Finally, concrete recommendations for actions and measures concerning the relevant stakeholders are derived, including a special view on improving the recyclability of PET trays and the use of respective recycled PET tray material in the long term.

The guiding principle for all considerations regarding the optimisation of PET tray recycling is the implementation of a closed-loop system (‘tray-to-tray’). Figure 1 illustrates this cycle, showing the stakeholders and the interrelationships along the value chain.

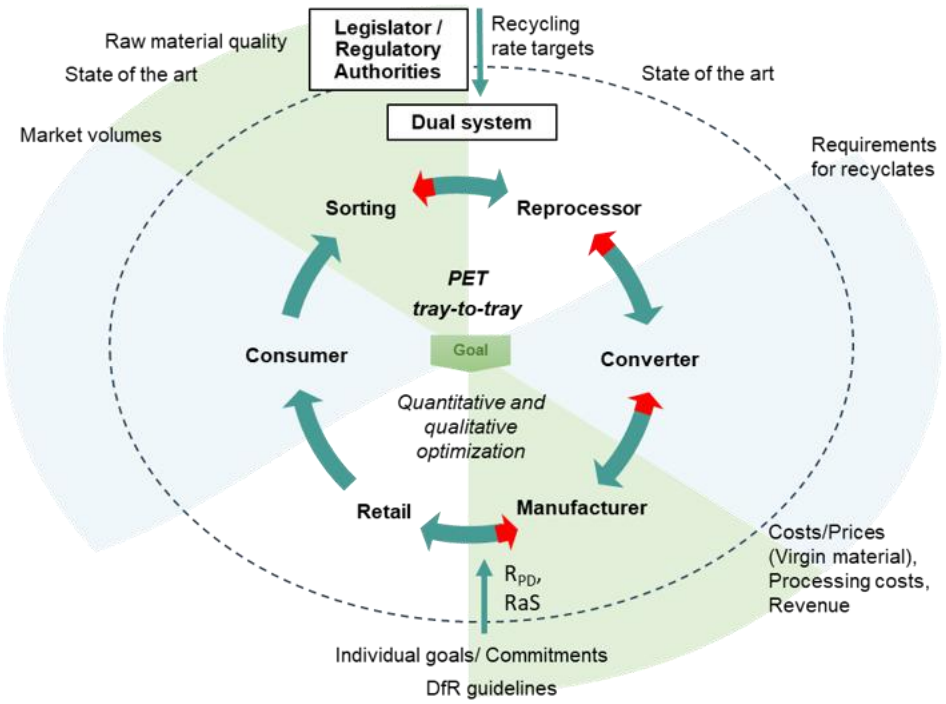

Figure 1: An idealised representation of the material and causal relationships within a closed-loop PET tray-to-tray recycling cycle ('tray-to-tray'). Interactions between the stakeholders involved, technical process steps, and regulatory and economic influences

Developing and optimising the illustrated 'tray-to-tray' recycling cycle means that it is necessary to achieve both a quantitative increase in the volumes of material circulating within the cycle and to ensure high quality of the recycled material. This requires coordinated collaboration between all stakeholders along the value chain – from product design through collection and sorting to processing and reuse in PET trays.

Manufacturers and converters influence the recyclability of the trays through their choice of materials, design and product specifications, whilst having to balance functional requirements, costs and regulatory requirements. The packaging reaches consumers via retailers, and consumers' disposal behaviour influences the quality of the collected material streams.

The PET trays are then collected via the dual systems/PROs and sorted on their behalf. The sorting plants separate PET streams according to specified fractions and purity levels, from which recycled materials can be produced in downstream processing stages and, assuming they meet the required quality standards, reused in PET trays. Legal and institutional requirements, such as recycling targets, quality standards and 'design for recycling' guidelines, set the regulatory and economic framework.

Figure 1 illustrates that a 'tray-to-tray' cycle only functions through the systemic interplay of technical, economic and regulatory factors. The starting point for all process steps is the actual volume of PET trays, the quantity, composition and origin of which determine the requirements for collection, sorting and recycling.

2. Volume of PET trays (GVM)

2.1. Framework and methodology

2.1.1. Subject, background and objectives

The studies on the volume of PET trays and thermoformed products were carried out by GVM Gesellschaft für Verpackungsmarktforschung mbH as part of an independent sub-project. The full results of this sub-project are summarised in a separate report. Chapter 2 contains extracts from this report dealing with the methodological principles and the results of the market volume survey.

The volume of PET trays was assessed for six EU countries and for Europe as a whole (EU-27).

In light of the study's objectives, the following key questions were examined:

1. How many PET trays are placed on the market across the EU as a whole and in selected individual EU countries?
2. What is the ratio of food to non-food applications?
3. What is the ratio of mono- to multilayer containers?
4. What is the volume of post-consumer PET trays generated as waste?

The results were broken down for the following countries and country groups:

- Germany
- France
- Italy
- Netherlands
- Spain
- Poland
- Rest of the EU (combined)
- Total EU market

The reference base year for the study is 2024. The study focuses on selected PET packaging applications, which are referred to here, for simplicity, as PET trays. The following types of packaging are included:

- Trays (e.g. for fresh fruit, ready-made salads or meat and cheese products),
- Cups (e.g. for ready-made desserts or ready-to-eat fruit),
- Blister packs (e.g. for household goods or fittings),
- Transparent boxes (e.g. for toys or electrical appliances),
- Round tins (e.g. for confectionery or Christmas tree baubles).

Exclusions

Composite packaging made of PET and aluminium is not included, provided that the grammage of the aluminium is high enough for such packaging to be classified as aluminium during the sorting process. No distinction is made between different types of PET or container sizes. Beverage bottles are not covered by the study.

The results are limited to household-related consumption of packaging and are defined in accordance with the catalogue of packaging subject to mandatory participation in recycling schemes published by the Central Agency for Packaging Registration. The results are based on the volume (market quantity) and disposal routes of PET trays, with the volume given in tonnes and the respective disposal routes as percentages.

The results are broken down into various product groups:

- Food
- Non-food

Definition of food

According to the legal definition at EU level under Article 2 of Regulation (EC) No 178/2002, ‘food’ means: ‘any substance or product intended to be, or which may reasonably be expected to be, ingested by humans in a processed, partially processed or unprocessed state.’ This explicitly includes beverages, chewing gum and all substances, including water, which are intentionally added to food. The following, amongst others, are not considered to be food: animal feed, live animals prior to slaughter, plants prior to harvest, medicinal products, cosmetic products, tobacco products, narcotic drugs and psychotropic substances, as well as residues and contaminants.

Mono- vs. multilayer packaging

For the purposes of this study, a distinction is made between mono- and multilayer packaging. Multilayer packaging, as defined in this study, refers to full-surface composites made of PET and other plastics.

Composites consisting of different PET layers have been classified as monolayer packaging.

Three categories were defined for the classification of the packaging under consideration:

1. Thermoformed trays for food
2. PET cups and other semi-rigid PET packaging for food
3. Other PET films for non-food products

Category	Examples of contents	Examples of packaging materials
1 PET bowls and trays Food	Berries/grapes	Trays with hinged lids
	Meat and sausage products, self-service	Semi-rigid flat tray
	Self-service fast food	Dish, dimensionally stable
2 PET cups, other semi-rigid Food	Hard and sliced cheese, self-service	Wrappers
	Spices	Tins, round tins
	Cold drinks	Cups
3 PET films (non-food)	Batteries, toilet blocks, household items	Blister packs, wrappers
	Books, electronic goods	Protective sleeves
	Screws, nuts, washers	Clear plastic box

Table1 : Overview of the defined test categories (Source: own representation, GVM)

Lids, covers, inserts and similar packaging materials (e.g. for fresh salads) made of PET are assigned to the category in which the main packaging material is classified.

The data basis for this analysis is building on a research approach that combines methods from both primary and secondary market research.

B2B primary market research

To identify current market trends and gather expert knowledge directly from the field, targeted surveys and interviews are conducted with relevant stakeholders in the value chain. These include:

- Dual systems: interviews on the collection of PET trays and recycling rates.
- Industry & production: Discussions with packaging and packaging material manufacturers, as well as industry associations.
- Waste management sector: Surveys of waste management companies and operators of sorting facilities.
- Subject matter experts: Consultation with specialist industry experts (e.g. Cyclos GmbH, HTP GmbH, CEFLEX, DVI, FPE, ifeu, Innoform, M.I.L.K, Pacoon)

Secondary market research

Secondary research draws on a wide range of internal and external data sources to ensure a sound data foundation:

- Exclusive GVM sources: access to databases on market volumes (Germany/Austria), packaging sample databases, the GVM packaging panel and specific GVM studies (e.g. recycling balance sheet, waste generation and recovery).
- External databases and company information: Use of business databases (e.g. Dun & Bradstreet), address directories, and the analysis of annual reports, balance sheets, websites and product catalogues.
- Public sources: Analysis of data from statistical offices (Destatis, Eurostat), reports from public authorities and ministries (e.g. Federal Environment Agency, BMUKN, LAGA, BMWE) and publications by NGOs.
- Industry and media sources: trade associations, chambers of commerce and economic institutes (e.g. Ifo, DIW).
    - Analyses by market research companies (e.g. GfK, Nielsen, Circana).
    - Specialist literature, trade journals, daily newspapers and specialist internet portals.

The study is based on a multi-stage methodology developed by GVM Gesellschaft für Verpackungsmarktforschung mbH. It combines internal data, external secondary sources and qualitative expert interviews to provide an accurate picture of the market for PET trays in Europe.

Determination of market volume and information sources

The primary basis for determining the market volume is the GVM database 'Market volumes for packaging'. To validate this data, a systematic evaluation of the following sources is carried out in a second step:

- GVM archive, analysis of specialist literature
- External search engines and databases
- Official statistical data
- Data from retail and consumer panels
- Results of expert surveys
- Store visits

Determining the total market size for individual countries and the EU

In the third stage of the analysis, the market size of the selected countries and that of the EU-27 as a whole is determined. To do this, we use the following sources, amongst others:

- Population data
- Data on gross domestic product, private consumption and other key indicators
- Data on product consumption in the respective countries
- Data on packaging consumption in the respective countries
- GVM studies on the consumption of packaging films in Europe
- GVM studies on the consumption of plastic packaging in Europe
- Third-party studies on the consumption of plastic packaging in Europe

2.2. Market volume in Germany

2.2.1. Volume of PET trays

The following figures provide an overview of the market volume of PET trays in Germany in 2024, broken down by product groups for food and non-food applications.

PET in kilotonnes – Germany	Food		Non-food	Total
	1 PET bowls and trays – food	2 PET cups, other semi-rigid food packaging	3 PET films Non-food	
	101.8	18.8	23.4	144.0

Table2 : PET tray consumption in Germany in 2024 – product groups (Source: own compilation, GVM)

In Germany, a total of 101.8 kt of PET food containers and trays were produced in 2024, accounting for 71% of all PET food containers. At 18.8 kt, PET cups and other semi-rigid food packaging accounted for 13 %. The non-food sector accounted for 23.4 kt, representing 16 % of total consumption. A total of 144 kt of PET trays were consumed in Germany, 84 % of which were used for food. (s. Figure 2)

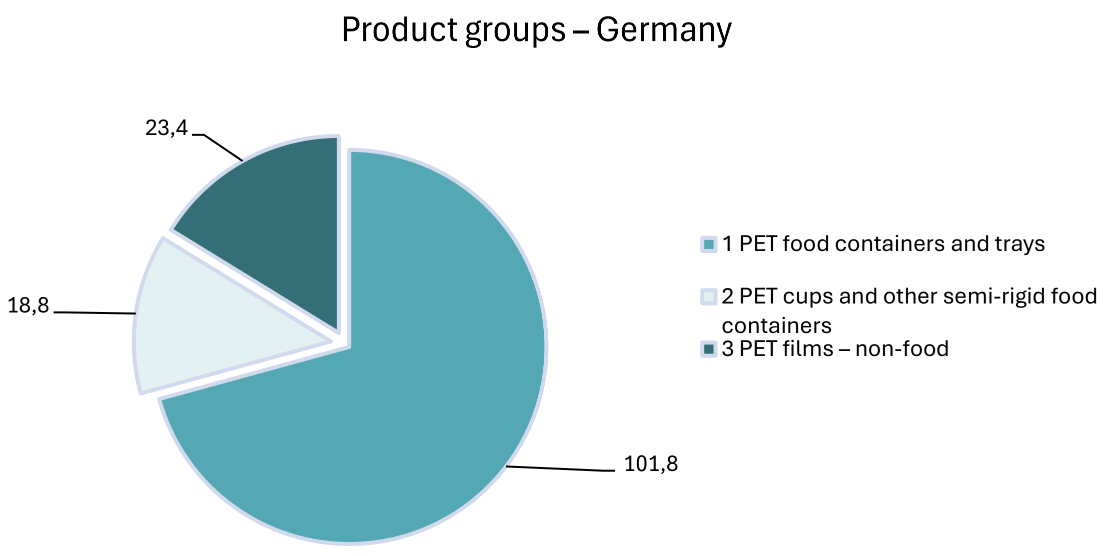

Figure 2: PET tray consumption in Germany in 2024 (in kt) – Product groups [3]

PET in kilotonnes – Germany	1 PET food containers and trays	2 PET cups, other semi-rigid food packaging	3 PET films Non-food	Total
1. Monolayer	60.3	11.4	23.0	94.6
2. Multilayer	41.6	7.3	0.4	49.3
Total	**101.8**	**18.8**	**23.4**	**144.0**

Table3 : PET tray consumption in Germany – product groups, 2024 (Source: own compilation, GVM)

In 2024, monolayer PET trays accounted for 63.7 % (94.6 kt) of the total in Germany. Multilayer trays accounted for 37.3 % (49.3 kt) of the total volume of PET trays. Monolayer packaging dominates across all sectors, whilst multilayer trays are used almost exclusively for foodstuffs.

PET trays are used in a wide range of applications, where they are particularly valued for their stability and suitability for food contact. Trays and containers made from mono-PET are mainly used for fruit, vegetables and meat products. Much of this packaging is also used in the catering sector as service packaging. Food packaging made from monolayer PET encompasses a range of contents, such as chilled products, ready-made desserts, cheese and other dairy products. In the case of food packaging made from multilayer PET, meat, sausage and cheese packaging predominates, often coated with PE as a sealing medium. In the non-food sector, blister packs play a particularly important role; these are used, for example, for household goods, toys or electronic products [5,6].

2.2.2. Volume of flexible PET

Alongside rigid trays, flexible PET also plays a significant role in the packaging market, with total consumption in Germany amounting to 60.4 kt in 2024. Based on this, the food sector accounted for the largest share at 36 kt, representing 59.5 %. The remaining 24.5 kt, or 40.5 %, was used in the non-food sector.

PET in kilotonnes – Germany	4 Other flexible PET for food	5 Other flexible PET (non-food)	Total
	36.0	24.5	60.4

Table4 : Consumption of flexible PET packaging – product groups, 2024 (Source: own compilation, GVM)

In the flexible PET packaging sector, 26.9 kt (74.7 %) of food packaging consists of multilayer packaging. For non-food items, the figure is 16.5 kt (67.4 %). In both the food and non-food sectors, composite materials are the main type used for flexible PET packaging.

PET in kilotonnes – Germany	4 Other flexible PET – food	5 Other flexible PET – non-food	Total
1. Monolayer	9.1	8.0	17.1
2. Multilayer	26.9	16.5	43.4
Total	**36.0**	**24.5**	**60.4**

Table5 : Material composition of flexible PET packaging – product groups, 2024 (Source: own illustration, GVM)

Flexible PET packaging is used for both food and non-food products and includes, amongst other things, reusable carrier bags. Applications for flexible monolayer packaging include, for example, flat pouches. Other types of multilayer packaging for food include not only meat, sausage and cheese products but also pouches for coffee, provided they do not contain aluminium foil. Another example of flexible multilayer packaging is roasted nuts. In the non-food sector, multilayer PET is primarily used to package detergents, pet food and hygiene products.

2.2.3. Total PET volume

In 2024, the total volume of PET packaging in Germany amounted to 204.4 kt. When looking at the various product groups, it becomes clear that PET food containers and trays, at 101.8 kt, account for almost half of the total market (49.8 %) and are therefore the dominant type of packaging. The second largest share is accounted for by other flexible packaging for the food sector, at 17.6 % (36.0 kt). Significantly smaller shares are accounted for by PET cups (9.2 %), non-food films (11.4 %) and other flexible non-food packaging (12.0 %).

PET in kilotonnes – Germany	Semi-rigid PET packaging			flexible PET packaging		Total
	1 PET trays and containers for food	2 PET cups, other semi-rigid food packaging	3 PET films – non-food	4 Other flexible PET – food	5 Other flexible PET (non-food)	
	101.8	18.8	23.4	36.0	24.5	204.4

Table6 : PET consumption in Germany – product groups, 2024 (Source: own compilation, GVM)

Monolayer packaging dominates the PET tray market, whilst multilayer packaging predominates in the film sector. In total, 111.7 kt of monolayer and 92.7 kt of multilayer packaging were used, corresponding to a share of 54.6% for monolayer and 45.4% for multilayer. PET trays account for the largest share of PET waste, for both monolayer and multilayer products.

PET in kilotonnes – Germany	1 PET trays and containers for food	2 PET cups, other semi-rigid food packaging	3 PET films (non-food)	4 Other flexible PET food packaging	5 Other flexible PET (non-food)	Total
1. Monolayer	60.3	11.4	23.0	9.1	8.0	111.7
2. Multilayer	41.6	7.3	0.4	26.9	16.5	92.7
Total	**101.8**	**18.8**	**23.4**	**36.0**	**24.5**	**204.4**

Table7 : PET consumption in Germany – by sector, 2024 (Source: own compilation, GVM)

2.2.4. Disposal routes and collection volumes for PET trays

93 % of the total volume of PET trays in Germany comes from private households and 7 % from comparable sources. In the household sector, 69 % of PET trays are disposed of via the light packaging collection scheme (yellow bag or yellow bin), whereas for comparable sources of waste the figure is only 31 %. Overall, this means that in Germany, 66.3 % of PET trays generated in the household sector are currently collected by the dual systems.

Estimate of PET tray disposal	Households	Comparable Waste generation points
Proportion of packaging volume	93 %	7 %
Light packaging collection	69 %	31%
Residual waste	31%	69%

Table8 : Disposal of PET trays (Source: own illustration, GVM)

The majority (73.6%) of the collected PET trays are sorted out as rejects and are mostly thermally recovered. The recycling rate of 17.5% is considerably lower than the recycling rate for plastic packaging of 52.2% (2023) [1].

There are two main reasons for the low recycling rate of PET trays. Firstly, sorting facilities and recycling plants are heavily specialised in PET bottles, meaning that trays are predominantly sorted out and excluded from the recycling process [6]. Secondly, 34.3 % of PET trays in Germany consist of multilayer materials, which are difficult or impossible to recycle mechanically. Even for monolayer trays, there have so far only been initial attempts to establish recycling infrastructure, such as the Faerch plant in the Netherlands. Furthermore, PET trays account for only a small proportion – around 5 % – of the total volume of plastic packaging [5]. This reduces the economic incentive for recycling companies to adapt their processes specifically to PET trays [9].

Flexible PET is currently almost exclusively thermally recycled in Germany. This is primarily because sorting plants for light packaging collection schemes are designed for rigid packaging, particularly bottles [10]. Although many PET films are, in principle, recyclable, they are not sorted in a way that allows for recycling [10]. Technically speaking, 41.5 % of PET films could be recycled together with PET trays. This proportion includes both mono-PET films and separable PET multilayer films.

PET trays in Germany	Collection rate	Reject rate	Recycling rate
	66.3%	73.6%	17.5%

Table9 : Recovery of PET trays (Source: own compilation, GVM)

2.3. Market volume in Europe

2.3.1. Volume of PET trays

In the reference year 2024, 823.9 kt of semi-rigid PET packaging was generated in Europe. Germany recorded the highest absolute consumption of PET trays among the EU-27 countries at 144.0 kt, followed by Italy (121.6 kt), France (116.7 kt) and Spain (96.2 kt). The remaining EU-27 countries, with 248.6 kt, account for around 30.2% of the total volume of PET trays used for packaging in the EU.

Consumption of PET trays in Europe (in kilotonnes)	Germany	France	Italy	Netherlands	Poland	Spain	Rest of the EU	EU 27
1 PET food containers and trays	101.8	83.9	95.4	26.2	49.3	78.3	189.8	624.8
2 PET cups, other semi-rigid food containers	18.8	14.8	14.8	4.5	7.7	10.2	34.4	105.2
3 PET films – non-food	23.4	18.0	11.3	5.9	3.3	7.6	24.5	93.9
Total result	**144.0**	**116.7**	**121.6**	**36.5**	**60.3**	**96.2**	**248.6**	**823.9**

Table10 : Consumption of PET trays in Europe in kt – product groups, 2024 (Source: own illustration, GVM; data basis: [4])

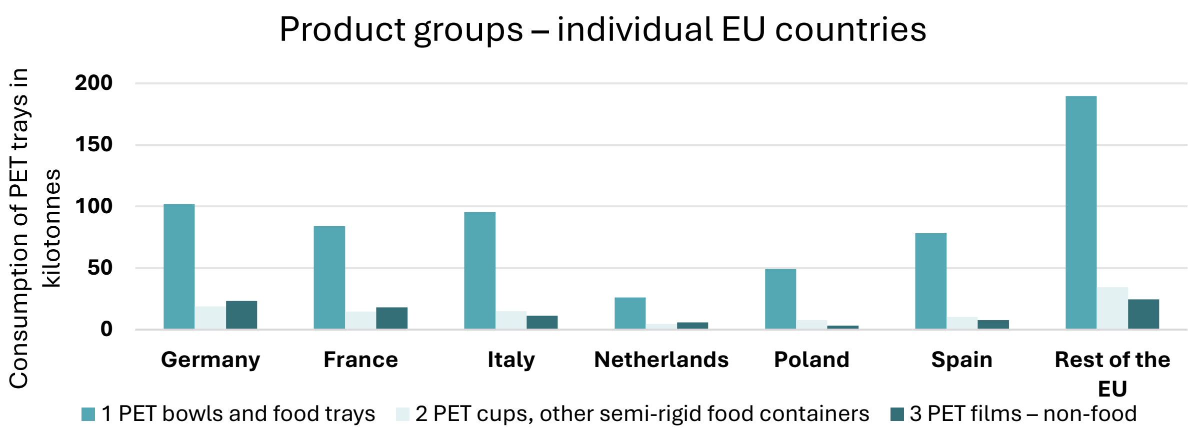

Figure 3: Consumption of PET trays in Europe (in kt) – product groups, 2024 (Source: own illustration, GVM)

Consumption PET trays in kilotonnes	Germany	France	Italy	Netherlands	Poland	Spain	Rest of the EU	EU 27 total
1. Monolayer	94.6	77.4	86.1	25.6	35.4	67.5	154.4	541.0
2. Multilayer	49.3	39.3	35.5	10.9	24.8	28.7	94.2	282.9
Total result	**144.0**	**116.7**	**121.6**	**36.5**	**60.3**	**96.2**	**248.6**	**823.9**

Table11 : PET tray consumption in Europe in kt – Layer, 2024 (Source: own compilation, GVM)

In all the countries considered, PET trays are predominantly used for food packaging [7].

In 2024, a total of 541 kt of monolayer PET was used for PET trays in the EU. This represents 65.7 % of all PET trays. In all the countries surveyed, the use of monolayer PET outweighs that of multilayer PET. The proportion of monolayer PET is lowest in Poland at 58.8 % and highest in Italy at 70.8 %. At 65.7 %, Germany is exactly in line with the European average. The following Figure 4 illustrates the distribution between monolayer and multilayer PET.

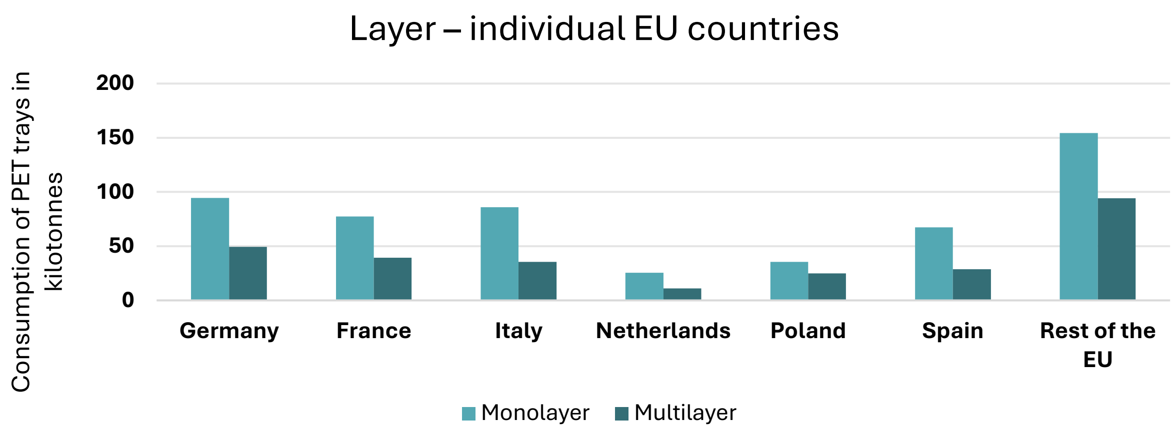

Figure 4: PET tray consumption in Europe in kt – by layer, 2024 (Source: own illustration, GVM)

	Germany	France	Italy	Netherlands	Poland	Spain	Rest of the EU	EU 27
1 PET food containers and trays	**101.8**	**83.9**	**95.4**	**26.2**	**49.3**	**78.3**	**189.8**	**624.8**
1. Monolayer	60.3	50.3	65.1	16.9	28.2	53.6	109.5	384.0
2. Multilayer	41.6	33.6	30.3	9.3	21.0	24.7	80.2	240.8
2 PET cups, other semi-rigid food containers	**18.8**	**14.8**	**14.8**	**4.5**	**7.7**	**10.2**	**34.4**	**105.2**
1. Monolayer	11.4	9.4	9.9	3.0	4.0	6.4	21.1	65.1
2. Multilayer	7.3	5.4	5.0	1.5	3.7	3.9	13.3	40.1
3 PET films – non-food	**23.4**	**18.0**	**11.3**	**5.9**	**3.3**	**7.6**	**24.5**	**93.9**
1. Monolayer	23.0	17.7	11.1	5.7	3.2	7.5	23.9	91.9
2. Multilayer	0.4	0.3	0.3	0.1	0.1	0.2	0.6	2.0
Total result	**144.0**	**116.7**	**121.6**	**36.5**	**60.3**	**96.2**	**248.6**	**823.9**

Table12 : PET tray consumption in Europe in kt, 2024 (Source: own illustration, GVM; data basis: [4])

1 PET bowls and food trays	Germany	France	Italy	Netherlands	Poland	Spain	Rest of the EU	EU 27
1. Monolayer	59.2%	59.9%	68.2%	64.5%	57.3%	68.5%	57.7%	61.5%
2. Multilayer	40.8%	40.1%	31.8%	35.5%	42.7%	31.5%	42.3%	38.5%

Table13 : PET tray consumption in Europe – food trays, 2024 (Source: own illustration, GVM)

Monolayer PET packaging predominates in all categories. However, there are variations within the categories, which are discussed on the following pages.

