GUIDANCE ON THE IMPROVED COLLECTION AND SORTING OF FIBRE-BASED PACKAGING FOR RECYCLING

August 2022

4ever green

1. Introduction

4evergreen is a cross-industry alliance promoting low-carbon and circular fibre-based packaging. By bringing together the entire value chain, the different work streams of 4evergreen aim for a comprehensive outlook on the lifecycle of fibre-based packaging. In order to facilitate the eventual recycling of fibre-based packaging waste, collection and sorting is crucial.

This **'Guidance on the improved collection and sorting of fibre-based packaging for recycling'**, hereafter referred to as the Guidance, is based on input received from around 50 participating companies from all relevant industry segments along the value chain. The Guidance reviews the pertinent regulatory and institutional frameworks and provides an assessment of available collection and sorting scenarios.

The recommendations in this Guidance are based on a consensus reached through discussions between work stream participants and experts. These recommendations are written based on best practices, and are **intended to guide the implementation of future collection, sorting and recycling infrastructure, in order to meet EU legal requirements and realise 4evergreen's aspirational targets including a 90% recycling rate for fibre-based packaging.** As such, this Guidance affects all key actors in the (fibre-based) packaging waste value chain (e.g. producers/importers, (local) authorities, waste handlers/collectors, recyclers, NGOs), but is **geared towards policymakers and packaging recovery organisations**.

The Guidance (and thus recommendations) will use source-separated collection within households as a starting point. Here, fibre-based packaging is to be collected in either the regular paper and board stream or the lightweight packaging stream. The 'routes' from collection to recycling at dedicated paper and board mills are also examined, followed by practical recommendations how to improve collection.

2. Fibre-based packaging waste recycling rate targets

The EU has adopted material-by-material packaging waste recycling rate targets for both 2025 and 2030[1]:

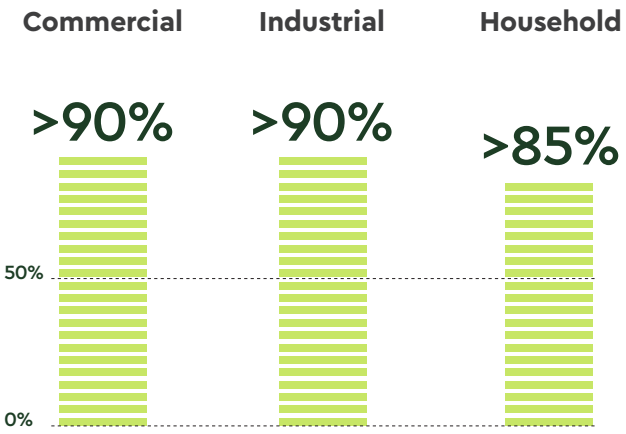
PACKAGING WASTE RECYCLING RATE TARGETS EU

Year	All packaging waste	Plastic	Wood	Ferrous metals	Aluminium	Glass	Fibre-based
2025	60%	50%	25%	70%	50%	70%	75%
2030	70%	55%	30%	80%	60%	75%	85%

Source: EU Directive 2018/852
Note: Fibre-based packaging is named "paper and cardboard" packaging in the respective directive

The above-mentioned percentages can be considered minimum targets as EU member states may implement even more ambitious packaging waste recycling targets in their respective national legislation (e.g. Germany, Spain and Sweden). **Likewise, the aspirational goal of 4evergreen is to increase the overall (European) recycling rate of fibre-based packaging to 90% by 2030**. To achieve this, the Guidance specifically focuses on (less developed) household collection rather than on commercial and/or industrial collection.

As such, 4evergreen proposes the following (source-by-source) recycling rate sub-targets:



How are these targets derived? 4evergreen applies the most recent applicable calculation rules used in EU Directive 2018/852 (article 6a, section 1b). These rules are based on the actual reprocessing of fibre-based packaging waste into recycled products.

[1] The UK has also set packaging waste recycling targets, broadly in line with the EU

3. Framework and boundaries

4evergreen endorses several basic principles which are key in achieving fibre-based packaging waste recycling rate targets, regardless of the route from collection to recycling.

In principle, all fibre-based packaging products are recyclable. Nevertheless, not every paper and board mill can actually recycle all types of fibre-based packaging. A perfectly fine raw material for one mill could be a non-recyclable material for another mill. Effective and efficient recycling thus requires that fibre-based packaging products end up in the designated paper and board mill which in turn requires matching collection and sorting systems.

