STEEL FOR PACKAGING

Source: Tata Steel.

Good practices in separate collection, sorting and recycling of steel for packaging

Report 2018

APEAL

Abstract

Produced by APEAL, the Association of European Producers of Steel for Packaging[1], this report examines the diverse routes discarded steel packaging takes, to become a secondary raw material which will be used to manufacture a new steel product.

Good practices in separate collection, sorting and recycling of steel for packaging showcases the varied projects, systems and processes via which steel packaging is recycled, closing the material loop. It is intended to serve as a central reference for examples of good practice which contribute to the recycling rate of steel for packaging.

Between being placed in a dry recyclables bin and used once again at a steel plant after sorting and processing, used steel packaging can be subject to a wide range of processes. These include separate collection, household waste collections, sorting at Material Recovery Facilities (MRFs), extraction via Mechanical-Biological Treatment and recovery from bottom ashes.

All of these systems contribute to the delivery of used steel packaging as a secondary raw material that is ready to be recycled at the steelworks and used in the production of new steel products.

A permanent material[2] that can be infinitely recycled to make high quality products, steel can be easily sorted out from the waste stream due to its magnetic properties which make it the most economical packaging material to sort, recover and recycle, over and over again. The 2015 recycling rate is 77.5%, making steel for packaging the most recycled packaging material in Europe, bringing ever-greater savings in emissions, resource and energy use[3], making steel the perfect material for the circular economy.

Providing a representative sample, this report highlights examples which APEAL believes constitute best practice in different geographical areas across Europe.

[1]APEAL (n.d.). Retrieved from: www.apeal.org
[2]Metal Packaging Europe, Permanent Material. (n.d.). Retrieved from: www.metalpackagingeurope.org
[3]APEAL. (2017). All-time high for steel packaging recycling in Europe. [Press release]. Retrieved from: www.apeal.org

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About **APEAL**

APEAL, the Association of European Producers of Steel for Packaging, is a federation of the four major producers of steel for packaging ArcelorMittal, Tata Steel Packaging, thyssenkrupp Packaging Steel, and U.S. Steel Košice. These four companies employ over 200,000 workers in Europe.

Founded in 1986, today APEAL represents over 95% of the total European production of steel for packaging. We are committed to working with all relevant stakeholders to ensure understanding and support for steel as a sustainable and resource efficient packaging solution. Our vision is that of a closed material loop, with 80% recycling by 2020 and no steel packaging to landfill.

APEAL objectives are:

- Contribute positively to the development of EU policy related to Steel for Packaging, particularly in the areas of packaging, waste, recycling and recovery
- Monitor technical developments to ensure industry compliance
- Document, support and communicate the environmental, social and economic benefits of Steel for Packaging

About
Steel for Packaging

APEAL represents the EU producers of steel for packaging.

Steel is a unique packaging material, combining exceptional performance capabilities with unrivalled environmental credentials. Strong, formable and long-lasting, steel offers numerous benefits for the safe packaging of a wide variety of products. The primary use of steel packaging sheets and coils is the manufacture of tin cans. The table below illustrates how steel sheets and coils are used by packaging manufacturers to produce a variety of products.

Market segment	Examples of final products
Food	Pet food Fish Cans Vegetables and soup
Beverages	Beer, soft drinks, juices
Aerosol cans	Personal care, household and industrial products
General line	Cans for paint, edible oil or syrups; decorative tins (promotional packaging); tins for confectionery and for dry products (milk powder/coffee), industrial products
Closures	Crown corks and twist off for glass bottles and jars
Non- packaging	Toys and gas canisters, including speciality packaging and drums

Table 1: Main market segments for steel packaging (tinplate, ETP). APEAL.

