



Factsheet 12 | How can the recyclability of packaging be increased?

This factsheet outlines the key factors that determine how recyclable packaging is, such as packaging design. It then goes on to describe how EPR schemes relate to packaging producers, fillers and recycling companies.

To ensure recycling of as much packaging as possible, waste has to be collected, sorted and transferred to recycling plants equipped to carry out the recycling processes required. It is also crucial that packaging should be recyclable by design. However, it is worth remembering that if there are no comprehensive, reliable systems for collecting, sorting and recycling > See Factsheets 06, 07 and 11 packaging in a given country, there is no point in trying to make packaging more recyclable, because everything will be disposed of in landfill or dumpsites, or simply left to litter the environment.

If an EPR system is set up, and recycling targets are set in the accompanying legal framework, obliged companies are increasingly forced to take action to increase the recyclability of their packaging. This can pose a challenge, particularly for regional and/or smaller producers and importers. Large multinational producers and importers are already addressing this issue, and can help ensure that the appropriate information is made available in the country concerned. Experts can also help to redesign packaging used by producers.

Recyclability of packaging

Defining recyclability and how to measure it

Recycling is an essential prerequisite for a circular economy and the sustainable use of natural resources. The first step in facilitating it should be taken when packaging is first designed. Packaging designers need to consider a number of factors, including how to make the packaging as recyclable as possible at the end of the in-use phase. Their decisions should be informed by the existing collection, sorting and recycling infrastructure available in the relevant country or region.

This poses the question of how to assess the recyclability of packaging. Objective information on how easy or difficult a given type of packaging is to recycle must be based on verified, clear and transparent requirements and assessment criteria.



Various different approaches to this problem are currently being discussed at European level. The overarching aim is to harmonise the criteria for assessing recyclability. This is a relatively difficult task, because standards for collecting, sorting and recycling waste vary significantly between the various Member States of the European Union. Although it is possible to draw up uniform criteria for 'design for recycling', packaging is only 'recyclable' in practice where the appropriate systems for collecting, sorting and recycling packaging are in place.

With this in mind, the two terms can be defined for our purposes as follows:

- 'Design for recycling' is used to refer to packaging that fulfils all the key criteria for recyclability provided the necessary infrastructure is in place. Without this infrastructure, packaging cannot be described as recyclable regardless of how well it is designed.
- 'Recyclability' depends on the composition of the packaging (whether it meets the requirements of design for recycling) and the actual recycling options available once it has been used.

In addition, for the purposes of this factsheet, the term 'recyclability' refers to high-quality, mechanical recycling. This definition of recyclability describes the ability of any given packaging to substitute for virgin raw materials in typical applications following industrial recovery processes. If it can replace new raw materials, it is recyclable. By the same token, this means that packaging is not recyclable if it can only be used for energy recovery, and biodegradable packaging is not included in our definition of recyclability either. The question of how materials should be classified that can only be recycled through chemical recycling processes, is still being debated, since the processes are still in development.

Recyclability has been an important issue in Europe in recent years. In France, Italy and Germany there is a legal requirement to take recyclability into account when setting EPR fees. Experts and system operators have drawn up various standards in this regard.

However, packaging that is recyclable in Western Europe, for example, might not be recyclable in other parts of the world. This is why recyclability always depends on local circumstances and the conditions in the area concerned. That said, there are some general principles that can be applied to improve recyclability regardless of local conditions, such as reducing the number of different materials used in individual items and making sure materials are easy to identify and separate. Reducing the variety of materials used and making sure they can be easily separated will always improve recyclability, wherever you are in the world.

How to make packaging more recyclable

In order to improve the recyclability of packaging, it is very important that sorting and recycling companies build close working relationships with raw material suppliers and packaging manufacturers, and that they exchange information and knowledge freely. Recycling and sorting companies should have full details of the composition and material properties of the relevant packaging so that they can handle it in the most appropriate way. On the other hand, raw material suppliers and packaging manufacturers need to know about recycling methods in order to improve their packaging designs.

