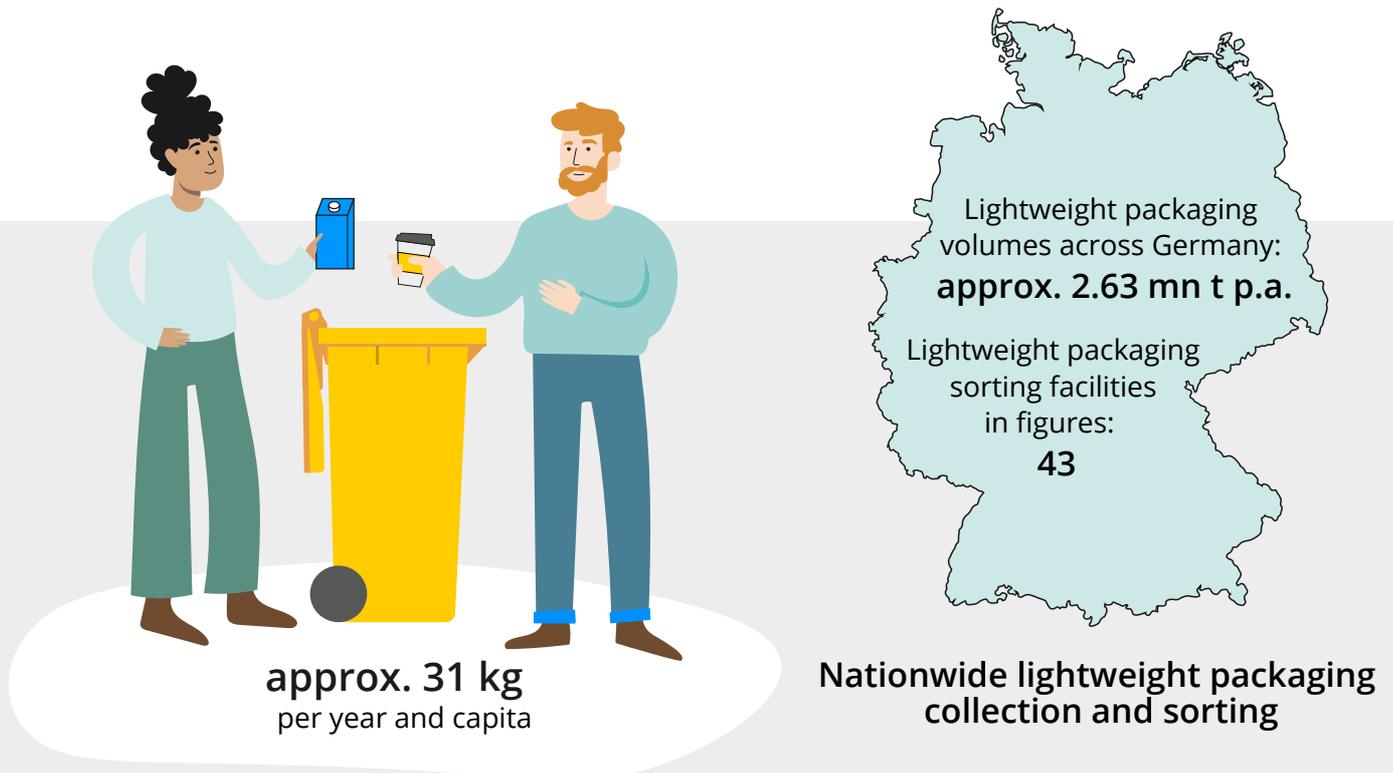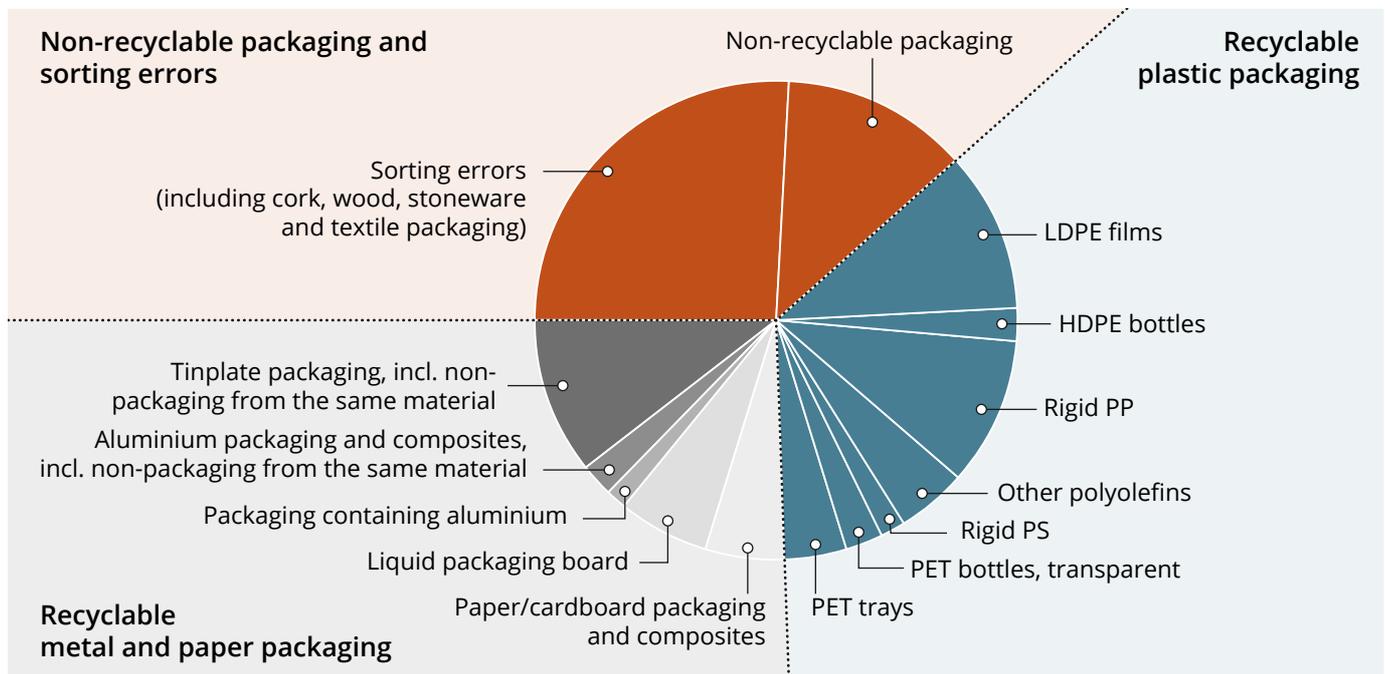# Sorting lightweight packaging