Introduction

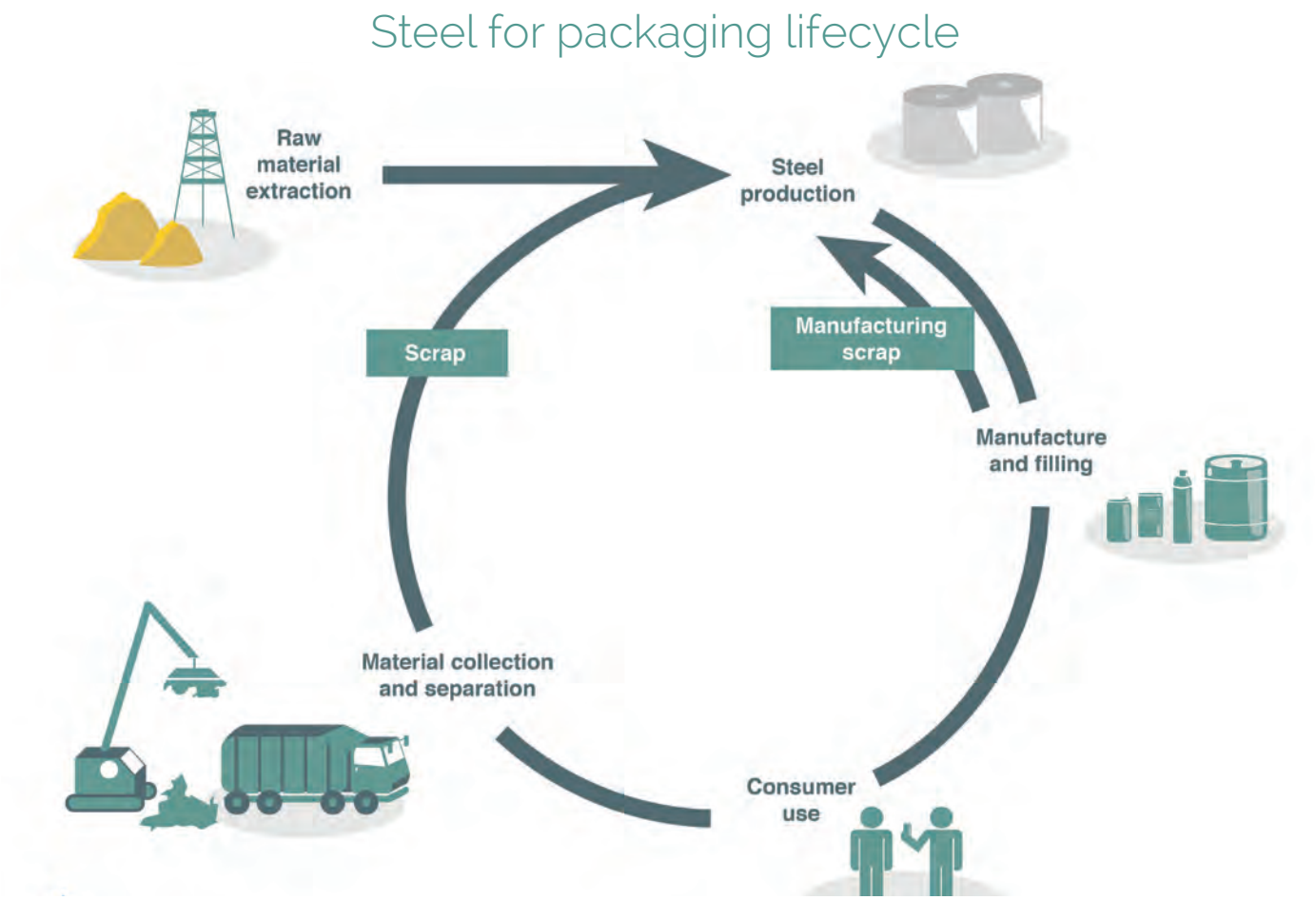
Good practices in separate collection, sorting and recycling of steel for packaging provides a summary of cases where steel for packaging is effectively extracted from the waste stream and successfully recycled across the European Union (EU).

The European framework legislation for steel for packaging recycling includes the Packaging and Packaging Waste directive[4] (PPWD) and the Waste Framework Directive[5] (WFD).

This report is timely as the "Circular Economy Package" proposed by the European Commission on 2 December 2015 is expected to be adopted and published in the Official Journal in 2018.

Steel is a permanent material that can be recycled and used to produce new steel products again and again. The recycling of steel leads to the avoidance of emissions like greenhouse gases and eutrophication and also helps to save energy and natural resources like iron ore, coal and limestone.

This report provides information relevant to all organisations and stakeholders both in the public and the private sector wishing to learn more about a real and successful material recycling story.



[4]EUROPEAN PARLIAMENT AND COUNCIL DIRECTIVE 94/62/EC of 20 December 1994 on packaging and packaging waste. (1994, consolidated). Official Journal of the European Communities, No L 365/10. Retrieved from : http://eur-lex.europa.eu
[5]DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives. (2008). Official Journal of the European Union, L 312/3.Retrieved from: http://eur-lex.europa.eu

APEAL Statistics: steel packaging recycling in Europe

APEAL conducts an annual data collection exercise for steel packaging recycling in Europe.

Mirroring the methodology used by Eurostat, but focused on domestic steel recycling figures, APEAL collects data to provide the yearly steel packaging recycling rate – the current legislation foresees that the European countries can choose to report the recycling of packaging as 'metals' or separately as 'steel' and 'aluminium'. The fitness check of the Packaging and Packaging Waste Directive as a consequence of the Circular Economy Package suggests that EU Member States will have to implement systems to report ferrous metals and aluminium separately.

The most recent data collection exercise (data from 2015) resulted in a recycling rate of 77.5%[6], confirming that steel packaging was the most recycled packaging material in Europe.

