Verification and examination of recyclability

Requirements and assessment catalogue

of the Institute cyclos-HTP

Revision 3.3

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1. Introduction

Recycling is an important factor of sustainable utilization of resources. The recyclability can be determined for individual packaging types and goods. It is an individual attribute and, in the form of a gradual index, an expression and instrument of applied product reliability.

Recyclability is generally defined by two parameters: the composition of the object and the real recycling options after utilization.

A recyclability check may provide important information on optimisation of packaging and goods. For this, however, scientifically-founded, comprehensible and transparent requirements and assessment foundations for all concerned have to be established. For this reason the engineering and expert companies HTP and cyclos have developed this concept and requirements and assessment catalogue for verification and examination of recyclability.

Recyclability is a relevant environmental requirement. However, there may also be different situations in which other requirements have priority. These situations are not taken into account for verification of recyclability.

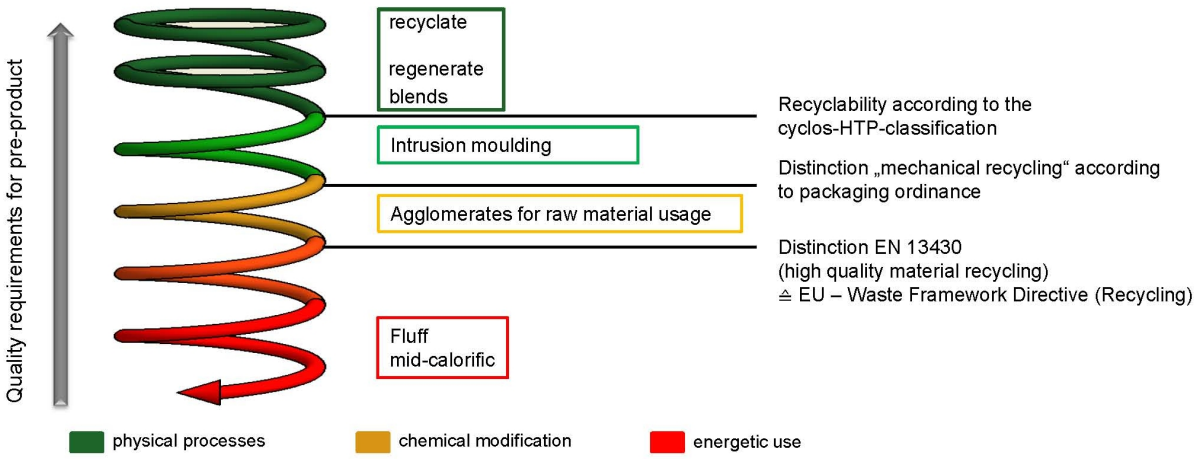
2. Recyclable – what does it mean?

Recycling means closing loops. For this reason, the term of "recycling" in this assessment catalogue is to be closely laid out according to this definition. In the following, recycling always means processing of materials without modification of the molecule structure to produce recyclates, regenerates, blends or alloys to replace corresponding virgin material in standard applications. This benchmark is illustrated by the red marking in figure 1.

The basic understanding of closed-loop recycling, in which recycling material does not only replace corresponding virgin material but is also repeatedly used in primary application, is here added by a second level in which closed recycling loops may be realized on a lower quality level. An example for this is the production of polyolefin-based regranulates. The application of these regranulates replaces corresponding virgin material, however, it is limited, e.g. in colouring, in comparison to actual virgin material. This quality of level 2 can, depending on new colouring, additives, etc. also be achieved when the recycling process chain is run through repeatedly, so that potentially closed loops can be realized after a first cascade level in the utilization chain.

In contrast, material utilization processes, which include secondary raw materials in production without replacing the virgin material typical for the respective application, are not regarded as recycling in the sense of this assessment catalogue. Utilization processes that apply materials directly or indirectly as energy source, are also not taken into account.

Figure 1: Definition and delimitation of the term "recycling"



The declaration of a product, e.g. a packaging, as "recyclable" or "100% recyclable" must have a substantial basis. This also helps to prevent public debates and legal arguments.

Important foundations include:

- DIN EN ISO 14021 "Environmental labels and declarations - Self-declared environmental claims (Type II *environmental labelling*)" – This standard requires that environmental product declarations must not be misleading but substantiated and verifiable. The property must be real and not only hypothetically met.
- DIN EN 13430 "Packaging - Requirements for packaging recoverable by material recycling" – This standard defines certain minimum requirements. For this assessment catalogue, additional requirements exceeding the standard, which are crucial for substantial verification and examination, are defined. These include:
  - Individual recyclability must be at least already specifically applicable to a relevant extent. Only the option of establishing recyclability in appropriate intervals is not sufficient.
  - For measurement or declaration of the percentage proportion of recyclability of products with different material components, whose recycling is subject to different approaches, positive influence of the individual components is only declared if a respective diversifying separation is actually applied.

- When measuring or declaring the percentage proportion of recyclability, the potential rate of substitution of the corresponding virgin material is applied instead of the interface of provisioning of secondary raw materials.

The term of recycling combines now established multi-stage, complex process chains on an industrial scale. Due to its advanced standardization, the specific properties of a product can be assessed in the post-use phase.

Against the background of more than 20 years of practical experience with the framework conditions of recycling structures and the technical design of recycling processes, Institute cyclos-HTP has developed this requirements and assessment catalogue. Based on objective measures, the recyclability of collected used materials collected via the available material collection schemes can be characterised in quality and quantity.

Based on the requirements placed on packaging with reusable materials according to DIN EN 13430, the relevant criteria have been put in concrete terms and further defined.

This catalogue is to be continuously complemented and particularly updated to take into account technical changes with an impact on the applied classification, if required.

The respectively latest revision of the catalogue is the basis of assessment for product certification regarding the declaration "recyclable" by Institute cyclos-HTP.

3. Research and assessment matrix, Overview

Recyclability can be defined as qualitative and quantitative behaviour of a product in the post-use phase via the respectively specific process chain to primary raw material substitution. This means that it must be possible to collect the material using existing collection facilities and to sort it in a qualified manner. Its reprocessability must enable recirculation.

For assessment, reference schemes are required to realistically illustrate the existing processing structures in the relevant stages. During assessment, the product to be assessed runs through this simulated reference process chain. The assessment criteria are derived from the influencing parameters of the respective stage of the specific process cascade (approaches).

The reference processes applied for the preparation of this requirements and assessment catalogue as well as their technical requirements are specified in appendix 2. The individual countries providing specific collection structures are also specified.

The assessment or certification object is the product as a whole (packaging is assessed without its content). If utilization requires the product to be disassembled to individual components, these are classified, examined and assessed individually. The overall result is then determined by adding up the weighted individual results. This is also valid if it is known by experience that a splitting up by the final user or by mechanical input during transport can be assumed in general or as a minimum be plausible.

If packaging cannot be fully emptied for technical reasons, these filling material proportions always remaining in the packaging after use are incorporated qualitatively according to their separability and compatibility with the Recyclate (see K1).

The following assessment matrix lists the individual approaches with their central respective assessment criteria. During the individual assessment the entire cascade process is also to be considered so that in individual cases criteria which are not relevant to the considered in Table 1 generally should be supplemented (e.g. size, format and surface weight).

3. Research and assessment matrix, Overview

Table 1: Approaches of individual material fractions and assessment criteria

path	0 approach (Assignability to a recycling Pathway)	1 percentage of recyclable material[1)]	2 detect -able by NIR[2)]	3 electrical conduct- ivitie[4)]	4 ferro- magnet- ism[4)]	5 material- density after dissinte- gration[3) or 4)]	6 Time[4)] and yield[1)] for dissolution in water	7 melting- behavior[1)]	8 non seperat- able recyclate contamin- ations[4)]	total score[1)] 1 x 2 x 3 x 4 x 5 x 6 x 7 x 8 in %
1.	plastic film	X	-	-	-	X	-	X	X	
2.	PE	X	X	X	X	X	-	X	X	
3.	PP	X	X	X	X	X	-	X	X	
4.	PS	X	X	X	-	X	-	X	X	
5.	PET-bottles transparent	X	X	-	-	-	-	X	X	
6.	mixed-plastics rigit	X	X	X	-	X	-	X	X	
7.	mixed plastics film	X	(X)	X	-	X	-	X	X	
8.	drink carton (coated cardboard packaging)	X	X	-	-	-	X	-	X	
9.	ferrous metal	X	-	X	X	-	-	X	X	
10.	non ferrous metal	X	-	X	X	-	-	X	X	
11.	paper and cardboard packaging	X	X	X	X	-	X	-	X	
12.	glass	X	X	-	-	-	-	X	X	
13.	paper	X	X	-	-	-	X	-	X	

1) scoring 0-1 (ease of emptying will be evaluated)
2) scoring 0; 0,25; 0,5; 0,75 or 1
3) scoring 0 to 1
4) scoring 0 or 1

Please note: The values to be determined for the criteria 5 and 7 refer to the proportion of recyclable material as specified under criterion 1.

Explanations on the assessment matrix

C0: Approach

A superordinate criterion for classification of products according to their recyclability is the availability of an applicable collection and processing structure. This structure is required if the product can be attributed with respect to its material content to one of the recyclate pre-products listed under "approach". If such assignment is not possible, the recyclability typically cannot be verified unless specific, generally accessible collection and processing structures can be verified in the individual cases.

Thus, only specifications with an effective processing option for high-quality recycling is practically, at least optionally, available to a significant extent.

Attributability means that the product – subject to additional checks – is compatible with the specifications of the respective recycling technology according to its composition. All following criteria are applied or assessed approach-specifically.

C1: Percentage of recyclable material

The "percentage of recyclable material" specifies the potentially recyclable mass proportion of the total mass of the product (new goods). If packaging cannot be fully emptied for technical reasons, these unavoidable filling material proportions are applied as related material component and respectively taken into account in the following qualitative assessment criteria.

Based on the available processing options, the potentials of recyclable material correspond to different mass proportion. The usually occurring correlations are specified in the following table.

Table 2: Overview of recyclable percentages

path	percentage of recyclable material	non-recyclable components
plastic film; PE; PP; Mixed-plastics rigid and film	PO-percentage	other plastics, labels/sleeves etc.
PS	Polystyrene-percentage	other plastics, non plastic material, labels/sleeves etc.
PET-bottles - transparent	PET-transparent percentage additional PO-percentage (caps)	other plastics, labels/sleeves non PET
plastic-coated cardboard packaging/ drink carton	percentage of fiber	plastic- and non-ferrous film, other packaging components, wet strength fiber
tin cans / ferrous metal	Percentage of ferromagnetic metal alloy	plastic-components, labels/sleeves
aluminum / non-ferrous metal	percentage of non-ferrous metal	plastic-components, labels/sleeves
paper and cardboard composites	percentage of fiber	plastics and aluminum, wet strength fiber
glass	glass and metal percentage	plastic caps, labels/sleeves
paper, cardboard	percentage of fiber, filling material, coating pigments	non fiber incl. binding agent, wet strength fiber

The assessment index is determined based on plausible manufacturer specifications on the product material composition. The result is generally directly proportional applied in the overall assessment result (exceptions see CAT 2).