Germany's dual systems commission the collection of more than 2.63 million tonnes of waste in yellow bags and bins in Germany annually. Effective sorting facilities are the key to recovering this collected mix.

Lightweight packaging volumes across Germany:
approx. 2.63 mn t p.a.

Lightweight packaging sorting facilities in figures:
43

approx. 31 kg
per year and capita

Nationwide lightweight packaging collection and sorting

The collected mix contains not only recyclable packaging made from various materials (such as plastics, tin-plate, aluminium, plastic composites, paper/plastic composites, liquid packaging board) but also sorting errors and non-recyclable packaging from all material groups. Sorting facilities use special technologies to sort out these contaminations. For recyclable packaging, modern sorting facilities achieve sorting rates of more than 95%, providing the foundation for high-quality recycling.

Sorting rates using state-of-the-art technology

Non-recyclable packaging and sorting errors

Non-recyclable packaging

Recyclable plastic packaging

Sorting errors (including cork, wood, stoneware and textile packaging)

LDPE films

HDPE bottles

Tinplate packaging, incl. non-packaging from the same material

Rigid PP

Aluminium packaging and composites, incl. non-packaging from the same material

Other polyolefins

Packaging containing aluminium

Rigid PS

Liquid packaging board

PET bottles, transparent

Paper/cardboard packaging and composites

PET trays

Recyclable metal and paper packaging

The technology being used today in sorting facilities makes it possible to achieve very high sorting rates (relative to the packaging in the collected mix) for packaging made of the following materials:

Plastic packaging (where designed for recyclability):	> 95 %
Liquid packaging board:	> 95 %
Aluminium packaging:	> 95 %
Tinplate packaging:	> 99 %

Figure: Sortability of packaging collected in the yellow bag or bin; source: CHI Institut cyclos-HTP; last updated: December 2025

1 Which sorting technologies and devices are used in sorting facilities?

Packaging waste is largely sorted automatically in up to 17 sorting fractions. Plastic packaging is typically sorted by type of plastic and packaging. Modern sorting facilities use different technologies and machines. Sieving and air-stream sorting technologies and sensor-based sorting machines (e. g. near-infrared detection) ensure that packaging waste made from many different materials is sorted and transferred for recovery.