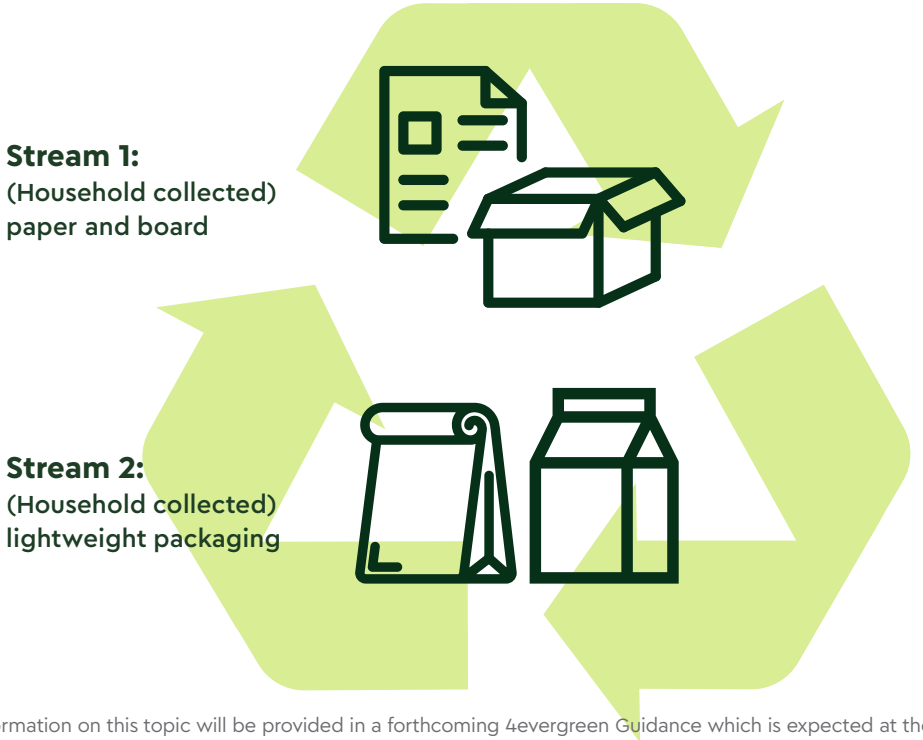
Source-separated collection of fibre-based packaging is fundamental. **As such, 4evergreen endorses collection systems where material is sorted into different streams at the source (e.g. households), laying a strong foundation for recycling at suitable paper and board mills.**

In this Guidance, a distinction is made between two coexisting recycling streams for fibre-based packaging waste originating in households (both will be addressed in more detail in later chapters):

With regard to the first stream, co-mingled collection systems where dry recyclables (e.g. plastic, paper, metal, glass) are all collected in the same recycling stream are to be avoided, if necessary by regulation. Following mandatory sorting at a material recycling facility, the resulting 'paper for recycling' fraction rarely meets the quality requirements of European (standard) paper and board mills – in terms of unwanted materials and cross-contamination. Instead, a dedicated collection stream needs to be in place for clean (packaging and non-packaging) paper and board, excluding liquid packaging board and certain[2] fibre-based composite packaging. This will also be described in later chapters.

With regard to the second stream, mixed collection systems are a well-established solution due to existing (and upcoming) sorting technologies linked to specialised paper and board mills. Targeted material may include plastic packaging, metal packaging, liquid packaging board and certain[2] fibre-based composite packaging. Glass should be kept separate.

Despite good intentions by consumers to support recycling, fibre-based packaging products placed in the 'wrong' recycling stream negatively affect the recycling process and could end up being sent to incineration



[2] Specific information on this topic will be provided in a forthcoming 4evergreen Guidance which is expected at the end of 2022

plants or landfill. Public awareness and education about these consequences is key.
Today, fibre-based packaging products collected with and sorted from the residual waste stream are not considered suitable for recycling in paper and board mills as fibres may have been contaminated with organic waste.

Naturally, littering must be avoided in all cases.

Following the latest amendment of the Packaging and Packaging Waste Directive (EU Directive 2018/852; article 7), European member states are required to implement national extended producer responsibility schemes (EPR) by the end of 2024[3]. This obliges affected stakeholders (e.g. municipalities, producers) to, among other things, develop the required infrastructure to collect packaging waste separately at source (i.e. households and possibly also at the business level). Minimum requirements for such schemes have been set out in the latest amendment of the Waste Framework Directive (EU Directive 2018/851; article 8a).