[6]APEAL. (2017). All-time high for steel packaging recycling in Europe. [Press release]. Retrieved from: www.apeal.org

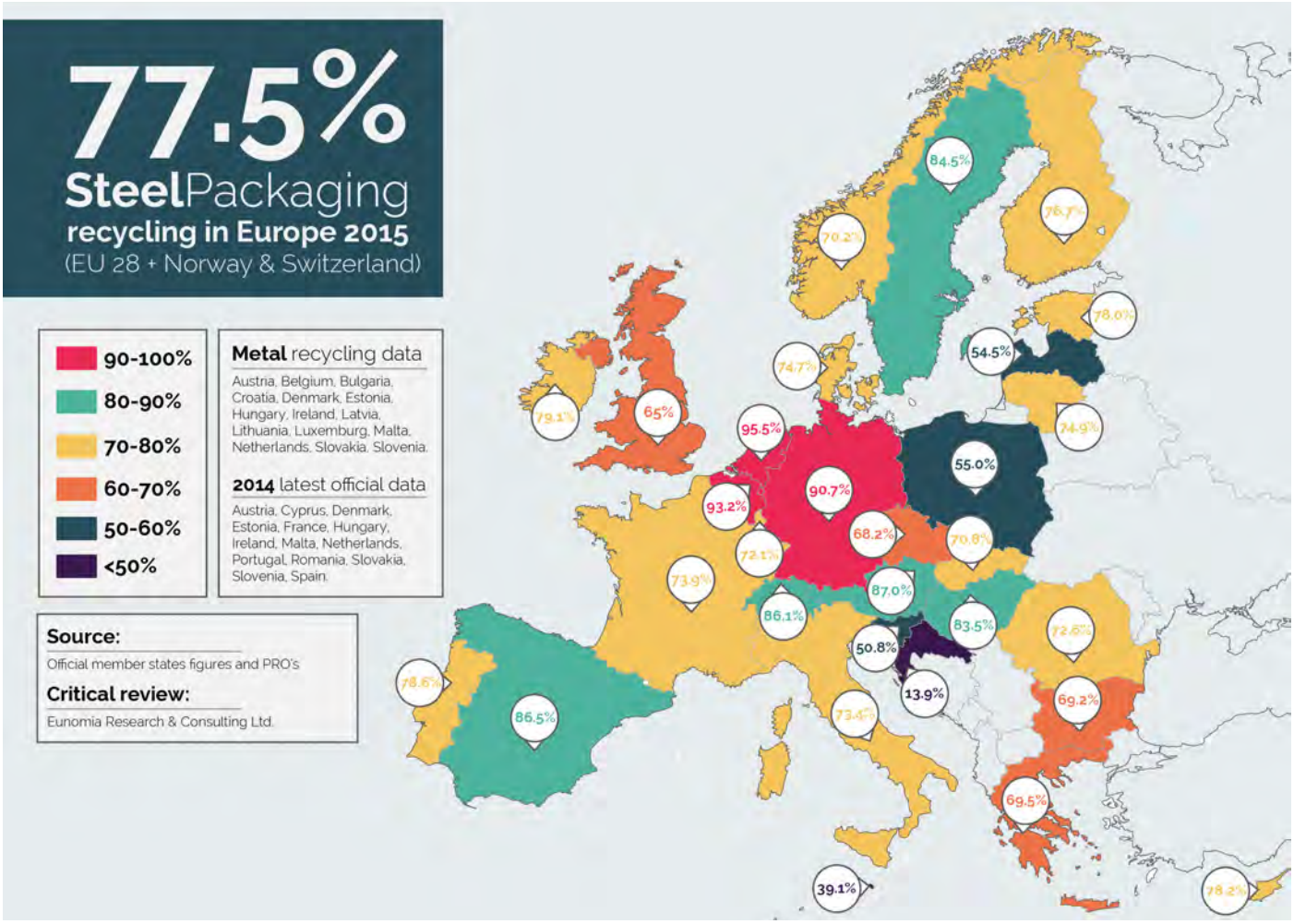


Figure 1: 2015 Steel packaging recycling in EU 28+2 APEAL.

To ensure the data collected is reliable, the methodology and data sources used by APEAL for the calculation of the steel recycling rates are third party reviewed, audited and certified by the energy and waste specialist consultancy, Eunomia.

The current packaging waste recycling statistics reported by Eurostat allow European Member States to measure the recycling of packaging materials at different steps of the value chain. Due to the national differences present at Member State level in Europe, the point at which recycling is measured varies from one country to the other.

APEAL supports recycling statistics that measure “real recycling”, meaning the recycling rate refers to recovered materials that are actually integrated in a new material production process.
As all steel packaging returned to the steel works is effectively recycled and integrated in the production process of new steel, the APEAL recycling rate measures ‘real recycling’.

Today, steel is the best placed of all packaging materials to reach the targets proposed by the revision of the Packaging and Packaging Waste Directive in the context of the Circular Economy Package.

Steel for Packaging and Circular Economy

The EC started working on the so called 'Circular Economy Package' in December 2015 as part of a Circular Economy Strategy for the European Union[7].