In the EU, PET food trays and containers are predominantly made from a single material. The European average share of monolayer PET in this sector stands at 61.5 %. However, there are significant differences between individual countries: in Poland, the proportion of monolayer packaging is the lowest at 57.3 %, whilst Spain has the highest proportion at 68.5 %, closely followed by Italy at 68.2 %. Germany, with a monolayer proportion of 59.2 %, lies below the European average.

2 PET cups, other semi-rigid food packaging	Germany	France	Italy	Netherlands	Poland	Spain	Rest of the EU	EU 27
1. Monolayer	60.9%	63.4%	66.5%	65.9%	52.2%	62.2%	61.3%	61.9%
2. Multilayer	39.1%	36.6%	33.5%	34.1%	47.8%	37.8%	38.7%	38.1%

Table14 . PET tray consumption in Europe – Other food trays, 2024 (Source: own compilation, GVM)

In the EU, other PET food containers are also predominantly manufactured from a single material. The proportion of monolayer PET across the EU stands at 61.9 %, which is 0.4 percentage points higher than for PET bowls and trays. As in other categories, Poland has the lowest proportion of monolayer PET at 52.2 %.

3 PET films – non-food	Germany	France	Italy	Netherlands	Poland	Spain	Rest of the EU	EU 27
1. Monolayer	98.2%	98.3%	97.7%	97.9%	96.4%	97.8%	97.6%	97.9%
2. Multilayer	1.8%	1.7%	2.3%	2.1%	3.6%	2.2%	2.4%	2.1%

Table15 : Consumption of PET trays in Europe – non-food trays, 2024 (Source: own compilation, GVM)

Italy has the highest proportion of monolayer packaging at 66.5 %, followed by the Netherlands at 65.9 %. Germany, with a monolayer proportion of 60.9 %, is once again below the European average.

Across the EU, PET trays for non-food products are manufactured almost exclusively from a single material. The proportion of monolayer PET in this sector stands at 97.9% across the EU. Compared with food packaging, the differences between individual countries are significantly smaller for non-food trays. Poland has the lowest proportion of monolayer packaging at 96.4 %, whilst France, at 98.3 %, followed by Germany at 98.2 %, has the highest proportions. Overall, the differences between countries amount to a maximum of 1.9 percentage points.

The average per capita consumption of PET trays in the EU is 1.84 kg. Italy has the highest per capita consumption at 2.06 kg, followed by the Netherlands at 2.04 kg. Although Germany has the highest total consumption of PET trays at 144.0 kt, its per capita consumption of 1.73 kg is 0.11 kg below the EU average when adjusted for population size. Spain also lies above the EU average at 1.99 kg. France falls below this at 1.71 kg, as does Poland, which has the lowest per capita consumption at 1.64 kg.

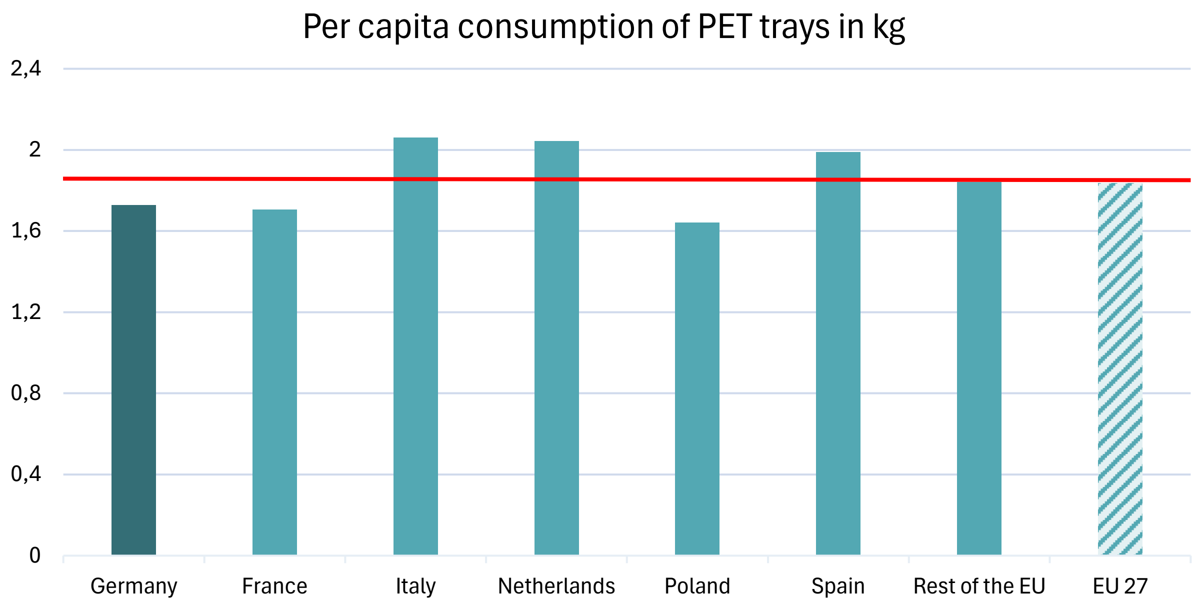

Figure 5: Consumption of PET trays in Europe – non-food trays, 2024 (Source: own illustration, GVM; data basis: [3])

3. State of the art in PET recycling

3.1 Mixed collection systems and collection

In Germany, PET packaging is predominantly collected through mixed collection systems for lightweight packaging (LWP), which are organised by the dual systems. Collection is carried out via the yellow bag or yellow bin, in which plastic packaging, metals and composite materials are collected together. Separate collection of LWP is now established nationwide. Special collection systems, in which – for example, as in France – paper packaging or paper and cardboard are collected together with LWP, can be neglected. In almost all EU Member States, very similar collection methods have been established or are currently being introduced for reasons of practicality and to minimise system costs. The subsequent process stage of sorting by packaging material type and format is therefore presented and discussed as an example of the collection method involving the separate collection of recyclables in a mixture of plastic, metal and composite packaging, excluding glass as well as paper and cardboard packaging, as this can be regarded as the state of the art in Europe today. However, the fundamental conclusions regarding the specific requirements for the sorting and provision of a PET tray fraction also apply to alternative collection methods.

3.2 Sorting

3.2.1 Process management

Sorting represents the central interface in the recycling cycle of PET trays, where decisions are made regarding the material composition, purity and, ultimately, the recyclability of the material streams. Sorting plays a key role, particularly in the context of the desired ‘tray-to-tray’ recycling, as it creates the prerequisite for the provision of high-quality recyclates.

The sorting of lightweight packaging (LWP) takes place in specialised sorting plants which, in accordance with the state of the art, employ a largely standardised sequence of individual mechanical operations for preparation, and a combination of mechanical and sensor-based, automated processes for separating the individual sorting fractions.

Figure 6 schematically illustrates a typical layout and the process logic of a state-of-the-art LWP sorting plant. The aim of this process chain is to separate the heterogeneous input stream into pure, recoverable fractions in accordance with the quantitative and qualitative specifications of the respective PROs (Producer Responsibility Organisations).

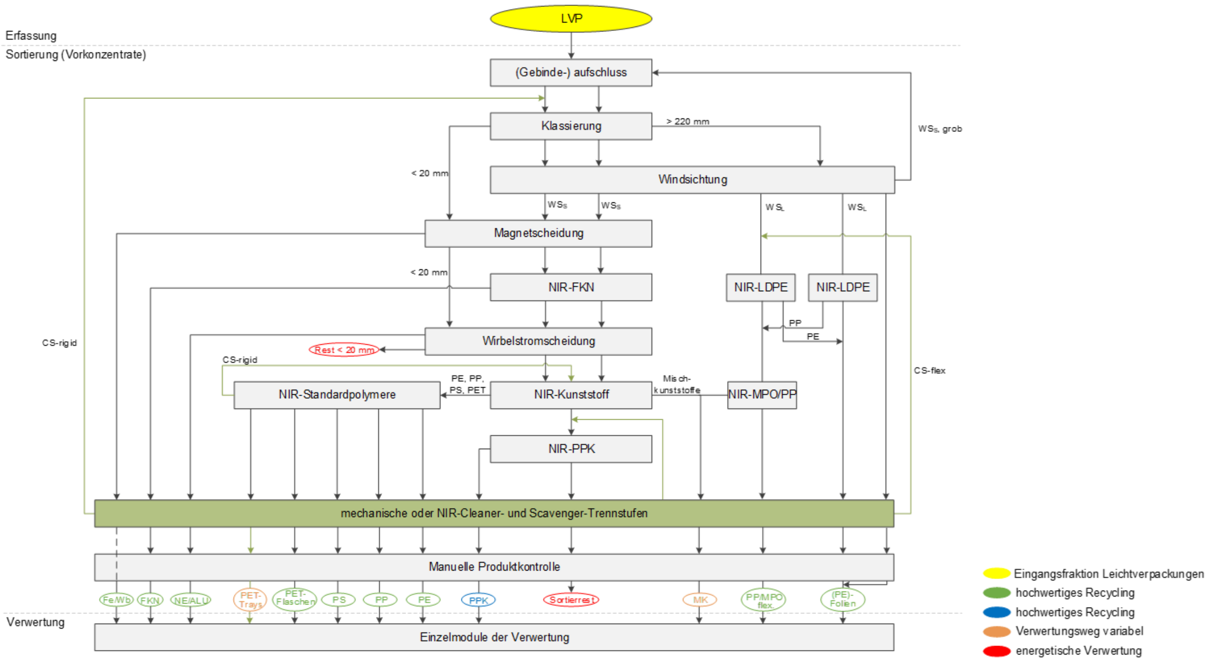

Figure 6: Exemplary, simplified process flow for LWP sorting (Source: HTP/CHI)

The product portfolio shown in Figure 6 is representative for the current diversification in large-scale German plants with throughputs of over 100,000 t/a or serving a population between 3 and 4 million residents. The standardisation of the process sequence stems from the process engineering requirements for conditioning the mixed waste stream for the respective specific sorting stages.

A rough breakdown of the sub-processes distinguishes between

- Process stages for preparation prior to the actual sorting (breakdown of packaging, screening, pre-separation of flat and three-dimensional packaging, usually via air classification (for mixed waste streams with a high paper content, such as those in France, via ballistic separators).
- Process stages for the initial enrichment of the target fractions (so-called 'Rougher' stages); for plastic sorting fractions, state-of-the-art technology currently relies exclusively on NIR or NIR-VIS-based automatic sorting machines.
- Cleaner process stages for further cleaning and concentration of the Rougher products (often involving multiple stages using mechanical or automatic sorting machines, depending on the required purity), including manual product inspection sorting where necessary, depending on the respective product specifications.
- Process stages designed to maximise product yield (so-called 'scavenger' stages). For plastic fractions, the scavenger stages consist exclusively of sensor-based sorting machines, which are usually set to a lower level of selectivity than the

rougher stages. The number and positioning of scavenger stages depend on the requirements set by the PROs regarding the sorting rates to be achieved.

Within LWP sorting, PET bottles have occupied a special position since the start of separate collection of recyclables due to the high added value that can be achieved. A further driver of technological development was the high proportion of this type of packaging at the time the system was introduced, a situation that still exists today in countries without a mandatory deposit on beverage packaging. The current situation in Germany is historically determined; hence a brief review:

The first milestone in the development was the introduction of plastic type sorting in 1999, with the specification of a PET bottle fraction (fraction number 325) with a purity of 98 %. Since 2003, the PET sorting stages have been implemented as NIR-VIS stages; the integrated spectral analysis in the visible wavelength range not only enabled better separation of PET bottles that did not meet specifications (opaque ones), but also offered the option of economically producing colour-sorted grades within the LWP sorting process; however, unlike in Belgium or Italy, for example, this was never implemented in Germany due to the introduction of the mandatory deposit return scheme. In Germany, the sudden slump in the proportion of PET bottles in the LWP mix, coupled with a steady increase in the volume of PET trays (due to substitution with PP), led to the problem that it was no longer possible for existing plants to produce a PET bottle fraction of the required purity. As a compromise solution, the Dual System created mixed PET sorting specifications allowing tray content of up to 50 % (fraction numbers 328-1 to 328-3) and established capacities for decentralised re-sorting in order to produce marketable grades by separating out the tray content. Further efforts up to 2017 were aimed at reducing the proportion of trays in the mixed PET fraction. Various advancements in sensor-based sorting (higher resolution, faster processors, full-spectrum analysis) laid the groundwork for more selective sorting of PET bottles. PET trays were largely transferred to the mixed plastics stream. It was only with the establishment of independent recycling capacities for PET thermoforms that it became possible to plan and implement specific solutions for their raw material supply within the LWP sorting process.

The state of the art in process technology, as reflected in the generation of sorting plants built from 2020 onwards, is illustrated in Figure 7. It differs from the PET sorting solution with target fraction 328-1 in the previous generation as it features an additional NIR-VIS separator, which is positioned in the reject stream of the PET bottle separation stage. PET trays are therefore no longer sorted as a residue from the PET bottle sorting process (indirectly or as a reject), but are sorted positively, just like the PET bottle fraction. Among other things, this enables high-quality requirements for both sorted products to be met as required – without mutual interference – through appropriate programme adjustments. To minimise output losses caused by the additional sorting stage, the reject streams from the tray separator are also integrated into the design of the scavenger stages.

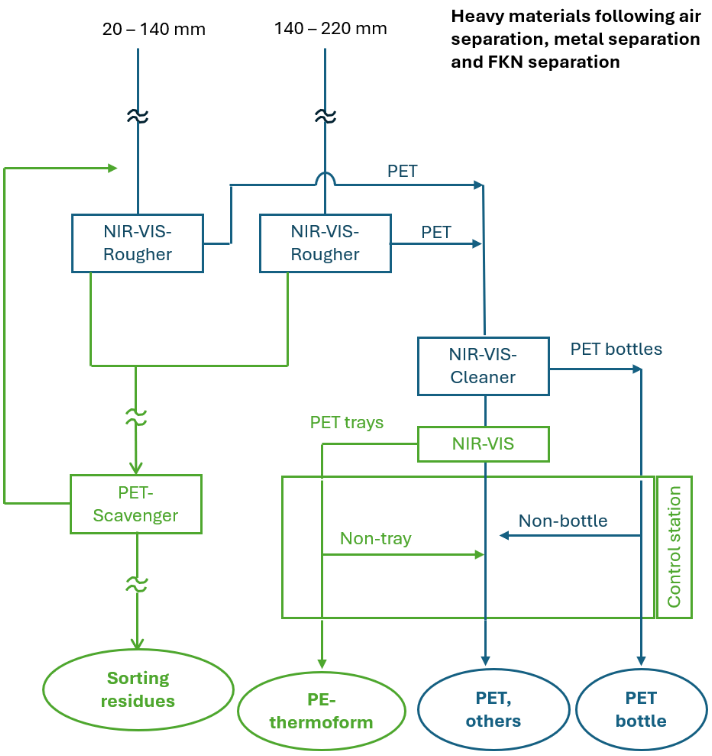

Figure 7: PET sorting – bottles (in blue) and addition of thermoforms (in green) (Source: CHI/HTP)

As mentioned, the process flow outlined in Figure 7 is not yet established across the board. In most sorting plants, PET trays continue to be processed alongside other PET items or mixed plastics. In Germany, according to our own surveys, only 4 out of 38 LWP sorting plants are equipped with a dedicated PET thermoform sorting system, which corresponds to around 15 % of installed sorting capacity. By contrast, countries such as the Netherlands and Belgium, where the majority of capacity consists of new facilities built after 2020, are already predominantly equipped with PET thermoform sorting systems using the best available technology (BAT). With regard to retrofitting existing plants, it should be noted that, whilst this is in principle possible, the conversion costs can be substantial depending on the plant configuration, particularly if the space requirements for further upgrades were not already factored in as reserve space during the original planning stage.

The costs of retrofitting existing sorting plants for PET thermoform sorting depend largely on the configuration and current layout of the existing plant. Key cost factors include the machinery used, the necessary conveyor systems and product handling (press feeding). In particular, the conveyor systems can have a significant impact on the total investment, depending on the available space and the structural conditions. From a design perspective, the installation of additional NIR and VIS sensor systems is also required; depending on the required product specifications, a corresponding manual inspection station may also need to be taken into account. In addition, costs are incurred for planning, mechanical and electrical installation, steelwork and site inspections, documentation, transport and freight costs, as well as commissioning and test runs. Taking all the factors mentioned into account, experience shows that the investment costs are in the region of approximately 900,000 to 1,300,000 euros. For any retrofit, a thorough analysis of the conditions at the respective plant is essential in order to accurately assess the individual costs involved and to specify the above-mentioned cost framework.

As part of the technical design, it must also be checked whether the existing compressor system has sufficient reserve capacity. If this is not the case, it may be necessary to increase the compressor capacity or select the next larger compressor stage. In this context, additional investment, maintenance and infrastructure costs may need to be taken into account.

It is not possible to provide a flat-rate figure for the specific operating costs, as these depend largely on the plant capacity and throughput. For a sorting plant with an annual throughput of 100,000 t, the additional costs of sorting a high-quality PET tray fraction can be estimated, by way of example, at between €3.30 and €4.20 per t of LWP. This figure includes all fixed (e.g. depreciation) and variable operating costs, but not the marketing costs for the PET tray fraction. The (additional) production costs per t of PET tray fraction, assuming a yield of 3.5 % of the LWP input, can be estimated at approximately €95 to €120 for this example.

The study ‘Comparison of innovative identification methods for post-consumer lightweight packaging’ has already shown that sorting concepts for the targeted identification of PET thermoforms are technically feasible and are regarded as best available techniques (BAT) [13]. In principle, all innovative automated sorting methods for plastic packaging are based on multi-sensor detection systems, in which the NIR camera is combined with high-resolution optical scanners. For a description of the individual technology variants, please refer to the aforementioned comparative study of identification methods. In broad terms, a distinction can be made between marker-based and image analysis-based systems.

State-of-the-art sensor-based sorting is the central element of LWP sorting. It is primarily based on a combination of mechanical separation, sensor-based detection and the active ejection of individual objects. Near-infrared spectroscopy (NIR) is the established core technology, enabling the identification of polymer-based materials based on their characteristic spectral signatures in the wavelength range > 780 nm; it forms the basis of today’s sorting of plastics in LWP systems. Visual sensors are also used to detect colour, transparency or surface characteristics. Physical separation following identification is usually carried out via controlled compressed-air valves, which are located on a strip at the belt transfer point shortly after the detection unit.

Limitations of NIR-based differentiation by format

Figure 8 shows a comparison of the NIR reference spectra of PET bottles and PET trays. The figure illustrates that the spectral signatures of both packaging formats are very similar in the NIR wavelength range; characteristic absorption bands of the PET polymer appear almost identical, with only minor differences in intensity.

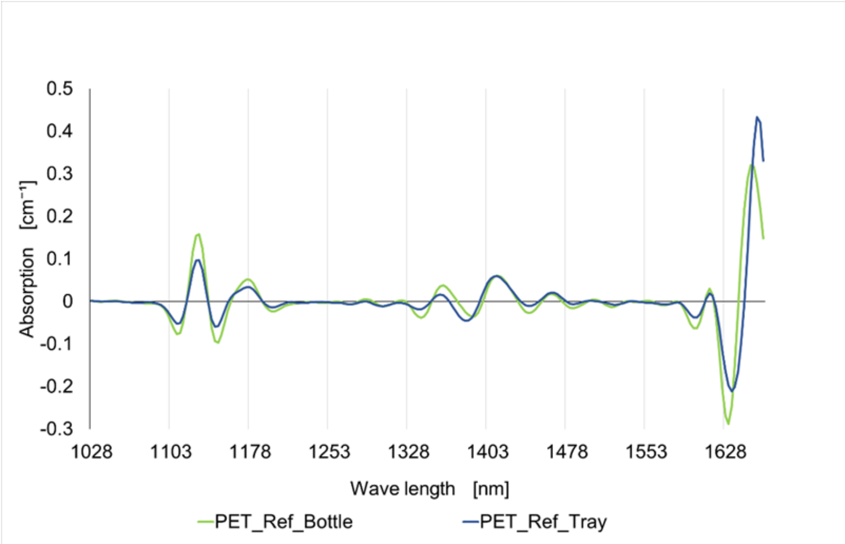

Figure 8: Comparison of reference spectra – PET bottle (green) and PET trays (blue)

This high spectral similarity is material-related and demonstrates that NIR spectroscopy allows for the reliable identification of PET as a type of plastic but does not enable a reliable distinction between different formats of the same polymer. The differences visible in the figure are minor and cannot be reliably distinguished under practical conditions - for example, in the case of soiled, printed or deformed post-consumer material.

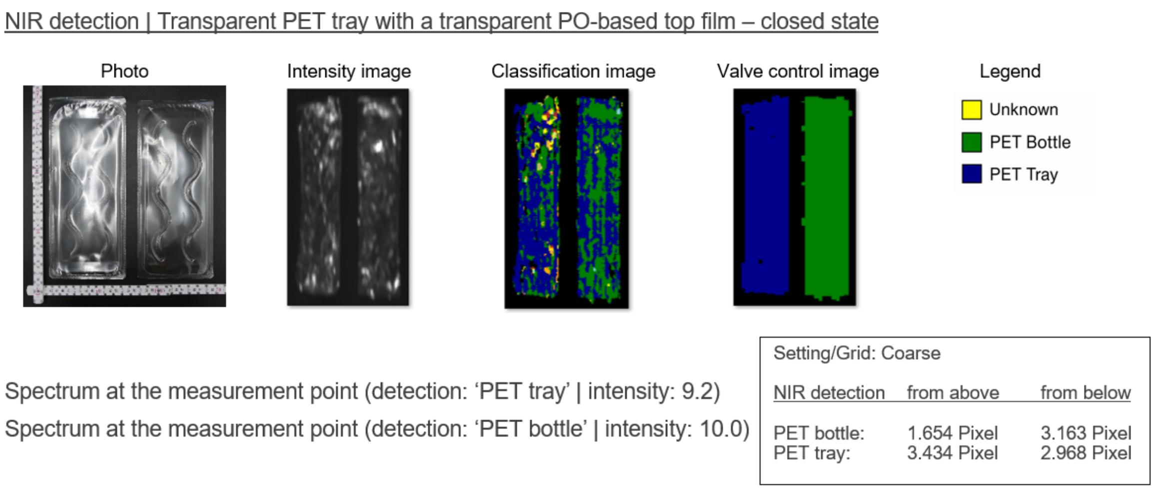

Figure 9: Practical example illustrating the limitations of NIR-based sorting. Transparent PET tray with a PO-based top film in the closed position, photographed from the top and bottom

The example shown in Figure 9 illustrates these limitations of purely NIR-based sorting. A transparent PET tray with a PO top film is classified differently depending on which upper surface-side is analysed: whilst one side is correctly identified as a PET thermoform, the other is sometimes misclassified as a PET bottle. This is caused by interference from the top film, as well as geometric and optical effects that distort the measurement spectrum of the base material. The classification images also show significant pixel heterogeneity, with unknown or incorrectly assigned pixels.

As the objects pass the NIR camera whilst lying flat on the conveyor belt, their position and orientation have a decisive influence on the result in each individual case. In practice, this often leads to conservative settings/decisions, particularly in the cleaner stages, and consequently to the objects being routed to the respective reject stream of the sorting stage.

Overall, it is evident, as things stand in 2026, high-quality, single-grade sorting of PET trays is failing not so much due to difficulties in detecting PET, but rather due to a lack of selectivity between different PET packaging formats. Multilayer structures, top films, labels, varying wall thicknesses and differing geometries can lead to unreliable classifications. Consequently, advanced sorting technologies that provide additional information beyond the pure material composition are becoming increasingly important. At the same time, the importance of packaging designs suitable for recycling continues to grow, a topic discussed in more detail in Chapter 6.

Image-based sensor technology and AI-supported object recognition

A key approach to overcoming the limitations of NIR detection is the use of imaging sensor systems with object recognition. RGB cameras capture features such as colour, contour, surface and geometry in 2D image analysis, thereby enabling a more differentiated evaluation than the essentially purely material-based NIR classification of the reflectance spectrum. 3D laser triangulation offers the additional option of supplementing this data with height and volume information.

Analysis is increasingly carried out using AI-based classification models, which can precisely assign packaging to individual categories – even down to distinguishing between brands – on the basis of large sensor datasets.

In practice, such methods are used in multi-sensor sorting systems: NIR provides material recognition, whilst RGB and, where applicable, 3D cameras capture the data for AI-generated detailed classification.