The examples below demonstrate a number of ways in which recyclability can be improved:

Example 1 shows how recyclability can be improved by swapping a full-size sleeve for a small label. The bottle with the full sleeve cannot be identified using infrared scanners as part of mechanical separation systems, but the bottle with the smaller label will be easily spotted by the scanners.



Figure 1: Full sleeve vs partial sleeve (© Institut cyclos-HTP 2020, own representation)

Example 2 shows what happens to recyclability when a SiO_x plasma coating is added to the barrier layer of a fruit juice bottle.

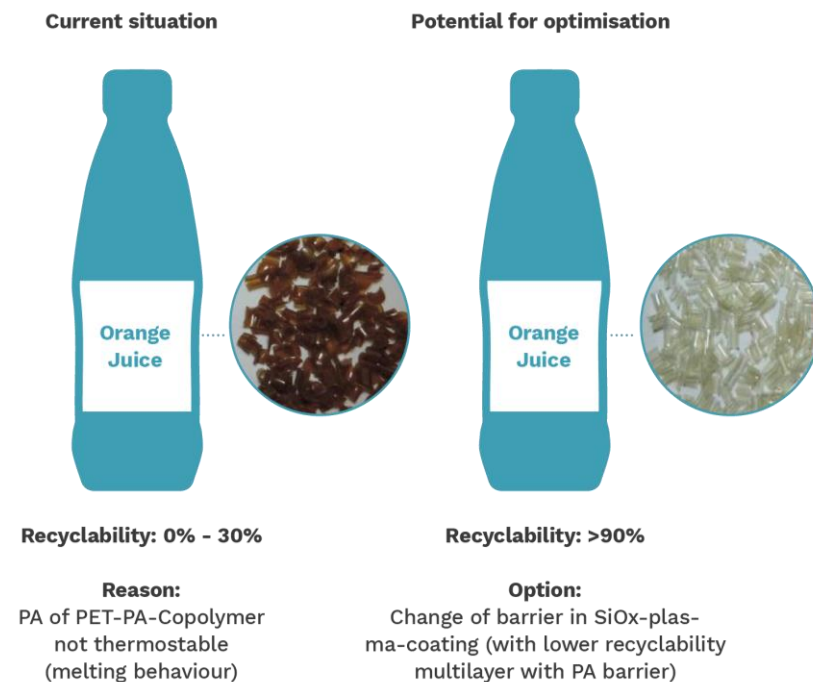


Figure 2: Barrier layers compared (© Institut cyclos-HTP 2020, own representation)

These two examples show that the recyclability of an item often depends on some very specific factors, and they must be considered on an individual basis in order to identify potential improvements.

How to draw up standards for recyclability

The PRO has an important role to play in improving recyclability, as it can use modulated EPR fees to encourage efforts to make packaging more recyclable. > See Factsheet 03 Despite countless efforts to establish uniform criteria for assessing recyclability, different PROs still take different approaches, as demonstrated by the examples below.

For instance, in Germany, a **minimum standard for recyclability has been published**¹. This standard includes a list of which properties makes packaging recyclable and which properties can prevent packaging from being recycled. The standard sets out minimum requirements on assessing recyclability in the context of fee modulation, directed at PROs. To ensure that all EPR systems use the same basic framework for assessing recyclability (as defined in Section 21 (1) (1) and Section 21 (3) of the German Packaging Act – *Verpackungsgesetz*), the agreed standard is officially published by the Central Agency Packaging Register (ZSVR), in consultation with the German Environment Agency. Although these standards have been developed for the German system, this approach could also be applied to other countries to make packaging easier to recycle. > See Country Report Germany

Table 1: Material types, material groups and recycling paths (Information based on German minimum standard⁴; representation based on own modification)