High-quality recycling requires the separability of individual materials in a narrow sense. The currently established recycling processes are mostly focused only on one, rarely on a few materials whose admissible component and processing properties are specified in the respective products or recyclate characterisation according to DIN standard. All other components are regarded as process-specific contaminants.

With regard to the quality of contaminants, three categories are to be generally distinguished (the respective mass proportions are specified under C1 within the assessment):

CAT 1: Materials that can be separated quantitatively by the processes established in the recycling process.

According to CAT 1, the proportion of contaminants leads to a quantitative limitation of the recyclability and is taken into account in C1 by respectively reducing the index.

CAT 2: Materials that cannot be separated by the processes established in the recycling process, however, that have no or no significant impact on the recyclate properties up to a defined relevant concentration.

The respective proportion is not added as accepted material within assessment criterion C1. An exception is regular mixture components of the recyclate (alloy, blend, master batch) such as PP-percentage in HDPE or LDPE-percentage in PP blend.

CAT 3: Material that cannot be separated by the processes established in the recycling process and that degrades the quality of the recyclate to uselessness or otherwise lead to disproportionately high process costs.

The assessment of contaminant proportion of CAT 3 is specified under C8 and defines that the recyclability cannot be verified (assessment index 0).

The following table contains examples of typical "contaminants" of the categories 1 - 3 (i.e. particularly, neither final nor fixed assignment). In some cases, the assessment depends on the concentration. Therefore, individual assessments are applicable at all times. For this reason, the examination always includes research on potential incompatibility of inseparable material combinations and additives, printing colours, etc...

3. Research and assessment matrix, Overview

Table 3: Overview over typical contaminants in individual approaches

	path	grade 1	grade 2	grade 3
1	plastic film	paper labels; water soluble adhesives; non PO- plastics	PP-films	non water soluble adhesives combined with wet strength paper labels Components of EuPIA (Exclusion list for printing Inks and related products)
2	PE	paper labels; water soluble adhesives; plastics > 1 g/cm³	EVOH-barrier layer; PP* (e.g. caps); labels, etc.	silicon components; expended plastics components; non water soluble adhesives combined with wet strength labels Components of EuPIA
3	PP	paper labels; ALU lid; water soluble adhesives; plastics > 1 g/cm³	EVOH-barrier layer; PE* (e.g. caps) labels, chalk, etc.	silicon components; expended plastics components; non water soluble adhesives combined with wet strength labels Components of EuPIA
4	PS	paper labels; ALU lid; water soluble adhesives; plastics > 1,08 g/cm³		Other impurities, density range 1,0 – 1,08 g/cm³ Components of EuPIA
5	PET-bottles, transparent	plasma coating (clear); water soluble or basic soluble adhesives; paper labels; PE, PP-labels and sleeves	AA-blockers UV-stabilizers	PET-G, PET-C; EVOH / PA-mono layer-barrier layer; PVC, PS, PET-G-labels/sleeves; Non soluble adhesives (water or basic at 80°C); non magnetic metals; elastomers with density > 1 g/cm³ Components of EuPIA
6/7	mixed -plastics	paper labels; PS, PET, PA, PVC, ABS, PC, etc.	LDPE* EVOH-barrier layer	silicon components; expended plastics, density< 1 g/cm³ Components of EuPIA
8/11	paper and cardboard composites/ drink carton	plastic labels; plastic and metal layer; plastic and metal parts; wet strength paper;	printing inks and adhesives; water soluble inks and adhesives, re-dispersive; paper coating agents	components of EuPIA
12	glass	paper and plastic labels	lead oxide	glass composites with metal or plastic layers
13	paper and cardboard	plastic parts; wet strength paper	printing inks and adhesives; water soluble inks and adhesives, re-dispersive; paper coating agents	components from EuPIA

*percentage will be evaluated in a 75% ratio as product and 25% substracted as unwanted

C2: Identifiability in NIR reflection measurement / optical detectability

Materials that are separated by default using NIR spectrometric reflection measurements, i.e. that need to be pre-concentrated, are tested for compliance with the requirements of unambiguous detection with regard to the target fraction. If these conditions are not met, e.g. due to considerable labelling with foreign material or as a consequence of too dark colours caused by carbon black additives, the index 0 is assigned. If correct identification depends on the position, the index 0.25, 0.5 or 0.75 (0.25 and 0.75 for two-stage process steps) is assigned. Index 1 corresponds to unrestricted identifiability.

The determination is made on the basis of an empirical measurement under standardized conditions with operationally deployed classifiers of the current generation.

For glass, the NIR reflection behaviour is replaced by the transmission of visible light.

C2´: discharge behavior

The sensor-based sorting methods show compared to other separation techniques, the specialty that the separation of this items is a separate stand-alone part of the process that is in particular independent of the detection of physical properties such as mass and shape.

The corresponding assessment (sub) criterion is called separation behavior.

Measurement and quantification take place in a dynamic test under standard conditions optional in terms of pressure and valve block design.

A test result of >70% correct separation at positive registration is required for a positive unrestricted consideration of this criteria. A result of less than 30% leads to 0 (not separable) for C2`. In between 30% and 70% the factor is set to 0,5. If deductions are made, the cause must be shown for insufficient separation behavior in the test certificate.

C3: Effective electrical conductivity

On the one hand, this criterion for materials to be recycled via the fraction non-ferrous metals/aluminium takes into account whether sufficient requirements for separation using the standard eddy current separation process are met. The classification separable (assessment factor 1) or insufficiently recyclable is carried out on empirical basics.

On the other hand, all other materials with a recycling approach that is not defined according to the included non-ferrous metal proportions, except coated carton packaging, are assessed differently at the same measuring method: If the separation behaviour is defined by the metal

proportion, the assessment index 0 applies for the examined approach; the product is then obligatory set using approach 10. If practically no relevant impact can be identified, index 1 is set.

C4: Ferromagnetism

Ferromagnetic product properties are usually dominant for recyclability. In all standard recycling processes, this material property is applied for separation as one of the primary process stages.

If the product has ferromagnetic components, it has to be checked first whether these are sufficient to define the recycling approach. In borderline cases, this is regarded as complied with if the product can be lifted with a magnet system with an operational height of 450 mm from a distance of 300 mm.

If this is the case, the material is assessed independently of the other material proportion via the approach for tin plate / ferrous metals. Exceptions from this assessment benchmark are made for products that exceed a length of 220 mm in minimum 2 dimensions. In the actual recycling process, it can be assumed that these products are pulped prior to separation.

C5: Material density after disintegration

The density criterion takes into account the fact that float-sink sorting is the central process step to produce high-quality recycles within plastics reprocessing.

Classification and assessment according to the density criterion are carried out after disintegration by grinding to approx. < 12 mm to 15 mm. The assessment criterion is whether the generated material parts are under or over the technically relevant separation density of 1 g/cm³ (PE, PP, PO cut) or 1.08 g/cm³ (PS).

If the above specified values are exceeded or fallen below, e.g. due to filling material or coating, the material is assessed as non-recyclable. Partly exceedance, unless already considered under number 1, is quantitatively included in the assessment. (The application of incompatible plastics of one density class in a product within plastics recycling is managed under C1 or C8.)

C6: Speed of dissolution in water

If products are to be recycled using one of the existing recycling approaches for waste-paper, this requires that fibre pulping is applied in the operational parameters in the paper recovery process.

As a reference for products to be assigned to the approaches 11 and 13 the required pulping time for mixed waste-paper (type 1.02) is applied. For assignment to approach 8, the dissolution time for liquid packaging is applied.

Fibre losses in reject are applied by a deduction factor of 1.

C7: Melting behaviour

Solid / liquid separation as implied, e.g. in melt filtration for regranulation of plastics, is basically assessed as other physical separation processes without phase change.

During recovery of plastics, material or contaminants (see C1) that can only be separated from the recyclate proportion in molten condition, however, is taken into account in the assessment of the recycling rate by a deduction factor of 2 as the solid / liquid separation is always connected with a loss in recyclate.

Process-intrinsic loss in recyclate due to evaporation or oxidisation are subject to a standard deduction based on documented data. The losses occurring during the pyrolysis of non-ferrous metals are subject to a standard deduction of 9.4% for aluminium and aluminium compounds as well as 13.6% for aluminium-containing compounds, respectively related to the proportion of non-ferrous metals (Source: Survey of VAW Aluminium AG: Ökologische Effizienz der stofflichen Verwertung der DSD-Aluminium-Verpackungs-Fraktion durch Pyrolyse [ecological efficiency of material recycling of the DSD aluminium packaging fraction by means of pyrolysis]; 2000). Melting furnace losses during recovery of ferrous metals (evaporation of the tin content) are subject to a standard deduction of 70% of the tin proportion. (Source: Wullrich, W.; Schicks, H.: Presentation at the Duisburger Recyclingtage, Moers, 1992). Losses that occur during melting by oxidation of paint or additional plastic coatings are already taken into account under C1.

All losses are regarded as partly difference to the factor of 1.

(For material systems with comparable melting behaviour or finely-dispersed inclusions, reference is made to C1 and C8 under observation of the mixing capability (blends, alloys, filling materials) and compatibility with the recyclate properties. The same applies for

materials that are subject to decomposition in the temperature range of remelting required for recyclate production.)

C8: Inseparable contaminants / material-conditional cross contamination

If the product to be assessed can be assigned contaminants of CAT 3 (see C1), economic production of marketable recyclate can no longer be assumed and the product is referred to as non-recyclable (assessment index 0).

Overall assessment

In overall assessment, the determined individual indexes C1 to C8 are multiplied. If the result is not 0, the result is classified as recyclable according to DIN EN ISO 14021.

The summary assessment index specified in % is configured in such a way that it represents the proportion of the product that is actually available for monetary creation of value after application of high-quality recycling for resource saving.

A differential test certificate is issued on the classification. The overall assessment is indicated quantitatively as "% recyclable".

The certification entitles to use the test seal of the institution "cyclos/HTP" to indicate the independent verification of the environmental label and declaration "recyclable". Rights and obligations of the utilization of the seal are specified separately.

Instead of the number, the category of the degree of recyclability can also be specified. It is also specified on the test certificate.