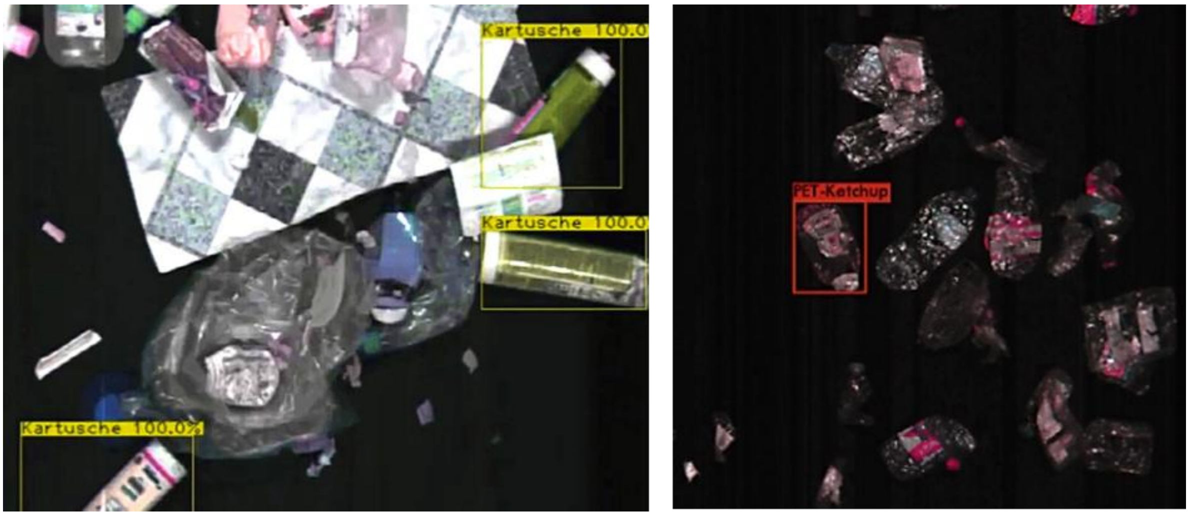

Figure 10: Example images for AI-assisted object recognition

Source 1: https://steinertglobal.com/de/sortiersysteme/sensorsortierung/nir-sortiersysteme/unisort-pr/
Source 2: https://steinertglobal.com/de/cirrec/

AI-assisted object recognition is already in practical use in some sorting plants and is implemented either as an integrated function in NIR sorting machines or via individually installed sorting robots. Examples of applications include the separation of PET trays and PET bottles. Overall, around one third of total sorting capacity is equipped with object recognition. Within this innovative sorting capacity, PET accounts for 29% of the additional sorting fractions generated. Furthermore, around 75% of facilities regard the innovative sorting of PET as a potential retrofit measure. [13]

3.2.2 Specifications

When it comes to the quality requirements for the PET trays sorting fraction, a distinction must be made between sorting specifications and the input specifications of individual recyclers.

Sorting specifications are set by the PROs. They determine, to a greater or lesser extent, which fractions are produced and what requirements apply in terms of purity and specific contaminants. In doing so, they set the framework for the operation of sorting plants. The individual input specifications of recyclers, on the other hand, define the specific acceptance criteria of individual PET tray processors. They are usually more narrowly defined, as they are based on the technical and economic constraints of the respective plant and the specific requirements for the intended use of the recycled material.

Table16 shows the requirements for PET tray sorting fractions in a summarised form. In addition to purity (here: PET tray content), the table compares the respective permissible PET bottle content with the total upper limit for components that do not meet the specifications.

	Specifications	***Country***	***PET trays***	***PET bottles***	***PET general***	***Contaminants***	***Notes, Source***
SYSTEM SPECIFICATIONS	DSD Spez. 328-**6**	Germany	≥ 90 %	≤ 5 %	-	≤ 9 %	328-6 is not officially listed by DSD (unlike 328-5)
	DSD Spez. 328-**5**	Germany	≥ 75 %	≤ 20 %	-	≤ 17 %	
	Fost Plus PETT	Belgium	≥ 90 %	≤ 6 %	-	≤ 10 %	Blister packs ≤ 2 %
	Corepla SELE-VPET/C	Italy	-	≤ 15 %	-	≤ 11,5 %	Multilayer packaging is specifically listed under “contaminants”
	KIDV	Netherlands	≥ 80 %	≤ 20 %	-	≤ 6 %	
	ARA/Brantner Nr. 499 "PET sonstige Flaschen"	Austria	accepted	Accepted: “Non-beverage bottles, all colors, clear and solid-colored”	-	≤ 5 %	No specific specifications for trays
	Ecoembes PET	Spain	-	-	≥ 95.5 %	≤ 4,5 %	No specific specifications for trays
	APA	Portugal	Trays are excluded from general PET collection				No specific specifications for trays
PLANTS	Cirrec Input Specifications	-	**≥ 95 %**	≤ 5 %	-	-	Source: Interview
	Sulayr Input Specifications	-	**≥ 85 %**	≤ 15 %	-	< 5,5 %	Source: Interview
	Repetco Input Specifications	-	**≥ 85 %**	≤ 15 %	≥ 95 %	-	Source: Interview

Table16 : Specifications for ‘PET, other rigids’ – system and plant specifications

The overview reveals significant differences: some PROs already define specific tray fractions with minimum PET tray content, whilst others permit them as permissible components within PET bottle fractions or as components of non-bottle PET fractions.

There is also a clear discrepancy between the purity levels required by the sorting specifications and the quality standards demanded by recyclers.

The lack of harmonisation in system specifications makes it difficult to sort PET trays effectively and limits the availability of suitable feedstock for tray-to-tray mechanical recycling.

In summary, sorting represents a key bottleneck in the tray-to-tray recycling of PET trays. As things stand in 2026, it continues to rely predominantly on NIR-based material recognition, which is well-established for PET bottles but reaches its physical and systemic limits when applied to PET thermoformed trays. The high spectral similarity between PET bottles and PET trays, as well as complex packaging structures, lead to inconsistent sorting results and make it difficult to produce high-quality tray fractions.

3.3 Mechanical recycling

Mechanical recycling represents the dominant recovery route for sorted PET tray fractions according to the current state of the art. In the tray-to-tray cycle shown in Figure 11, it forms the central processing stage between the sorting of PET trays and the reuse of the recovered recyclates. In this phase, the material streams provided by the sorting process are either channelled into high-quality material recovery or, where quality losses are limited, used in demanding applications.

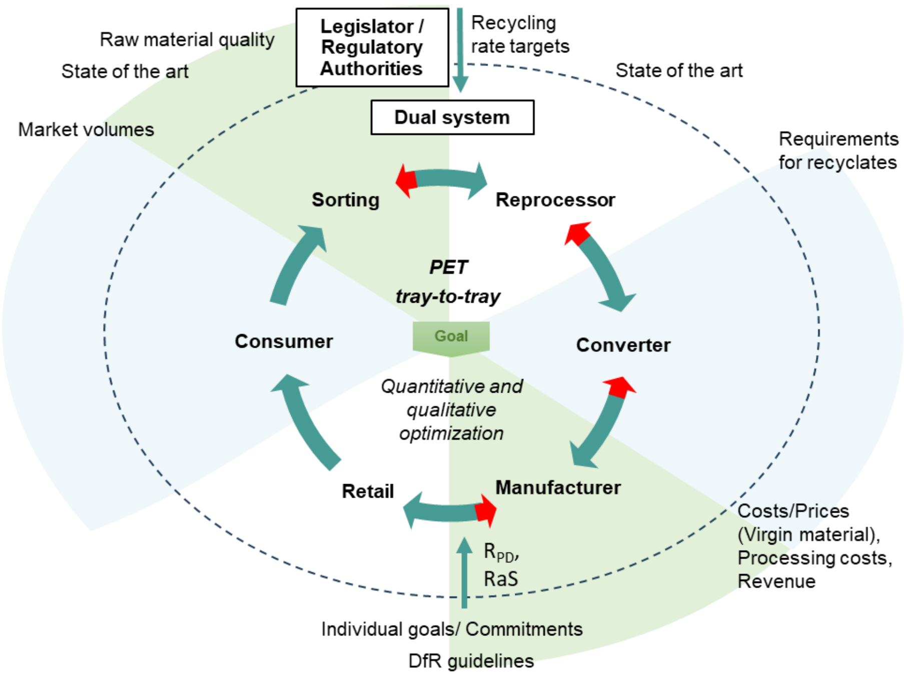

Figure 11: An idealised representation of the material flows and interrelationships within a closed-loop PET tray-to-tray recycling cycle ('Tray-to-Tray'). Interactions between the stakeholders involved, technical process steps, and regulatory and economic influe

Mechanical recycling encompasses all physical and mechanical process steps involved in the processing of sorted PET tray fractions, including shredding, washing processes, separation of foreign materials and subsequent regranulation. The aim is to produce a recycled material that meets both the material-specific requirements for further processing and the quality requirements of the respective application. Both sets of requirements should, as far as possible, correspond closely to those of virgin PET, which is typically used for PET trays. Ideally, the quality of the recycled material would match that of virgin PET. The achievable quality of the recycled material depends largely on the purity of the input materials, as well as on the proportion of foreign polymers, composite structures and functional additives.

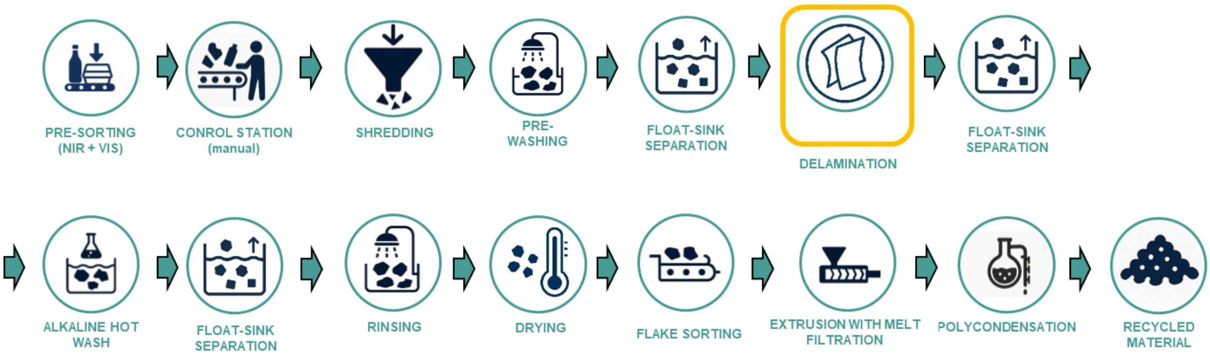

Figure 12: Typical process steps in the mechanical recycling of PET trays in a state-of-the-art tray-to-tray cycle – from the pre-sorting of sorted PET tray fractions to the production of a PET recyclate in industrial processing plants

Figure 12 shows typical process steps in the mechanical recycling of PET trays within the context of a state-of-the-art tray-to-tray cycle. Whilst basic process steps such as washing and float-sink separation are also familiar from bottle recycling, the recycling of PET trays requires additional processing steps due to their more complex material structures compared to PET bottles (e.g. multilayer systems, top films, coatings or functional additives).

These composite structures have a significant impact on the quality of the recycled material and usually cannot be completely removed in conventional mechanical recycling. Delamination is therefore becoming increasingly important as an additional step in the mechanical recycling of PET trays. It separates multilayer packaging such as PET/PE or PET/PE/EVOH into its main components, reduces the proportion of foreign polymers and thus improves the purity and processability of rPET.

The need for a delamination step arises primarily from the significant market share held by multilayer PET trays. Research regarding the volume of PET trays in Germany and the EU shows a declining market share for multilayer trays. Nevertheless, these still account for around one-third of the total volume in Germany. In conventional mechanical recycling, they can only be processed into single-grade PET to a limited extent. At the same time, however, the integration of delamination increases the complexity of the plant and places additional demands on process control, operation and cost-effectiveness.

In addition to Figure 12, the interview results highlighted the use of specialised technologies in recycling plants, including SSP and LSP processes for post-condensation, two-stage IR heaters for efficient heating and drying, liquid extrusion systems for direct processing, and separation units such as zig-zag separators and hydro-cyclones as alternatives to float-sink separation; integrated processing solutions, such as those from EREMA, are also used.

To provide a practical overview of tray-to-tray recycling of PET trays, the study examined four recycling plants: CIRREC (Netherlands), Sulayr (Spain), REPETCO (Spain) and Veolia UK (United Kingdom). These plants represent different industrial approaches and stages of development in PET tray recycling, as shown in the overview atTable17 .

	cirrec	Sulayr	REPETCO	VEOLIA
Location	Duiven, Netherlands	Valle del Zalabí (Granada), Spain	Albacete, Spain	Battlefield (near Shrewsbury), England
Commissioning	2018 (first line) 2024	2009 2024 (second plant)	March 2023	Early 2026 (planned)
Nominal capacity (input)	> 60 kt/a	45 - 60 kt/a	100 kt/a	80 kt of PET packaging per year, including PET trays
Special features of the process	Frictional delamination of multilayer PET/PE materials	Delamination of multilayer PET/PE materials	Delamination of PET/PE multilayer food packaging	-
Recyclates	rPET pellets, food-grade	rPET flakes (pellets produced externally only)	rPET pellets, food-grade and rPE	-

Table17 : Recycling plants utilising tray-to-tray recycling of PET trays

Since 2018, CIRREC has been operating a plant at its Duiven site (Netherlands) for the processing of PET trays, with a nominal capacity of around 60,000 tonnes per year, which produces rPET pellets for high-quality applications.

Sulayr has been active in PET tray recycling since 2009 and operates two plants in Spain with a combined capacity of approximately 45,000 to 60,000 tonnes per year; these are designed for multilayer PET packaging and utilise integrated delamination processes, yielding rLDPE as a by-product in addition to rPET.

REPETCO has been operating a plant in Albacete (Spain) since 2023 with a nominal capacity of around 100,000 tonnes per year, which processes multilayer PET/PE food packaging via delamination and produces rPET pellets and rPE.

In addition, Veolia UK is planning to build a tray-to-tray recycling plant near Shrewsbury (England) with a planned total capacity of around 80,000 tonnes per year, of which a limited proportion is expected to be allocated to the processing of PET trays.

Based on the facilities under consideration, it is possible to estimate the currently available input capacities for the mechanical tray-to-tray recycling of PET trays. Taking into account the stated plant capacities and other existing capacities, the total available capacity for the current period under consideration (2025) is around 235,000 to 250,000 tonnes per year for the mechanical tray-to-tray recycling of PET trays. The Veolia UK plant is not included in this estimate, as it is currently still under construction and will not be operational by the time under consideration.

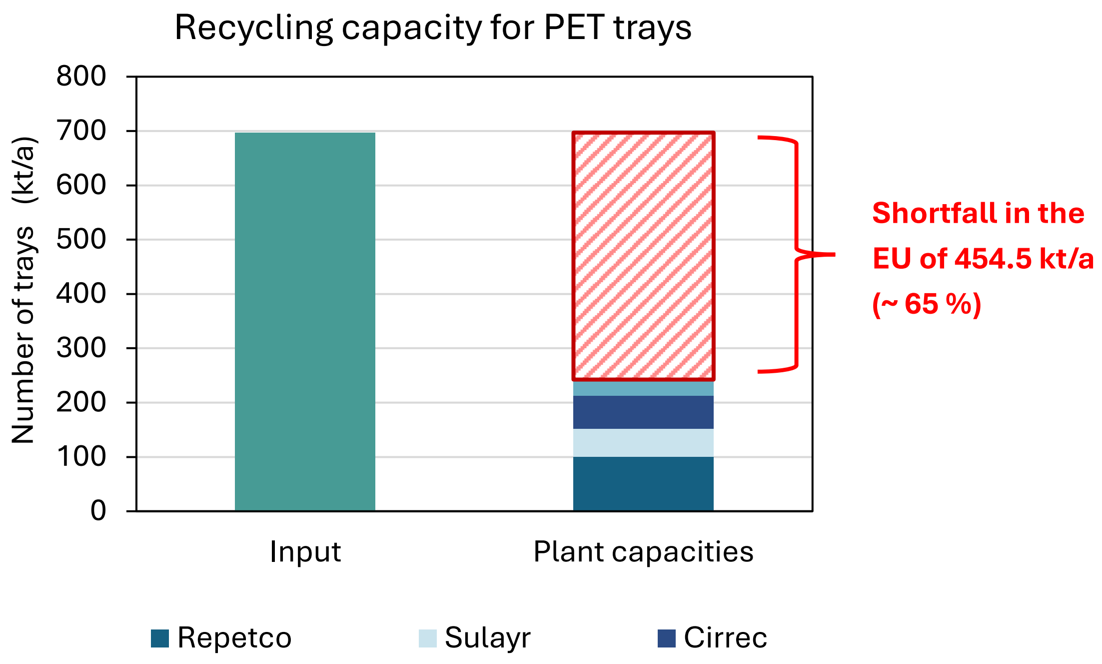

Figure 13: Determination of recycling capacities already in place in Europe and the resulting Europe-wide shortfall

Market research carried out by GVM shows that a total of 823 kt of semi-rigid PET packaging was generated in Europe in 2024. In accordance with the definition of 'packaging waste recycled at scale' (*Recycling at Scale, RaS*) under Article 3(39) of the PPWR, it must be ensured that at least 55 % of this packaging is recycled. When considered in isolation, this corresponds, for the PET thermoforms packaging category, to a recycled product output of 452 kt of PET flakes.

Figure 14: Determination of the required input capacity for PET trays

Assuming an average projected yield of an ambitious 65 %, this results in a required input of 697 kt of PET trays. As the current total capacity of PET recyclers stands at 242.5 kt, this results in a capacity shortfall of (at least) 454.5 kt per year.

Challenges from the recyclers' perspective

From the recyclers' perspective, the mechanical recycling of PET trays is associated with a number of regulatory, economic, infrastructural and technological challenges. At the regulatory level, the design of existing EPR schemes is perceived as inadequate, as these focus primarily on PET bottles and have so far given only secondary consideration to PET trays. Targeted incentives for the design of PET trays to facilitate recycling or for the use of recycled materials are largely lacking. Furthermore, differing national regulations within Europe make it difficult to harmonise collection, sorting and recycling streams, which limits the scale-up of tray-to-tray recycling.

In many cases, virgin PET remains more cost-effective than high-quality recycled material, which reduces the willingness to invest along the value chain. Added to this is limited market stability for PET tray recyclates, as long-term off-take agreements and reliable sales markets are often lacking. This uncertainty has a direct impact on investment decisions regarding recycling capacity.

From the recyclers' perspective, there are also significant barriers at the infrastructural level. There is a shortage of specialised facilities equipped with both adapted sorting technologies and suitable washing and processing methods for PET trays. Building up the necessary capacity involves high investment costs and requires specific expertise that, to date, is available to only a few operators. Furthermore, the lack of harmonisation in collection and sorting systems across Europe acts as a structural barrier to efficient and predictable plant operation.

From a technological perspective, the heterogeneity of post-consumer material poses a key challenge. PET trays come in various forms, such as mono- or multilayer packaging, and in varying colour and material combinations. This diversity makes consistent sorting and processing difficult. Delaminating multi-layer structures is particularly challenging, especially in the case of composites containing copolyesters, as their thermal and mechanical properties are difficult to control during mechanical recycling and can have a negative impact on the quality of the recycled material.

Plant specifications

The challenges mentioned arise from the interplay of several factors along the value chain and converge at key interfaces, including the interface with the sorting process. As these influencing factors are significantly reflected in the requirements for the input material used, the plant input specifications are discussed in more detail below.

In contrast to the specifications set by the PROs, the specifications provided by the recyclers describe the specific input requirements of individual recycling plants and are directly linked to the process engineering capabilities, the target products and the economic constraints of the respective plant. The plant specifications presented inTable18 are based on interviews with the respective plant operators.

Specification	*PET trays*	*PET bottles*	*PET in general*	*Contaminants*
CIRREC Input specification	**≥ 95 %**	≤ 5 %	-	-
Sulayr Input specification	**≥ 85%**	≤ 15 %	-	< 5.5%
REPETCO Input specification	**≥ 85%**	≤ 15 %	≥ 95%	-

Table18 : Plant specifications

Results show that recycling plants using tray-to-tray recycling generally impose significantly higher requirements on the composition of the PET tray fraction than is the case at the system level (see Section 2.2.3). Whilst system specifications often permit minimum proportions of around 75 – 90% PET trays, the recycling plants under consideration require input materials with PET tray proportions of ≥ 85% to ≥ 95%. At the same time, permissible proportions of PET bottles and other contaminants are subject to much stricter limits. According to the interview results, none of the above-mentioned plants accepts PET bottles; these are already screened out during pre-sorting.

These stricter requirements stem from the need to ensure an input stream that is as stable and reproducible as possible. Particularly for high-quality applications in tray-to-tray recycling, even small proportions of contaminants or foreign polymers can have a negative impact on the quality of the recycled material. Plant specifications therefore serve not only to provide technical assurance for the recycling process, but also to ensure product quality and the economic viability of plant operations.

Overall, the plant specifications strengthen the fact that the requirements of recyclers often go beyond the specifications of the sorting systems. This presents a structural challenge at the interface between sorting and recycling, where discrepancies between system and plant specifications may arise.

3.4 Alternative processes (Fraunhofer IBP)

In addition to mechanical recycling as the dominant recovery method for PET trays, this study also aims to systematically catalogue chemical-physical and thermochemical recycling options for PET plastic, describe their current state of development and classify them according to technology readiness levels (TRL 1 to 9). The recycling processes considered are, in detail: pyrolysis, hydrogenation, selective dissolution processes and depolymerisation. The baseline research analyses the respective process principles, process steps, materials used and end products; documents the TRL assessment based on defined criteria; and carries out a preliminary screening of the environmental footprint (in particular the carbon footprint) using secondary data sources such as scientific literature and life cycle assessment databases, with a focus on the chemical recycling of PET. It identifies potential environmental hotspots and summarises the results in a consolidated report, which serves as the basis for further technology and strategy decisions, as well as for the development of future scenarios.

3.4.1 Conducting the research

3.4.1.1 Methods and data sources

In order to systematically analyse chemical recycling processes, analytical criteria were first defined, according to which the processes were examined. These cover the aspects of recycling processes that are relevant to this study and serve as a data basis for preparing the technology description and for classifying the level of technological maturity. Search criteria were defined for the research and applied to both academic and non-academic databases; interviews were also conducted with industry experts. The information gathered was analysed and prepared for the drafting of this chapter.

Scientific databases were used to search the scientific literature. The search was carried out in November 2025, primarily using the Scopus database (Elsevier) and supplemented by Google Scholar. The search terms used comprised combinations of terms relating to the material (e.g. 'PET' and 'polyethylene terephthalate') and the processes under consideration. The process names were used in accordance withTable19 .

Search terms: Processes	**Additional search term**	**Scopus hits**
Depolymerisation		1170
Hydrolysis	-	2318
	Enzymatic	412
	Alkaline	296
	Acidic	80
Glycolysis		3959
Methanolysis		132
Aminolysis		215
Alcoholysis		171
Solvolysis		50
Pyrolysis		1098
Debonding		73
Delamination		229
Hydrogenolysis		65
Hydrogenation		163 (many hits in a medical context)

Table19 : Search terms used for methods and evaluation; number of hits in the Scopus scientific search engine

The titles and abstracts of the hits were initially screened to assess the relevance of the literature in relation to the objective. The publications deemed relevant were analysed against the evaluation criteria defined at the outset. The results were collated for the different process variants, and the evaluation criteria were applied to assess the technology readiness level.

In addition, non-scientific literature was analysed. To this end, further internet research was carried out, particularly for the processes and stakeholders mentioned in the scientific literature and in expert interviews. Search engines (Google) and, where available, the websites of companies and other industry stakeholders were searched to collect and analyse further information from web sources and grey literature.

3.4.2 Findings from the research

Since around 2020, a significant increase in publications in the scientific literature on the chemical recycling of PET has been observed. At the same time, the scientific publications tend to cover relatively low technology readiness levels, typically TRL 3 to 5. Processes with higher TRLs are described much less frequently in the scientific literature, resulting in a gap between practical developments and scientific documentation. The information available in the scientific literature varies greatly depending on the level of technological maturity. In some cases, process flow diagrams and details on the quality of input and output streams are provided; in others, quantitative environmental information is also available. With regard to sustainability data, publicly available information is often limited – for example, due to unclear or non-comparable system boundaries – and is therefore only partially verifiable. For some processes, detailed environmental information based on life cycle assessment (LCA) studies is available, published by the process operators.

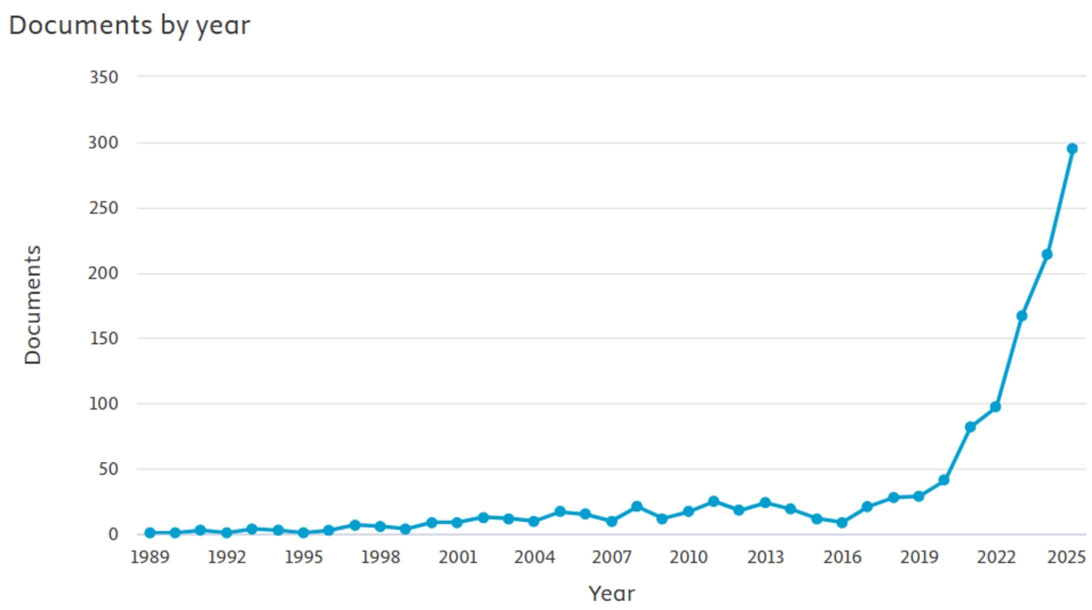

Figure 15: Number of hits on Scopus using the search terms 'PET AND depolymerisation', as at February 2026

3.4.3 Overview of process concepts and classification according to TRL

For the sake of clarity, a detailed overview of the alternative chemical process concepts examined can be found in Annex 9.1 of this report. It includes a description of the processes, information on input and output streams, and the advantages and disadvantages of the processes.

The concept of 'Technology Readiness Levels (TRL) Definitions' (EU reference) describes the TRL system in nine stages, ranging from basic research (TRL 1) to full system adaptation and commercial deployment (TRL 9). This classification helps to systematically assess the progress and commercialisation of recycling technologies such as the depolymerisation of PET. Key aspects here include the objectives of current development work, such as basic research, feasibility and concept development, demonstration, piloting, qualification and industrial application. In Figure 16 the TRL levels for processes and products are presented by Fraunhofer IGB [14] . These form the basis for classifying the process concepts.