4evergreen is in support of legislative initiatives that incentivise more investment and the wider participation of all relevant stakeholders in separate collection and post-collection sorting actions aimed at increasing the recycling rate of fibre-based packaging.

Moreover, 4evergreen supports EPR-fee structures which, to the largest extent possible, reflect the real net recycling costs for each type of packaging material. An economic assessment should take into account (a) collection costs, (b) need for and cost of sorting/ processing, (c) actual cost of recycling, and (d) the value of recyclates.

This Guidance, and specifically the routes from household collection to recycling (i.e. Chapters 6 to 8), are written as a recommendation for building future collection, sorting and recycling infrastructure. In every respect, **4evergreen also supports alternative infrastructures capable of meeting the recycling rate (sub)targets described in Chapter 2.**

[3] The UK has indicated that it will implement similar EPR legislation

4. Focus on household collection of fibre-based packaging

In Europe (EU27 + NO, CH, UK) 47 million tonnes of fibre-based packaging is consumed each year, of which 42 million tonnes is collected[4]. The material collected comes from three different sources: households (21% – 9 million tonnes), industrial (31% – 13 million tonnes) and commercial (48% – 20 million tonnes)[4]. The material can either be collected directly from one of these sources or be part of the municipal and/or dual selective collection system and be classified as municipal solid waste (MSW).

These sources have different characteristics and that have an impact on sorting needs:

- Collection from commercial and industrial streams is often high quality and seldom requires sorting because of the high degree of separation at source across Europe.
- Municipal collection from households and (small) businesses, such as restaurants, requires in most cases post-collection sorting in the majority of European geographies, with a heterogeneous landscape of collection fractions.
- Separate household collection sometimes requires collection sorting depending on the scheme in place, the level of consumer education, and awareness of the source-separation topic.

These three sources have significantly different recycling rates with industrial and commercial at 85% and 88% respectively, while sorted household collection is at 55%[5]. The mixed material (originating from households and commercial activities) collected through MSW has a recycling rate of 66%[6&7].

4evergreen concludes that focus needs to be put on household collection, while maintaining high recycling rates for industrial and commercial collection, since the current recycling rates need to be improved to reach an overall recycling rate of 90%. The 4evergreen guidance includes several steps that should be taken by countries, municipalities and other actors in the recycling value chain to make it easier for consumers to sort correctly, allowing the packaging to be sorted in the correct stream and recycled into a new valuable resource. This should reduce the share of fibre-based packaging in mixed MSW and increase the recyclability of the sorted household stream.

[4] RISI; Expert interviews; Press search; FAO; OECD; Cepi, team analysis
[5] RISI; Expert interviews; Press search; FAO; OECD; Cepi, team analysis
[6] There are differences between countries regarding the degree to which waste from commerce, trade, administration and even small industries is collected and managed together with waste from households and defined as MSW
[7] RISI; Expert interviews; Press search; FAO; OECD; Cepi, team analysis

5. Recycling solutions

The Waste Framework Directive named collection as a precondition for quality recycling. Implementation of separate collection and adequate sorting of fibre-based packaging is not only important to comply with European law, it is also necessary to create qualities that match the most suitable recycling technology, thus increasing the recycling rate.

Recycling of fibre-based packaging into new paper and board is an established technique in widespread use. In fact, fibre-based packaging can go through multiple cycles of production, use and recycling. The recycling processes are designed to maintain the quality of the fibres, thus allowing multiple cycles. In every cycle, the fibrous material must be cleaned of foreign materials, such as staples, laminates and adhesive applications. This can lead to some loss of fibrous material and a natural degradation of fibres. Depending on the end application, it can require virgin fibres to be added to the process.