The following scale is to be applied:

CAT C	recyclable, recyclable proportion	< 50%
CAT B	recyclable, recyclable proportion	50% - 70%
CAT A	recyclable, recyclable proportion	70% - 90%
CAT AA	recyclable, recyclable proportion	90% - 95%
CAT AAA	recyclable, recyclable proportion	> 95%

4. Appendices

4.1 Appendix 1: Certificate template

CERTIFICATE

Recyclability of Packaging

PRINCIPAL
Sample Street 1
D-00000 Sampletown

The company receives the certification of recyclability for the following packaging.

Designation

Packaging designation (Article No. XXXXXXXX)

Test result

Allocation to path/specification:	**Sample Type A, Fraction No. 000** **Sample Type B, Fraction No. 001**
Recycling path:	**Sample Type A, Fraction No. 000** **Sample Type B, Fraction No. 001**
Recyclate (final product):	**e.g. XX-regranulate**

Test standard/scope of application: Catalogue of requirements and assessment of the institute cyclos-HTP (state of XX.XX.XXXX)

In accordance with the test results and the examination document the recyclable percentage of the packaging amounts to:

XX %

This certificate (No. XXX) is valid until the **XX.XX.XXXX** (2 years upon issue). The certificate will lose its validity in case of qualitative or quantitative changes of packaging components.

Place, the XX.XX.XXXX

Institute cyclos / HTP

NAME
Publicly appointed and sworn expert of the IHK for packaging waste disposal
Competent authority: IHK Aachen

This certificate (No. XXX) is only valid in conjunction with 3 pages of the related assessment report.

Institute cyclos-HTP GmbH
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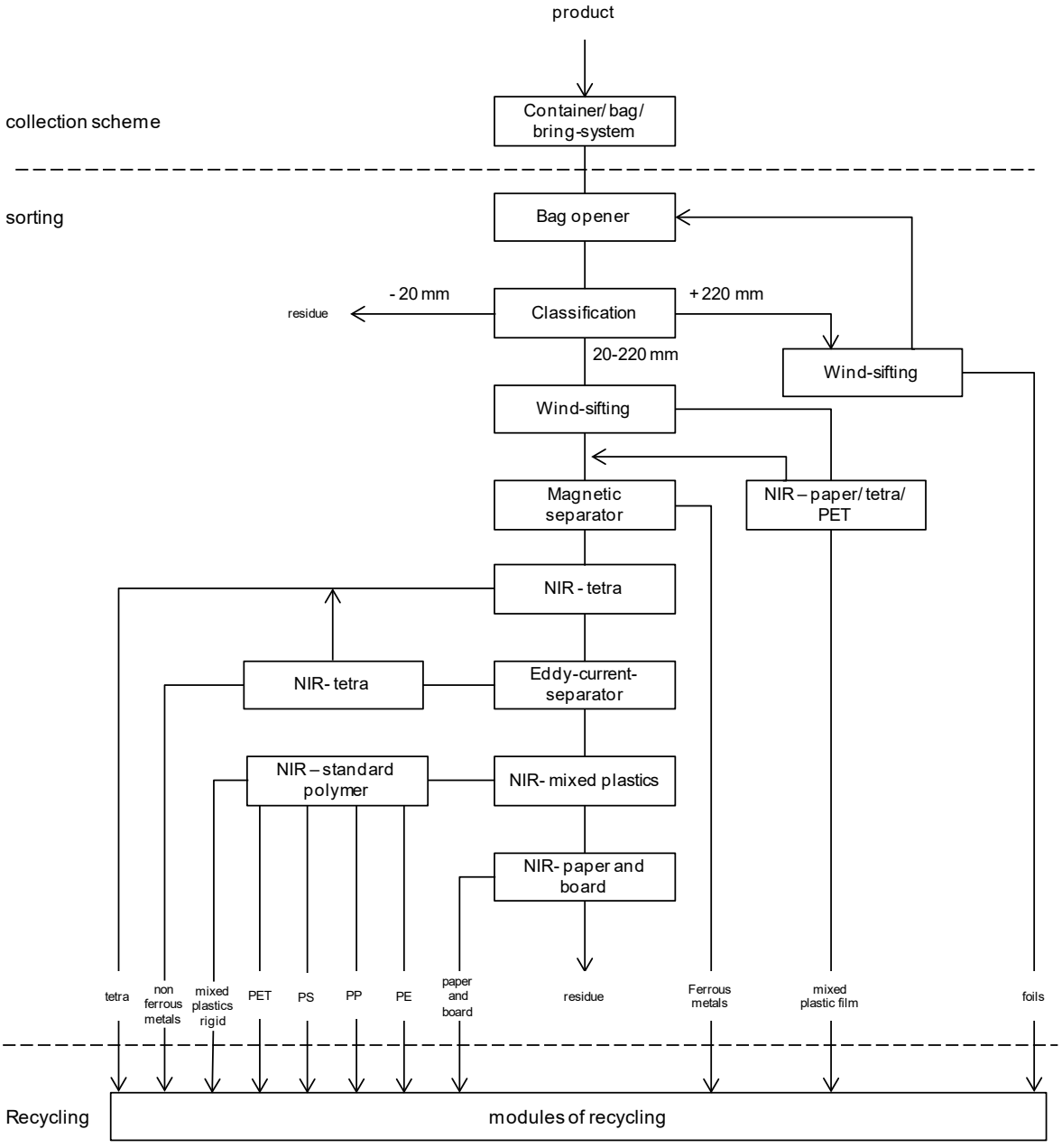
4.2 Appendix 2: Reference scenarios including explanations

- Overview - lightweight packaging / recycling bin
- Approach 1: Plastic foil
- Approaches 2 and 3: PE and PP
- Approach 4: PS
- Approach 5: PET
- Approach 6: Mixed plastics (inherently stable plastics)
- Approach 7: Mixed plastics (soft)
- Approach 8: Liquid packaging / plastic-coated carton packaging (drink carton)
- Approach 9: Tin plate / ferrous metals
- Approach 10: ALU / non-ferrous metals
- Approach 11: Paper cardboard compounds
- Approach 12: Glass
- Approach 13: Paper, cardboard

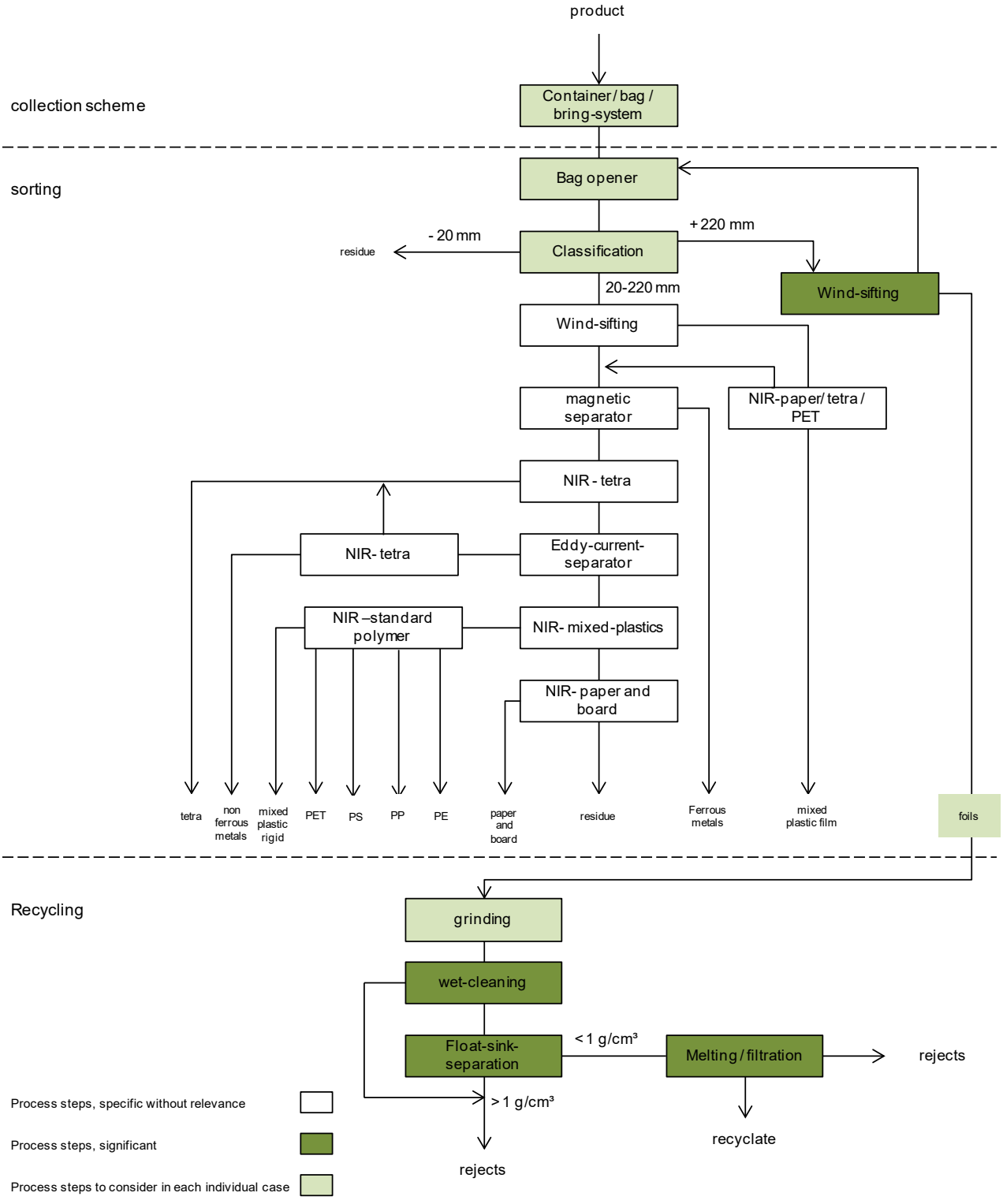
4.2.1 Overview – lightweight packaging / material

Reference scenario recyclability, overview (dated 01/2013)
Collection scheme lightweight packaging / bin for reusable materials



4.2.2 Approach 1: Plastic foil

Reference scenario recyclability, mixed-plastics foils (dated 01/2013)



Collection structures for plastic foils can be assumed in the following countries without further assessment:

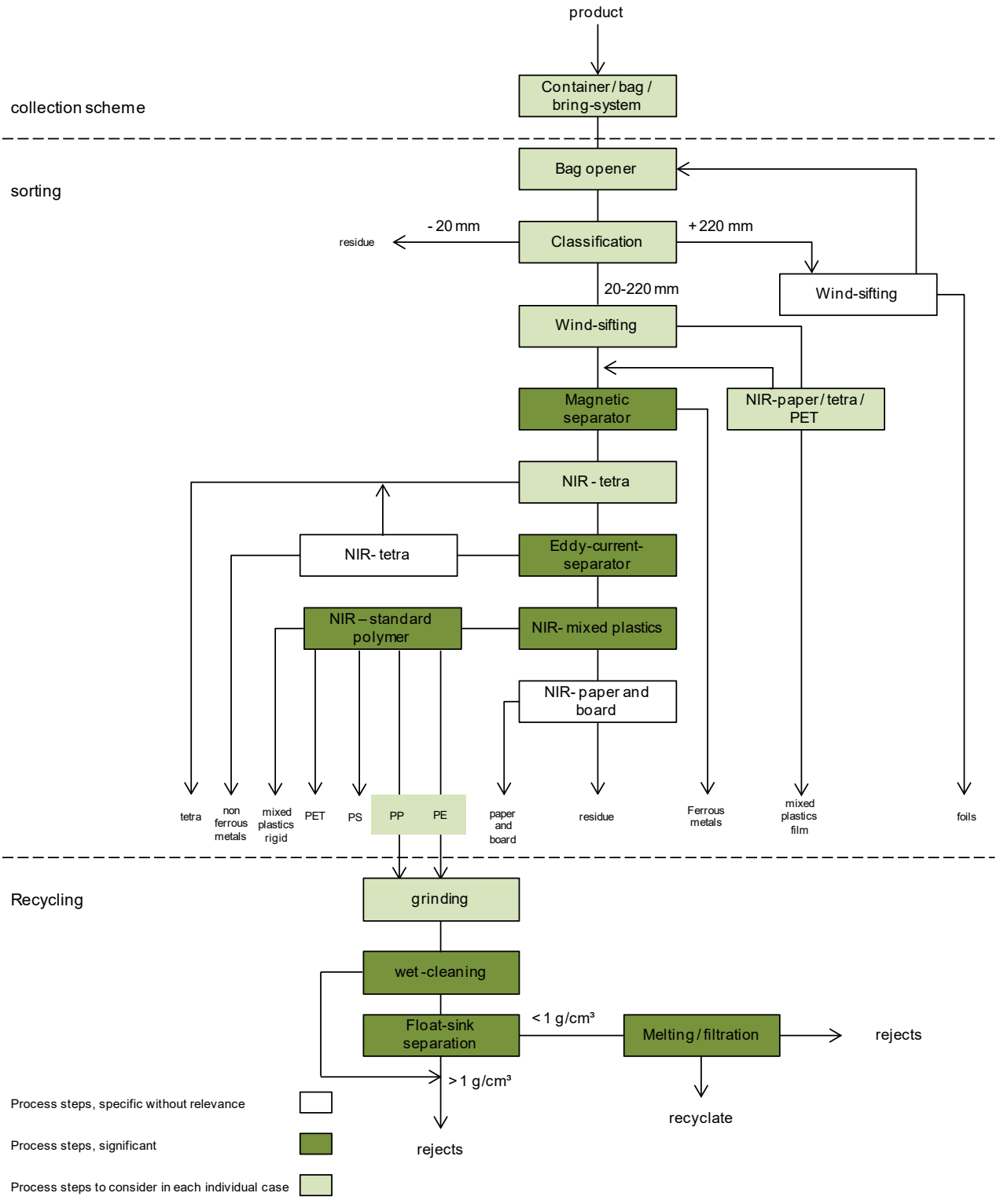
- Germany
- Netherlands
- Norway

To assess recyclability, the following process technology is usually required:

- wind-sifting for foil sorting
- Washing and qualified float-sink separation
- No additional requirements like hot washing, washing additives, etc.
- Extrusion with melt filtration

4.2.3 Approaches 2 and 3: PE and PP

Reference scenario recyclability, PE und PP (dated 01/2013)



Collection structures for PE and PP packaging can be assumed in the following countries without further assessment:

- Germany
- Netherlands
- Norway

With the additional attribute "Bottle and / or container" also in:

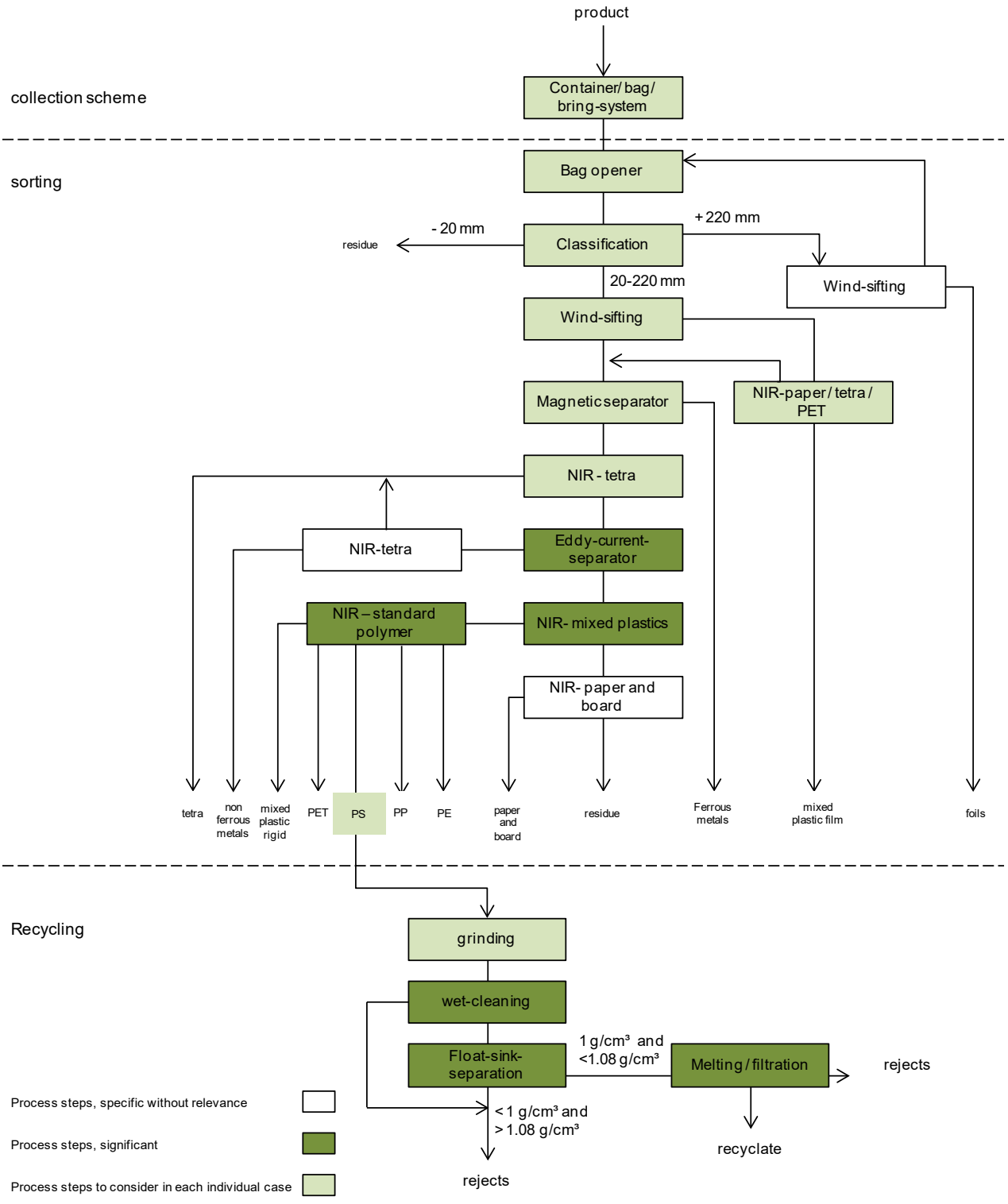
- Belgium
- Spain
- France
- Italy
- Austria
- Switzerland

To assess recyclability, the following process technology is usually required:

- NIR detection for PE/PP (22.5 mm maximum valve distance)
- Ideal conditions for NIR detection of small / small format material
  - High-resolution detection
  - Valve distance ≤ 16.5 mm
- Integration of the entire grain range > 20 mm by return and / or manual sorting in coarse grain > 220 mm
- Washing and qualified float-sink separation
- Extrusion with melt filtration

4.2.4 Approach 4: PS

Reference scenario recyclability, PS (dated 01/2013)



Collection structures for PS packaging can be assumed in the following countries without further assessment:

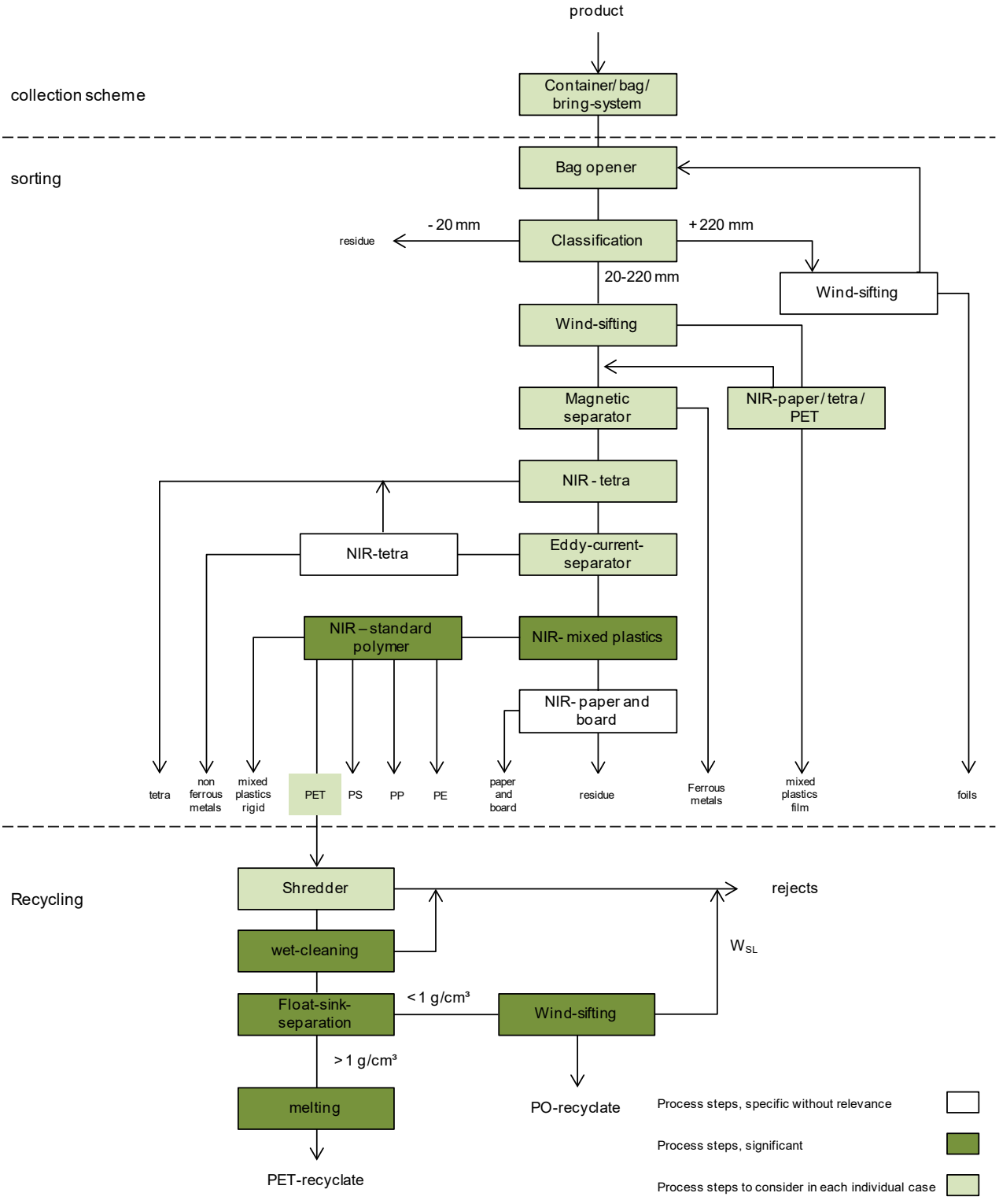
- Germany
- Netherlands
- Norway

To assess recyclability, the following process technology is usually required:

- NIR detection for PS (22.5 mm maximum valve distance)
- Ideal conditions for NIR detection of small / small format material
  - High-resolution detection
  - Valve distance ≤ 16.5 mm
- Washing and qualified float-sink separation
- Extrusion with melt filtration

4.2.5 Approach 5: PET

Reference scenario recyclability, PET (dated 05/2014)



Collection structures for PET beverage bottles can be assumed in the following countries without further assessment:

- European Union
- Switzerland

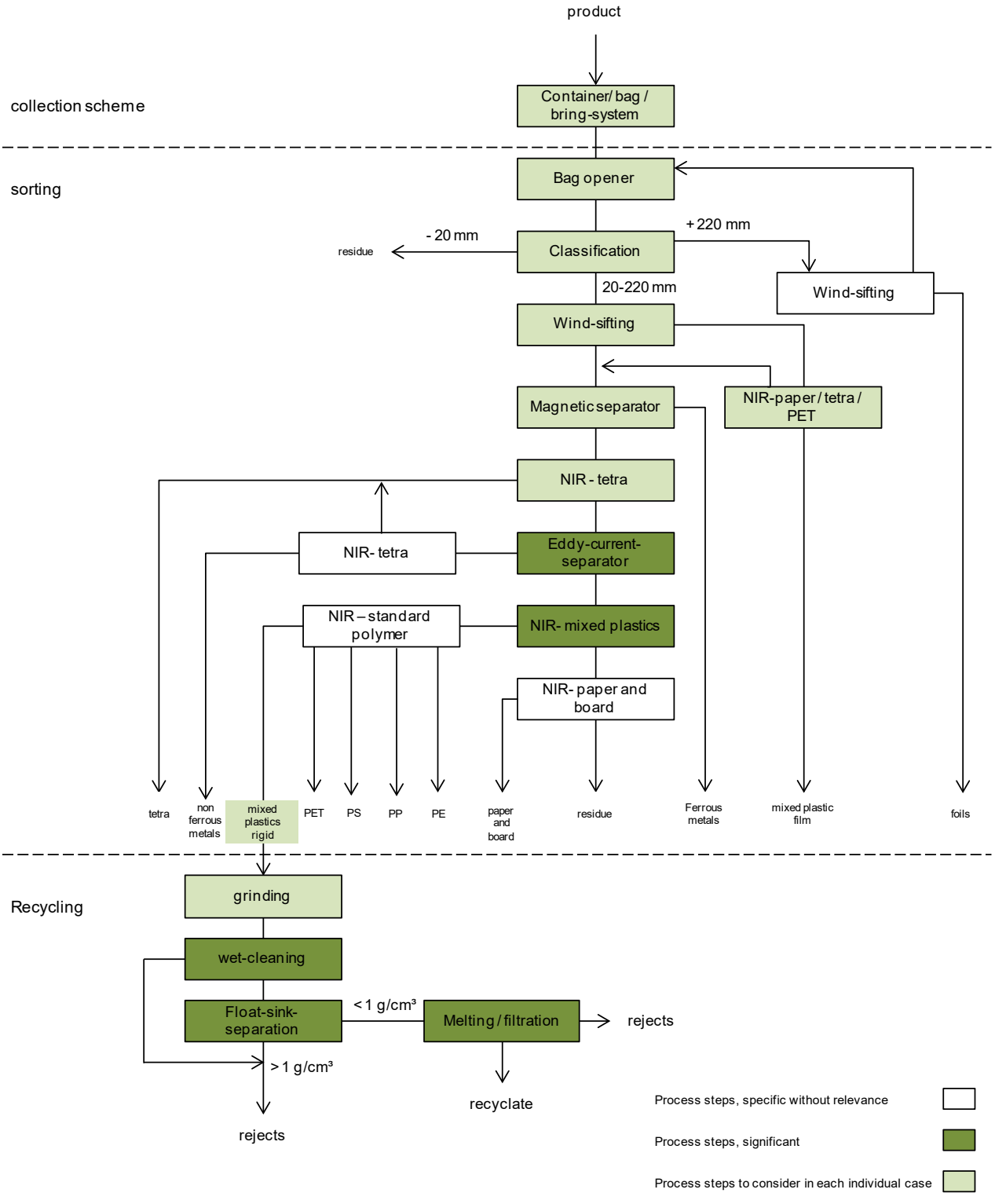
In Germany and Netherlands, also non-beverage bottle PET is collected.

To assess recyclability, the following process technology is usually required:

- NIR detection for PET
- Two-stage hot washing with at least one alkaline hot washing process and qualified float-sink separation
- Extrusion with melt filtration

4.2.6 Approach 6: Mixed plastics (inherently stable plastics)

Reference scenario recyclability, mixed plastic rigid (dated 01/2013)



Collection structures for mixed plastics rigid can be assumed in the following countries without further assessment:

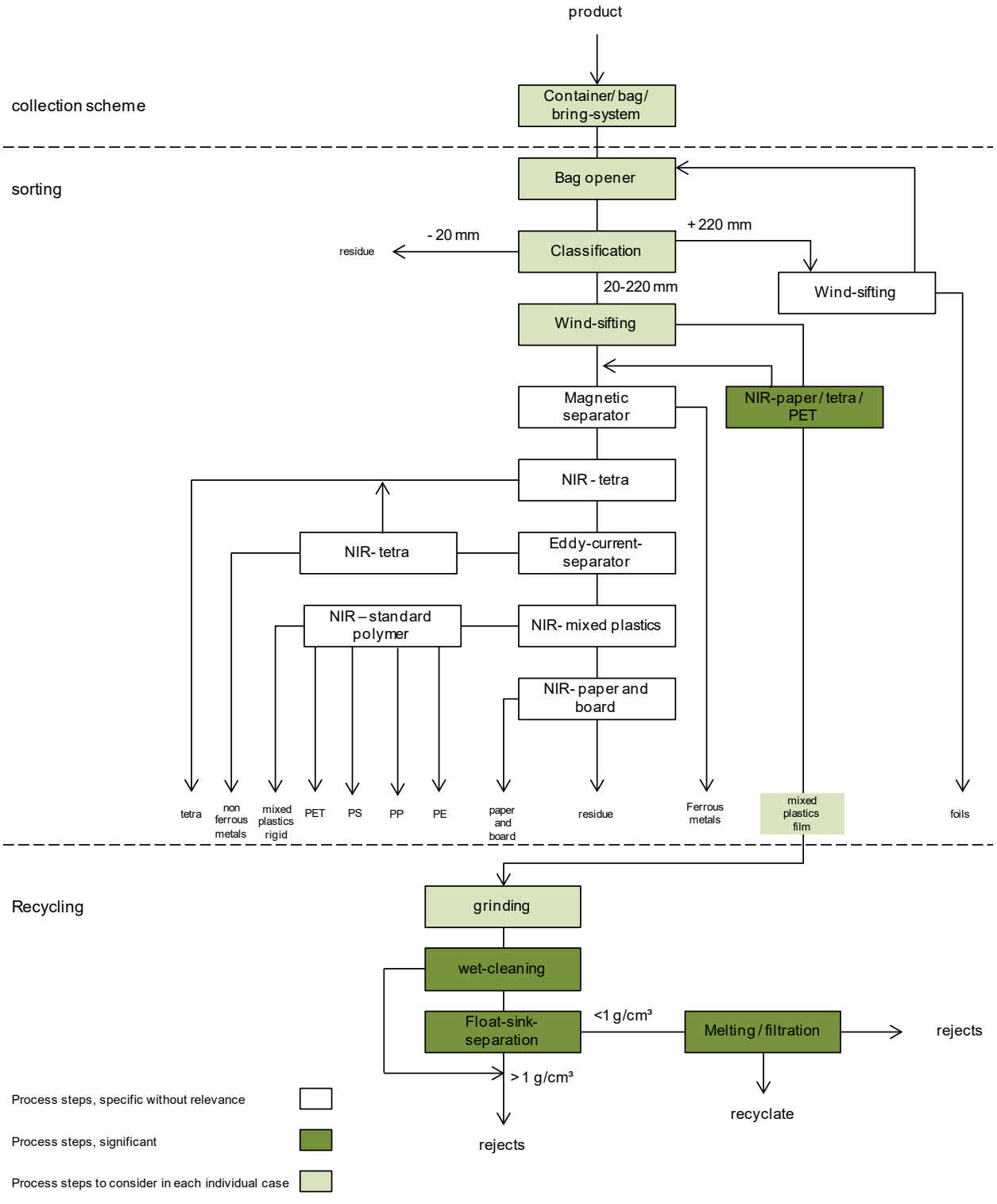
- Germany
- Netherlands
- Norway
- France

To assess recyclability, the following process technology is usually required:

- NIR detection for plastics (22.5 mm maximum valve distance)
- Ideal conditions for NIR detection of small / small format material
  - High-resolution detection
  - Valve distance ≤ 16.5 mm
- Integration of the entire grain range > 20 mm by return and / or manual sorting in coarse grain > 220 mm
- Washing and qualified float-sink separation
- Extrusion with melt filtration

4.2.7 Approach 7: Mixed plastics (soft)

Reference scenario recyclability, mixed plastic film (MKS (W)) (dated 01/2013)



Collection structures for mixed plastics foil can be assumed in the following countries without further assessment:

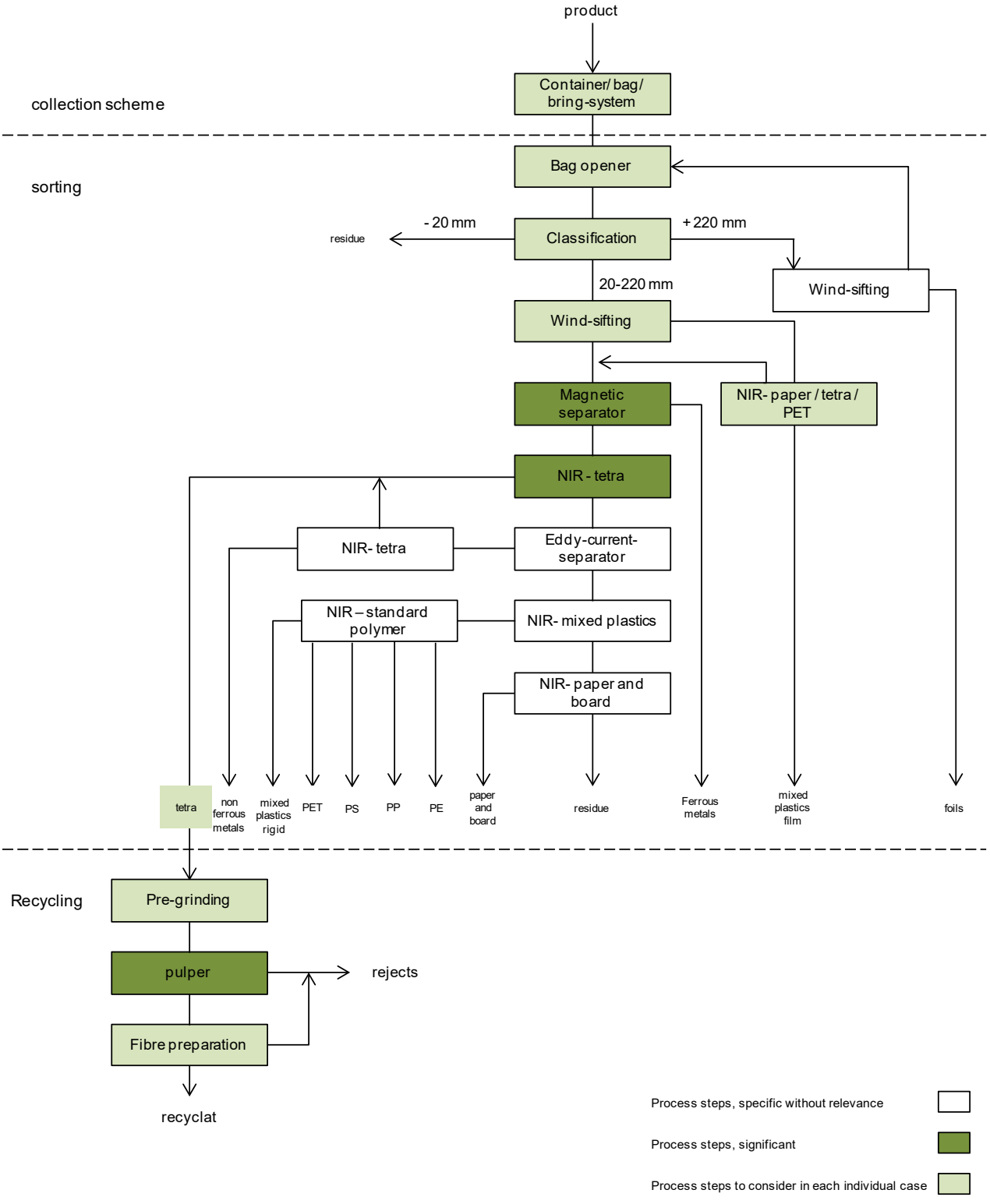
- Germany
- Netherlands
- Norway

To assess recyclability, the following process technology is usually required:

- Wind-sifting in the grain range of 20-220 mm
- NIR detection for paper, tetra and PET in the light fraction of the wind-sifter (post-cleaning)
- Washing and qualified float-sink separation
- Extrusion with melt filtration

4.2.8 Approach 8: Liquid packaging / plastic-coated carton packaging tetra

Reference scenario recyclability, tetra (dated 01/2013)



Collection structures for plastic-coated carton packaging (tetra) can be assumed in the following countries without further assessment:

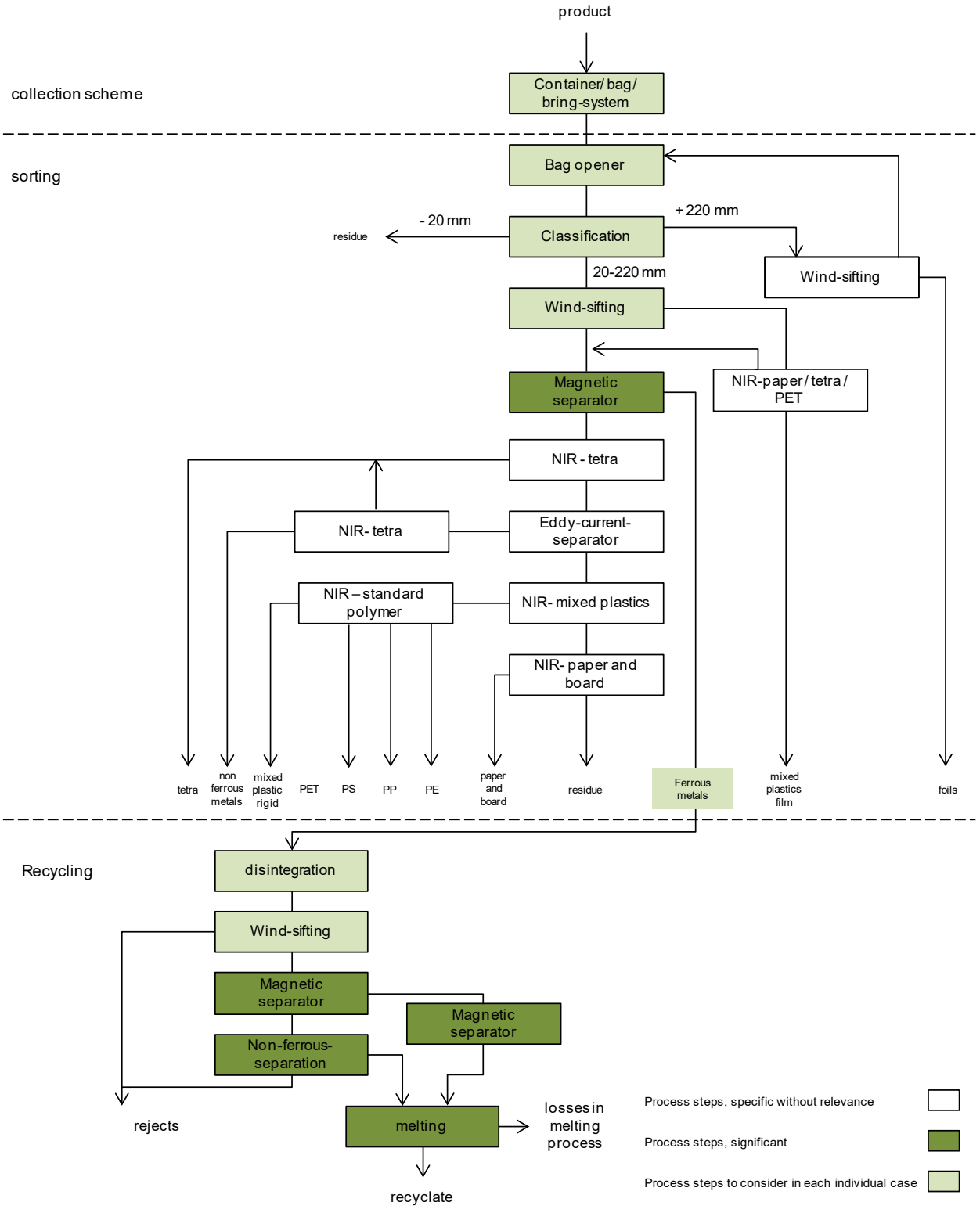
- EU and Switzerland

To assess recyclability, the following process technology is usually required:

- NIR detection for liquid packaging (tetra) in the light fraction of the wind-sifter, wind-sifter heavy fraction and in the eddy current separator product
- Pulping process with standard retention time
- Separation of insoluble components by classification

4.2.9 Approach 9: Tin plate / ferrous metals

Reference scenario recyclability, ferrous metals (dated 01/2013)



Collection structures for tin plate and ferrous metals can be assumed in the following countries without further assessment:

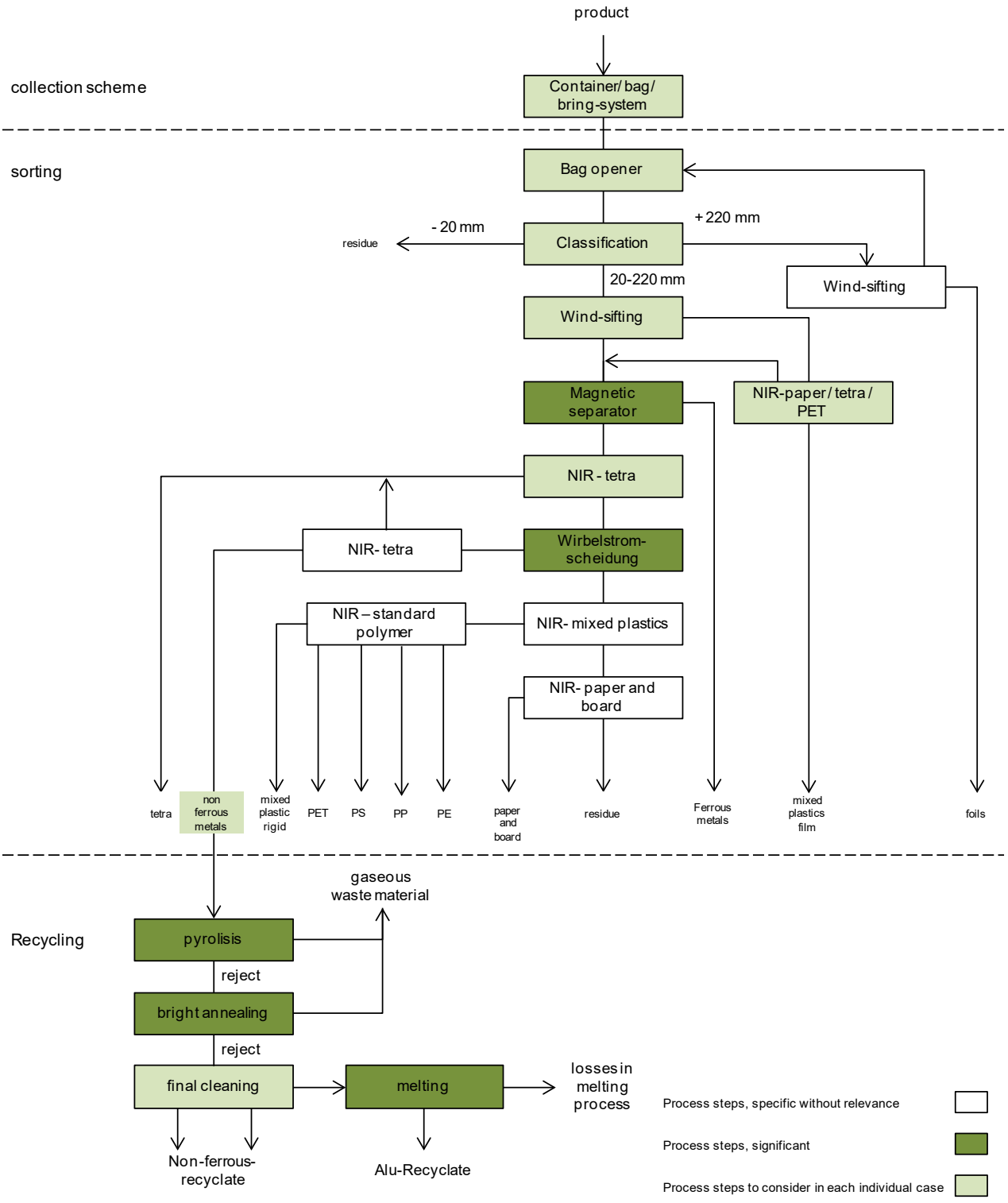
- EU and Switzerland

To assess recyclability, the following process technology is usually required:

- Magnetic separation for ferromagnetic components
- Operation height of the suspension magnet separator 450 mm
- Integration of the entire grain range > 20 mm by return and / or manual sorting in coarse material > 220 mm
- Ferrous metal recovery with magnet and eddy current separation
- Shredder process and subsequent eddy current separation for non-ferrous metal separation

4.2.10 Approach 10: ALU / non-ferrous metals

Reference scenario recyclability, non-ferrous metals (dated 01/2013)



Collection structures for aluminium and non-ferrous metals can be assumed in the following countries without further assessment:

Collection schemes for post consumer non-ferrous metal packaging are installed in most European countries. The organization varies and takes national specialises into account.

The different recycling paths can be classified as follows:

1. Separate collection of drink cans, either via deposit systems (northern countries, Germany) voluntary return systems (central and eastern countries, Turkey) or incentive-based schemes (UK, Ireland, France, Greece, etc.). Especially drink cans and menu trays are part of the separate collection scheme in UK and Switzerland (also tubes and caps).
2. collection schemes where aluminium packaging is put of the collection scheme for mixed packaging waste together with packaging made of plastic, ferrous metal, drink-cartons and partly also paper and OCC (Italy, Spain, Germany, Portugal, France, Belgium, Austria). Aluminium packaging is than separated in sorting facilities. In Germany also compounds or composites with aluminium-foil are in scope of scheme. In the other mentioned countries just items where the main component is aluminium like cans and menu trays are in scope.
3. Recovery from MSW (mechanical pre-treatment MBT or MT) e.g. in Netherlands

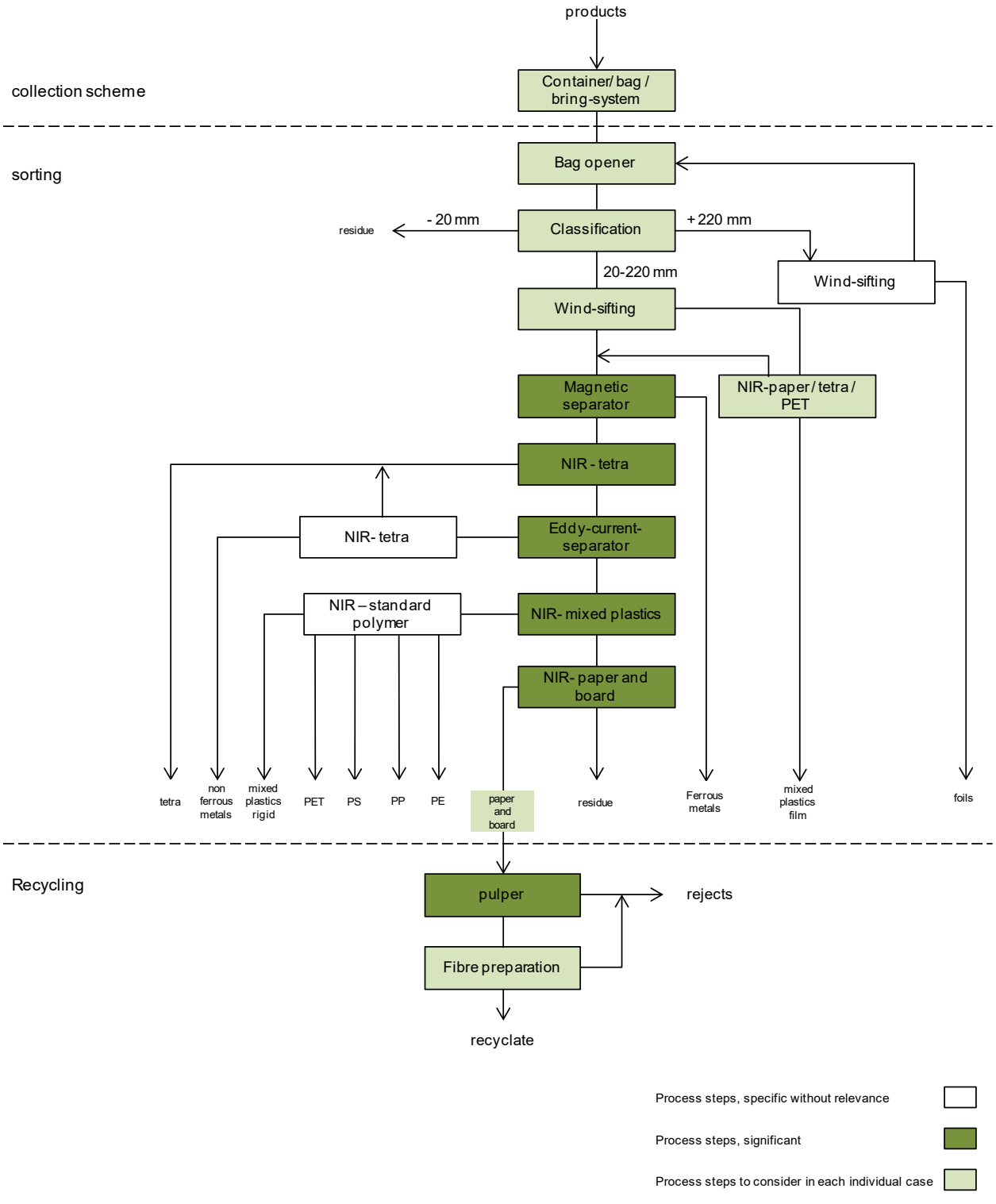
To assess recyclability*, the following process technology is usually required:

- Eddy current separation for metal components with mixed-pole system and eccentric magnet wheel
- NIR detection for paper, tetra and liquid packaging
- Integration of the entire grain range > 20 mm by material feed-back and / or manual sorting in coarse grain > 220 mm

* The reference scenario is not applicable for aluminium-recovery from bottom ashes.

4.2.11 Approach 11: Paper cardboard compounds

Reference scenario recyclability paper and board compounds (PPK – Verbunde) (dated 01/2013)



Collection structures for paper cardboard compounds can be assumed in the following countries without further assessment:

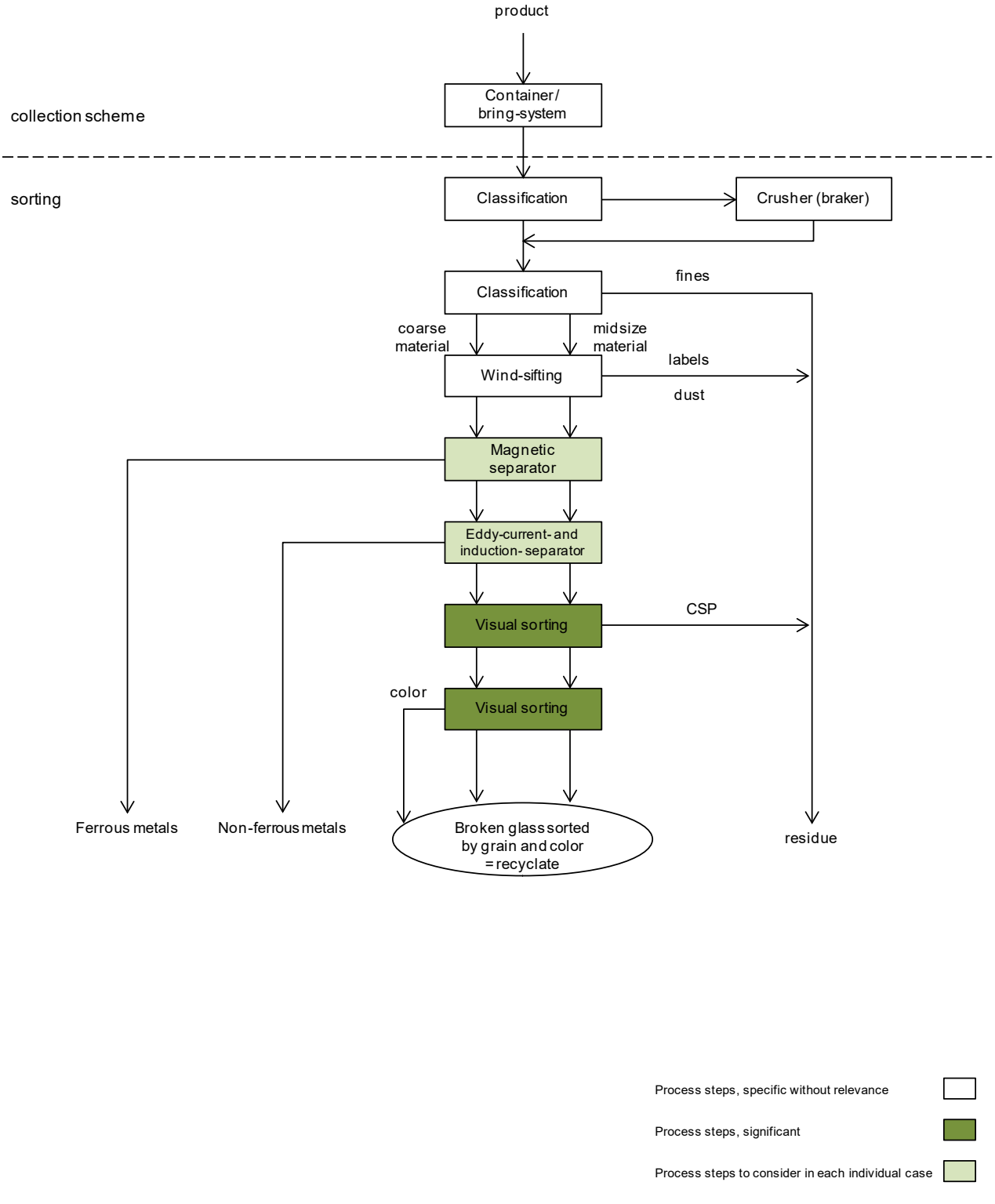
- Germany

To assess recyclability, the following process technology is usually required:

- NIR detection for paper cardboard and paper and tetra
- Integration of the entire grain range > 20 mm by return and/or manual sorting in coarse grain > 220 mm
- Material solution with sufficient dwell time
- Separation of insoluble components by classification

4.2.12 Approach 12: Glass

Reference scenario recyclability, glass (dated 02/2013)



Collection structures for glass can be assumed in the following countries without further assessment:

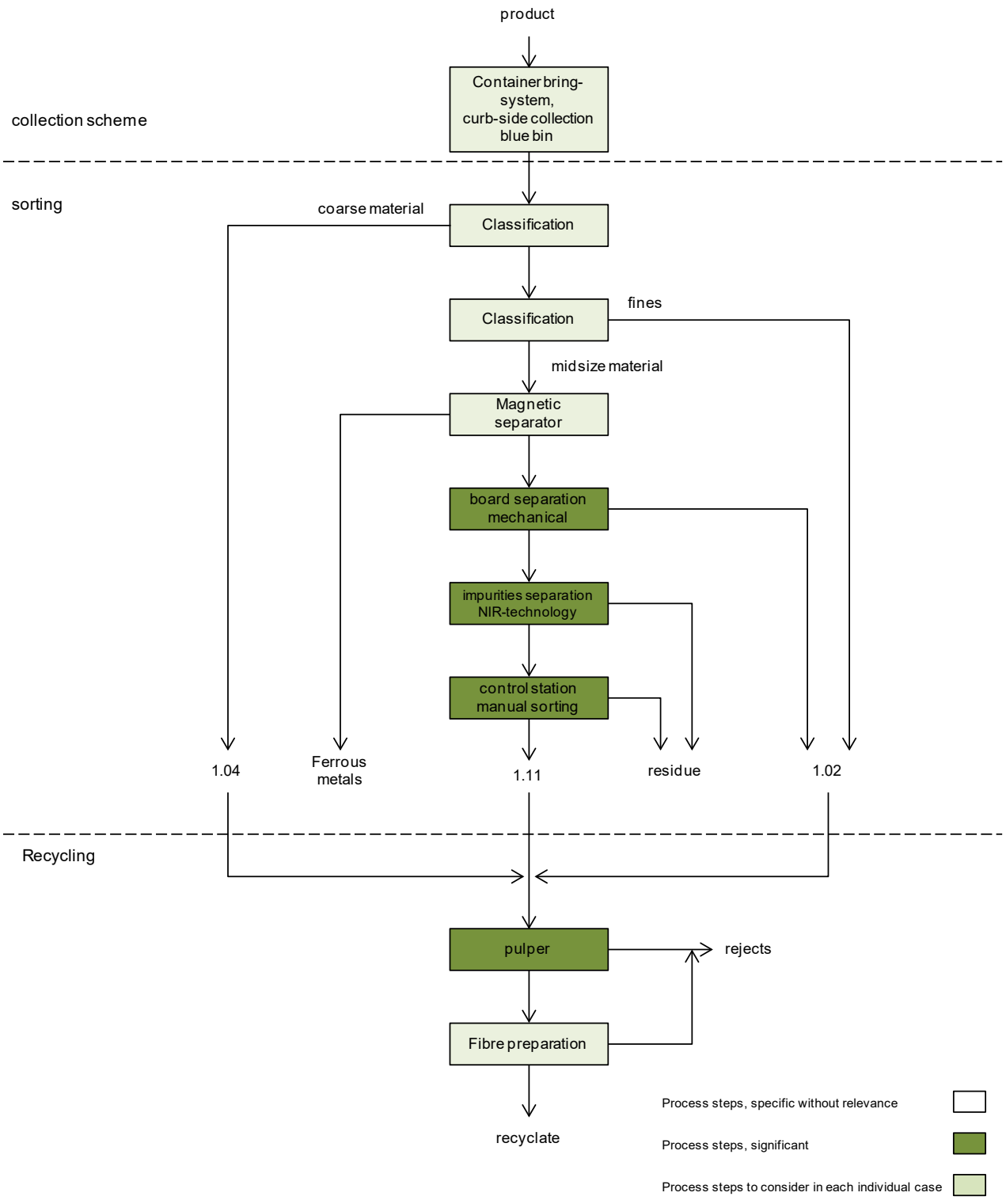
- European Union
- Switzerland

To assess recyclability, the following process technology is usually required:

- High-resolution colour detection for glass and ceramics, stone and porcelain with a grain size > 2 mm

4.2.13 Approach 13: Paper, cardboard

Reference scenario recyclability, paper and board (dated02/2013)



Collection structures for paper cardboard are already available in the following countries:

- European Union
- Switzerland

To assess recyclability, the following process technology is usually required:

- Mechanic cardboard separation
- Automatic sorting of contaminants
- Manual sorting of contaminants
- Material solution with sufficient dwell time (mixed waste-paper, type 1.02)
- Separation of insoluble components by classification

4.3 Appendix 3 Basic data form

Article designation:	**hd**
Article no.:	

1. Basic components

What specific basic components is the product made of (e.g. thermoformed tray and sealing foil or cup, sealing foil and cover)?

Basic component	Description	Individual weight in g or relative proportion of the entire product in %	Special features:
C0 (example)	Thermoformed tray	23 g (78%)	-
C0 (example)	Cap, Lid	8 g (22%)	filled (chalk)
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			
C10			

2. Materials and substances

What individual components do the specific basic components consist of (specification of all layers including coupling agent, adhesive, paint, coating, printing, etc. For plastics, please specify the precise type, e.g., PET-A, PE-NP, etc.)? For adhesive, additives, printing colours etc., please enclose the safety data sheets.

C0 (example)	**Layer / subcomponent**		**Proportion of the basic component (please complete at least 2 of the 3 columns)**			**Special features** (for adhesives, please specify information on water-solubility)
	Material / substance specification		**Weight or surface weight**	**Density**	**Layer thickness**	
	1	PE	20.0 g		22.0 µm	
	2	Coupling agent	2.0 g		2.0 µm	
	3	EVOH	4.8 g		4.0 µm	
	4	Coupling agent	2.0 g		2.0 µm	
	5	PE	22.0 g		22.0 µm	
	6					
	7					
	8					
	9					
	10					

C0 (example)	**Layer / subcomponent**		**Proportion of the basic component (please complete at least 2 of the 3 columns)**			**Special features** (for adhesives, please specify information on water-solubility)
	Material / substance specification		**Weight or surface weight**	**Density**	**Layer thickness**	
	1	PET	12.0 g / m²		11.0 µm	
	2	Printing colour	1.0 g / m²		1.0 µm	
	3	Adhesive	3.0 g / m²		3.0 µm	
	4	Aluminium	20.0 g / m²		7.0 µm	
	5	Adhesive	3.0 g / m²		3.0 µm	
	6	Print	0.02 g / m²		0.02 µm	
	7	PP	45.0 g / m²		50.0 µm	filled
	8					
	9					
	10					

C1	Layer / subcomponent		Proportion of the basic component (please complete at least 2 of the 3 columns)			Special features
	Material / substance specification		Weight or surface weight	Density	Layer thickness	(for adhesives, please specify information on water-solubility)
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

C2	Layer / subcomponent		Proportion of the basic component (please complete at least 2 of the 3 columns)			Special features
	Material / substance specification		Weight or surface weight	Density	Layer thickness	(for adhesives, please specify information on water-solubility)
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

C3	Layer / subcomponent		Proportion of the basic component (please complete at least 2 of the 3 columns)			Special features
	Material / substance specification		Weight or surface weight	Density	Layer thickness	(for adhesives, please specify information on water-solubility)
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

C4	Layer / subcomponent		Proportion of the basic component (please complete at least 2 of the 3 columns)			Special features
	Material / substance specification		Weight or surface weight	Density	Layer thickness	(for adhesives, please specify information on water-solubility)
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

C5	Layer / subcomponent		Proportion of the basic component (please complete at least 2 of the 3 columns)			Special features
	Material / substance specification		Weight or surface weight	Density	Layer thickness	(for adhesives, please specify information on water-solubility)
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

C6	Layer / subcomponent		Proportion of the basic component (please complete at least 2 of the 3 columns)			Special features
	Material / substance specification		Weight or surface weight	Density	Layer thickness	(for adhesives, please specify information on water-solubility)
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

3. Connections of basic components

Basic component no.			Type of connection (mechanical, fully glued, selectively glued, cladding, laminated, etc.)	For adhesives: Water-soluble?
1	and	2	Selectively glued	No
2	and	3	Mechanical, dispersible	

4. Paper cardboard-containing packaging

Are water-resistant paper cardboard parts included?

If yes, in which subcomponents / layers?

5. Printing colours

Are printing colours or raw materials of the EuPIA exclusion list applied?

If yes, in which basic components?

6. Additives, fillings, barrier layers

If not already provided under no. 2, specify in the following information on additives and barrier layers with reference to the individual components, if applicable.

Samples

☐ The following number of product samples in enclosed (usually 10) ____

Safety data sheets for the following materials, components enclosed / are subsequently provided

Contact

If you have questions or require additional information, please contact

Name: _____

Contact information: _____

_____

_____