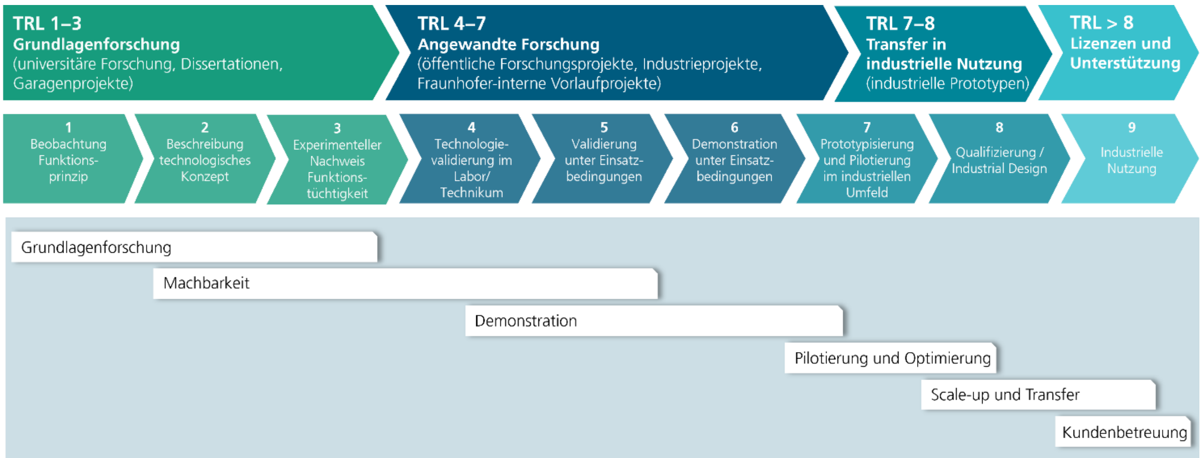

Figure 16: Description of the TRL levels © Fraunhofer IGB [14]

The following table presents the process concepts under consideration for chemical-physical recycling processes, their applications and relevant stakeholders, and classifies them according to the TRL levels presented. An overview of planned and operational plants for the chemical recycling of plastics in Europe was published by Fraunhofer UMSICHT in October 2025 in the form of an interactive map [15] .

Process concept	Process aspects			Classification by TRL	
Name	Transfer to industrial use	Current research and development work	Examples of relevant processes and stakeholders	Maximum TRL	Assessment based on
Pyrolysis	Yes	Industrial use	• Carboliq • OMV • Plastic Energy • Arcus Greencycling	9	Process description
Gasification	No	Demonstration	-	5	Process description
Hydrogenation	No	Experimental evidence	-	3	Process description
Selective dissolution methods	Yes	Transfer to industrial use	• PureCycle (Procter & Gamble) • Newcycling® (LYB Solvent Recycling GmbH, formerly APK AG) • Creavsolv® (Fraunhofer IVV)	6 to 8	Industrial-scale plants for polyolefins in operation: TRL 7–8; Demonstration for PET as the target polymer: TRL 6 (information provided by developers Creavsolv®, Fraunhofer IVV)
Depolymerisation – hydrolysis	Yes	Prototyping, qualification/industrial design,	• revolPET® (matterr) • MADE (Gr3n, DEMETO) • DePoly	6 to 7	Industrial demonstration and pilot plants currently in operation (revolPET®, MADE) and at the planning stage (DePoly)
Depolymerisation – Enzymatic hydrolysis	Yes	Transfer to industrial use	• Carbios • ESTER Biotech	7 to 8	Carbios' demonstration plant has been in operation since 2021; a commercial plant is in the planning stage
Depolymerisation – Solvolysis	Yes	Qualification/industrial design, industrial use	• Eastman (methanolysis) • Fraunhofer IFAM (glycolysis) • Ioniqa (glycolysis) • Rewind® PET (glycolysis) • SK Chemicals (glycolysis)	8 to 9	Process and plant descriptions, information provided by the developers
Mechanical recycling including delamination/debonding	Yes	Industrial use	• Various companies	9	Established for high-purity waste fractions, e.g. PET bottles

Table20 : Classification of chemical-physical recycling processes for PET according to TRL

3.4.4 Preliminary screening of the ecological footprint

For the processes under consideration, only rough estimates of environmental impacts are currently possible, as precise process data for industrial-scale operations are lacking. In principle, information on environmental sustainability aspects is available for all processes, with life cycle assessment (LCA) regarded as the most important method for evaluating the environmental footprint. For some processes, comprehensive and well-documented, externally peer-reviewed LCA studies with multiple impact indicators are available, such as the ISO 14040 and 14044-compliant and critically reviewed LCA study of Eastman's methanolysis process, albeit with the limitation that it is geographically specific to North America [16] . A similar standard-compliant life cycle assessment study, subject to critical external review, is also available for BASF SE's ChemCycling® pyrolysis process [17] . In its 2024 sustainability report, Carbios refers to an ISO 14040 and 14044-compliant and critically reviewed LCA study; however, this was not publicly available at the time of the research [18]. Companies frequently publish information on the environmental sustainability of processes at higher levels of technological maturity, for example on websites and in information sheets; however, this information is often limited to the Product Carbon Footprint (PCF) and is characterised by scant, incomplete or missing documentation of the objectives and scope of the study, the processes considered, the data sources used and the methodology applied, meaning they are of very limited use for evaluating the processes. The scientific literature contains life cycle assessment (LCA) studies on various chemical recycling processes with good documentation of the processes under consideration and the LCA methodology [17, 19-30] . These vary greatly in terms of the scale of the processes under consideration and often reflect the development status of processes at medium TRLs in applied research. Sphera's *Managed LCA Content* database does not contain any aggregated datasets for PET from chemical recycling or process datasets for the extraction of monomers from PET waste, but it does contain data on the production of pyrolysis gas and oil [31] .

The majority of available LCAs show very clear advantages of chemically recycled PET over virgin production, even though the absolute results show considerable variation [17, 19-30, 32-34] . Many scientific studies assess early stages of development; furthermore, in some cases, processes at an early stage of maturity still have a higher environmental impact than virgin material, although improvements are expected through further technological development and scaling up. Challenges lie in a lack of standardisation (system boundaries, reference systems, impact assessment), inconsistent results due to differing assumptions, and the influence of raw material quality and process design. Furthermore, it is difficult to account for scaling effects at this stage of development. In particular, the necessary purification steps must not be neglected. Although mechanical recycling generally has a lower environmental impact due to lower consumption of operating materials and energy [22] , it is limited by material degradation and contamination. Overall, it is evident that chemical recycling has the potential to significantly reduce the environmental footprint, particularly for PET, when mechanical recycling is not possible. Where contaminated or mixed waste streams cannot be recycled by other means, considerable advantages can be expected compared with incineration and virgin production.

4. Recyclate applications and requirements

For commercial (PCR) recyclates from dimensionally stable PET packaging, the following parameters are listed in the technical data sheets and specifications:

Technical parameters	Typical parameters
Product form	Flakes or pellets
Source (collection)	Household waste (post-consumer), industrial waste
Application, quality	e.g. foodstuffs (example: 'meets EFSA criteria, EU Directive 1616/2022')
Intrinsic viscosity (IV) [35]	0.60 – 0.80 dl/g
Colour	Transparent, crystallised, coloured, or L*a*b colour space
Melting point and range	240 – 250 °C
Crystallinity	10 – 95 %
Moisture content	< 1 %
PE or PO content	< 100 ppm – < 6,000 ppm
Impurity content	e.g. PA/EVOH < 50 ppm | fibres < 10 ppm | adhesive < 350 ppm
Bulk density	250 kg/m^3 (flakes) – 550 kg/m^3 (pellets)
Particle size or size range	1 – 10 mm flakes, 22 mg per pellet

The following intrinsic viscosity (IV) values typically apply to the various applications of A-PET and rPET:

- 0.40 – 0.70 dl/g→ for fibres, strapping
- 0.70 – 1.00 dl/g→ for trays (films/thermoforming)
- 0.70 – 0.85 dl/g→ for bottles made from preforms (injection moulding/blow moulding)

Scientific theses on PET trays and PET bottles:

- The NIR reference spectra contain (randomly) a significant proportion of foreign polymers (e.g. PE from sealing layers or label materials) [36].
- Compared with bottle-derived rPET, thermoforming-derived rPET is subjected to higher (thermal and mechanical) stresses during the manufacturing process of films and trays [37,38].
- Following processing, rPET derived from thermoforming exhibits a significant deterioration in its mechanical properties [37,38].
- rPET from thermoforms and rPET from bottles have similar crystallinity (weight percentage of crystallised molecular chains). However, rPET from thermoforms

contains a greater number of smaller crystals. Consequently, these smaller crystals have a greater influence, as they lead to a 'stiffer amorphous' phase. Despite their similar overall crystallinity, the influence of smaller crystals is considerable – similar to the size reduction of nanofillers, which drastically improve impact strength [38].

- In theory, SSP treatment allows PET derived from bottles to be processed and improved more effectively than PET from thermoforming films. As a result, the IV and molecular weight increase to a greater extent than in PET derived from thermoforming [38].

From this, the following differences in the properties of PET recyclates from their original applications can be deduced:

Characteristics	PET bottles	PET trays
Crystallinity	Lower	Tends to be higher due to greater molecular orientation during the film-making process
Recyclate properties	Higher mechanical strength	Tends to have lower strength
Wall thickness	Tends to be thin in the body area	Very thick at the rim, in some places significantly thinner in the deep-drawn area
SSP effectiveness	IV (intrinsic viscosity) can be improved more easily	Improving IV through SSP is more complex

The actual ability of processors and industrial sites to manage fluctuations in tray-grade rPET directly influences industrial acceptance. This is because, due to its material-specific properties, tray-grade rPET cannot be processed in the same way as virgin PET or bottle-grade rPET. Seal layers, adhesives and barrier materials such as PE or EVOH are finely dispersed within the PET matrix during the recycling process. This leads to cloudiness and opaque materials, as well as a deterioration in the mechanical properties of the recycled material. [36]

In addition, the thermal stress during processing causes degradation of the polymer chains, leading to a reduced intrinsic viscosity (IV), as is the case with PET from bottles. Furthermore, tray recyclers report that PET top films, due to their thin material thickness and the associated low intrinsic viscosity (IV), lead to a deterioration in the quality of the recycled material, as even small proportions in the PET flake stream can impair the mechanical properties of the recycled material. Furthermore, even so-called 'mono- -PET' lid films typically contain multi-layer sealing layers made of copolyesters, which undergo thermal degradation at standard PET processing temperatures, thereby causing yellowing or discolouration. This reduces the colour quality, market value and range of applications for the recycled material.

As IV is a measure of molecular weight and thus of the material's strength and processability, tray-grade rPET differs in its processing behaviour from virgin PET or high-quality bottle-grade rPET. To improve the material quality, additional process steps such as solid-state polycondensation (SSP) are required. Nevertheless, variations in composition, transparency and material properties persist, particularly due to different tray designs and multi-material constructions. This places greater demands on processors and industrial sites, which must adapt their processes to varying material qualities. The results therefore highlight the importance of monomaterial designs and packaging designs suitable for recycling for future closed-loop tray-to-tray systems. [36]

5. Analysis of fractions and the market situation for recycled materials

Within the scope of this study, the question to be addressed is whether the specifications for the various fractions within PET-based packaging can be modified and, where appropriate, consolidated in order to minimise sorting costs. One option worth to discuss for countries with deposit-return schemes is to differentiate in future LWP sorting exclusively on the basis of the criterion 'food-contact packaging', disregarding the formats (thermoformed or bottle). A prerequisite for such a scenario would be the compatibility of the different PET types with one another, both in terms of processing and the application of the recycled material.

The following table compares the differences between PET recyclates from various applications:

Characteristics	Trays	Transparent bottles	Jars, coloured items
Intrinsic viscosity (IV)	0.70 – 0.85	0.70 – 0.85 (tending towards the upper range)	0.70 – 0.80
Contamination from the product	Foodstuffs, fats	Foodstuffs, fats, cleaning agents	Cosmetic products (e.g. creams, oils), soap
Typical contaminants from packaging components	PE, PP, adhesives, labels, films, additives (CPET)	Adhesives, additives, barrier layers	Adhesives, additives, colour pigments
Level of contamination caused by packaging components	tends to be high	low	Tends to be high
Colour	Predominantly transparent	Transparent	*Partially coloured*
Strength, quality*	Average (can be repaired by SSP)	Very high	High

Table21 : Differences between rPET recyclates from various applications

The IV value is a key parameter for rPET in terms of processability and the mechanical properties of the products manufactured from it. It can be clearly observed that, with regard to applications for trays, bottles and jars, there is an overlap in the IV ranges, meaning that this parameter is not an exclusion criterion for recycled material from the tray fraction. By contrast, more pronounced differences can be observed in other characteristics such as contaminants, colour or mechanical strength, which can complicate the processing of blends comprising trays and transparent bottles. For this reason, it makes sense to continue treating transparent bottles as a separate recycling stream and to define the PET- tray fraction – including other PET food packaging – as a distinct sorting fraction. Opaque bottles and other PET-rigid non-food packaging remain as a third category.

Price trends for rPET compared with virgin material [39]:

The average price for rPET flakes from trays in Europe currently stands (as of April 2026) at €875/t, compared with €1,200/t in June 2025. The price has therefore fallen by around a quarter within 10 months.

Currently, the price of rPET flakes from bottles in Europe stands at €1,240/t, which is approximately 40 % higher than that of rPET flakes from trays. In June 2025, the price of rPET flakes from bottles in Europe was still €1,355/t, with a price difference of 13 % compared to trays. The price difference between rPET from trays and rPET from bottles is primarily related to quality. The higher production costs of rPET from trays must therefore be compensated by the collection prices for the sorted fractions.

In April 2026, the price of rPET flakes from bottles was around €300/t lower than that of virgin material. Until early 2026, rPET had always been significantly more expensive than virgin material. This reversal can be partly explained by the tight supply situation regarding chemical raw materials and feedstocks due to the current geopolitical situation in the Middle East (in particular the blockade of the Strait of Hormuz).

Assuming that similar grades of virgin PET are used for PET trays as for bottles, the price difference between rPET from trays and virgin PET was approximately €600/t. By contrast, the difference between rPET flakes from trays and virgin material stood at just €200/t in June 2025, meaning that the difference has tripled here too within 10 months.

Status of food-grade approvals:

Specifically, regarding the recycling of PET trays, there is currently only one published authorisation from the European Food Safety Authority (EFSA) concerning the process at Cirrec in the Netherlands [40].

A general prerequisite for EFSA authorisation of rPET for food applications is the successful completion of a so-called ‘ ’ challenge test. The effectiveness of the entire recycling process is demonstrated by deliberately contaminating the feedstock with toluene, chlorobenzene and other critical substances in accordance with EFSA and FDA guidelines. The recycled material produced in this way is analysed by means of a migration test following a 7-day storage period at 50°C. The decontamination effectiveness is determined for each substance. The efficiency of the processing procedure must exceed the respective limit values for each substance.

In addition to this requirement, at least 95 % of the input material (sorted fraction) must originate from food applications.

The process at Cirrec complies with EFSA requirements in terms of its design and efficiency and comprises the following stages:

- Pre-treatment with hot alkaline washing
- Decontamination at high temperatures under vacuum using a recognised technology (e.g. EREMA Basic)
- Extrusion of the flakes into granules with melt filtration to separate non-melting foreign material (particularly paper and aluminium)

It can be assumed that all rPET products made from food-grade trays comply with the EFSA guidelines described above and are produced using similar process stages.

6. Design for Recycling for PET thermoforms or 'PET, other rigids'

Design for Recycling (DfR) describes the approach of designing packaging, right from the development phase, in such a way that it is compatible with sorting and recycling processes and enables high-quality material recovery. Design and choice of materials influence not only the fundamental technical feasibility of recycling, but also the efficiency of existing collection, sorting and recycling infrastructure. DfR is therefore a holistic approach that takes into account the interfaces along the value chain and forms the basis for functioning and economically viable recycling loops. In particular, for PET thermoforms and the 'PET, other rigids' fraction, design for recycling is crucial, as these materials have so far only been integrated into existing recycling loops to a limited extent.

6.1 Comparison of existing DfR guidelines and assessments

Appendix 9.3 contains a comprehensive comparison of the DfR guidelines and assessments; the following chapter describes, in excerpts, the most relevant DfR characteristics for PET trays.

When comparing the DfR Guidelines and the assessments, it should be noted that the underlying methodology of the two standard variants is not comparable. Owing to their ordinal assessment, the DfR Guidelines essentially involve a direct evaluation of individual packaging attributes or components, without disclosing the underlying rationale or criteria to the user. Due to the ordinal scaling, the technical principles of recycling can only be represented to a limited extent. Recyclability assessments therefore avoid ordinal rating scales and classify items on the basis of criteria derived from process modelling. In doing so, analogous quantitative metrics are applied, which can be directly derived from the reference processes.

The following section presents a commented comparison of the key attributes of a PET tray alongside their respective classifications in various standards. For each attribute, the factual background is briefly explained, the classification is checked for consistency or deviation, and, in the event of a deviation, an analysis is carried out to determine whether this is justifiable on factual or methodological grounds.

Main body: PET/PE

	COTREP	RECOUP	APR	RecyClass	CEN	PETCORE	RecyClass (Tool)	CHI	ZSVR	EPBP
PE can be separated in standard PET recycling plants – clear PET										-

The design of the PET tray as a multilayer with a PE sealing layer requires a delamination option for PET trays. This has already been implemented in operational facilities.

The classification in the DfR Guidelines and Assessments is inconsistent on this point and cannot be justified either factually or methodologically.

Plastics with a density > 1 g/cm^3

	COTREP	RECOUP	APR	RecyClass	CEN	PETCORE	RecyClass (Tool)	CHI	ZSVR	EPBP
PET-G / PVC / PS			-							

With regard to the quality of recycled materials, the most important DfR criterion relates to the melting behaviour of the packaging components. All components or substances that cannot be reliably separated during washing or gravimetric sorting are thermally decomposed (pyrolysed) at the high remelting temperatures involved in PET recycling: adhesive residues, colour binders, plastics (particularly PVC and PVDC) or are incompatible due to differing melting temperatures (such as PS). The result is significant degradation or product rejects, which occur even with contamination in the ppm range.

The classification in the DfR Guidelines and Assessments is consistent on this point.

Top films with densities < 1 g/cm^3

	COTREP	RECOUP	APR	RecyClass	CEN	PETCORE	RecyClass (Tool)	CHI	ZSVR	EPBP
d < 1 g/cm^3, separable during the washing process								*Extract*	*Extractor*	-

At present, the recycling of PET trays and thermoformed packaging does not yet yield any by-products suitable for high-quality recycling.

Consequently, in the assessments, top films with a density of < 1 g/cm^3 are deducted, provided they can be separated without leaving any residue (no seal edges, no adhesive residues) during the washing process.

DfR guidelines generally confirm 'compatibility' with the process. The classification in DfR guidelines and assessments appears inconsistent on this point, though this is solely due to methodological differences.

Labels

	COTREP	RECOUP	APR	RecyClass	CEN	PETCORE	RecyClass (Tool)	CHI	ZSVR	EPBP
Fibre-based with fibre loss on clear PET, not wet-strength								*Print*	*Peel*	

Paper labels or self-adhesive paper labels (with or without 'fibre loss') can be removed without leaving any residue using state-of-the-art process solutions. The classification in the DfR Guidelines and Assessments is inconsistent on this point and cannot be justified either factually or methodologically.

This is particularly true given that paper labels must be assessed in the context of the adhesive application used. If the adhesive is wash-off capable, then classifying the paper label as 'incompatible with recycling' is factually unfounded (see also the table below).

	COTREP	RECOUP	APR	RecyClass	CEN	PETCORE	RecyClass (Tool)	CHI	ZSVR	EPBP
Wash-off capable (80°C)				*			*	*Extract*	*Extract*	

* 70 °C

The classification in the DfR Guidelines and Assessments appears inconsistent on this point, although this is solely due to methodological reasons.

Direct printing

	COTREP	RECOUP	APR	RecyClass	CEN	PETCORE	RecyClass (tool)	CHI	ZSVR	EPBP
Other direct printing										

The processing of PET trays feeds directly back into the closed-loop system (tray-to-tray recycling), which demands the highest quality standards for use as a food-contact material. Direct printing is uniformly classified as incompatible or unsuitable, as migration into the recycled material – and consequently into the food – cannot be ruled out due to the printing process and the high temperatures involved in the recycling process.

The classification in the DfR Guidelines and assessments is consistent on this point.

6.2 Interview results from recyclers

During the interviews, three PET tray recyclers were asked about potentially problematic packaging attributes that could lead to a loss of quality in the recyclate during the recycling process. The corresponding results are presented inTable 22 .

Description	unknown	Known, but insignificant due to low volume	known, technically		practically irrelevant
			largely resolved	not resolve d	
PET-G components	0	1	0	2	0
PET-C trays	0	0	2	1	0
POM components	0	0	1	1	0
EVOH / PA monolayer barrier layers	0	0	2	0	1
Other blended barriers	0	0	1	2	0
Silicone coatings	0	1	1	1	0
Slip agents	0	1	2	0	0
Clarifier	0	1	2	0	0
AA blockers	1	0	1	1	0
PA additive (PET-A copolymer)	1	1	0	1	0
Adhesive applications that are not soluble in hot alkaline washes	0	1	2	0	0
non-magnetic metals	0	0	2	1	0
Elastomer components with a density > 1 g/cm^3	0	1	1	1	0
Direct printing, excluding best-before date and batch number	0	1	2	0	0
Bleeding Inks	0	0	1	2	0
Silicone components	0	1	1	1	0
PET/PE trays, co-extruded	0	0	2	1	0
PET/PE trays, laminated	0	0	3	0	0
PET/PE trays, heat-sealed	0	0	2	1	0
Paper labels, wet-resistant finish	0	0	1	2	0
Paper labels, not treated to be water-resistant	1	0	1	1	0
Paper wrap	1	0	1	1	0
PVC labels/sleeves	0	0	1	1	1
PS labels/sleeves	0	1	1	1	0
PET-G labels/sleeves	0	1	1	1	0
Other plastic labels with a density > 1 g/cm^3	0	1	1	1	0
Top films with a density > 1 g/cm^3	0	0	2	1	0
Non-floating paper labels	0	0	0	2	1
Peel layers	1	0	2	0	0

Table 22 : Assessment of packaging attributes by three PET tray recyclers. Figures given as frequencies of

The table shows that PET-G components, as described in the guidelines mentioned above (see Chapter 6.1), can impair recycling quality or, in some cases, disrupt the recycling process. Although EVOH and PA monolayer barrier layers are predominantly classified as incompatible materials in the guidelines, two out of three recyclers assessed these as unproblematic. Slip agents and ‘clarifiers’ were also classified by the recyclers as non-interfering substances. According to GVM’s market research, PET trays containing slip agents account for the vast majority of the available volume, at around 70 %, and thus represent a relevant factor.

Adhesives that cannot be washed off during alkaline hot washing were also described as unproblematic elements, although they are classified as contaminants in the guidelines. Two out of three plant operators rated direct printing and ‘bleeding inks’ as problematic packaging characteristics. One of the interviewees stated that ‘bleeding inks’ occur more frequently in trays than in bottles and make the recycling process more expensive due to the increased effort required for water treatment.

Adhesive-laminated PET/PE trays were classified as non-critical by all three recyclers surveyed, whilst co-extruded PET/PE structures can cause problems due to potential processing challenges and are therefore less preferred. Similarly, peel layers were classified as unproblematic.

In the case of fibre-based labels or wrappings, classifications vary between recyclers. According to the recyclers, the fibres from labels are removed by elutriation, as failure to do so can lead to problems regarding the visual properties, mechanical stability and processability of the recyclates.

6.3 Best-case example(s)

Based on the sub-sections 6.1 and 6.2 , PET tray designs can be developed that enable more efficient sorting and recycling of PET trays. These designs serve as a guide for manufacturers in their Design for Recycling (DfR) efforts and are intended to simplify the entire recycling process, reduce material losses and improve the sustainability of the packaging. The following figures show two different design proposals as best-case designs.

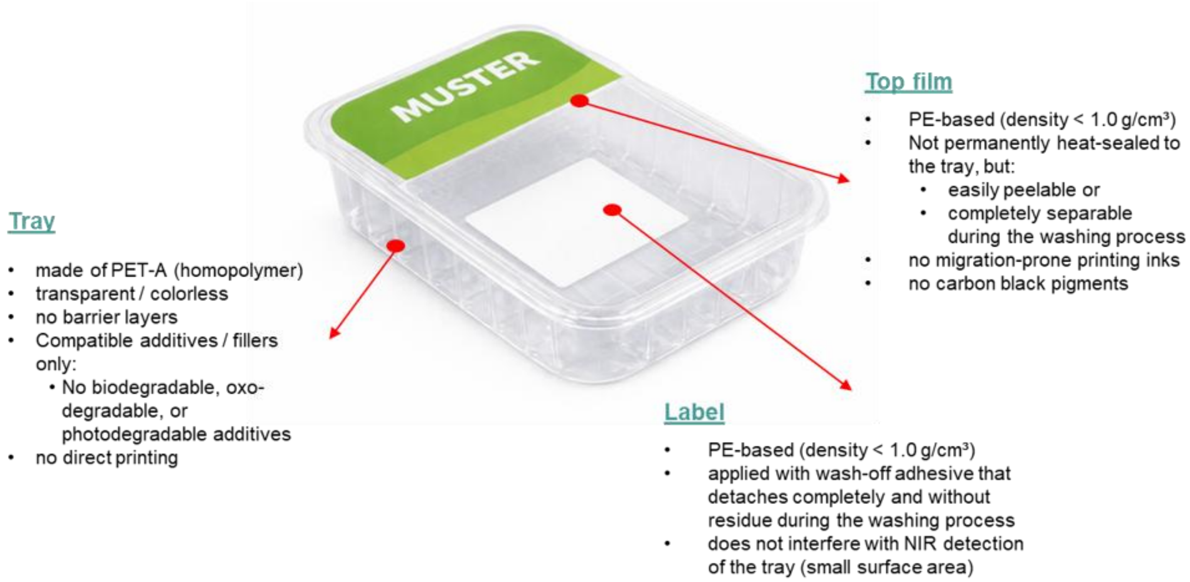

Figure 17: Option 1 – PET tray with PE-based top film and label

Figure 18: Option 2 – PET tray with PET top film and banderole

Figure 17 shows a transparent PET tray with a printed PE-based top film and a printed PE-based back label. Further conditions can be found in the illustration. Figure 18 shows an example with an unprinted film. For this instance, a printed sleeve is used, which must be removed by the consumer to use the product and is therefore considered a separate component. The remainder of the packaging consists of a transparent PET tray with an unprinted PET top film.