Material Group	Good material description	Disqualification	Recyclable material
Film	System-compatible articles made from plastic film, surface area > A4 in size, like bags, carrier bags and shrink-wrap, including ancillary components such as labels, etc.	Aluminised plastics are disqualified	LDPE (PO) share
PP	Rigid, system-compatible plastic articles made from PP, ≤ 5l in volume, like bottles, trays and cups, including ancillary components such as closures, labels, etc.	Sealant cartridges are disqualified	PP (PO) share
PE	Rigid, system-compatible plastic articles made from PE, ≤ 5l in volume, like bottles and trays, including ancillary components such as closures, labels, etc.	Sealant cartridges are disqualified	HDPE (PO) share
PS share	Rigid, system-compatible plastic articles made from PS, ≤ 1l in volume, like cups and trays, including ancillary components such as closures, labels, etc.	Foamed plastics, including EPS articles, are disqualified	PS share
PET bottles transparent	Rigid, system-compatible articles made from PET, ≤ 5l in volume. Includes ancillary components such as closures, labels, etc. Examples include bottles containing beverages, detergent and household cleaning agents.	Opaque PET bottles and other PET articles are disqualified	PET-A share, transparent; PO from closures
Beverage cartons	System-compatible retail packaging made from cardboard composite materials, consisting of cardboard/PE or cardboard/aluminium/PE, for liquid and paste product filling, including ancillary components such as closures, etc	Other articles from paper, paper board or cardboard are disqualified	Fibrous material share

¹ Minimum standard for determining the recyclability of packaging included in the EPR system, pursuant to Section 21 (3) of the *Verpackungsgesetz* (German Packaging Act) https://www.verpackungsregister.org/fileadmin/files/Mindeststandard/2020-01-22_Mindeststandard_VerpackG_EN.pdf

Material Group	Good material description	Disqualification	Recyclable material
Tinplate	System-compatible articles made from tinplate, like beverage or food cans and buckets, including ancillary components such as labels, etc		Steel share
Aluminium	System-compatible articles made from aluminium or containing aluminium foil, like trays and wrapping film, including ancillary components such as closures, labels, etc		Aluminium share

The minimum standard for determining recyclability in Germany also includes a summary of packaging groups/types and specific materials that prevent them from being recycled. Some examples are given in the table below:

Table 2: Overview of packaging groups/types and materials that prevent them from being recycled (Information based on German minimum standard¹; representation based on own modification)

Group/sort	Incompatibilities
Film and PE-LD	Water-insoluble adhesive applications in combination with wet-strength labels, PA barriers, PVDC barriers, non-polymer barriers (excluding SiOx/AlOx/metallisations), non-EVOH barriers
Rigid PE	Silicone components, components of foamed non-thermoplastic elastomers, water-insoluble adhesive applications in combination with wet-strength labels, PA barriers; PE-X components, PVDC barriers, non-PO plastics with a density of < 1 g/cm
Rigid PP	Silicone components, components of foamed non-thermoplastic elastomers, water-insoluble adhesive applications in combination with wet-strength labels, PA barriers, PVDC barriers, non-PO plastics with a density of < 1 g/cm ³
Rigid PS	Foreign plastics or multi-layers with a density of 1.0-1.08 g/cm ³ ; water-insoluble adhesive applications in combination with wet-strength labels
Transparent PET bottles	PET-G components; POM components; PVC components; EVOH barriers; silicone components, PA monolayer barriers for transparent PET bottles, colourless and 'light blue'; PVC labels/sleeves, PS labels/sleeves, PET-G labels/sleeves; other blended barriers; PA additives for transparent PET bottles, colourless and 'light blue'; insoluble adhesive applications (in water or alkaline at 80° C); non-magnetic metals; elastomer components with a density of > 1 g/cm ³ ; direct print (excluding production codes and 'best before' dates)
Glass	Lead and barium from crystal glass packaging

An example of how fees can be varied based on recyclability

Some countries choose another way to improve recyclability. The criteria are very clear because there is a detailed list of all the packaging and materials that are considered recyclable or not under the present system.