With respect to the input material, there are three main types of paper recycling processes. The detailed set up and level of complexity of the processes are also determined by the end product they produce. Common to all types is a pulping stage which disintegrates the paper and board structure into individual fibres and cleaning and screening stages.

a. **Mills with standard equipment** typically treat old corrugated containerboard (OCC) and/or mixed paper and mainly reject non-paper constituents and the foreign parts mentioned above. The output is a brownish pulp.
b. **De-inking mills** have similar cleaning and screening stages but also remove the ink. Inputs here are paper and board products on bleached substrates, and the output is a white or off-white pulp.
c. Paper and board for recycling, which cannot be recycled efficiently under a. and b., needs a special process. One well-established process concerns liquid packaging board (LPB), also known as beverage cartons. Typically, this is a two-sided lamination that needs an **enhanced pulping** action and a reject system for higher quantities. Similar processes can be adapted and optimised for wet-strength products and certain[8] other fibre-based composite packaging (FBCP), i.e. packaging composed of two or more materials, where the predominant material is paper. Depending on product design and the type and amount of non-paper constituents used, part of these products could be suitable for collection via the household paper and board stream, and then recycled in standard mills. Specific information on this topic will be provided in a forthcoming 4evergreen guidance which is expected at the end of 2022.

Paper for recycling is generally a blend of different fibre-based products. If the variety of products is low, such as in the treatment of liquid packaging board, additional process steps are being put in place to recover and recycle the non-paper constituents (e.g. 'polyal' from liquid packaging board).

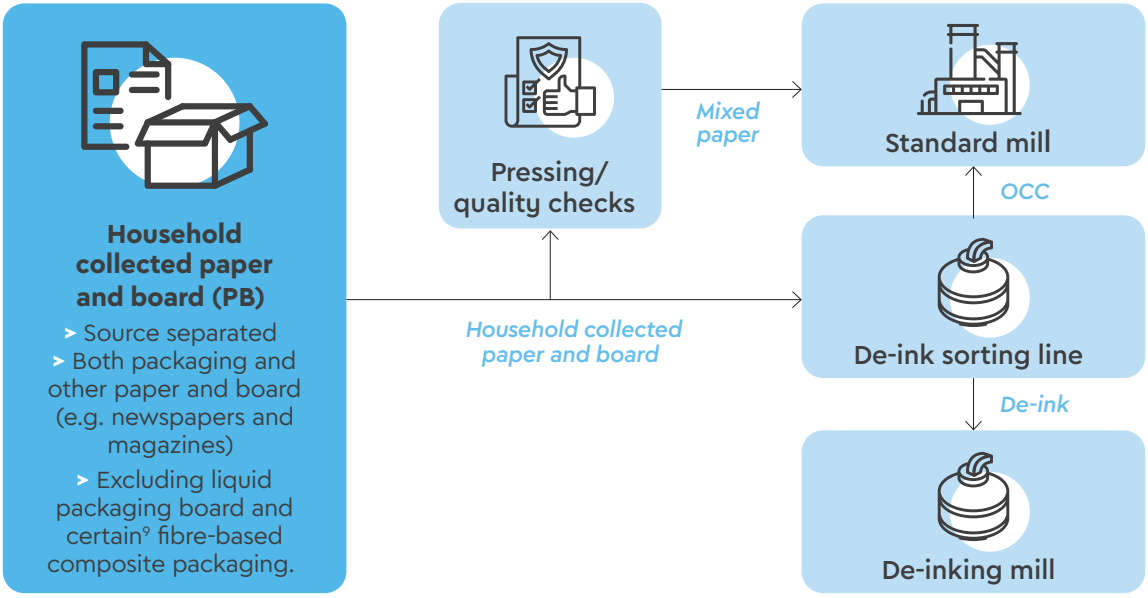
It is important that the collection and sorting set-up guides the different paper grades towards the right recycling process and end use to secure the highest quality and yield of recovered material across different types of recycling mills processing different types of fibre-based materials. Moreover, each paper mill will have its own special recipe and appropriate technical equipment related to the properties of the intended end products.

The highest efficiency and recycling rates will thus be obtained by ensuring that paper mills have access to fibre-based material that is collected and sorted into different feedstock fractions with sufficient quality to create the required recipe for their own products.

[8] Specific information on this topic will be provided in a forthcoming 4evergreen Guidance which is expected at the end of 2022

6. The standard mill route

The majority of fibre-based products originating from households, both packaging and non-packaging, can be easily collected and recycled in the same stream. Targeted material needs to conform to the collection requirements as set out in the section on the household route for fibre-based packaging. From there, two major sub-routes are possible:



Not depicted in the flowchart: Other (non-packaging) flows destined for de-inking mills and eventual mixed paper flows from de-ink sorting lines to standard mills.