As the functionality of the packaging must always be guaranteed, required barrier properties are considered right from the packaging design stage. Best-case designs based on monostructures reach their limits in certain applications where there are high requirements for oxygen, moisture or aroma barriers. Whilst delamination approaches for co-extruded or laminated multilayer trays in principle offer the possibility of improved material recovery, these processes are not fully efficient in practice and involve additional processing effort. Furthermore, experience shows that the quality of recycled material from multilayer trays often falls short compared to monolayer trays, meaning that monostructures continue to offer advantages in terms of process efficiency and recycling quality.

When selecting top film lidding based on PO or PET, tray recyclers hold differing views: one view is that the choice of material is hardly relevant, as the films are separated by air classification anyway and small residual amounts do not significantly affect the quality of the recycled material. The authors of this study, however, prioritise PO lidding films, as their lower density allows them to be easily separated from PET flakes using flotation processes, and the recovered PO fraction can be recycled. Mono-PET lid films, on the other hand, pose practical challenges despite their seemingly recycling-friendly design: due to their low intrinsic viscosity, they degrade the quality of the recycled material; they contain thermally unstable copolyester sealing layers; and the necessary separation steps lead to additional material losses. Furthermore, a heterogeneous input stream of PET- and PO-sealed trays increases the demands on sorting and raises the risk of contamination, which is why PO-based solutions are considered more advantageous from a recycling perspective.

7. Weakness Analysis – Barriers & Measures

Based on the findings of this study, the following section systematically outlines key weaknesses along the value chain, as well as the resulting barriers and potential measures for selected stakeholders, whilst also taking into account relevant stakeholders and external drivers.

Sorting technology	
Status (description) / Shortcomings	Technology is available; (qualitative) optimisation opportunities exist ➔ (AI-based sorting) Shortcomings: Level of implementation in practice
Requirements	Upgrade sorting systems
Target audience	- Operators of sorting facilities - Dual systems / PROs (by adjusting the sorting specifications)
External driver	Yes; Legislator (increase in quota) ➔ Implementation of eco-modulation using RaS criteria

Sorting/recycling interface	
Status (description) / Shortcomings	Discrepancy between recyclers' requirements and the sorting specifications of the facilities
Need	Development of adapted sorting specifications (PET trays + limited proportion of PET bottles/food-contact)
Recipient	- Dual systems / PROs
External driver	No

Recycling capacities	
Status (description) / Shortcomings	Insufficient to meet demand
Demand	Expansion to target capacities (RaS according to this study)
Recipient	- Recycling industry - Film manufacturers
External driver	Yes; Legislator (increase in quota) ➔ Implementation of eco-modulation using RaS criteria

Recycling technology	
Status (description) / Shortcomings	Mechanical recycling already in place at TRL9 Shortcoming: no recycling of by-products/rejects
Requirement	No need for new technology for PET Development of recycling options for integrated packaging components (top films, labels) ➔ Optimisation of recyclability!
Target audience	- Entire value chain, starting with recyclers
External driver	Yes; Implementation of eco-modulation using RaS criteria

DfR and recyclability	
Status (description) / Shortcomings	Room for improvement regarding DfR; optimisation criteria known
Requirement	A uniform standard across Europe
Target audience	- Manufacturers
External driver	Yes; Legislator Standard-setting based on objective criteria and **harmonisation/implementation of eco-modulation**

8. Summary and outlook

The study identified key weaknesses along the value chain. These include, first and foremost, an insufficient level of implementation of modern sorting technologies in practice. In this context, PET trays are no longer sorted as a by-product of PET bottle sorting (indirectly or negatively), but are sorted positively, just like the PET bottle fraction, to ensure that high-quality requirements are met in line with demand. Retrofitting existing plants is generally possible but always requires a technical and economic assessment if the necessary space requirements were not already factored in as reserves during the original planning. For scenarios aiming at the most comprehensive recycling of PET trays possible, this means that re-sorting plants will remain indispensable in the medium term and will act as a link between sorting and tray-to-tray recycling plants. The associated logistical and operational costs must be considered in the further development of the conceptual simulations.

Looking ahead, advanced sorting technologies will gain in importance; these provide additional information beyond the pure material spectrum to improve sorting accuracy for the separation of PET trays by type. A key approach to overcoming the limitations of conventional NIR detection is the use of imaging sensor systems with object recognition. Evaluation is carried out via AI-based detailed classification. AI-supported object recognition is already in use in some sorting plants (including for the separation of PET trays and PET bottles). For the technical possibilities of AI-supported image analysis to be utilised successfully, sorting specifications must be agreed with contractual partners and, in particular, economic incentives and reliable collection channels must be in place. In the absence of these framework conditions, there are neither incentives for investment nor any expansion of the necessary sorting capacities.

The lack of harmonisation in system specifications hinders the targeted sorting of PET trays and thus limits the availability of suitable feedstock for the desired 'tray-to-tray' recycling. Differing sorting specifications highlight the structural gap between the requirements of sorting plants and the needs of recyclers. Advanced sorting technologies such as image-based sensor technology, AI-supported object recognition and 3D geometry capture enable improved differentiation between PET trays and PET bottles and are regarded as the best available technology. However, their adoption has so far been limited and is heavily dependent on economic and systemic conditions.

This demonstrates that the sorting of PET trays cannot be resolved by individual technological measures alone, but requires a coordinated interplay of product design, sorting specifications (system specifications) and market mechanisms. It thus forms a key transition point for further considerations along the value chain. A comparison with the sorting specifications reveals that the acceptance specifications of recycling plants impose significantly higher requirements on the composition of the PET tray fraction than is the case at the system level.

The acceptance specifications of recycling plants are directly linked to the process capabilities of the individual facilities. However, they not only serve to ensure the technical soundness of the recycling process, but also to guarantee product quality and the cost-effectiveness of plant operations. The achievable quality of the recycled materials depends largely on the purity of the input materials, as well as on the proportion of foreign polymers, composite structures and functional additives. Whilst basic process steps such as washing and flotation separation are also familiar from bottle recycling, the recycling of PET trays requires additional processing steps due to complex material structures (e.g. multilayer systems, top films, coatings or functional additives), including SSP or LSP processes for post-condensation, two-stage IR heaters for efficient heating or drying, liquid extrusion systems for direct processing, and separation units such as zig-zag separators and hydro-cyclones as alternatives to flotation; in addition, integrated processing solutions are utilised.

For recyclers, the mechanical recycling of PET trays represents a number of challenges. At the regulatory level, the structure of existing EPR schemes is perceived as inadequate, as the focus is primarily on PET bottles and, to a lesser extent, on PET trays. Targeted incentives for the design of PET trays to facilitate recycling or for the use of recycled materials are largely lacking. Building up the necessary capacity involves high investment costs and requires specific expertise that, to date, is available to only a few players. Furthermore, the lack of harmonisation of collection and sorting systems across Europe acts as a structural barrier to efficient and predictable plant operation. From a technological perspective, the heterogeneity of post-consumer material presents a key challenge. This diversity complicates consistent sorting and processing. Delamination of multi-layer structures is particularly challenging, especially in composites containing copolyesters, as these are only controllable to a limited extent in mechanical recycling and can have a negative impact on the quality of the recycled material.

It is evident that recyclers are less confronted with isolated technical problems rather than dealing with an interplay of systemic framework conditions. It is the combination of regulatory requirements, market mechanisms, infrastructure availability and technological limitations that determine the extent to which PET trays can actually be recycled in closed tray-to-tray loops today.

At the same time, new regulatory requirements, particularly in the context of the PPWR, are becoming increasingly important. In this regard, both the requirements for the recyclability of packaging and the stipulations on the minimum use of recycled content play a central role in future market development. In future, recyclability will be a decisive factor in determining market authorisation and the level of participation fees. Consequently, packaging design that is suitable for recycling is becoming a key requirement for achieving the environmental policy objectives of the PPWR. One shortcoming is the lack of harmonisation in the area of design for recycling (DfR). There is a need to develop a uniform Europe-wide standard based on objective criteria and state-of-the-art technology.

Based on the volume of waste generated in 2024, volume scenarios and the resulting volume requirements for Recycling at Scale (RaS) as well as the use of recycled materials under the PPWR are derived. This considers that Article 7 of the PPWR establishes the regulatory basis for the minimum use of recycled content even before the 2030 and 2040 targets, whilst 'Recycling at Scale' will become an additional key requirement for assessing recyclability from 2035 onwards.

According to the market research carried out by GVM, a total of 823 kt of semi-rigid PET packaging was generated in Europe in 2024. In accordance with the definition of 'packaging waste recycled at scale' (*Recycling at Scale, RaS*) under Article 3(39) of the PPWR, it must be ensured that at least 55 % of individual packaging categories are recycled. When considered in isolation, this corresponds to 452 kt of rPET flakes for PET thermoforms.

With an average yield of an ambitious 65 %, this results in a required input of 697 kt of PET trays. As the current total capacity of PET recyclers stands at 242.5 kt, this results in a capacity shortfall of 454.5 kt of PET trays per year.

This estimate illustrates that, despite the existence of a few specialised plants, the currently available capacity to the industry is limited and can only cover a fraction of the potential volume of PET trays.

The volume scenarios developed show that, in view of the PPWR milestones for 2030 and 2040, a significant increase in demand for high-quality recycled material is to be expected. Assuming that recycling at scale is achieved from 2035 onwards, there will be increasing pressure to significantly boost both collection and sorting rates and the quality of the recyclates. Tray-to-tray recycling is therefore not merely a possible recycling option, but a necessary prerequisite for achieving the PPWR targets, as only material-based closed-loop recycling of PET trays can provide sufficient quantities of high-quality recyclates to meet future recycled content targets, reduce the use of virgin material and, at the same time, demonstrate 'recycling at scale' for this packaging segment.

Against this backdrop, eco-modulation based on recyclability, sortability and recycled content criteria is of particular importance. As a policy instrument, it can help to orient packaging designs more strongly towards recyclability, improve the quality of input streams and reduce systemic inefficiencies. At the same time, incentives are created for investments in sorting and recycling infrastructure. Overall, it is evident that establishing a functioning PET tray-to-tray recycling system is less a question of fundamental technical feasibility. A combination of regulatory impetus, economic incentives and technological optimisations are crucial to enabling the long-term circular economy of PET trays. The selection of the appropriate recycling process for thermoformed PET packaging depends largely on the purity of the waste stream, as mechanical recycling remains the first choice for single-material, high-quality streams, whilst chemical processes are primarily suited for contaminated or complex mixtures. Chemical recycling is an umbrella term for various technologies with a wide range of target products and process routes. PET depolymerisation differs clearly from thermal conversion processes such as pyrolysis and gasification and comprises several sub-groups (hydrolysis, enzymatic hydrolysis, solvolysis), which specifically recover monomers such as terephthalic acid and ethylene glycol. Although pyrolysis plants are already in commercial operation, PET is not an ideal feedstock due to its heteroatoms and typically produces oils rather than high-value monomers. Depolymerisation generally yields higher-value products in this context; however, most depolymerisation plants are not yet commercial, though they are at advanced TRL levels with a clear path to industrial scale-up (demonstration and pilot plants). Both start-ups and established chemical companies such as LyondellBasell, BASF, Eastman and SK Chemicals are investing in the development of plants for the depolymerisation of PET. Not all processes are currently suitable for food contact; however, once decomposition into monomers or smaller molecules has taken place and these are fed back into established polymerisation pathways (for example, via pyrolysis or gasification followed by cracking/hydrotreating), equivalence to virgin material can be achieved and approval may become possible. Overall, the processes investigated will not replace mechanical recycling but will complement it in a targeted manner, as chemical recycling is more costly and energy intensive. Key barriers for scaling up include the low price of virgin material, regulatory uncertainties (particularly regarding food contact) and integration into existing value chains, such as connecting the recovered monomers to nearby PET polymerisation plants.

Building on these findings, the second part of the study will use conceptual simulation exercises to develop, formulate and discuss possible future scenarios under the constraints of recyclable packaging (DfR, 2030 and 2038), minimum recycled content targets (2030 and 2040) and Recycling at Scale (RaS, 2035).

The subsequent scenario development will be based on the regulatory milestones of the PPWR, in particular the requirements for Design for Recycling (DfR) by 2030, the mandatory use of recycled materials by 2040, and the scaling up of industrial recycling capacities by 2035 (RaS). The aim of this outlook is to anticipate possible development pathways for the value chain, identify areas where action is needed, and derive concrete measures for the stakeholders involved.

Building on the results from Phase 1, this section develops and consolidates baseline scenarios and working hypotheses. Analysis of the collected data shows that, in key areas, existing packaging structures do not yet meet the requirements of the PPWR. This gives rise to several plausible future pathways, ranging from an incremental adaptation scenario through a technology-driven transformation pathway to a structurally driven change fostered by regulation. At the same time, key research gaps are identified, particularly regarding the detectability of packaging materials in the sorting process, quality assurance for post-consumer recyclates, and the scalability of pilot solutions to an industrial scale.

For each scenario, the necessary technical and logistical capacities are quantified in line with the requirement profile. This encompasses sorting and processing capacities, quality assurance infrastructure, and the timeline for capacity development with a view on the ‘Recycling at Scale’ milestone by 2035. The analysis underlines that considerable lead times must be factored in for investment decisions and plant design.

Implementing the identified scenarios requires specific framework conditions for all stakeholders in the value chain. For packaging manufacturers and converters, this means, in particular, switching to DfR-compliant designs at an early stage. System operators and waste management companies are required to adapt their sorting specifications and processes. Brand manufacturers and retailers face the task of aligning their product development with recycling requirements. In this context, the respective planning times for plants and infrastructure must be considered as critical paths, which make early decision-making essential.

Material balances and reliable cost estimates are drawn up for each scenario. These include investment costs for sorting and recycling facilities, ongoing operating costs, potential revenues from secondary raw materials, and the costs of non-compliance in the event of regulatory requirements being breached. Comparing the scenarios enables a well-founded assessment of the economic viability of different implementation strategies.

Concrete catalogues of measures for the relevant areas of action are derived from the scenario analyses. These comprise, firstly, requirements for Design for Recycling (DfR) at the packaging level; and secondly, the reorganisation of sorting specifications, particularly for Category 8 in the context of the PPWR. Thirdly, recommendations are formulated for the drafting of contracts between system operators, recyclers and converters, which take into account the changed quality and quantity requirements. Finally, the investment requirements for recyclers and converters are to be set out on a scenario-specific basis.

9. Appendix

9.1. Description of the process concepts

Pyrolysis

The pyrolysis of PET waste is a thermochemical process carried out in the absence of oxygen, which breaks down polymeric PET into smaller molecules at high temperatures. Due to the oxygen molecules already present in PET, this process is currently only suitable for mixed plastics containing a maximum of 20 % PET. Whilst pyrolysis plants today predominantly process polyolefin streams (PE/PP), targeted PET pyrolysis or co-pyrolysis is technically feasible but requires a tailored design, as PET forms oxygen-containing, corrosive products (in particular terephthalic acid and benzoic acid). In the context of the EU Waste Framework Directive and the Green Deal, pyrolysis is considered chemical recycling provided that the products are recycled into new plastics or monomers; furthermore, the future requirements of the PPWR and mass balance recognition for chemically recycled raw materials are relevant.

The process takes place in an oxygen-free environment or in an inert gas atmosphere at temperatures of around 400 to 700 °C and is endothermic, meaning it requires external heat. The reaction primarily produces pyrolysis oils, pyrolysis gas and coke, typically with higher tar and aromatic content. These products often require further processing and are mainly used in the production of chemical feedstocks, fuel precursors or monomer recovery.

In terms of the life cycle assessment, the energy requirements of the high-temperature stage and the resulting emissions dominate the environmental impacts of recycling. Electric heating using electricity from renewable sources, or the use of process gases for self-heating, improves the environmental balance; heat recovery from hot exhaust gases and condensates is standard practice. At sites co-located with crackers, logistics and upgrading can be consolidated, thereby ensuring product quality and offtake.

In Germany, industrial pyrolysis activities have so far focused primarily on mixed plastics rich in polyolefins, whilst dedicated PET pyrolysis is scarcely established on a commercial scale. Operators of plants for mixed plastic waste (including Carboliq and Recenso, as well as other and demonstration projects) generally report limitations regarding PET or its deliberate exclusion. The ChemCycling® initiative by the chemical company BASF, for example, uses pyrolysis oils as a feedstock for crackers under a mass-balance approach, although the feed specifications usually only permit the processing of PET in small proportions.

Gasification

The gasification of PET waste is a catalytic high-pressure process that converts post-consumer or post-industrial PET into high-quality monomers and derivatives and is therefore classified as chemical recycling within the meaning of the EU Waste Framework Directive, provided that the products are returned to polymer production as raw materials.

Pyrolysis and gasification differ primarily in terms of atmosphere, temperature and target products. Pyrolysis aims to produce liquid and solid products, whilst gasification aims to produce gaseous synthesis gas. Gasification operates with limited oxidation (air or O_2, often with steam) at higher temperatures of approximately 750 to 1100 °C and is partially autothermal. The target product is a low-tar synthesis gas consisting of H_2 and CO (typically H_2/CO ~1–2), which, following gas purification (dust, tar, acid gases), can be used for electricity or heat, methanol production, Fischer-Tropsch synthesis, or – following additional shift/PSA – for hydrogen. By comparison, pyrolysis produces more solid residues, whilst gasification results in lower ash content and a higher carbon conversion rate (>90 to 95 %). Gasification is also more tolerant of contaminated feedstocks, whereas pyrolysis is more sensitive to heteroatoms. Unlike pyrolysis, gasification is not yet in commercial use.

The gasification of PET converts sorted and pre-treated plastic waste into a usable synthesis gas. First, the PET fractions are separated from contaminants such as PVC, metals and foreign plastics, crushed into flakes, dried and fed evenly into the reactor. Due to common additives in PET, particularly antimony compounds from the manufacturing process, fine particles are to be expected in the process gas, which must subsequently be separated out. Fluidised-bed or fixed-bed gasifiers are primarily used as reactors. At the reaction temperatures and under stoichiometric undersupply of oxidising agents, PET first undergoes thermal depolymerisation, followed by gasification reactions that produce a synthesis gas comprising H_2, CO, CO_2 and small proportions of CH_4 and light hydrocarbons.

In Germany, the process complies with the requirements of the Packaging Act (VerpackDG) and extended producer responsibility; at EU level, it addresses the objectives of the Green Deal, the circular economy and future requirements of the PPWR. Of particular relevance is the growing demand for high-quality recycled material for PET bottles and technical polyesters, with chemical recycling serving as a complement to the mechanical processing of coloured or additive-contaminated streams.

The preferred raw material is single-type, colourless PET flakes from returnable bottle streams or light packaging sorting, as mixed colours, fibres and films can in principle be processed but increase the cleaning and additive removal requirements. Pre-treatment comprises shredding, hot washing with alkaline media, rinsing, drying, and the separation of metals and PVC using NIR and density separation.

Hydrogenation

During the hydrogenation (hydrogenolysis) of PET, the polymer is broken down into smaller, higher-value molecules in the presence of hydrogen via a heterogeneous catalyst [41] . In the process described by Choi et al., this takes place in a three-phase suspension column (SBCR) [42] . Sorted, dried PET is slurried in a high-boiling, hydrogen-soluble solvent (e.g. n-hexadecane) together with finely dispersed catalyst particles, and hydrogen is introduced into the suspension at elevated pressure and 200–280 °C. The mass transfer of H_2 into the liquid phase and to the catalyst surface is crucial and is strongly determined by viscosity, which in turn depends on the PET molecular weight and the solvent-to-PET ratio. Catalysts promote the cleavage of the C–O bonds. After the reaction, the hydrogen is separated and recycled, the catalyst is hot-filtered and regenerated, and the solvent and products are recovered by distillation/crystallisation. Hydrogenation is particularly suitable for contaminated or mixed PET streams; with regard to food contact, approval would be possible, in particular, if the material is broken down into monomers and subsequently processed into PET of virgin material quality via established polymerisation pathways. From a sustainability perspective, hydrogen production and energy supply are the dominant factors contributing to the environmental impacts arising during recycling. This process is still at an early stage of development, and industrial application is not yet widespread.

Selective dissolution processes

Selective dissolution processes aim to separate plastic fractions from composite and mixed waste by dissolving the target polymer, thereby removing contaminants. This allows, for example, composites of PET and polyolefins to be separated by selectively dissolving the target fraction in a specialised solvent formulation, whilst the other fraction remains undissolved. Unlike depolymerisation, PET is not broken down into monomers in this process but is dissolved as a polymer and recycled. It is therefore classified as material recycling. The choice of solvent plays a key role here. The solvent must be capable of effectively dissolving PET, whilst other materials such as polypropylene (PP), polyethylene (PE) and contaminants such as dyes remain undissolved. The dissolution of PET is carried out in a suitable solvent mixture under controlled conditions (temperature e and pressure) to achieve the targeted dissolution of these specific plastic fractions.

Following dissolution, the impurities are separated by mechanical or physico-chemical means. Undissolved impurities are removed, for example, by filtration or centrifugation, so that only PET and soluble impurities remain in the solution. The PET can be recovered by precipitating it or by evaporating the solvent. To achieve this, the PET, which is dissolved as a macromolecule, is recovered from the solution using a precipitating agent and, where necessary, by adjusting process parameters such as temperature. Through this targeted, selective precipitation, dissolved impurities remain in the solvent. Impurities such as dyes and other contaminants are removed in the process, enabling a higher quality of plastic to be achieved compared with mechanical recycling methods. The solvent used is sent for treatment, e.g. by distillation, to enable its recirculation. The precipitated PET can then be dried and used as a secondary raw material.

The strength of the process lies in the recovery of high-purity PET from composite materials and complex mixtures. Key selective solvent-based processes for plastics recycling include, for example, the CreaSolv® process developed by the Fraunhofer Institute for Process Engineering and Packaging (IVV) [43,44] , the PureCycle process [43], and the process developed by LYB Solvent Recycling GmbH (formerly Newcycling APK AG) [46]; however, these focus on polyolefins as the target fraction.

Depolymerisation

Depolymerisation refers to chemical recycling processes that aim to break down plastics into their monomers. This recycling process enables the recovery of monomeric building blocks, which can subsequently be used to manufacture new PET or other materials. For the depolymerisation of PET, the monomers obtained are usually terephthalic acid and ethylene glycol, or derivatives of these two monomers, depending on the process variant used and the method of breaking the PET's ester bonds.

The basic principle of depolymerisation is the breakdown of the polymer. The chemical structure of PET is broken down using various chemical or enzymatic methods to recover monomers, which are generally used for the re-polymerisation of PET. Partial depolymerisation of PET into oligomers and their use in products other than re-synthesised PET is also possible [47] , although this is not the focus of this study. Following depolymerisation, the recovered monomers can be purified and processed to remove impurities. This can be achieved through various mechanical and chemical process steps such as filtration, selective dissolution, precipitation or distillation of individual fractions. The resulting separation of foreign and interfering substances makes it possible to achieve a level of purification of the feedstock that cannot be attained by purely mechanical recycling processes for PET. Through the re-polymerisation of the recycled monomers, a high-purity polymer can thus be produced. This makes this process variant significant for contaminated and mixed waste streams and contributes to the use of the recycled material in applications with high-quality requirements, e.g. for food contact.

Typical process steps in the technical application of these methods include pre-treatment of the PET, for example by mechanical comminution; the cracking reaction with the addition of reagents and catalysts; and the separation and processing of the end products during or after the cracking reaction. The depolymerisation can be carried out under varying process conditions, in particular at different temperatures and pressures, and using catalysts such as acids, bases, metal oxides and biocatalysts, resulting in various process variants for depolymerisation. These variants of depolymerisation can be categorised according to various criteria, although the terms are not always clearly distinguished from one another. They exhibit varying degrees of technical maturity and therefore require separate description and evaluation. The most important process variants are described below.

Hydrolysis

The basic principle of hydrolysis is the cleavage of the ester bond in the PET polymer through reaction with water. There are several variants of this process, which differ in terms of the catalyst used and, consequently, the cleavage mechanism involved in the chemical attack on the ester bond. The specific technical implementation gives rise to process variants characterised by different auxiliary materials and process conditions (temperatures ranging from 50 to 400 °C, varying pressures).

In neutral hydrolysis, the cleavage reaction takes place using pure water or steam. It requires high temperatures and pressures, which is why catalysts are frequently used in variants of the hydrolysis process. In acidic hydrolysis, a strong acid such as sulphuric acid is used as a catalyst. The reaction takes place in an aqueous phase at elevated temperatures, generally above 100 °C, though sometimes also at lower temperatures [48]. The primary reaction products are terephthalic acid and ethylene glycol, although depending on the process, further salts or by-products may be formed. In alkaline hydrolysis, a base such as sodium hydroxide or potassium hydroxide is used as a catalyst. Here too, the reaction takes place in an aqueous phase at elevated temperature or pressure. Sodium salts of terephthalic acid and ethylene glycol are initially formed, which are then further processed by neutralisation or conversion into the free monomers. Both the acidic and alkaline variants are well documented and are based on established process steps.

Enzymatic hydrolysis

Enzymatic hydrolysis utilises specialised biocatalysts (enzymes) such as PETase or MHETase to break the ester bond. The PETase enzyme first catalyses the breakdown of PET into mono(2-hydroxyethyl)terephthalic acid (MHET). The resulting MHET is then cleaved by the enzyme MHETase into terephthalic acid and ethylene glycol. The enzymatic hydrolysis process takes place in bioreactors under milder conditions (pressure, temperature), where the enzymatic reactions occur under controlled conditions. Enzymatic hydrolysis has seen significant technical advances in recent years. For example, Carbios is currently working on scaling up a process for the enzymatic hydrolysis of PET from pilot scale to industrial scale [49] . Due to the milder process conditions involved in enzymatic hydrolysis (temperature often between 30 and 70 °C, atmospheric pressure) and the high specificity of the reaction, it is widely regarded as having great potential in terms of sustainability.

Solvolysis

In solvolysis, solvents are used to break the ester bonds in PET and recover monomers. Solvolysis processes can be broadly categorised according to the solvent used into alcoholysis (mono-functional alcohol), glycolysis (di-functional alcohol, typically ethylene glycol) and aminolysis. The reaction steps, process conditions and monomers produced vary depending on the reagents used to cleave the ester bond. Process control also differs depending on the plant configuration and can be carried out in screw extruders or in specialised reactors, which influences throughput and scalability. The depolymerisation rate in solvolysis also depends on pressure and temperature; for example, process temperatures in glycolysis typically range from 80 to 150 °C [48] .