Modern sorting facilities use the following separation processes:

— 4 to 5 sieving machines separate packaging waste by size, using different mesh sizes.
— 5 air classifiers separate light materials via air flows.
— 5 ballistic separators use mobile paddles to separate waste by format into flexible, rigid and fine components.
— 4 to 5 magnetic separators separate ferrous components using a magnetic field.
— 2 to 3 eddy current separators separate non-ferrous metals using a rotating magnetic field.
— 27 to 50 near-infrared (NIR) separators for plastics and 4 to 6 NIR separators for fibre-based packaging separate waste components using infrared reflection.

Sorting quality relies not only on the technical processes used in sorting facilities but also on packaging that is designed for recylability. Material property, design (e.g. colour, composite materials) and labels are decisive factors that enable – or prevent – sensors from identifying packaging and allocating it to the correct material flows.

Black packaging in the sorting process

While black packaging is generally considered non-sortable, it is not the dark colour itself that matters but the type of pigments used. Where carbon black is contained in the colour, it prevents the reflection of near-infra-red (NIR) radiation. As a result, optical sorting systems will be unable to identify the packaging. This may also apply to other shades of colour if they contain carbon black pigments: grey, dark blue, olive or brown.

Near-infrared identification of a black PE bottle

| Dyed black, using carbon black; non-sortable | Non-carbon black colour pigments; fully sortable |
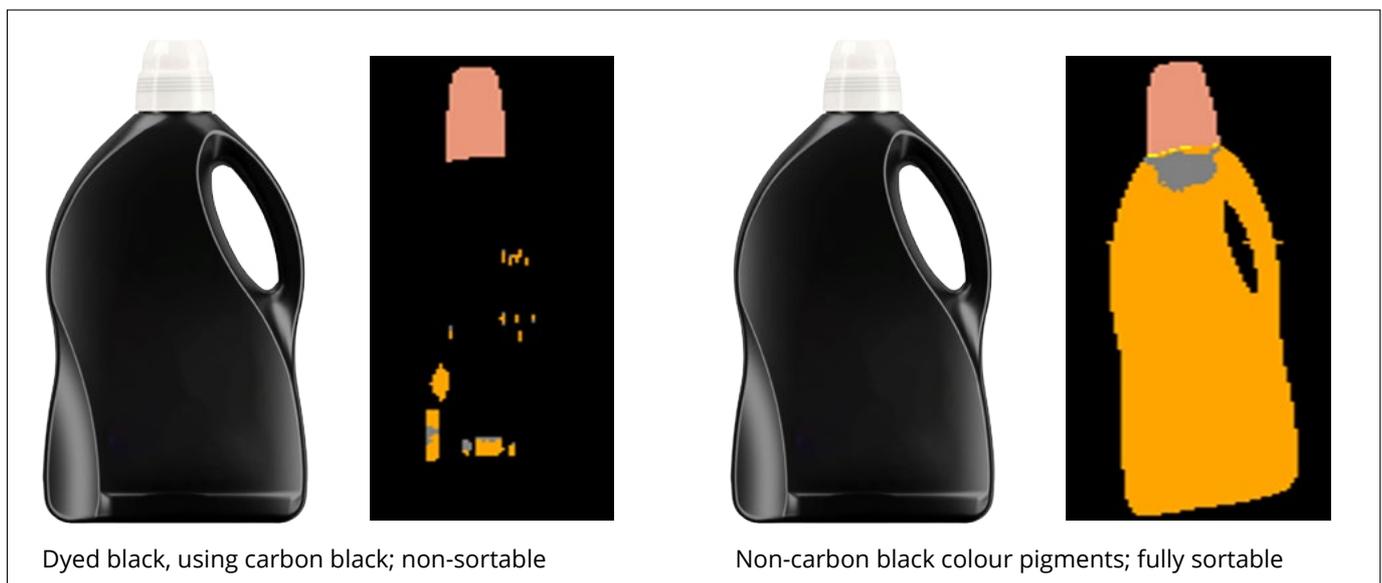
🟧 PE 3D   ⬛ PE 2D   🟫 PP 3D   🟥 PP 2D

Figure: NIR identification of a black PE bottle with PP cap and PE label; source: CHI Institut cyclos-HTP; last updated: December 2025

Large labels in the sorting process

Packaging labels generally do not prevent correct identification of materials in modern sorting facilities, which use near-infrared (NIR) spectroscopy to identify the material composition of the layers analysed. Thin labels made of non-valuable material do not tend to impair the identification of the packaging's main body because the digital image is decisive for the packaging to be sorted correctly. However, decoration, thickness or special label designs can limit the identification of packaging, which is why it makes sense to check in some cases.