The legislative proposal which underpins the Circular Economy Package includes an Action Plan for the EU, to facilitate the move towards a new economic model.

- It also includes a fitness check of the following legislative proposals:
- a review of the Waste Framework Directive[8], which gathers all relevant issues regarding the treatment of all sorts of wastes generated in Europe
- the Packaging and Packaging Waste Directive[9], which lays down more specific details concerning the generation of packaging waste and includes the packaging waste recycling targets with which all packaging materials have to comply
- the Landfill of Waste Directive[10], which tackles and regulates the sorts of landfills present across Europe
- and the Waste Electric and Electronic Equipment, End-Of-Life vehicles, and Batteries and Accumulators and Waste Batteries and Accumulators Directive[11] is proposed.

The five legislative proposals follow the European Union ordinary legislative procedure. Once the EP and the EC agree on a final compromise text, the Commission will release the final legislative text and publish it in the in the Official Journal of the European Union.
These directives are translated into national legislation in a process called 'transposition' and enter into force at national level usually within two years after the adoption of the legislation, which is determined by the publication in the Official Journal of the European Union.

The different Member States are given a certain level of flexibility when it comes to translating European directives into national laws; this often generates differences in the way the Directives are implemented.

National authorities in each Member State are responsible for the enforcement of these national laws, but the European Commission (EC) also performs transposition and conformity checks.

As an advanced industrial sector, APEAL and its members support the switch from a linear to circular economy[12].

[7]European Commission. (2015). Closing the loop: Commission adopts ambitious new Circular Economy Package to boost competitiveness, create jobs and generate sustainable growth [Press release]. Retrieved from: http://europa.eu/rapid/press-release_IP-15-6203_en.htm
[8]DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives. (2008). Official Journal of the European Union, L 312/3.Retrieved from: http://eur-lex.europa.eu
European Commission. (2015). Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 94/62/EC on packaging and packaging waste. Retrieved from: http://eur-lex.europa.eu
[9]European Commission. (2015). Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 1999/31/EC on the landfill of waste. Retrieved from: http://eur-lex.europa.eu
[10]European Commission. (2015). Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directives
[11]2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment. Retrieved from: http://eur-lex.europa.eu
[12]APEAL. (2017). Circular Economy Package confirms steel for packaging as a recycling leader. [Press release]. Retrieved from : https://www.apeal.org/

Good practices in separate collection, **sorting and recycling of steel for packaging**

Steel packaging undergoes many steps after fulfilling its function and being discarded.

Depending on the waste management strategy of the EU Member State in which steel for packaging becomes waste, it will follow different treatment routes.

Steel for packaging can be sorted at source, separately collected co-mingled with other dry recyclables and sent for sorting to a Material Recovery Facility. After that, a steel scrap bundle will be sent for final recycling to the steel making plant.

Where separate collection of dry recyclables is not fully implemented, steel packaging is discarded with the residual waste stream and perhaps sent to a waste-to-energy plant. Thanks to steel magnetic properties, steel can be extracted from the bottom ash residue to be integrated in the steel making process again. Steel packaging also arises from Mechanical-Biological Treatment plants where these are integrated in the waste management setting.

Each of these treatment routes enables the secondary raw material to be integrated in the production process of new steel.