'Alcoholysis' refers to the use of a monohydric alcohol (one hydroxyl group) – including the widely used methanolysis or ethanolysis approaches – or a polyhydric alcohol (several hydroxyl groups) for depolymerisation. The monomers produced during methanolysis are dimethyl terephthalate (DMT) and ethylene glycol. Eastman already operates methanolysis plants in the USA on an industrial scale [50] . Glycolysis refers to a variant of alcoholysis in which a dihydric alcohol is used for cleavage, typically ethylene glycol. The basic principle for this variant is also the cleavage of the ester bond; however, the dihydric alcohol results in different reaction pathways and product profiles compared to monohydric alcohols. The reaction products formed are the monomers bis(2-hydroxyethyl) terephthalate (BHET) and ethylene glycol (EG), or derivatives thereof, e.g. diethylene glycol (DEG). Examples of processes for the glycolysis of PET include Ioniqa [51] , Rewind® PET [52] and SK Chemicals. Compared with the solvolysis processes described above, aminolysis is at a less advanced stage of development and is mainly described in the context of research work. In aminolysis, ammonia or amines such as ethanolamine are used for the cleavage reaction to produce terephthalamides such as N,N'-bis(2-hydroxyethyl)terephthaldiamide (BHETA).

In depolymerisation, the integration of the recovered monomers into PET polymerisation plants plays a significant role in terms of logistics and take-up. Many of the processes are designed for the processing of various PET fractions and, in some cases, are aimed not only at recycling PET from packaging but also at the processing of fibres and textiles. Overall, the processes for the depolymerisation of PET offer a wide range of options which can be utilised depending on the composition of the waste streams, the intended use of the recycled material and the economic conditions for PET recycling.

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9.3. DfR-Richtlinien/Assessments

	PET Trays, Pots and other rigids								PET Trays, Pots and other rigids			PET bottles	
	D4R-Guidelines								D4R-Assessments	Recyclability-Assessments		D4R-Guidelines	
	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear Pots, trays and other rigids	**PET coloured Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b: PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
Date/Version:	March 25th, 2025	July 24th, 2024	Version 2024, accessed on 21st August 2025	Last updated on September	January 2025	Date: 2025-06	Date: 2025-06	Date: 2025-06	accessed October 2023	Fassung 6.1	2025	accessed October	accessed October
Link:	https://www.cotrep.fr/en/steps/pots-and-trays/pt-clear-pet/	https://www.cotrep.fr/en/steps/pots-and-trays/pt-coloured-pet/	https://www.recoup.org/research-and-reports/recyclability-by-design-2024-with-bpf/	https://plasticsrecycling.org/apr-design-hub/apr-design-guide/pet-rigid/	https://recyclass.eu/guidelines/clear-pet-thermoforming-trays/	-			https://recyclass.eu/recyclability/online-tool/	https://www.cyclos-htp.de/publications/r-a-catalogue/	https://www.verpackungsregister.org/fileadmin/files/Mindeststandard/Mindeststandard_VerpackG_2025.pdf	Design Guidelines - EPBP - European PET Bottle Platform	https://www.epbp.org/design-guidelines/products
Legende:	Full compatibility – ideal	Full compatibility – ideal	COMPATIBLE for recycling for most applications	PREFERRED	FULL COMPATIBILITY	Green / Full compatibility			PREFERRED - NO DEDUCTION	Category MV: valuable material	valuable material	FULL COMPATIBILITY	FULL COMPATIBILITY
	Tolerated compatibility	Tolerated compatibility											
	Limited compatibility - conditional	Limited compatibility - conditional	MAY BE SUITABLE for recycling for some applications	Detrimental	LIMITED COMPATIBILITY	Yellow / Limited compatibility			LIMITED COMPATIBLE	Category 1 (CAT 1): (in reprocessing) separable non-valuable materials	separable or conditionally compatible	CONDITIONAL	CONDITIONAL
										Category 2 (CAT 2): conditionally compatible			
	Not compatible and/or disruptive	Not compatible and/or disruptive	NOT SUITABLE for recycling	Non-Recyclable	NO - LOW COMPATIBILITY	Red / Not compatible			NOT RECYCLABLE	CAT 3: incompatible	Incompatibilities	LOW COMPATIBILITY	LOW COMPATIBILITY
				Needs Testing									
BODY | MATERIAL													
PET (PET-A, PET-C, PET (non-specific)	PET	PET	-	Intrinsic Viscosity (IV): between 0.72- 0.90 dL/g as determined by ASTM D4603 test method	PET Thickness > 180 µm	PET	PET	A-PET, CPET	PET Thickness >= 180 µm	PET-A PET-A opaque PET-C	PET-A PET-A opaque PET-C	PET	PET
				Crystaline Melting Point: 225-255 °C as determined by ASTM D3418-15 test method	PET trays with porous enabling liquid retention	Thickness >180 microns; or more than 2,41x10-4(g/cm2) ratio weight/total surface	Thickness >180 microns; or more than 2,41x10-4(g/cm2) ratio weight/total surface	Thickness >180 microns; or more than 2,41x10-4(g/cm2) ratio weight/total surface	PET trays with porous enabling liquid retention				
				Monomer Composition: > 90% PTA or DMT reacted with MEG									
	PET in association with a PET-based sealing layer	CPET		Intrinsic Viscosity (IV): <0.72 dL/g or > 0.90 dL/g as determined by ASTM D4603 test method	-	PET thickness >150 microns; or between 2,01x10-4 and 2,41x10-4(g/cm2) ratio weight/total surface.	PET thickness >150 microns; or between 2,01x10-4 and 2,41x10-4(g/cm2) ratio weight/total surface.	PET thickness >150 microns; or between 2,01x10-4 and 2,41x10-4(g/cm2) ratio weight/total surface.	PET Thickness < 180 µm (sorting test)				
	To date, colored and opaque packaging (e.g. CPET) are not included in the recycling stream. Work is on going to assess the possibility of including them in the medium/long term.			Monomer Composition: < 90% PTA or DMT reacted with MEG									
				Crystaline Melting Point <225 °C or > 255 °C, or non-crystallizable	Other PET multilayers; PETG; C-PET; PET-GAG; Expanded PET Thickness < 180 µm (sorting test)	PET thickness below 150 microns; or less than 2,01x10-4(g/cm2) ratio weight/total surface.	PET thickness below 150 microns; or less than 2,01x10-4(g/cm2) ratio weight/total surface.	-					
Recycled PET	-	-	-	-	-	-	-	rPET	Improvement by 1 (+), 2 (++) or 3 (+++) levels by rPET content: More than 90% (+++) Between 50% and 90% (++) Between 15% and 50% (+) Less than 15%	rPET	rPET	-	-
Bio Based/PEF	-	-	-	-	Polymer resin can be either fossil- or bio-based, virgin or recycled.	-	-	-	-	PEF	PEF; Materials in multilayer Density > 1 g/cm³ - PEF layer	-	-
Expanded PET	PET with additive loads or expanded	Expanded PET d > 1 (gaz, blowing agent)	-	Foamed PET: > 95% sinks in water per PET-S-05	-	-	-	-	-	-	-	-	-
			-	Foamed PET: > 51% and < 95% sinks in water per PET-S-05	-	-	-	-	-	-	-	-	-
		Expanded PET d < 1 (gaz, blowing agent)	-	Foamed PET: < 51% sinks in water per PET-S-05	Other PET multilayers; Expanded PET Thickness < 180 µm (sorting test)	-	-	XPET	-	-	-	-	-
PET-G	Copolyester (PETG, PET-GAG, PET hot-fill)	Copolyester (ex. PETG*, PET-GAG, PET hot-fill*) * guideline from test results	-	-	-	polyesters not complying with the definition of PET or CPET (e.g. PETG…)	polyesters not complying with the definition of PET or CPET (e.g. PETG…)	polyesters not complying with the definition of PET or CPET (e.g. PETG…)	Included in: Others (PLA, PVC, PS, PETG etc.)	PET-G	PET-G	PETG	PETG
Other PET	Copolyester (PETG, PET-GAG, PET hot-fill)	Copolyester (ex. PETG*, PET-GAG, PET hot-fill*) * guideline from test results	-	-	Other PET multilayers; PETG; C-PET; PET-GAG; Expanded PET Thickness < 180 µm (sorting test)	polyesters not complying with the definition of PET or CPET (e.g. PETG…)	polyesters not complying with the definition of PET or CPET (e.g. PETG…)	polyesters not complying with the definition of PET or CPET (e.g. PETG…)	-	-	-	-	-
		PET in association with other plastic resins (PET/PE, PET/PLA, PET/PVC, etc.)											
		PET in association with a none plastic material (wood, ceramics …)											

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear Pots, trays and other rigids	**PET coloured Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b: PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
PBT	-	-	-	-	?	PBT	-	PBT	?	PBT layer	PBT; Materials in multilayer Density > 1 g/cm³- PBT layer	PBT (as a bottle material)	PBT (as a bottle material)
PE or PP	PET in association with other plastic resins (PET/PE, PET/PLA, PET/PVC, etc.)	PET in association with other plastic resins (PET/PE, PET/PLA, PET/PVC, etc.)	PE seal Layer	-	PET/PE multilayer with or without barrier not hindering NIR detection of the PET	-	PET/PE* ; PET/PE/EVOH/PE and other PET/polyolefin structures. The polyolefin layer shall be separable from the PET layer using regular PET recycling lines (see Laminating adhesives)	PET/PE* ; PET/PE/EVOH/PE and other PET/polyolefin structures. The polyolefin layer shall be separable from the PET layer using regular PET recycling lines (see Laminating adhesives)	PE	PE layer (non-specific) HDPE, MDPE, LDPE, LLDPE, rHDPE, rLDPE, PE-PP-copolymer layer, mPE (Metallocen) layer; Plastomer (PE) layer	Materials in multilayer Density > 1 g/cm³: PE-layer	-	-
						-	PET/PE; PET/PE/EVOH/PE and other PET/polyolefin structures. The polyolefin layer shall be separable from the PET layer using delamination processes (see Laminating adhesives)	PET/PE; PET/PE/EVOH/PE and other PET/polyolefin structures. The polyolefin layer shall be separable from the PET layer using delamination processes (see Laminating adhesives)	PP	PE-EVA blend layer; PE-X layer; PE Peel layer (non-specific)	Materials in multilayer Density > 1 g/cm³: PE-x layer, PE peel-layer (non-specific)		
						-	Non separable PET/PE or PET/polyolefin structures	-		PP layer; PP copolymer layer (non-specific); PP-PE-copolymer layer; PP terpolymer layer; rPP layer;	Materials in multilayer Density > 1 g/cm³: PP layer; PP Peel layer (non-specific)		
PLA	PLA PET/PLA	PLA PET/PLA	-	-	PLA	PLA	-	PLA	PLA	Included by: " other polymer layers"	-	PLA	PLA
POM	-	-	-	-	-	-	-	-	Included in: Other polymers (PE, PP, PS, EPS, PVC, Others)	Included by: " other polymer layers"	-	-	-
PVC	PET in association with other plastic resins (PET/PE, PET/PLA, PET/PVC, etc.)	PET in association with other plastic resins (PET/PE, PET/PLA, PET/PVC, etc.)	-	-	PVC	PVC	-	PVC	Included in: Others (PLA, PVC, PS, PETG etc.)	Included by: " other polymer layers"	-	PVC and other halogenated compounds	PVC and other halogenated compounds
PS	included by: "PET in association with other plastic resins (PET/PE, PET/PLA, PET/PVC, etc.)"	included by: "PET in association with other plastic resins (PET/PE, PET/PLA, PET/PVC, etc.)"	-	-	PS	PS	-	PS	Included in: Others (PLA, PVC, PS, PETG etc.)	PS- / rPS-layer	-	PS	PS
Non Plastic Material	PET in association with a none plastic material (paper, wood, ceramic,metal, etc.)	PET in association with a none plastic material (wood, ceramics)	-	-	-	-	-	-	aluminium layer thicker than 5 µm	Aluminium layer* *Examination of design-related material losses	Materials in multilayer Density > 1 g/cm³: Aluminium layer* *Examination of design-related material losses	-	-
Others	-	-	-	-	-	polyesters not complying with the definition of PET or CPET (e.g. PETG…); as defined in PART 1	PET/EVOH/PET; PET/PA/PET	PLA; PVC; PS; PBT; XPET; polyesters not complying with the definition of PET or CPET (e.g. PETG…)	Oxo- and bio-degradable plastics	PA layer, PVDC layer, PVOH layer	Multilayer structure, density < 1 g/cm³* *Examination of design-related material losses	PC	PC
	-	-	-	-							Materials in multilayer Density > 1 g/cm³: PA layer, PVDC-Layer, PVOH layer EVOH layer		
Comments	Mono PET trays with an adhesive deposited on the sealing edge are mono PET trays. 'Sorting and regeneration studies are underway on different copolyesters (PETG, PCTA, etc.) to verify their orientation in the sorting center and the impact during regeneration.	-	-	-	Polymer resin can be either fossil- or bio-based, virgin or recycled	-	* PE includes also EVA, EMA, EEA and EBA and PE-g-MAH as a tie layer.	* PE includes also EVA, EMA, EEA and EBA and PE-g-MAH as a tie layer.	-	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
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BODY | SIZE													
Size / Dimension	-	-	-	Large Size Boundary: ≤ 7.5 liters (2 gal) in volume Large Size Boundary: > 7.5 liters (2 gal) in volume Small Size Boundary: > 2 in (5 cm) in any two dimension Small Size Boundary: ≤ 2 in (5 cm) in any two dimensions 2D/-3D Boundary: Smallest uncompressed packaging dimension ≥ minimum dimensions per APR-RES-SORT-05 2D/-3D Boundary:: Smallest uncompressed packaging dimension < minimum dimensions per APR-RES-SORT-05	Items compacted < 5 cm Items compacted < than 2 cm	-	-	-	Size > 5 cm (compacted): The size of the packaging should not prevent the sortability of the packaging. Size = 5 cm (compacted): A sorting test is recommended. Please refer to the RecyClass Sorting Protocol. Size < 2 cm (compacted): Based on the European state of art technologies the packaging will get lost during the sorting steps.	-	-	smaller than 4 cm (when compacted) or larger than 5 liters	smaller than 4 cm (when compacted) or larger than 5 liters
BODY | COLOUR													
Transparent Clear	Transparent clear	-	Clear / uncoloured	clear	Transparent clear	clear	clear	-	Transparent clear	Transparent clear	Transparent clear	Transparent clear	n.a.
Transparent Light Green	Other transparent colours	Transparent green	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	transparent green	Other transparent colours	-	-	Light and opaque NIR detectable colors	Transparent colours	coloured transparent	coloured transparent	included by: "other transparent colours"	included by: "transparent, light colours"
Transparent Light Blue	Transparent blue	Blue	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	transparent blue	Other transparent colours	transparent light blue	transparent light blue	-	Transparent colours	coloured transparent	coloured transparent	x	included by: "transparent, light colours"
Other Transparent Colours	Other transparent colours	All colour except blue and transparent green* * guideline from test results	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	other Transparent Colors	Other transparent colours	-	-	Light and opaque NIR detectable colors	Transparent colours	-	-	included by: "other transparent colours"	included by: "transparent, dark colours"
Opaque	Opaque	-	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	Opaque	Opaque	-	-	Light and opaque NIR detectable colors	Opaque	"PET-A opaque"	"PET-A, PET-C opaque"	Opaque	Opaque
Black and Dark Colors	Other transparent colours / Opaque	Not detectable black colour in external layer	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	black/dark colors passing SORT-S-01 black/dark colors not passing SORT-S-01	-	-	-	Light and opaque NIR detectable colors non detectable colors	Carbon black (sorting test)	standard colour pigment carbon black (sooth)	-	-	-
Metallic	Metallic	Metallic	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	-	Metallic	-	-	Metallic	Metallic	-	-	Metallic	Metallic
Fluorescence	Fluorescence	Fluorescence	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	-	-	-	-	Fluorescent colors	Fluorescent	-	-	Fluorescence	Fluorescence
Others	-	All colour with mineral content > 1%* * guideline from test results	NIR detectable colours* Non-NIR detectable colours e.g containing carbon black*	-	-	-	-	Light and opaque NIR detectable colors non detectable colors	-	-	-	-	-
Comments	To date, colored and opaque packaging (e.g. CPET) are not included in the recycling stream. Work is on going to assess the possibility of including them in the medium/long term.	-	*No additives or processes should result in not intentionally added substances (NIAS) as this would contaminate food grade recycled content	-	-	-	-	-	-	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear Pots, trays and other rigids	**PET coloured Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b: PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
BODY | BARRIER / COATINGS													
EVOH	EVOH	EVOH	EVOH	-	Barrier material within PE layer (i.e PE/EVOH/PE) or with barrier material blended in PE EVOH	EVOH	PET/PE/EVOH/PE The polyolefin layer shall be separable from the PET layer using regular PET recycling lines (see Laminating adhesives) PET/PE/EVOH/PE The polyolefin layer shall be separable from the PET layer using delamination processes (see Laminating adhesives) PET/EVOH/PET	EVOH barrier material laminated and incorporated into the polyolefin liner, separable with current washing, friction in recycling lines. This includes PE-g-MAH as tie layer between PE and EVOH. PE includes EVA, EMA, EBA and EEA EVOH barrier material laminated and incorporated into the polyolefin liner, non- separable with current washing, friction in recycling lines.	For multilayers: Barrier material within PE layer (i.e PE/EVOH/PE) or with barrier material blended in PE EVOH	EVOH layer	EVOH layer	EVOH	EVOH multilayer with up to 3 wt% EVOH and no tie layers; EVOH multilayer with >3 wt% EVOH or with tie layers
Oxygen Scavengers	included by: "Other barriers and resins (multilayer or blends barrier)"	included by: "Other barriers and resins (multilayer, blends, hydrosoluble barrier)"	included by additives: O2 scavengers	Oxygen Scavengers that pass PET-CG-01 when using aging condition per PET-P-12 Untested Oxygen Scavengers	PET based oxygen scavenger without yellowing effect PET based oxygen scavenger with limited yellowing effect Any other oxygen scavenger	Pet based oxygen barrier or scavenger with no yellowness effect after oven test as described in EN-ISO 15348 PET based oxygen Barriers or Scavenger with limited yellowness effect after oven test as described in EN-ISO 15348. Oxygen Scavengers using a different carrier than PET and/or showing a strong yellowness effect after oven test as described in EN-ISO 15348	-	Pet based oxygen barrier or scavenger	PET based oxygen scavenger with no yellowness effects (EPBP Oven Test) PET based oxygen scavenger with limited yellowness effects (EPBP Oven Test) Any other oxygen scavenger	Oxygen scavenger (PA free)	Oxygen scavenger (PA free)	oxygen scavengers	oxygen scavengers
PA	PA	PA* * guideline from test results	PA (Nylon)	-	PA	PA	PET/PA/PET	-	PA	PA layer	Materials in multilayer Density > 1 g/cm³: PA layer	- Nylon-MXD6 in a 3-layer structure with up to 5 wt% Nylon-MXD6 and no tie layers; Nylon-MXD6 in a 3 layer structure, with > 5 wt% Nylon-MXD6 or with tie layers; Nylon-MXD6 in a 5 layer structure; monolayer Nylon-MXD6 blend;	Nylon-MXD6 in a 3-layer structure with up to 6 wt% Nylon-MXD6 and no tie layers Nylon-MXD6 in a multilayer structure with up to 6 wt% Nylon-MXD6 and tie layers; monolayer Nylon-MXD6 blend Nylon-MXD6 in a multilayer structure with > 6 wt% Nylon-MXD6;
PVDC	included by "Other barriers and resins (multilayer or blends barrier)"	included by "Other barriers and resins (multilayer, blends, hydrosoluble barrier)"	-	-	included by: "Any other barrier"	-	-	PVDC as barrier	included by: "Any other barrier"	PVDC layer	Materials in multilayer Density > 1 g/cm³: PVDC layer	-	-
PVOH	included by "Other barriers and resins (multilayer or blends barrier)"	included by "Other barriers and resins (multilayer, blends, hydrosoluble barrier)"	-	-	included by: "Any other barrier"	-	-	-	included by: "Any other barrier"	PVOH layer	Materials in multilayer Density > 1 g/cm³: PVOH layer	-	-
Other Barriers and Additives	Other barriers and resins (multilayer or blends barrier)	Other barriers and resins (multilayer, blends, hydrosoluble barrier)	None	Other untested Addtives/Barriers Other Additives/Barriers	SiOx and AlOx plasma for barrier on lid; Barrier layers within the PET layer or in direct contact to PET layer Any other barrier	SiOx plasma-coating Additives intended to induce degradation	Barrier material laminated or incorporated into the polyolefin liner	Nucleating agent for CPET (crystallinity control) Impact modifiers for CPET Additives intended to induce degradation	Barrier layers within the PET layer or in direct contact to PET layer Any other barrier	SiOx AlOx Seal-edge coating (wash-off in hot wash, 80 °C acrylic-based coating Seal-edge coating (not washable off in hot wash, 80 °C other blended barriers other coatings* **Examination of design-related material losses	SiOx AlOx Seal-edge coating (wash-off in hot wash, 80 °C acrylic-based coating Seal-edge coating (not washable off in hot wash, 80 °C other blended barriers other coatings* **Examination of design-related material losses	SiOx plasma-coating PGA multilayer ; PTN alloy -	SiOx plasma-coating carbon plasma-coating PTN alloy PGA multilayer -