In principle, the household collected paper and board described above is ready for recycling in standard paper and board mills. As material is already sorted by households, no further sorting is required. Prior to reaching the mill, the bulk of the material will be pressed into industrial size bales of 'paper for recycling' and checked for quality in dedicated plants. Here again, consumers play a vital role in the (at source) sorting process, and public education is key.

Alternatively, the household collected paper and board can be handled at dedicated (de-inking) sorting lines. This generally splits the stream in two: a de-ink stream (e.g. mainly used newspapers and magazines) which can be consumed by de-inking mills and an OCC stream (e.g. mainly used packaging) which can be consumed in standard paper and board mills.

From the perspective of both standard and de-inking mills, **EN643 is regarded as the applicable industry standard**, providing a detailed grading list for batches of paper for recycling, entailing:

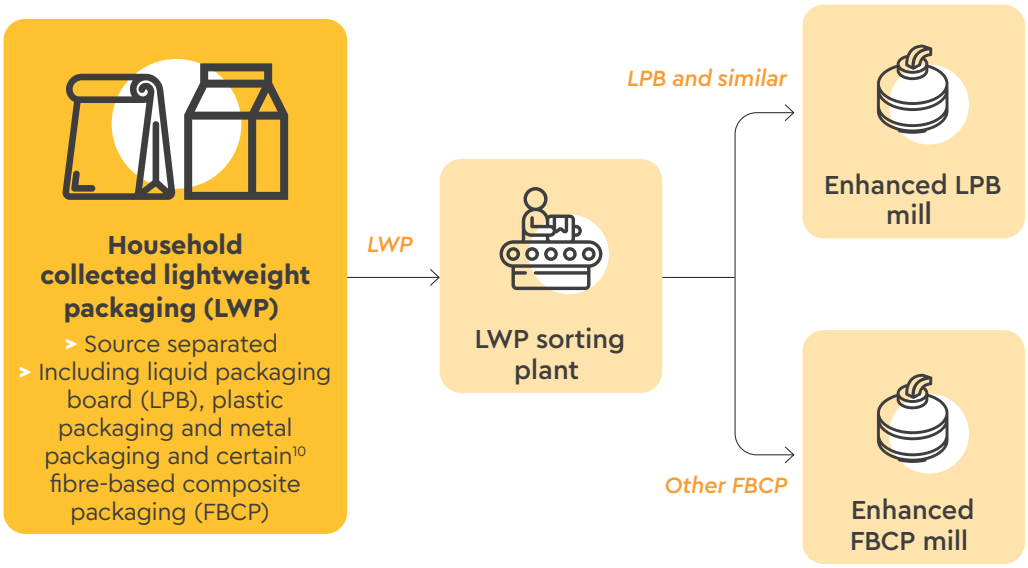
- For all grades
  - Hazardous waste tolerance (zero tolerance)
  - Moisture tolerance (maximum 10%)
- For each grade
  - Content description
  - Tolerance level for non-paper components (e.g. plastic, metal, not part of the product)
  - Tolerance level for other unwanted material (e.g. material detrimental for production)

The abovementioned (sub)routes allow for recycling grades conform EN643 (i.e. mixed paper: 1.01/1.02; OCC: 1.04; de-inking: 1.11).

[9] Specific information on this topic will be provided in a forthcoming 4evergreen Guidance which is expected at the end of 2022

7. The enhanced mill route

Liquid packaging board (LPB) is already being collected with lightweight packaging (LWP) in many countries across Europe (mainly together with plastic and metal packaging), separating them at source from other paper and board. In some countries, such as Germany, other fibre-based composite packaging (FBCP) is also accepted in the lightweight packaging collection. Typically, LWP is sent to a dedicated sorting plant capable of separating the LWP into different materials suitable for recycling. For fibre-based packaging, two qualities are being separated for recycling, i.e. LPB and other FBCP:



EN643 describes some fibre-based multi-material grades for recycling, such as liquid packaging board or cups, but the variety of these materials is increasing. Also, the non-paper constituents need to be considered for recycling.

Therefore, the existing classification for these materials within EN643 is no longer granular enough to meet all the requirements for recycling. New or improved standards are required to cover innovative barrier paper packaging solutions entering a fast-evolving market.

For this reason, as an interim but not comprehensive solution, enhanced recycling mills are applying bilateral commitments on specific input requirements beyond EN643, which are consequently a guideline for sorting plants to produce these qualities. An example from Germany can be highlighted. Specification n° 512 is in place to describe the quality needed for liquid packaging board to be recycled in dedicated enhanced mills. Furthermore, enhanced mills capable of processing other FBCP can rely on sorting according to specification n° 550.