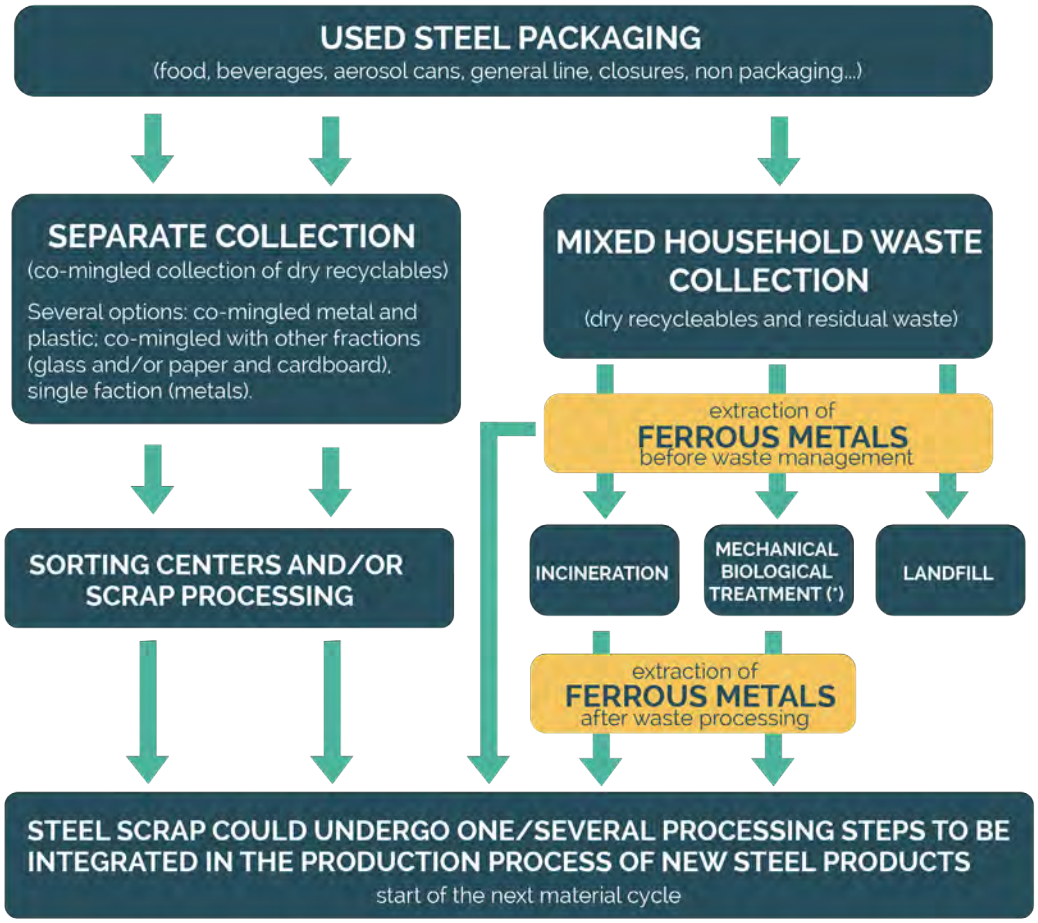


Figure 2: Overview of the recycling system for steel packaging. APEAL

The first step towards recycling of steel packaging: awareness raising activities and campaigns

Steel packaging is commonly used for products widely available in day-to-day life from tin cans to aerosols or beverage cans passing through a wide array of other applications.

The first step towards a real recycling dynamic starts at domestic level, by correctly choosing the bin in which steel for packaging items should be placed once discarded. The decision by local authorities on the availability of adequate structures for source separation of the waste, and the information provided to consumers about how to correctly sort steel waste in order to make it easily available for recycling are key to ensure high quality material enters a recycling facility.

To highlight the importance of the authorities and consumers' education about steel packaging recycling, two examples have been provided below. Many other industry initiatives and other good practice cases also exist.

The Green Laboratory for Recycling

The Green Laboratory for Recycling[13] is an awareness raising campaign conducted by the Green Dot in Romania (Ecorom Ambalaje[14]) in cooperation with the Romanian Ministry of Environment and Climate Change and the Romanian Ministry of Education. This national program was launched in September 2012 and was active and running until 2014. The purpose was to bring added value to the Romanian education system and increase awareness of the importance of properly sorting packaging waste.

[13]EcoRom Ambalaje. (2012). The Green Laboratory for Recycling. Retrieved from: http://www.adcromania.ro/
[14]EcoRom Ambalaje. (n.d.). Retrieved from: http://ecoromambalaje.ro

The programme designers put together a fully-immersive interactive experience targeting primary school children. The experiential education approach used multimedia interaction guiding the students through three different steps:

- The mini 3D cinema zone – film broadcasting processes of 5 packaging waste streams inside a Material Recovery Facility (MRF)
- The digital area (equipped with tablets) – sorting simulation contest
- The magic recycling cube – simplified mechanics of recycling for packaging waste materials

At the end of each semester, students reaching the highest national score were rewarded with a visit to a recycling factory in Romania.

The success of this awareness raising campaign resulted not only from the format of the programme – a fully modified bus combining dynamism and interactive high-tech learning – but from the involvement of teachers and parents who were also welcome to take part in it.

Figure 4: The Green laboratory for recycling brochure. Ecorom ambalaje.

One year after the official launch, The Green Laboratory for Recycling won two international awards: Golden Award for Excellence at the European CSR Awards and the Small and Medium Business Section and Silver Stevie Award in the International Business Awards competition.

Interactive sorting plant visits, France

The first step towards a clean material flow starts at household level and education is a key step towards better quality material.

French municipalities in partnership with sorting centres or Material Recovery Facilities have developed a project enabling children from local schools to participate in interactive visits to French sorting plants in their region.

The visits allow children to virtually interact with situations in which they would have to choose how to properly sort their waste. Explanatory videos as well as interactive games are used to show children how to separate all packaging formats available in their day-to-day lives effectively, and learn what can and cannot be placed in the different waste bins.