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear Pots, trays and other rigids	**PET coloured Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b: PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
BODY | ADDITIVES and DENSITY													
PET d > 1	-	Expanded PET d > 1 (gaz, blowing agent)	-	*s. expanded PET*	-	-	-	-	-	-	-	-	-
PET d < 1	-	Expanded PET d < 1 (gaz, blowing agent)	-	*s. expanded PET*	-	-	-	-	-	-	-	-	-
AA blockers	AA blockers	AA blockers	AA blockers	-	AA blockers	AA blockers; with limited effect on clarity	AA blockers; with limited effect on clarity	-	AA blockers	AA-blocker	AA-blocker	AA blockers	AA blockers
Antiblocking Masterbatch	-	-	Anti-block	-	Antiblocking masterbatch (max 3%) Antiblocking masterbatch (> 3%)	Antiblocking masterbatch (without affecting clarity) -	Antiblocking masterbatch (without affecting clarity) -	Antiblocking masterbatch <= 3 % -	Antiblocking masterbatch (max 3%) Antiblocking masterbatch (> 3%)	Anti-block	Anti-block	- -	- -
Antiblocking agents	-	-	Anti-block	-	-	antiblocking agents; with limited effect on clarity	antiblocking agents; with limited effect on clarity	-	Anti-blocking agents	Anti-block	Anti-block	-	-
Anti-fogging agents	-	-	-	-	Anti-fogging agents	anti-fogging (on coating area) with limited effect on clarity	anti-fogging (on coating area) with limited effect on clarity	-	Anti-fogging agents	-	-	-	-
Anti-stat agents	-	-	-	-	Anti-stat agents	-	antistat agents; with limited effect on clarity	-	Anti-stat agents	-	-	-	-
Bio-/oxo-/photodegradables additives	Bio-/oxo-/photodegradables additives	Bio-/oxo-/photodegradables additives	-	Degradable Additives: Renders Package Non-Recyclable	Bio/Oxo/Photodegradable additives	-	Additives intended to induce degradation	Additives intended to induce degradation	Bio/Oxo/Photodegradable additives	Bio-/oxo-/photodegradables additives	Bio-/oxo-/photodegradables additives	bio-/oxo-/photodegradable additives	bio-/oxo-/photodegradable additives
Nanocomposites	Nanocomposites	Nanocomposites	-	-	Nanocomposites	Nanocomposites not allowed by food contact regulation	Nanocomposites not allowed by food contact regulation	Nanocomposites not allowed by food contact regulation	Nanocomposites	Nanocomposites	Nanocomposites	Nanocomposites	Nanocomposites
Optical brightener	Optical brightener	Optical brightener	-	Optical Brighteners	Optical brighteners	optical brighteners; with limited effect on clarity	optical brighteners; with limited effect on clarity	-	Optical brighteners	-	-	Optical brighteners	Optical brighteners
PA	-	-	-	-	-	-	-	-	-	PA additivation	PA additivation	-	-
Silicone	Silicone on surface for unstacking	-	Minimal silicone surface coating (de-nest)* *No additives or processes should result in not intentionally added substances (NIAS) as this would contaminate food grade recycled content	-	Silicone surface coating	Silicone surface coating (on coating area);without affecting clarity	Silicone surface coating (on coating area);without affecting clarity	Silicone surface coating (on coating area)	Silicone surface coating	Silicone coating	-	Organosilicon compounds	Organosilicon compounds
Toners	-	-	-	Untested Toners Toners	-	-	-	-	-	-	-	-	-
UV stabilisers	UV stabilisers	UV stabilisers	UV stabilisers	-	UV stabilizers	UV stabilizers; with limited effect on clarity	UV stabilisers with limited effect on clarity	-	UV stabilizers	UV stabilisers	UV stabilisers	UV stabilizers	UV stabilizers
Others	PET with additive loads or expanded	PET with additive loads or expanded	-	Other untested Addtives/Barriers Other Additives/Barriers	-	-	Additives intended to induce degradation	Nucleating agent for CPET (crystallinity control) Impact modifiers for CPET Additives intended to induce degradation	Any other PFAs-based additives	Master batch; Color batch; Absorbers (mineral); Lime, chalk; Talc; Titan dioxide Anti-slip additive	Master batch; Color batch; Absorbers (mineral); Lime, chalk; Talc; Titan dioxide Anti-slip additive Coloration using carbon black–based pigments (also when used in internal layers)* *Examination of design-related material losses	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear **Pots, trays and other rigids**	**PET coloured** **Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b:** **PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
DECORATION| LABELS													
PE or PP-Labels	PP, OPP, PE partial	LABEL ON PACK OR CAP: Plastic d <1 (ex. PP, OPP, PE)	PP / OPP Less than 60% coverage on face Labels that are removed in or before the wash step*	-	Labels in PE; PP; OPP (all with density <1 g/cm³)	PE; PP; OPP; all with density <1 g/cm³	PE; PP; OPP; all with density <1 g/cm³	PE; PP; OPP; all with density <1 g/cm³	Labels in PE; PP; OPP (all with density <1 g/cm³)	-	-	PE; PP; OPP; all with density <1 g/cm³	PE; PP; OPP; all with density <1 g/cm³
	PP, OPP, PE total	LABEL ON PACK OR CAP: PET on a PET pack which is not transparent green or white/opaque								Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, (removable without residue in alkaline hot wash, 80 °C)	Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, (removable without residue in alkaline hot wash, 80 °C)		
	LABEL ON BODY OR CAP / ON NOT PRINTED TRANSPARENT PET LID: Paper, PP, OPP, PE with not water releasable adhesive									Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, not removable without residue in alkaline hot wash, 80 °C	Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, not removable without residue in alkaline hot wash, 80 °C		
PET-Labels	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID": Other plastic d>1 (ex. PET on PET clear packaging, PETg, PS, etc.)	LABEL ON PACK OR CAP: Other plastic d>1 (ex. PVC, PETg, PS, PET on opaque PET pack and transparent green PET)	PET	-	PET-polymer (<50% coverage)	foamed PETG (even with density <1 g/cm³);	Materials with density >1 g/cm³ (e.g. PVC; PS; PET; PETG; PLA);	Materials with density >1 g/cm³ (e.g. PET; PETG)	-	Label / Sealing film: Monolayer film/coextruded multilayer film made of PET (except PET-G), density > 1 g/cm³, unprinted and not lacquered	Label / Seal film: Monolayer film / coextruded multilayer film made of PET (except PET-G), density > 1 g/cm³, unprinted and unlacquered		
										Label / Sealing film: Coextruded multilayer film made of PET (except PET-G)/PE, unprinted and not lacquered	Label / Sealing film: Coextruded multilayer film made of PET (except PET-G)/PE, unprinted and not lacquered	foamed PET (density <0.95g/cm³)	foamed PET (density <0.95g/cm³)
		LABEL ON MONO OR MULTI LID D<1, WITHOUT METAL: Other plastic d>1 (ex. PVC, PETg, PS, PET)					foamed PETG (even with density <1 g/cm³);	foamed PETG (even with density <1 g/cm³)		Label / Seal film: Multilayer PET film, adhesive-laminated, density > 1 g/cm³, unprinted and unlacquered* *Testing for design-related material losses	Label / Seal film: Multilayer PET film, adhesive-laminated, density > 1 g/cm³, unprinted and unlacquered* *Testing for design-related material losses	materials with density >1 g/cm³ (e.g. PET; PETG); foamed PETG (even with density <1 g/cm³); PET with washable inks	materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG; PLA); foamed PETG (even with density <1 g/cm³); PET with washable inks
PLA-Labels	-	-	-	Polymer Film Label: Film label that contains PLA or PVC	included by: "Plastic labels with density > 1 g/cm³"	Materials with density >1 g/cm³ (e.g. PLA);	Materials with density >1 g/cm³ (e.g. PLA);	Materials with density >1 g/cm³ (e.g. PLA);	Included by: "Non PO with a density > 1 g/cm3"	Included by: "Mono-/multilayer film including printing and coating, density > 1 g/cm³"	Included by: "Mono-/multilayer film including printing and coating, density > 1 g/cm³"	materials with density >1 g/cm³ (e.g. PLA);	materials with density >1 g/cm³ (e.g. PLA);
PS-Labels	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID":	LABEL ON PACK OR CAP: LABEL ON MONO OR MULTI LID D<1, WITHOUT METAL: Other plastic d>1 (ex. PVC, PETg, PS, PET)	-	-	included by: "Plastic labels with density > 1 g/cm³"	Materials with density >1 g/cm³ (e.g. PVC; PS; PET; PETG; PLA);	Materials with density >1 g/cm³ (e.g. PS)	Materials with density >1 g/cm³ (e.g. PS)	Included by: "Non PO with a density > 1 g/cm3"	Included by: "Mono-/multilayer film including printing and coating, density > 1 g/cm³"	Included by: "Mono-/multilayer film including printing and coating, density > 1 g/cm³"	EPS materials with density >1 g/cm³ (e.g. PS)	EPS materials with density >1 g/cm³ (e.g. PS)
PVC-Labels	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID": PVC	PVC	PVC	Polymer Film Label: Film label that contains PLA or PVC	included by: "Plastic labels with density > 1 g/cm³"	Materials with density >1 g/cm³ (e.g. PVC; PS; PET; PETG; PLA);	Materials with density >1 g/cm³ (e.g. PVC)	Materials with density >1 g/cm³ (e.g. PVC)	Included by: "Non PO with a density > 1 g/cm3"	Included by: "Mono-/multilayer film including printing and coating, density > 1 g/cm³"	Included by: "Mono-/multilayer film including printing and coating, density > 1 g/cm³"	materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds)	materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds)
Fibre-based labels	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID": Paper partial with a water releasable adhesive	LABEL ON PACK OR CAP: Paper	Paper over 60% coverage on face	Paper Label	BPA-free paper labels without fibreloss during recycling process	BPA-free paper labels* without fiber loss during recycling process	BPA-free paper labels* without fiber loss during recycling process	BPA-free paper labels* without fiber loss during recycling process	BPA-free paper labels without fibreloss	Paper label (not wet-strength / wetstrength equipped)	Paper label (not water-resistant / water-resistant treated)	Paper	Paper
	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID": Paper total with a water releasable adhesive	LABEL ON MONO OR MULTI LID D<1, WITHOUT METAL: Paper with a water releasable adhesive											
	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID": Paper with not water releasable adhesive	LABEL ON MONO OR MULTI LID D<1, WITHOUT METAL: Paper with not water releasable adhesive			Paper labels with fibreloss during recycling process; Paper labels containing BPA; Non floating paper labels	Paper with full coverage, Paper labels with fiber loss (pulping).	Paper with full coverage, Paper labels with fiber loss (pulping).	Paper with full coverage Paper labels with fiber loss (pulping). Non floating paper labels	Paper with fibreloss; Paper containing BPA				

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear **Pots, trays** **and other rigids**	**PET coloured** **Pots, trays** **and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b:** **PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
Metal Layer Aluminium, metalized, or metallic printed labels	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID": Multilayer with an alu layer (ex. paper/alu, PP/alu)	LABEL ON PACK OR CAP: Multilayer with an alu layer (ex. paper/alu, PP/alu)	Metalised	Label with metal decoration where surface area ≤ Preferred Surface Area per RES-SORT-03b Labels with metal decoration that are untested OR do not pass SORT-S-03 Labels with metal decoration where surface area > Preferred Surface Area per RES-SORT-03b	included by: "Plastic labels with density > 1 g/cm³"	Metallized materials compromising NIR detection or sink float separation.	Metallized materials compromising NIR detection or sink float separation.	Metallized materials compromising NIR detection or sink float separation.	Non PO with a density > 1 g/cm3	-	-	lightly metallised labels	lightly metallised labels
Others (Labels)	"LABEL ON BODY OR CAP" + "ON NOT PRINTED TRANSPARENT PET LID" + "LABEL ON MONO OR MULTI D<1, WITHOUT METAL, LID": Other plastic d>1 (ex. PET on PET clear packaging, PETg, PS, etc.)	LABEL ON PACK OR CAP: Other plastic d>1 (ex. PVC, PETg, PS, PET on opaque PET pack and transparent green PET)	In Mould label Labels that result in detection error Labels that cannot be removed	Polymer Film Label: Film label that floats in water Film label that sinks in water	Plastic labels with density > 1 g/cm³	Non-detaching or welded labels;	Non-detaching or welded labels;	Non-detaching or welded labels;	Non PO with a density > 1 g/cm3	Mono-/multilayer film including printing and coating, density > 1 g/cm³ Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, (removable without residue in alkaline hot wash, 80 °C) Mono-/multilayer film including printing and coating, density < 1 g/cm³, not completely removable in alkaline hot wash at 80 °C	Mono-/multilayer film including printing and coating, density > 1 g/cm³ Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, (removable without residue in alkaline hot wash, 80 °C) Mono-/multilayer film including printing and coating, density < 1 g/cm³, not completely removable in alkaline hot wash at 80 °C	materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG; PLA); non-detaching or welded labels;	materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG; PLA); non-detaching or welded labels;
Coverage	An integral label reduces collection efficiency in the sorting center Coverage limit (% surf.) to improve the sorting efficiency: – Volumes > 500 ml: % surf. < 70% – Volumes < 500 ml: % surf. < 50%	LABEL ON PACK OR CAP: An integral label reduces caption efficiency in the sorting center Coverage limit (% surf.) to improve the sorting efficiency: Volumes > 500 mL: % surf. < 70% Volumes < 500 mL: % surf. < 50%	Less than 60% coverage on face over 60% coverage on face	Main Body Volume ≤ 550 mL: ≤ 55% Surface Area Coverage Main Body Volume > 550 mL: ≤ 75% Surface Area Coverage Main Body Volume ≤ 550 mL: > 55% Surface Area Coverage Main Body Volume > 550 mL: >75% Surface Area Coverage	Labels with a size that does not hinder the recognition of the underlaying PET-polymer (<50% coverage) Labels with a coverage >50% (sorting test)	Labels with less than 70% packaging coverage for packaging over 500 ml, 50% equal and below 500 ml.	Labels with less than 70% packaging coverage for packaging over 500 ml, 50% equal and below 500 ml.	Labels with less than 70% packaging coverage for packaging over 500 ml, 50% equal and below 500 ml. Labels with more than 70% packaging coverage for packaging over 500 ml, or more than 50% equal and below 500 ml.	With a size that does not hinder* the recognition of the underlaying PET-polymer (<50% coverage) Large labels (>50% covering for <500 ml and >70% covering for >500 ml)*	-	Large-area labeling (> 50% of the projected surface) with foreign material* *Testing for design-related material losses	-	-
Comments	-	-	*No additives or processes should result in not intentionally added substances (NIAS) as this would contaminate food grade recycled content	-	-	*It is required to accomplish EuPIA Exclusion Policy for Printing Inks and Related Products and not contain hazardous substances that can harm recycling as expressed in red column.	*It is required to accomplish EuPIA Exclusion Policy for Printing Inks and Related Products and not contain hazardous substances that can harm recycling as expressed in red column.	*It is required to accomplish EuPIA Exclusion Policy for Printing Inks and Related Products and not contain hazardous substances that can harm recycling as expressed in red column.	*Testing the sorting behaviour by following the RecyClass Sorting Protocol is recommended	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear **Pots, trays** **and other rigids**	**PET coloured** **Pots, trays** **and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b:** **PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
DECORATION | SLEEVE													
PE or PP Sleeve	Plastics d<1 (ex. PP, OPP, PE) partial Plastics d<1 (ex. PP, OPP, PE) total	PP, OPP, PE d <1	-	-	-	PO, PE, PP, OPP, all with density <1 g/cm³	PO, PE, PP, OPP, all with density <1 g/cm³	PO, PE, PP, OPP, all with density <1 g/cm³	-	-	-	sleeves with partial bottle coverage in PE; PP; OPP; all with density full sleeves translucent for IR detection in PE; PP; OPP; EPS; foamed PET; LDPET; all with density <0.95 g/cm³	sleeves with partial bottle coverage in PE; PP; OPP; all with density full sleeves translucent for IR detection in PE; PP; OPP; EPS; foamed PET; LDPET; all with density <0.95 g/cm132
PET Sleeve	Other plastics d>1 (ex. PET, PETG, PS, PLA)	PET on a PET pack which is not transparent green or white/opaque Other plastics d>1 (ex. PET on opaque PET pack and transparent green PET, PETG, PS, PLA and PVC)	-	-	-	-	-	PET based sleeve with density <1g/cm3 Materials with density >1g/cm3 (eg. PETG) Foamed PETG (even with density <1g/cm3)	-	-	-	full sleeves translucent for IR detection in PE; PP; OPP; EPS; foamed PET; LDPET; all with density <0.95 g/cm³ materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG); foamed PETG (even with density <1 g/cm³); PET with washable inks	full sleeves translucent for IR detection in PE; PP; OPP; EPS; foamed PET; LDPET; all with density <0.95 g/cm132 materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG); foamed PETG (even with density <1 g/cm³); PET with washable inks
PS Sleeve	Other plastics d>1 (ex. PET, PETG, PS, PLA)	Other plastics d>1 (ex. PET on opaque PET pack and transparent green PET, PETG, PS, PLA and PVC)	-	-	-	-	-	Materials with density >1g/cm3 (eg PS)	-	-	-	full sleeves translucent for IR detection in EPS with density <0.95 g/cm³ materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG)	full sleeves translucent for IR detection in EPS with density <0.95 g/cm3 materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG)
PVC Sleeve	PVC	PVC	-	-	-	-	-	Materials with density >1g/cm3 (eg PVC)	-	-	-	PVC	PVC
Others (Sleeve)	Plastics d<1 (ex. PP, OPP, PE) partial Plastics d<1 (ex. PP, OPP, PE) total Other plastics d>1 (ex. PET, PETG, PS, PLA)	Other plastics d<1 Other plastics d>1 (ex. PET on opaque PET pack and transparent green PET, PETG, PS, PLA and PVC)	-	-	-	Paper wrap attached/glued to the packaging	-	Materials with density >1g/cm3 (eg metal, PVC, PS, PETG) metallized materials.	-	-	-	materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG); metallised materials; heavily	materials with density >1 g/cm³ (e.g. PVC and other halogenated compounds; PS; PET; PETG); metallised materials; heavily
Coverage	An integral sleeve reduces collection efficiency in the sorting center Coverage limit (% surf.) to improve the sorting efficiency: – Volumes > 500 ml: % surf. < 70% – Volumes < 500 ml: % surf. < 50%	An integral sleeve reduces caption efficiency in the sorting center Coverage limit (% surf.) to improve the sorting efficiency: Volumes > 500 mL: % surf. < 70% Volumes < 500 mL: % surf. < 50%	-	-	-	Sleeves with partial coverage (max. 70%) and wraps with full coverage of the packaging	Sleeves with partial coverage (max. 70%) and wraps with full coverage of the packaging	Sleeves with partial coverage (max. 70%) and wraps with full coverage of the packaging Full sleeves or wraps	If a plastics packaging contains a label or sleeve made out of another material than plastic, to ensure the package sortability, the maximum covering of the package body should be 50%; otherwise, the non-plastic materials should be removed by consumers to access the product.				