This sorting is important as an enhanced recycling mill is not necessarily capable of recycling all fibre-based packaging types. Indeed, an enhanced mill developed to recycle liquid packaging board or materials with a similar composition will not automatically be able to recycle other fibre-based composite materials. The technology being used in an enhanced mill is linked to dissolving/disintegration time, fibre quality and properties, additives, agents, adhesives, fillers, non-fibre components but also the purity of feedstock bales coming from sorting.

Deviations at the packaging material level can impact the established recycling process at the paper mill and lead to inefficiencies. Therefore, the sorting step is a necessity to secure that enhanced mills can source the qualities they are able to recycle with the installed equipment and taking into account the requirements of their end products.

Specific industry standards beyond EN643 – determining the input requirements for special grades treated by enhanced recycling mills and applied consequently as a guideline for sorting plants – can secure qualities needed for recycling, as well as for the non-fibre constituents, and support investments in additional recycling capacity.

[10] Specific information on this topic will be provided in a forthcoming 4evergreen Guidance which is expected at the end of 2022

8. Modelling the household route for fibre-based packaging from collection to recycling

Household collection schemes define suitable recycling streams for various grades of fibre-based packaging, which in turn has a fundamental impact on the efficiency of paper recycling. In essence, this concerns practical matters, such as looking at the number of recycling streams households are dealing with and what sort of instructions or information they receive on how or where to discard what packaging product.

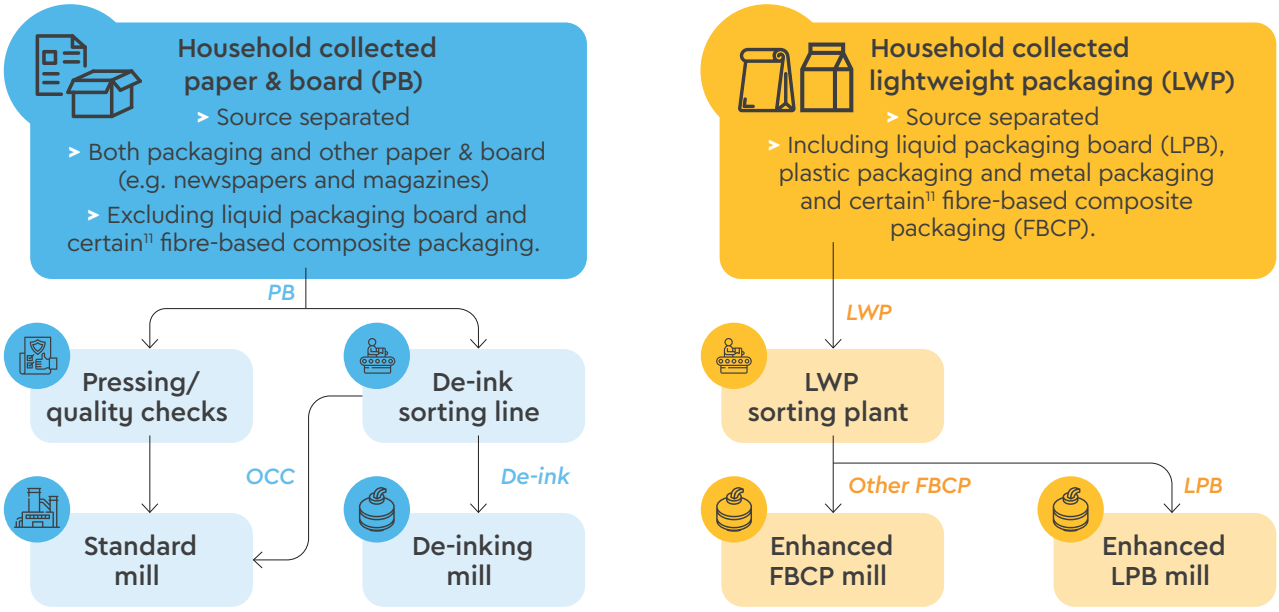
4evergreen recommends two co-existing streams for the collection of fibre-based packaging which is intended to guide the implementation of future collection, sorting and recycling infrastructure:

> **Stream 1:** (Household collected) paper and board
  - Route: standard mill
  - Target material: Source separated clean packaging and other paper and board (e.g. newspapers and magazines)
  - Excluding liquid packaging board and certain[11] fibre-based composite packaging
> **Stream 2:** (Household collected) lightweight packaging
  - Route: enhanced mill
  - Target material: Source separated liquid packaging board (LPB), plastic packaging and metal packaging and certain[11] fibre-based composite packaging, (FBCP)
  - Post-collection sorting is mandatory

The below chart visualises the collection and sorting route for the recycling of fibre-based packaging that 4evergreen believes can achieve the most optimal results.