For example: packaging with no recycling possibility are ceramics or PVC packaging while efficient recycling possibilities exist for paper-cardboard, steel, aluminium, glass and PE/PP/PET bottles. It

is also possible to have a third category for recycling facilities in the process of development (e.g. for flexible plastics).

A bonus-malus approach can be additionally applied depending on the categorisation.

In addition to this example, other institutions are working with their own assessment frameworks (see Table 3).

Table 3: Assessment frameworks and Design-for-Recycling (DfR) Guidelines (Source: Institute cyclos-HTP 2018, internal document, own representation)

	DIN EN 13430	Institut Cyclos-HTP	RecyClass	RECOUP	European PET Bottle Platform
Type	Assessment catalogues	Assessment catalogues	Assessment catalogues + DfR guidelines	DfR guidelines	DfR guidelines
Scope	All packaging	All packaging	Plastic packaging	Plastic packaging	PET bottles
Applies to	EU	EU	EU	International standard (focused on Europe, USA)	EU
Reference standards	Various, including CR 14311, EN 13437	DIN EN ISO 14021; DIN EN 13430	-	-	-
Definition of recyclability	YES	YES	-	-	-
Object of assessment	Complete packaging	Complete packaging*	Complete plastic packaging	Single components of plastic packaging	Single components of plastic packaging
Assessment parameters	Material recyclability on a sliding scale (0-100%)	Recyclability on a sliding scale (0% - 100%)	Recyclability on a pegged scale (A to F)	Recycling compatibility on an extended binary scale (traffic light system)	Recycling compatibility on an extended binary scale (traffic light system)
Set point to quantify recyclability	Delivery for reprocessing	Recyclate	Recyclate	-	-
Benchmark	New packaging	New packaging	New packaging	New packaging	New packaging

	DIN EN 13430	Institut Cyclos-HTP	RecyClass	RECOUP	European PET Bottle Platform
Basis of assessment	Packaging components	Packaging specification and empirical analysis	Packaging specification and questionnaire	Classification based on defined material-specific indicators	Classification based on defined material-specific indicators and quick tests
Cross-references	none	Recoup RecyClass DIN EN 13430	EPBP	EPBP, COTREP, PRE, Eco Emballages, ...	PRE, COTREP, ...
Testing and assessment criteria	Process-step based, starting with production	Process-step based, starting at after-use stage of product cycle	see DfR guidelines	Not explicitly stated. In practice, criteria are derived from the process-specific qualitative and quantitative requirements for recycling and, to a lesser extent, sortability	

Key readings and other sources



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Video series:

EPR Explained! (12) Recyclability of packaging

Institute cyclos-HTP (2019). Verification and examination of recyclability. Available at [http://cyclos-htp.de/fileadmin/user_upload/2019_Katalog/Verification and examination of recyclability - Revision 4.0.pdf](http://cyclos-htp.de/fileadmin/user_upload/2019_Katalog/Verification_and_examination_of_recyclability_-_Revision_4.0.pdf)

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<http://www.conai.org/en/businesses/environmental-contribution/>

Imprint

Published by:

Deutsche Gesellschaft für Internationale
Zusammenarbeit (GIZ) GmbH
PREVENT Waste Alliance
Friedrich-Ebert-Allee 32 + 36
53113 Bonn
Germany

Tel. +49 61 96 79-0
Fax +49 61 96 79-11 15

info@giz.de

contact@prevent-waste.net

www.giz.de

<https://prevent-waste.net/en/epr-toolbox/>

cyclos GmbH
Westerbreite 7
49084 Osnabrück
Germany
<https://cyclos.de>

Authors:

Agnes Bünemann, Jana Brinkmann, Dr. Stephan Löhle and Sabine Bartnik.

Credit design cover photo & figures: creative republic Frankfurt

For more details on copyrights:

https://prevent-waste.net/downloads/PREVENT_EPRToolbox_Distribution.pdf

Bonn, Germany 21 September 2020 (video series: EPR Explained! published in July 2021)