Near-infrared identification of a PET bottle (clear, transparent)

Photography   Intensity image   Classification image   Intensity image

Settings/resolution: fine

NIR-detection

PET bottle: 1,410 pixels
PP (3D):   299 pixels
POM, PMMA, PLA: 4 pixels
ABS: 1 pixel
unknown: 57 pixels

- PET bottle
- PP 3D
- POM, PMMA, PLA
- ABS
- unknown

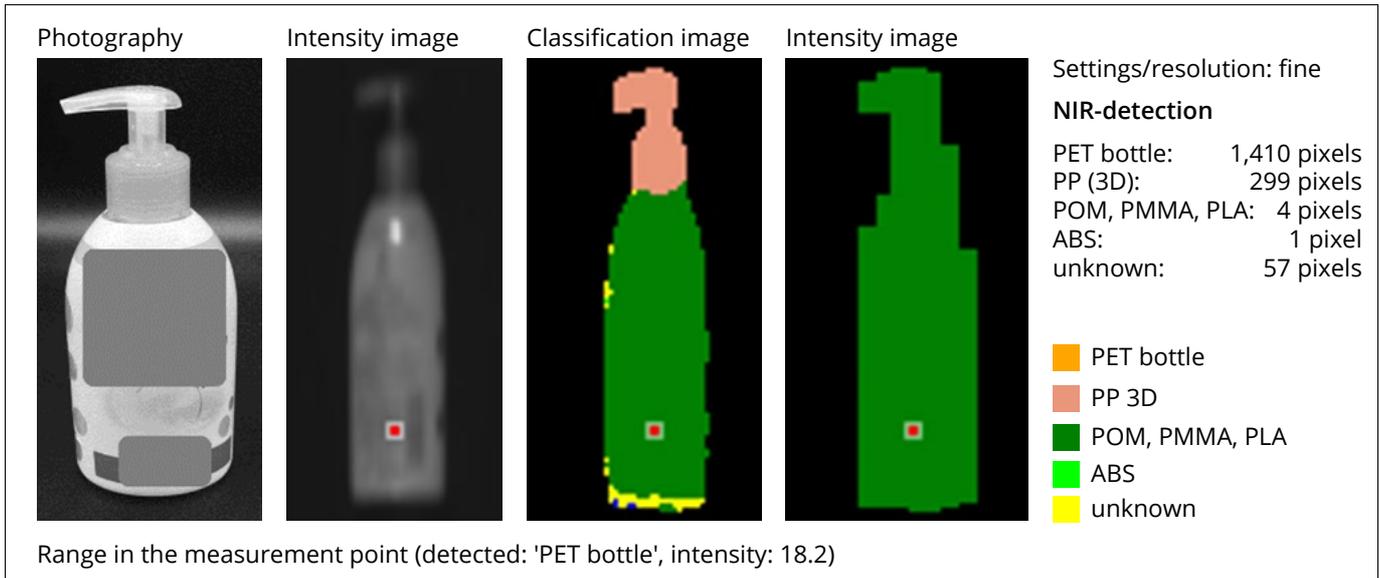Range in the measurement point (detected: 'PET bottle', intensity: 18.2)

Figure: PET bottle (clear, transparent) with PS sleeve and pump dispenser; source: CHI Institut cyclos-HTP; last updated: December 2025

2   Technical trends and developments

Sorting facilities are a cornerstone of the circular economy and a key factor for the quality of the flow of recyclables. Modern and precise sorting technologies are essential to separating packaging waste so it can be transferred for high-quality recycling. To meet these requirements going forward, facilities must undergo constant improvements. The following trends can currently be observed on the market:

— Sensors for automatic process management and control
— Automatic sorting quality control
— Product portfolio diversification in line with recycling requirements
— Transition to multi-sensor AI-based sorting devices

> ℹ Sorting technology is advancing. Reliable sorting is only possible if (i) companies design packaging for recyclability and (ii) consumers separate the individual packaging components (e. g. separate the lid from the yoghurt pot).