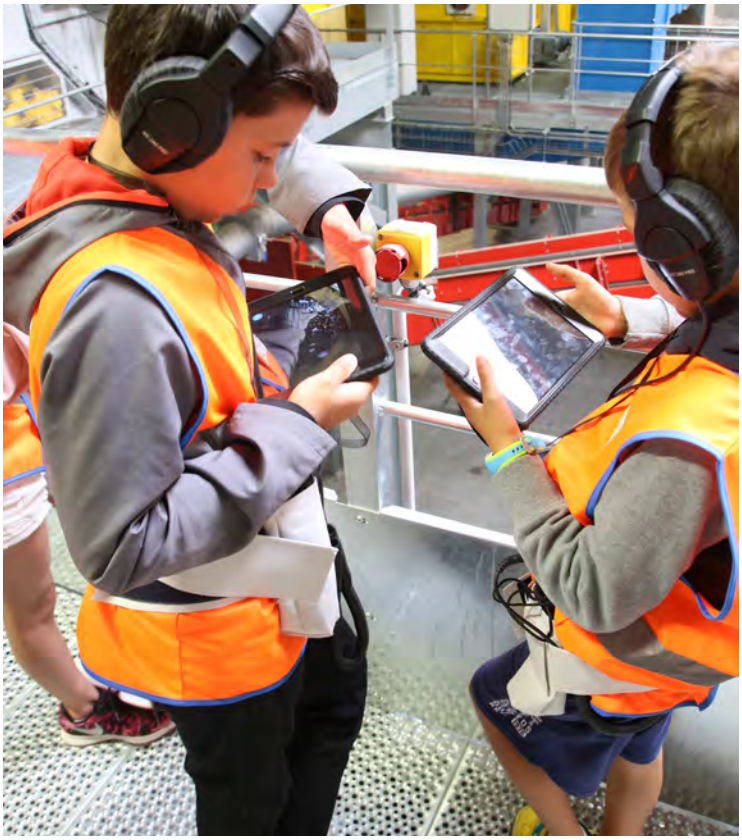


Figure 5: Children visiting sorting facility and using interactive support. Image courtesy of Trivalis.

Awareness raising campaigns tailored to the needs of different target audiences are crucial to achieve a better recycling society. Site visits, explanatory videos and interactive learning experiences form a very interesting set that can help to draw attention on how to properly separate packaging waste at home. Other awareness raising activities target different groups such as adults or businesses, like the initiative Every Can Counts[15].

These two good practices focus on early age consumers, and are integrated at the school level therefore providing a parallel learning experience. They are interactive and user friendly and successfully combine innovative learning with the acquisition of visual first-hand knowledge about recycling technology. What can be agreed is that raising awareness is the first step towards quality improvement when it comes to steel packaging recycling.

The second step towards recycling steel packaging: separate collection of household packaging waste.

The rise of separate collection in Europe and North America happened during the 1990s.

As the limitations of source separation became apparent, especially public willingness to participate and the increasing complexity and costs of collecting an increasing number of mono-material fractions separately, source separation programmes where recyclables are partially or fully commingled, expanded rapidly. This is most notable in English speaking countries (USEPA, 2011; WRAP, 2011b), and the collection of mixed packaging waste has become the norm in Europe[16].

The Waste Framework Directive (Directive 2008/98/EC) lays down in Article 11 that separate collection systems for at least paper, metal, plastic and glass should be implemented across the European Union by 2015.

Country-specific lightweight packaging waste collection schemes are often designed and organised by national and local/regional authorities. When planning and designing the implementation of a household separate waste collection system there is no 'one size fits all' solution. This explains why it is difficult to find publications that identify an optimal household separate collection system.

[15]Every Can Counts. (n.d.). Retrieved from: https://www.everycancounts.eu/
[16]Cimpan C., Maul A., Jansen M., Wenzel H. (2015) . Central sorting and recovery of MSW recyclable materials: A review of technological state-of-the-art. Journal of Environmental Management.

What is clearly agreed is that separate collection of lightweight packaging waste has many advantages, even if opinions differ when it comes to the design and implementation of the different systems[17]. When it comes to recovering steel packaging as a secondary raw material, separate collection of dry recyclables proves to be the desired collection route. Its unique magnetic properties make steel the easiest and most economical packaging material to recover and recycle over and over again and are a definite advantage when it comes to extract it from the packaging waste flow.

The Case of Fostplus, Belgium

The separate collection of packaging waste in Belgium is organized by Fostplus (Belgium Green Dot).

Dry recyclables are collected separately from the residual waste stream and placed in blue bags, which are defined as PMC bag (Plastic, Metals and Cartons[18]). This system runs with the use of specific bags for the dry recyclables but other countries have a curbside collection system or 'bring points'.

Figure 7: Sorting rules for the dry recyclables (or blue) bag. Fostplus.

[17]European Commission - DG ENV (2016). Assessment of separate collection schemes in the 28 capitals of the EU (Reference: 070201/ENV/2014/691401/SFRA/A2).
[18]Fostplus. (n.d.). Règles de tri PMC. Retrieved from: https://www.fostplus.be
[19]Belgium, density of population. (n.d.). Wikipedia. Retrieved from: https://en.wikipedia.org/wiki/Belgium
[20]Fostplus (n.d.) Sorting rules for the blue bag. Retrieved from: https://www.fostplus.be/

It is important to note that collection systems can also vary at regional and even at municipal levels.