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear **Pots, trays** **and other rigids**	**PET coloured** **Pots, trays** **and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b:** **PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue** **PET bottles**	**Transparent coloured PET bottles**
ADHESIVES													
Label Adhesive	LABEL ON BODY OR CAP / ON NOT PRINTED TRANSPARENT PET LID: PP, OPP, PE partial with a water releasable adhesive	ADHESIVE (LABEL AND BONDED LID): Water releasable at 60 - 80°C in alkaline conditions and residue-free	Removeable Water releasable in 60 - 80°C	Releasing Adhesive: Used on Polymer Film Label Substrate that floats in water	ADHESIVES (FOR LIDS, LABELS, SOAKING PADS...) Alkali/water soluble or alkali/water releasable adhesive at 70°C	Label Adhesive: Alkali/water-releasable adhesive at (60 to 80°C)	Label Adhesive: Alkali/water-releasable adhesive at (60 to 80°C)	Label Adhesive: Adhesive: Alkali/water-releasable adhesive at (60 to 80°C)	ADHESIVES (FOR LIDS, LABELS, SOAKING PADS...) Completely alkali/water soluble or alkali/water releasable adhesive at 70°C	Label/absorbent pad/bubble pad: Adhesive application (wash-off capable in cold wash / wash-off capable in hot wash / wash-off capable in alkaline hot wash)	Label / Absorbent insert / Air-cushion insert: Adhesive application (wash-off capable in hot wash, 80°C)	alkali/water releasable at 60-80°C	alkali/water releasable at 60-80°C
	LABEL ON BODY OR CAP / ON NOT PRINTED TRANSPARENT PET LID: PP, OPP, PE total with a water releasable adhesive	LABEL ON MONO OR MULTI LID D<1, WITHOUT METAL: Plastic d<1 (ex. PP, OPP, PE) with a water releasable or not adhesive	-	Releasing Adhesive: Used on Polymer Film Label Substrate that sinks in water	ADHESIVES (FOR LIDS, LABELS, SOAKING PADS...) Partially alkali/water soluble or alkali/water releasable adhesive at 70°C	-	-	-	ADHESIVES (FOR LIDS, LABELS, SOAKING PADS...) Partially alkali/water soluble or alkali/water releasable adhesive at 70°C	Label/absorbent pad/bubble pad: Adhesive application (wash-off capability unknown)	Label / Absorbent insert / Air-cushion insert: Adhesive application (wash-off capability unknown)* *Examination of design-related material losses	alkali/water soluble, non-releasable or releasable above 80°C	alkali/water soluble, non-releasable or releasable above 80°C
	LABEL ON BODY OR CAP / ON NOT PRINTED TRANSPARENT PET LID: Paper, PP, OPP, PE with not water releasable adhesive	ADHESIVE (LABEL AND BONDED LID): Not water releasable at 60 - 80°C in alkaline conditions	Not removable in water	Non-Releasing Adhesive: Used on Polymer Film Label Substrate	ADHESIVES (FOR LIDS, LABELS, SOAKING PADS...) All other adhesives	-	-	Label Adhesive: Bi-component solventless adhesives	ADHESIVES (FOR LIDS, LABELS, SOAKING PADS...) All other adhesives	Label/absorbent pad/bubble pad: Adhesive application (not wash-off capable in aqueous solution)	Label / Absorbent insert / Air-cushion insert: Adhesive application (not wash-off capable in hot wash, 80°C)		
Laminating adhesives	-	-	-	-	LAMINATING ADHESIVES FOR MULTILAYERS** Water-based acrylics	Alkali/water-washable or releasable adhesive* at (60 to 80°C)	Alkali/water-washable or releasable adhesive* at (60 to 80°C)	Alkali/water-washable or releasable adhesive* at (60 to 80°C)	LAMINATING ADHESIVES FOR MULTILAYERS** Water-based acrylics	Main component: Adhesive (non-specific) Adhesive (Acrylat based) Adhesive (PU based)	Main Body: adhesive application* *Examination of design-related material losses		
					LAMINATING ADHESIVES FOR MULTILAYERS** EVA	Laminating adhesives: Delaminable adhesive*	Laminating adhesives: Delaminable adhesive*	Laminating adhesives: Delaminable adhesive*	LAMINATING ADHESIVES FOR MULTILAYERS** EVA				
					LAMINATING ADHESIVES FOR MULTILAYERS** Solvent-free laminating adhesives	-	Laminating adhesives: Polyurethane based adhesives. Adhesives that contain BPA.	Laminating adhesives: Polyurethane based adhesives. Adhesives that contain BPA.	LAMINATING ADHESIVES FOR MULTILAYERS** Solvent-free laminating adhesives				
Others	-	-	-	-	-	-	Other adhesives: Alkali/water-washable or releasable adhesive* at (60 to 80°C)	Other adhesives: Alkali/water-washable or releasable adhesive* at (60 to 80°C)	Parts different than lidding films and adhesives: Water or alkali release at 60-80°C without reactivation	-	-	-	-
							Other adhesives: Delaminable adhesive*	Other adhesives: Delaminable adhesive*	Parts different than lidding films and adhesives: Any other adhesive				
						Other Adhesives: Polyurethane based adhesives. Adhesives that contain BPA.	Other Adhesives: Polyurethane based adhesives. Adhesives that contain BPA.	Other Adhesives: Polyurethane based adhesives. Adhesives that contain BPA.	-				
						Sealing adhesives: Adhesive for sealing purpose locally applied for closure, separable with current washing, friction in recycling lines, i.e. alkali/water soluble or alkali/water releasable adhesive at 60- 80ºC	-	Sealing adhesives: Adhesive for sealing purpose locally applied for closure, separable with current washing, friction in recycling lines, i.e. alkali/water soluble or alkali/water releasable adhesive at 60- 80ºC					
Comments	Washable in water at 60-80°C in alkaline conditions Favor a removable adhesive remaining mainly on the label.	Limit the amount of used adhesive	s. Note on individual label materials	-		* Delamination of materials shall be tested according to "Delamination procedure" in prEN 18120-11, Packaging — Design for recycling of plastic packaging — Part 11: Recyclability evaluation process for plastic packaging — Protocols for PET Rigid packaging (except bottles)	* Delamination of materials shall be tested according to "Delamination procedure" in prEN 18120-11, Packaging — Design for recycling of plastic packaging — Part 11: Recyclability evaluation process for plastic packaging — Protocols for PET Rigid packaging (except bottles)	* Delamination of materials shall be tested according to "Delamination procedure" in prEN 18120-11, Packaging — Design for recycling of plastic packaging — Part 11: Recyclability evaluation process for plastic packaging — Protocols for PET Rigid packaging (except bottles)	-	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear **Pots, trays and other rigids**	**PET coloured** **Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b:** **PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
DECORATION | DIRECT PRINTING and INKS													
Without Printing / None inks	Without printing	Without printing	None	-	-	Preferred on lid if flexible or removable closure or label	Preferred on lid if flexible or removable closure or label	Preferred on lid if flexible or removable closure or label	No direct printing	-	-	-	-
Laser marked	DIRECT PRINTING ON PACK: Laser marked	DIRECT PRINTING ON PACK: Laser marked	Embossed / laser printing (minimal)	-	Laser marking for production or expiry date Any other laser marking	Laser marked	Laser marked	Laser marking for mandatory information such as production or expiry date	Laser marked	-	-	Laser marked	Laser marked
Production date	DIRECT PRINTING ON PACK: Production or expiry date mark	DIRECT PRINTING ON PACK: Production or expiry date mark	Minimal direct printing, e.g. production or expiry date	-	Production or expiry date directly applied on tray	-	-	-	Production or expiry date	-	-	Production or expiry date	Production or expiry date
Toxic or hazardous inks / EuPIA /NIAS	INK (ON LABEL, LID, CAP, SLEEVE): EuPIA Best pratice	EuPIA good pratice	EuPIA good manufacturing practices (for non food applications)	-	Retentive inks compliant with EuPIA Exclusion Policy applied on removable parts (lids & labels) PVC co- and terpolymer binders; any other chlorinated binders Inks non-compliant with EuPIA Exclusion Policy	Inks and coatings compliant with EuPIA Exclusion Policy for Printing Inks and Related Products. * Inks and coatings NOT compliant with EuPIA Exclusion Policy for Printing Inks and Related Products.	Inks and coatings compliant with EuPIA Exclusion Policy for Printing Inks and Related Products. * Inks and coatings NOT compliant with EuPIA Exclusion Policy for Printing Inks and Related Products.	Inks and coatings compliant with EuPIA Exclusion Policy for Printing Inks and Related Products. * Inks and coatings NOT compliant with EuPIA Exclusion Policy for Printing Inks and Related Products.	-	-	-	non-toxic; follow EUPIA Guidelines Toxic or hazardous inks	non-toxic; follow EUPIA Guidelines Toxic or hazardous inks
Washability	INK (ON LABEL, LID, CAP, SLEEVE): Not washable in water at 60-80°C in alkaline conditions (eg. Ink between 2 material layers or on the surface below a varnish layer) INK (ON LABEL, LID, CAP, SLEEVE) Washable (ex. surface printing)	DIRECT PRINTING ON PACK: Direct printing – not washable ink at 60-80°C, on PET packaging other than transparent green and opaque white DIRECT PRINTING ON PACK: Direct printing – washable ink at 60-80°C	-	Label Inks: Hot Caustic Resistant Ink used on Film Label Substrate that floats in water Label Inks: Wash off Inks used on Film Label Substrate that sinks in Direct Print Inks: Hot Caustic Resistant Ink	-	Inks*, lacquers*, varnishes* or coatings*, all of them shall be washable.	Inks*, lacquers*, varnishes* or coatings*, all of them shall be washable.	Inks*, lacquers*, varnishes* or coatings*, all of them shall be washable.	-	-	-	Washable inks	Washable inks
Bleeding inks	Avoid high bleeding inks	Avoid high bleeding inks	Inks that bleed and dye wash-solution	-	Bleeding inks	Bleeding inks	Bleeding inks	Bleeding inks	-	-	-	inks that bleed	inks that bleed
Metallic inks	Metallic inks	Metallized ink	-	-	-	-	-	-	-	-	Large-area (> 50% of the projected surface) applied metallic pigments (coating, lacquer, or embossing) *Testing for design-related material loss	Metallic inks	Metallic inks
Other direct printing	DIRECT PRINTING ON PACK: Any other direct printing	DIRECT PRINTING ON PACK: Direct printing on PET packaging transparent green or opaque white	Minimal direct printing, e.g. production or expiry date Printing inks that do not lead to NIAS after the washing process Extensive colour printing with printing inks that result in NIAS	-	Any direct printing on PET thermoform	Preferred on lid if flexible or removable closure or label Direct printing on the main body containing date coding and batch number Printing that inhibit NIR sorting by type of inks and surface coverage	Preferred on lid if flexible or removable closure or label Direct printing on the main body containing date coding and batch number Printing that inhibit NIR sorting by type of inks and surface coverage	Preferred on lid if flexible or removable closure or label Direct print in the main body Print that inhibit NIR sorting by type of inks and surface coverage	Any other direct printing	Main component: Direct printing with non-PVC-based binder Main component: Direct printing with PVC-based binder	Main Body: Direct printing (except for production code, best-before date, and UFI code)	Any other direct printing	Any other direct printing
Others Inks	-	-	-	-	-	Stay-on inks in reusable packaging for mandatory information at minimized size Inks that inhibit NIR sorting with a surface coverage higher than 50%. Inks with PVC based binders. Inks containing BPA.	Stay-on inks in reusable packaging for mandatory information at minimized size Inks that inhibit NIR sorting with a surface coverage higher than 50%. Inks with PVC based binders. Inks containing BPA.	Stay-on inks in reusable packaging for mandatory information at minimized size Inks that inhibit NIR sorting with a surface coverage higher than 50%. Inks with PVC based binders. Inks containing BPA.	-	-	> 50% fully black printed (including background color) using carbon black–based pigments* *Testing for design-related material loss	-	-
Comments	INK (ON LABEL, LID, CAP, SLEEVE): Avoid high bleeding inks and inks containing chlorine (Cl) or nitrogen (N).	-	-	-	-	*It is required to accomplish EuPIA Exclusion Policy for Printing Inks and Related Products and not contain hazardous substances that can harm recycling as expressed in red column.	*It is required to accomplish EuPIA Exclusion Policy for Printing Inks and Related Products and not contain hazardous substances that can harm recycling as expressed in red column.	*It is required to accomplish EuPIA Exclusion Policy for Printing Inks and Related Products and not contain hazardous substances that can harm recycling as expressed in red column.	Printing covering larger than 50% of the surface and/or use of dark colours: Testing the sorting behaviour by following the RecyClass Sorting Protocol is recommended	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear **Pots, trays** **and other rigids**	**PET coloured** **Pots, trays** **and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b:** **PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue** **PET bottles**	**Transparent coloured PET bottles**
CLOSURE SYSTEMS | CAPS / RIGIDS													
PET	CAP NOT SEALED/BONDED: Not printed transparent PET CAP SEALED/BONDED: Not printed transparent PET; peelable and/or with water releasable adhesive CAP SEALED/BONDED: - Not printed transparent PET; not peelable and with not water releasable adhesive - PET in association with a PET-based sealing layer ; not printed Colored, opaque or printed PET Copolyester (ex. PETG, PET-GAG, PET hot-fill)	CAP NOT SEALED/BONDED: PET, transparent or blue or transparent green, not printed CAP NOT SEALED/BONDED: - PET, transparent or blue or transparent green, printed - PET, all color except blue or transparent green, printed or not CAP SEALED/BONDED: PET, printed or not, peelable and/or with water releasable adhesive PET with mineral > 1%, printed or not	-	-	-	Closure/openings - rigid: PET - that fulfil all requirements of “Green/Full compatibility” of the main body Closure/openings - rigid: PET - that fulfil at least one requirement of “Yellow/Limited compatibility” of the main body Closure/openings - rigid: PET - that fulfil at least one requirement of “Red/Not compatible” of the main body	Closure/openings - rigid: Unprinted transparent PET matching main body of the packaging unit design criteria - Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PETG)	Closure/openings - rigid: Unprinted transparent PET matching main body of the packaging unit design criteria - Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PETG)	-	-	-	-	-
PE or PP	CAP NOT SEALED/BONDED: PP, PE and other plastics d<1 CAP SEALED/BONDED: PE or PP or other plastic d<1 ; peelable and/or with water releasable adhesive	CAP NOT SEALED/BONDED: PE or PP CAP SEALED/BONDED: PE or PP or other plastic d>1 ; peelable and/or with a water releasable adhesive	-	Polyolefin Closure: All components of closure float in water per PET-S-05 Polyolefin Closure: Any component of closure sinks in water per PET-S-05	-	Closure/openings - rigid: Printed or unprinted floating combination of polyolefins with density < 1 g/cm3	Closure/openings - rigid: Printed or unprinted floating combination of polyolefins with density < 1 g/cm3	Closure/openings - rigid: Printed or unprinted floating combination of polyolefins with density < 1 g/cm3	-	-	-	CLOSURE SYSTEMS: PE; PP; together all with density <1 g/cm^3 CLOSURE SYSTEMS: materials with density >1 g/cm^3 (e.g. highly filled PE; metals)	CLOSURE SYSTEMS: PE; PP; together all with density <1 g/cm132 CLOSURE SYSTEMS: materials with density >1 g/cm^3 (e.g. highly filled PE; metals)
Metal	Metal	Metal	-	Metal Closure: Categorized as APR Design Preferred or Detrimental to Recycling per SORT-S-03 Metal Closure: Untested or categorized Renders Package Non-Recyclable per SORT-S-03	-	-	-	-	-	-	-	CLOSURE SYSTEMS: materials with density >1 g/cm^3 (e.g. highly filled PE; metals)	CLOSURE SYSTEMS: materials with density >1 g/cm^3 (e.g. highly filled PE; metals)
PVC	PVC	included by: "Other plastics d>1 (alone or in blend)"	-	Non-polyolefin Closure: Made with or contains PVC Non-polyolefin Closure: Sink in water after granulation per PET-S-05	-	Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PVC; PS; PETG; PLA);	Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PVC; PS; PETG; PLA);	Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PVC)	-	-	-	-	-
Others	CAP NOT SEALED/BONDED: PP, PE and other plastics d<1 CAP SEALED/BONDED: PE or PP or other plastic d<1; peelable and/or with water releasable adhesive Others plastics mono or multi d>1 Wood	CAP NOT SEALED/BONDED: Other plastics d<1 CAP SEALED/BONDED: PE or PP or other plastic d>1 ; peelable and/or with a water releasable adhesive Other plastics d>1 (alone or in blend) Wood	-	Other closure	-	Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PVC; PS; PETG; PLA)	Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PVC; PS; PETG; PLA)	Closure/openings - rigid: Materials with density >1 g/cm^3 (e.g. PVC; PS; PETG; PLA)	-	-	-	CLOSURE SYSTEMS: materials with density >1 g/cm^3 non-detaching or welded closures	CLOSURE SYSTEMS: materials with density >1 g/cm^3 non-detaching or welded closures
Comments	-	-	No mention of caps	-	No mention of caps	-	-	-	No mention of caps	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear Pots, trays and other rigids	**PET coloured Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b: PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
CLOSURE SYSTEMS | LIDS / FLEXIBLE													
PET (Lids)	HEAT SEAL LID: Not printed transparent PET lid, peelable BONDED LID: Not printed transparent PET lid, peelable and/or with a water releasable adhesive	HEAT-SEALED LID: Printed lid, peelable BONDED LID: Printed or not PET lid, peelable and/or with a water releasable adhesive	LIDDING FILM: Easily removed by end user or easily removed early in the recycling process; or; as main polymer (PET)	-	Unprinted PET or BOPET films Foamed PET	Closure/openings - flexible: Printed or unprinted BOPET films and laminates*	Closure/openings - flexible: Printed or unprinted BOPET films and laminates*	Closure/openings - flexible: Unprinted PET or BOPET films	PET or BOPET films with no glue residuals (Glue Removal Test & Oven Test); Foamed PET	Label / Sealing film: Monolayer film/coextruded multilayer film made of PET (except PET-G), density > 1 g/cm³, unprinted and not lacquered	Label / Seal film: Monolayer film / coextruded multilayer film made of PET (except PET-G), density > 1 g/cm³, unprinted and unlacquered	-	-
	HEAT SEAL LID: Not printed transparent PET lid ; not peelable BONDED LID: Not printed transparent PET lid, not peelable and with a not water releasable adhesive									Label / Sealing film: Coextruded multilayer film made of PET (except PET-G)/PE, unprinted and not lacquered	Label / Sealing film: Coextruded multilayer film made of PET (except PET-G)/PE, unprinted and not lacquered		
						PETG	PETG	PETG; Foamed PET		Label / Seal film: Multilayer PET film, adhesive-laminated, density > 1 g/cm³, unprinted and unlacquered* *Testing for design-related material losses	Label / Seal film: Multilayer PET film, adhesive-laminated, density > 1 g/cm³, unprinted and unlacquered* *Testing for design-related material losses		
Paper (Lids)	HEAT SEAL LID: Mono or multi lid d<1, without metal (ex. plastic, plastic/paper) ; peelable BONDED LID: Mono or multi lid d<1, without metal ; peelable and/or with a water releasable adhesive (ex. plastic, plastic/paper)	HEAT-SEALED LID: Mono or multi lid d<1, without metal; peelable (ex. plastic, plastic/paper) BONDED LID: Mono or multi lid d<1, without metal ; peelable and/or with a water releasable adhesive (ex. plastic, plastic/paper)	-	Liner/-Safety Seal containing Paper	-	-	-	-	-	-	-	-	-
Metal/Aluminium (Lids)	HEAT SEAL LID: Mono or multi lid d<1 with metal (ex. plastic/alu, metallization) BONDED LID: Mono or multi lid d<1, with metal (ex. plastic/alu, metallization)	HEAT-SEALED LID: Mono or multi lid d<1, with metal (ex. plastic/alu, metallization) BONDED LID: Mono or multi lid d<1, with metal (ex. plastic/alu, metallization)	-	Liner/-Safety Seal containing Metal	-	-	-	-	-	-	-	-	-
	HEAT SEAL LID: Aluminium lid (peelable or not) BONDED LID: Aluminium lid (peelable or no, water releasable or not adhesive)	HEAT-SEALED LID: Aluminium lid (peelable or not) BONDED LID: Aluminium lid (peelable or not, water releasable or not adhesive)											
d < 1	HEAT SEAL LID: Mono or multi lid d<1, without metal (ex. plastic, plastic/paper); peelable BONDED LID: Mono or multi lid d<1, without metal ; peelable and/or with a water releasable adhesive (ex. plastic, plastic/paper)	HEAT-SEALED LID: Mono or multi lid d<1, without metal; peelable (ex. plastic, plastic/paper) BONDED LID: Mono or multi lid d<1, without metal ; peelable and/or with a water releasable adhesive (ex. plastic, plastic/paper)	-	Polyolefin Liner/-Safety Seal: Floats in water per PET-S-05	Floating plastics with density < 1 g/cm³ and easily removal from the tray and without glue residuals	Closure/openings - flexible: Printed or unprinted floating combination of polyolefins with density < 1 g/cm3	Closure/openings - flexible: Printed or unprinted floating combination of polyolefins with density < 1 g/cm3	Closure/openings - flexible: Printed or unprinted floating combination of polyolefins with density < 1 g/cm3	Floating combination of plastics with density < 1 g/cm³ (EPBP Sink/Float Test) with no glue residuals (EPBP Glue Removal Test & EPBP Oven Test)	Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, (removable without residue in alkaline hot wash, 80 °C)	Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, (removable without residue in alkaline hot wash, 80 °C)	-	-
	HEAT SEAL LID: Mono or multi lid d<1, not peelable BONDED LID: Mono or multi lid d<1, not peelable ; not peelable and with a not water releasable adhesive	HEAT-SEALED LID: Mono or multi lid d<1, not peelable BONDED LID: Mono or multi lid d<1, not peelable and with a not water releasable adhesive		Polyolefin Liner/-Safety Seal: Sinks in water per PET-S-05		Closure/openings - flexible: Printed or unprinted floating combination of polymers* with density < 1 g/cm3	Closure/openings - flexible: Printed or unprinted floating combination of polymers* with density < 1 g/cm3	Closure/openings - flexible: Printed or unprinted floating combination of polymers* with density < 1 g/cm3					
	HEAT SEAL LID: Mono or multi lid d<1 with metal (ex. plastic/alu, metallization) BONDED LID: Mono or multi lid d<1, with metal (ex. plastic/alu, metallization)	HEAT-SEALED LID: Mono or multi lid d<1, with metal (ex. plastic/alu, metallization) BONDED LID: Mono or multi lid d<1, with metal (ex. plastic/alu, metallization)	-	-	-	-	-	-	-	Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, not removable without residue in alkaline hot wash, 80 °C	Label / Sealing film: Mono/multilayer film incl. print and lacquer, density < 1 g/cm³, not removable without residue in alkaline hot wash, 80 °C	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear Pots, trays and other rigids	**PET coloured Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b: PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
Others	-	-	LIDDING FILM: Easily removed by end user or easily removed early in the recycling process LIDDING FILM: Removed later in the recycling process (washing process)	Removable Closure Liner or Safety Seal Non-Polyolefin Liner/-Safety Seal: Sinks in water per PET-S-05	-	Liners: none	-	Liners: PE; PE+EVA; EVA; EMA; PP; TPO; EPE and EPP all with density <1g/cm³ Liners: Floatable Silicon (density <1g/cm3)	-	-	Seal film: Additives in PET-A/PET-C: AA-Blocker Anti-Block Nanocomposite Oxygen Scavenger (PA free) UV stabilisators	-	-
	HEAT SEAL LID: Mono or multi lid d>1 (except not printed transparent PET, peelable) BONDED LID: Mono or multi lid d>1 (except not printed transparent PET, peelable)	HEAT-SEALED LID: Mono or multi lid d>1 (except peelable PET) BONDED LID: Mono or multi lid d>1 (except peelable PET and/or with a water releasable adhesive)	-	Non-Polyolefin Liner/-Safety Seal: Made with or contains PVC	Any other film	-	Closure/openings - flexible: Closure/openings with density >1 g/cm³ (e.g. PVC; PS; PETG; PLA)	Liners: Materials with density >1gr/cm3 (eg. PVC, silicon, metals) silicone (even with density <1g/cm3). Foamed PET. Any other floatable or non-floatable Materials with density >1 g/cm³ (e.g. PVC; PS; PETG; PLA)	Any other sinking film with density > 1 g/cm3 (Sink/Float-Test)	Label / Seal film: Mono-/multilayer film including printing and coating, density > 1 g/cm³	Label / Seal film: Mono-/multilayer film including printing and coating, density > 1 g/cm³ Seal film: Additives in PET-A/PET-C: PA additivation; other blended barriers	-	-
Barrier /Coatings (Lid)	-	-	-	-	SiOx and AlOx plasma for barrier on lid	SiOx, AluOx plasma or < 10 wt% EVOH if used together with 2wt% compatibilizer in addition to the tie layer (PE-g-MAH)	SiOx, AluOx plasma or < 10 wt% EVOH if used together with 2wt% compatibilizer in addition to the tie layer (PE-g-MAH)	-	-	Sealing film (density < 1 g/cm³): Coatings AlOx SiOx EVOH coating Seal film: acryl based coating; other coatings	Seal film: AlOx SiOx Seal film: acryl based coating; other coatings	-	-
Comments	HEAT SEAL LID: Promote a sealable layer remaining mainly on the lid Favor a polyester-based sealable layer. Further studies should be carried out on sealable layer and their potientiels impacts on the quality of rPET, especially for food contact application BONDED LID: Favor an adhesive that is removable during washing and/or remains mainly on the lid. Further studies should be carried out on adhesives and their potientiels impacts on the quality of rPET, especially for food SKIN: Limited information available to date. Specific study needs to be carried out. FLOWPACK, STRETCHABLE FILM: See flexible packaging guidelines because they are not mechanically bonded (no adhesive, not welded together, etc.) and their separation is necessary when consuming the product.	HEAT SEAL LID: Promote a sealable layer remaining mainly on the lid Further studies should be carried out on sealable layer and their potientiel impacts on the quality of rPET, especially for food contact application Given the lack of a dedicated line, lidded PET trays are currently not recyclable in France BONDED LID: Promote a sealable layer remaining mainly on the lid Further studies should be carried out on sealable layer and their potientiels impacts on the quality of rPET, especially for food contact SKIN: Limited information available to date. Specific study needs to be carried out. FLOWPACK, STRETCHABLE FILM: See flexible packaging guidelines because they are not mechanically bonded (no adhesive, not welded together, etc.) and their separation is necessary when consuming the product	-	-	-	* PE includes also EVA, EMA, EEA and EBA and PE-g-MAH as a tie layer	* PE includes also EVA, EMA, EEA and EBA and PE-g-MAH as a tie layer	* PE includes also EVA, EMA, EEA and EBA and PE-g-MAH as a tie layer	-	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear Pots, trays and other rigids	**PET coloured Pots, trays and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b: PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
OTHER ATTACHMENTS													
Absorbent pad/insert	Absorbent pad d<1 (e.g. fruit PE) ; not sealed/bonded or with a water releasable adhesive Absorbent pad d>1 (ex. PE/Cellulose) Other absorbent pads	-	*s. below inserts in general*	-	Soaker pads & bubble pads easily removable by hands Soaker pads not hindering recognition of the underlaying PET polymer by covering less than 50% of the back of the tray (sorting test mandatory above 50% coverage) Black soaker pads (sorting test) Soaker pads & bubble pads not easily removable by hands or leaving residue glue	Porous enabling liquid retention as substitution of soaker pad Inserts in HDPE / LDPE / PP, Soaker pads*, bubble pads and paper & carboard* - all shall be completely removable Glued soaker pads or non-compliant soaker pads	Porous enabling liquid retention as substitution of soaker pad Inserts in HDPE / LDPE / PP, Soaker pads*, bubble pads and paper & carboard* - all shall be completely removable Glued soaker pads or non-compliant soaker pads	Porous enabling liquid retention as substitution of soaker pad Inserts in HDPE / LDPE / PP, Soaker pads*, bubble pads and paper & carboard* - all shall be completely removable and leave no glue traces Glued soaker pads or non-compliant soaker pads	Soaker pads & bubble pads easily removable by hands Soaker pads not hindering recognition of the underlaying PET polymer by covering less than 50% of the back of the tray (sorting test mandatory above 50% coverage) Black soaker pads (sorting test) Soaker pads & bubble pads not easily removable by hands or leaving residue glued	Absorbent PE, density < 1 g/cm^3 PP, density < 1 g/cm^3 XPS, density < 1 g/cm^3 Cellulose	Absorbent insert / Air-cushion insert: Cellulose PE, density < 1 g/cm^3 PP, density < 1 g/cm^3 XPS, density < 1 g/cm^3 Absorbent material	-	-
Metal/Aluminiumn (other Attachments)	Metal	Aluminium element	INSERTS: Metallic	-	Metals	Components made of metals Tamper evidence components: metallized materials	Components made of metals Tamper evidence components: metallized materials	Components made of metals Tamper evidence components: metallized materials	Metal components	-	-	materials with density >1 g/cm^3 (e.g. metal, RFID tags); non-detaching or welded components	-
PA (other Attachments)	-	-	INSERTS: PA (Nylon)	-	PA	Components made of PA (Nylon)	Components made of PA (Nylon)	Components made of PA (Nylon)	PA (Nylon)	-	-	-	-
Paper/Cardboard (other Attachments)	Cardboard unglued for blister Cardboard glued for blister	Blotting paper d<1 with or without water releasable adhesive Blotting paper d<1 with a line of not water releasable adhesive Adhesive free cardboard for blister Blotting paper d>1 Glued cardboard for blister	INSERTS: Paper	Paper Attachments	Paper & cardboard not loosing fibres Paper & cardboard loosing fibres	Paper & cardboard* - all shall be completely removable	Paper & cardboard* - all shall be completely removable	Paper & cardboard* - all shall be completely removable	Paper and cardboard not loosing fibres inserts Paper and cardboard loosing fibres inserts				
PC (other Attachments)	-	-	INSERTS: PC	-	PC/PMMA	Components made of PC	Components made of PC	Components made of PC	PC/PMMA	-	-	-	-
PE or PP (other attachments)	included by: "Element d<1 ; not sealed/bonded or with a water releasable adhesive"	included by: "Element d<1 not bonded or with a water releasable adhesive"	INSERTS: HDPE / LDPE	-	Inserts in HDPE / LDPE / PP like Soaker pads, bubble pads (all inserts should be completely removable, leave no traces and have a density of <1 g/cm^3)	Tamper evidence components: PE; PP; OPP; all with density <1 g/cm^3 Seals/valves: PE; PE+EVA; PP; TPO; all with density <1g/cm^3; TPS all with density <0.95g/cm3 Inserts in HDPE / LDPE / PP - all shall be completely removable	Tamper evidence components: PE; PP; OPP; all with density <1 g/cm^3 Base cup, handles or other components made of PE or PP which are separated by grinding and float/sink - all with density <1 g/cm^3 Inserts in HDPE / LDPE / PP - all shall be completely removable	Tamper evidence components: PE; PP; OPP; all with density <1 g/cm^3 Base cup, handles or other components made of PE or PP which are separated by grinding and float/sink all with density <1 g/cm^3; Inserts in HDPE / LDPE / PP - all shall be completely removable	Inserts in HDPE; LDPE; PP removable without traces and density < 1 g/cm^3	-	-	-	-
PET (other attachments)	Not printed transparent PET ; not sealed/bonded or with a water releasable adhesive Not printed transparent PET ; bonded or with a not water releasable adhesive Colored or printed PET Copolyester (PETG, PET-GAG, PET hot-fill)	PETG, PS, PLA elements	INSERTS: PET	-	-	Tamper evidence components: Materials with density >1 g/cm^3 (e.g PETG); Foamed PETG (even with density <1 g/cm^3) PET - that fulfil all requirements of "Green/Full compatibility" of the main body Transparent clear or light blue PET attachments. PET - that fulfil at least one requirement of "Yellow/Limited compatibility" of the main body PET - that fulfil at least one requirement of "Red/Not compatible" of the main body	Tamper evidence components: Materials with density >1 g/cm^3 (e.g PETG); Foamed PETG (even with density <1 g/cm^3) PET - that fulfil all requirements of "Green/Full compatibility" of the main body Transparent clear or light blue PET attachments. PET - that fulfil at least one requirement of "Yellow/Limited compatibility" of the main body PET - that fulfil at least one requirement of "Red/Not compatible" of the main body	Tamper evidence components: Materials with density >1 g/cm^3 (e.g PETG); Foamed PETG (even with density <1 g/cm^3) PET - that fulfil all requirements of "Green/Full compatibility" of the main body PET - that fulfil at least one requirement of "Yellow/Limited compatibility" of the main body PET - that fulfil at least one requirement of "Red/Not compatible" of the main body	-	-	-	unpigmented PET coloured PET	PET
PMMA (Acrylic) (other attachments)	-	-	INSERTS: PMMA (Acrylic)	-	PC/PMMA	Components made of PMMA	Components made of PMMA	Components made of PMMA	PC/PMMA	-	-	-	-

	COTREP		RECOUP	APR	RecyClass	CEN/TC 261 FprEN 18120 5:2024 Packaging — Design for recycling of plastic packaging — Part 5: Guideline for PET rigid packaging (except bottles)			RecyClass (Tool)	CHI Requirements and assessment catalogue	ZSVR Minimum standard (aus dem Deutschen übersetzt)	EPBP	
	PET clear **Pots, trays** **and other rigids**	**PET coloured** **Pots, trays** **and other rigids**	**PET Trays**	**PET rigid**	**Transparent Clear PET Thermoforms**	**Table 1 — Design Guidelines for Clear Monolayer Monomaterial PET rigid packaging (except bottles)**	**Table 2 — Design Guidelines for Clear Multilayer PET rigid packaging (except bottles)**	**Table 3 — Design Guidelines for Color rigid PET packaging (except bottles)**	**PET tray stream transparent monolayer (clear PET thermoforming trays)**	**Path 5b:** **PET trays**	**Thermoforms made of PET-A, PET-C – rigid (transparent, clear/colored, opaque) | Reference application: Thermoforms (contact-sensitive)**	**Transparent clear / light blue PET bottles**	**Transparent coloured PET bottles**
PS (other attachments)	-	PS	INSERTS: PS, EPS	-	PS, EPS	Tamper evidence components: Materials with density >1 g/cm³ (e.g PS); Components made of PS / EPS	Tamper evidence components: Materials with density >1 g/cm³ (e.g PS); Components made of PS / EPS	Tamper evidence components: Materials with density >1 g/cm³ (e.g PS); Components made of PS / EPS	PS; EPS	-	-	-	-
PU (other attachments)	-	-	INSERTS: PU	-	PU	Components made of PU	Components made of PU	Components made of PU	PU	-	-	-	-
PVC (other attachments)	PVC	PVC	INSERTS: PVC	-	PVC	Tamper evidence components: Materials with density >1 g/cm³ (e.g PVC) Components made of PVC	Tamper evidence components: Materials with density >1 g/cm³ (e.g PVC) Components made of PVC	Tamper evidence components: Materials with density >1 g/cm³ (e.g PVC) Components made of PVC	PVC components	-	-	-	-
RFID	RFID	RFID	-	RFID Attachments	-	-	-	-	-	-	-	materials with density >1 g/cm³ (e.g. metal, RFID tags)	materials with density >1 g/cm³ (e.g. metal, RFID tags)
Silicone (other Attachments)	-	-	-	-	-	Seals/valves: Floatable Silicon* (density <1g/cm3) Seals/valves: Non floatable Silicon	Seals/valves: Floatable Silicon (density <1g/cm3) -	Seals/valves: Floatable Silicon (density <1g/cm3) Seals/valves: Non floatable Silicon	-	-	-	-	-
Thermoset plastics (other attachments)	Thermosed plastics	Thermosed plastics	INSERTS: Thermoset plastics	-	Thermoset plastics	Components made of thermoset plastics	Components made of thermoset plastics	Components made of thermoset plastics	Thermoset plastics	-	-	-	-
Other	Element d<1 ; not sealed/bonded or with a water releasable adhesive	Element d<1 not bonded or with a water releasable adhesive Welded or bonded elements with a not water releasable adhesive	INSERTS: Must be fully removable without leaving a trace* *No additives or processes should result in not intentionally added substances (NIAS) as this would contaminate food grade recycled content	If polymers used for PET attachments meets criteria listed in Base Resin section Non-Welded Polyolefin Attachments: All components of an attachment float in water per PET-S-05 Non-Welded Polyolefin Attachments: Any component of an attachment sinks in water per PET-S-05 Welded Non-PET Attachments	-	No other components preferred. Seals/valves. PE; PE+EVA; PP; TPO; all with density <1g/cm³; TPS all with density <0.95g/cm3 Materials with density >1 g/cm³ (e.g metal; PVC; PS; PETG)	No other components preferred. - Tamper evidence components: Materials with density >1 g/cm³ (e.g metal; PVC; PS; PETG)	No other components preferred. - Tamper evidence components: Materials with density >1 g/cm³ (e.g metal; PVC; PS; PETG)	-	-	-	base cup, handles or other components which are separated by grinding and float/sink - all with density <1 g/cm³; materials with density >1 g/cm³ (e.g. metal, RFID tags); non-detaching or welded components;	base cup, handles or other components which are separated by grinding and float/sink - all with density <1 g/cm³; -
Comments	Washable in water at 60-80°C in alkaline conditions Favor a detachable adhesive remaining mainly on the associated element (absorbent pad or other element). Project to be studied : Absorbent pad. Guidelines are likely to evolve.	-	-	-	-	* It is required to accomplish EuPIA Exclusion Policy for Printing Inks and Related Products and not contain hazardous substances that can harm recycling as expressed in red column.							
OTHERS													
PRODUCT RESIDUES	-	-	-	-	A if the index is < 5%; B if the index is < 10% C if the index is < 15% Index is >= 15 %	- - -			Index < 5 Index > 10: downgraded by 1 class Index > 10: downgraded by 2 classes Index > 15 %	-	-	-	-
Other design parameters	-	-	-	-	-	-	-	-	-	Structure: Different types of plastic on the front and back sides* *Testing for design-related material loss	Structure: Different types of plastic on the front and back sides* *Testing for design-related material loss	-	-
PFAS	-	-		-	-	-	-	-	-	PFAS coating ≥ threshold according to article 5, paragraph 5 PPWR	PFAS content in food-contact packaging ≥ limit value according to Article 5(5) of the PPWR	-	-