All fibre-based packaging is collected (source separated) by households and then further sorted by dedicated sorting plants into qualities demanded by standard and enhanced paper mills.

Liquid packaging board cannot be efficiently recycled in standard (and de-inking) mills. For other fibre-based composite packaging, this is less straightforward. Depending on product design and the type and amount of non-paper constituents used, part of these products could be suitable for collection in the household paper and board stream and recycling in a standard mill. Specific information on this topic will be provided in a forthcoming 4evergreen Guidance which is expected at the end of 2022.



[11] Specific information on this topic will be provided in a forthcoming 4evergreen Guidance which is expected at the end of 2022

9. Practical recommendations to improve household collection of fibre-based packaging

Both in terms of accessibility and complexity, a collection system should be easy to use and avoid creating any inconvenience for the user. To this extent, this guidance can be completed with practical recommendations.

Two main systems can be identified for the household collection of fibre-based packaging:

1. Collection at the household (kerbside collection) with or without the usage of collection bins

Collection of the material at the kerbside is easy for consumers, giving them a fixed collection frequency. Moreover, collection of several other household waste streams can be organised on the same day or even collected with the same compartmented truck.

Kerbside collection forces the consumer to store material at home until the fixed collection day. This may lead to increased humidity during wet conditions and could put more strain on the operators collecting. Also the cost will be higher in comparison with centralised collection.

These issues can be resolved by organising collection based on individual containers per household. For people living in multistorey buildings collection via containers (above- and underground) can provide a solution.

2. Central collection using drop-off points

Collecting material via drop-off points is an accessible option for the consumer. It also allows additional measures to be taken to ensure correct storage of the material. On the other hand, transporting material to the drop-off point might be seen as a hurdle for some users.

The big downside of drop-off points, however, is that special attention would be needed to maintain the quality of collected materials. These drop-off points are anonymous and it is difficult to control correct sorting behaviour.

Ideally, the collection should be organised according to a regular kerbside collection augmented by a network of distributed drop-off points.

A combination of both collection systems should also allow to optimise the collection frequency. The amount of additional drop-off bins should be based on the population density of the city or region, as too the frequency of collection.

Uniform, nation-wide collection and sorting instructions will boost participation in collection schemes and sorting quality at source. Uniformity on an EU-level is also supported by 4evergreen.

The quality of the collected material should be monitored and reported on a regular basis. Quality inspections should start at the point of collection and continue throughout the value chain until the point of recycling.

Consumers should be continuously informed about correct sorting instructions, the recycling process, examples of recycled applications and overall recycling results. Dialogue with consumers, refusing material and even penalties/incentives can be used to increase awareness and change behaviours.

Infrastructure should be developed and implemented to ensure effective collection, sorting and recycling of designated materials. **Clear and complete national legal and operational frameworks should be implemented to support these activities,** including:

- the citizen's responsibility to sort,
- the municipality's obligation to collect and recycle what is collected,
- targets to reduce municipal residual waste,
- responsibility and ownership regimes for the material (e.g. EPR),
- transparent reporting on recycling rates,
- translation of European legislation into (more ambitious) national recycling targets, and
- enforcement of regulations.

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ABOUT 4EVERGREEN

4evergreen is a cross-industry alliance perfecting the circularity of fibre-based packaging to contribute to a climate-neutral and sustainable society. Our goal is to raise the overall recycling rate of fibre-based packaging to 90% by 2030. We bring a particular focus on packaging with a lower circularity performance today, namely the types used for household, out-of-home and on-the-go consumption.

The alliance brings together industry representatives from across the fibre-based packaging value-chain, from pulp, paper and board manufacturers and recyclers to packaging producers and converters, including brand owners, retailers and waste management companies. It also comprises non-fibre material suppliers (e.g., adhesives, inks, coatings), technology providers (e.g., machinery, collection, and recycling solutions), and leading research institutes.

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