Separate waste collection in Belgian cities takes place via a door-to-door basis. A waste collection scheme is planned depending on many factors, one of them being the density of population. Belgium (and especially Brussels) has an average population density of 370.3 hab/km2[19] which makes the door-to-door system appropriate for cities and densely populated areas. Some other regions may benefit from bring points – points in which a series of containers are located for consumers to bring their waste to.
Fostplus has a specific set of rules[20] relating to the use of its blue dry recyclables bag that tell citizens which type of packaging waste can be placed in that waste stream. The better the sorting is at household level, the better the quality at the entrance of the sorting plant is expected to be.
Packaging items allowed for collection in the dry recyclables Belgian blue bag are:

- Metal packaging
- Plastic bottles and flasks
- Drinks cartons

Blue dry recyclable bags are collected separately from the other waste streams (residual, paper and cardboard at household level, since glass is collected at bring points) and taken to a dry recyclables sorting centre[21], also known as a Material Recovery Facility (MRF).

The aim of sorting centres or MRFs is to separate the waste into mono-material flows. Discarded steel packaging items are isolated from the waste stream via magnetic separation. Baling presses are then used to compress the steel into bundles which are suitable for transportation.

Steel packaging bundles (or compressed packaging steel scrap formats) need to adhere to a set of technical specifications in order to be accepted by the recycling party that will incorporate steel packaging scrap in the production process (i.e. the steelworks).

Typically, the moisture of the bales must not exceed 5% and the impurity threshold (or presence of foreign elements to the mono-material flow targeted) must not exceed 3% by weight[22].
Even if other collection routes (i.e. steel is recovered from bottom ash after incineration and through the Mechanical Biological Treatment route) also provide steel packaging scrap for recycling, source separation and separate packaging waste collection is the option that provides best quality material.

In order to ensure a favourable set-up for this route the following is advised:

- Source separation and separate packaging waste collection should be encouraged in order to ensure that it is the case;
  - No steel packaging shall be sent to landfills
  - The incineration of non-treated waste is regulated
- In case a Member State performs mixed waste collection for incineration, the ferrous metals can be recovered from bottom ashes or before incineration takes place. To ensure that this material can be accepted for use by the steelworks parameters are used for monitoring the quality criteria, e.g. Eurofer E46 standard.

[21]Recyclis. (n.d.). La ligne bleue – PMC. Retrieved from : https://www.recyclis.be/ligne-bleue.html
[22]Fostplus, Spécifications acier ANNEXE IV. Obtained via contact with Fostplus representatives.

Collection systems for beverage packaging: Deposit and Return Schemes (DRS)

Directive 94/62/EC on packaging and packaging waste[23] lays down measures to prevent the production of packaging waste and in addition, measures to increase reusing, recycling and recovering such waste. While regulatory steering measures taken at Member State level in order to introduce systems for the reuse of beverage packaging may serve environmental goals, they also have the potential to divide the internal market.

For market operators engaged in activities in several Member States, these systems often make it more difficult to take advantage of business opportunities within the internal market because they are required to adapt their packaging to the requirements of each individual Member State, which leads to additional costs. Past experience and on-going cases show that the adoption of unilateral measures in different Member States still poses problems. In particular, infringement procedures in the beverage sector have shown that national measures can lead to distortions of competition and in some cases, to the partitioning of the internal market[24].

Due to their nature, the scope of most DRS present in Europe is restricted to beverage packaging. The remaining packaging waste volumes (of which beverage is a relatively small fraction) are not tackled by Deposits. Since there is a need to provide separate collection for all household packaging waste generated not covered by Deposits, the costs of logistics are doubled: authorities need to foresee a global packaging collection system plus a DRS[25].

High levels of investment are also needed to establish DRS systems. It is not only implementation and running costs that are foreseen in this investment; costs increase for producers and consumers as well. Deposits cannot be the solution to increase recycling rates for complete material fractions since they only target beverage containers.

[23]Directive of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste (OJ L 365, 31.12.1994), as last amended by Directive 2005/20/EC of the European Parliament and of the Council of 9 March 2005 (OJ L 70, 16.3.2005).
[24]OJ C 107/1-C 107/2,9.5.2009.
[25] Cátedra Unesco de Ciclo de Vida y Cambio Climático. (2017). Estudio de sostenibilidad sobre la introducción de un SDDR obligatorio para envases en España: análisis ambiental, social y económoco comparativo con la situación actual". Retrieved from: www.esci.upf.edu

Third step towards recycling of steel packaging: ensuring quality of packaging steel scrap.

Discarded packaging is sorted at source at household level from the residual waste stream and then separately collected according to the principles laid down in Article 11 of the directive 2008/98/EC on Waste.

The purpose of the separate collection is to deliver a waste stream that is kept separately from household waste by type and nature so as to facilitate a specific treatment[26].

Source segregated or co-mingled, steel packaging is usually collected together with aluminium packaging, beverage cartons, plastic packaging and/or paper and cardboard[27]. Effective sorting of discarded steel packaging items is crucial to ensure high-quality recycling. Steel has unique magnetic properties that provide it with a natural advantage over other packaging materials, especially in the sorting step.

During the sorting step, discarded steel packaging items are removed from the waste stream by magnetic sorting and are stored separately. Steel packaging is then compressed in bundles or compressed packaging scrap formats. These bundles can present a certain level of foreign and/non-ferrous materials that are known as steriles or impurities. These come from the other packaging materials co-mingled with steel. Some of the most common are:

- Non-ferrous metals
- Combustible non-metallic materials (rubber, plastic, fabric, wood…)
- Plastic packaging waste
- Others

The presence of these materials in steel packaging scrap bundles determines a parameter called the **impurity level** (also known as the % of steriles). The efficiency of the sorting operations is measured by the presence of impurities in a steel packaging scrap bale.

The steel packaging recycling loop is closed when the packaging scrap bundles arrive at the steel plant and undergo their final recycling steps.

The final recycler (i.e. the steel industry) sets quality criteria for packaging scrap bundles in order to be able to incorporate this material in the production process of new steel. Depending on the country, these criteria involve values for maximum impurity/steriles level at the bundle, humidity and density. The quality criteria needs to be fulfilled by sorting centre operators or any other scrap handling entities to secure the recycling in the most demanding economic, technical and environmental conditions.

[26]Article 3, definitions of the WFD.
[27]European Commission - DG ENV (2016). Assessment of separate collection schemes in the 28 capitals of the EU (Reference: 070201/ENV/2014/691401/SFRA/A2).

Steel packaging can also arise in the residual municipal solid waste stream.

This can happen when EU Member States perform mixed waste collections for incineration or if domestic steel packaging items are not collected separately in the dry recyclables stream and therefore end up in the residual waste stream.

When municipal solid waste is sent to Mechanical Biological Treatment plants (MBT), steel packaging can be extracted (pre or post treatment) with the help of an electro-magnet and put back in the recycling loop. An additional treatment is often performed to separate steriles and deliver a material of a high enough quality to be accepted at the steelworks.

Four different examples of sorting systems in Europe: France, Belgium, United Kingdom and Germany.

France

The 'material standards' or standards par matériau[28] are a set of quality criteria that are contracted with municipalities to be delivered by waste treatment operators in French sorting centres, incineration plants, and Mechanical-Biological Treatment facilities (MTB).

These criteria are applied at the last stage of sorting household packaging from the separate collection waste flows in which steel packaging items are encountered.

The material standards exist for the following materials: steel, aluminium, plastic, paper/cardboard and glass. Every packaging material has a different set of standards. When the municipalities, in cooperation with the operators of the treatment plants, fulfil the material standards, the French Green Dot organisation (CITEO[29]) financially supports 80% of the packaging waste collection and sorting costs.

This is done by means of recycling certificates similar to the British Packaging Recovery Notes that are delivered by the recyclers. The financial support to municipalities complies with the 'polluter pays principle' where the responsibility for managing packaging waste is transferred from municipalities to the companies placing packed products in the EU market.

The recycling certificates are sent to municipalities and all recycled waste tonnages are reported to the French Green Dot (Citeo) in order to feed data for the French annual packaging waste statistics. This dataset will be used by the French Environment Agency (ADEME) to build the French annual material recycling rate. Recycling plants are audited by the waste management organisations.

[28] Standards par matériau. (2011). Retrieved from: http://www.ecoemballages.fr
(*) There is a revised Standards par matériau version 2017 (modification of the rate of humidity).

[29] Leko will be the second Producer Responsibility Organisation in operation in the French market since January 2018.

The French material standards for steel packaging

The material standards state that steel arising from household waste collection shall fulfil the following criteria after leaving the sorting facility:

Steel from separate waste collection	Steel from incinerator bottom ashes	Steel from mechanical-biological treatment plants (MBT)
Steel from household packaging waste shall be pressed into bundles and have a minimum magnetic content of 88% (*) and maximum 5% moisture.	Steel from household packaging waste extracted by magnetic s separation at municipal solid waste incineration plants shall have a minimum magnetic content of 55% and a maximum of 10% moisture.	Steel from household packaging waste in bulk, double shredded and magnetically sorted. Same criteria than for the steel from separate collection.

(*) Equivalent to a rate of 95% if empty steel packaging.

In addition, the final recyclers (i.e. the steel-making plant in this case) have developed the material standards with the addition of new criteria such as the density of the steel packaging bundles.

The French system encompasses the fulfilment of the 'material standards' or standards par matériau by the concerned actors of the supply chain. The complete set of requirements sets a threshold sorting centre operators have to comply with and its application is compulsory, thus enabling the track of quality in packaging scrap bundles.

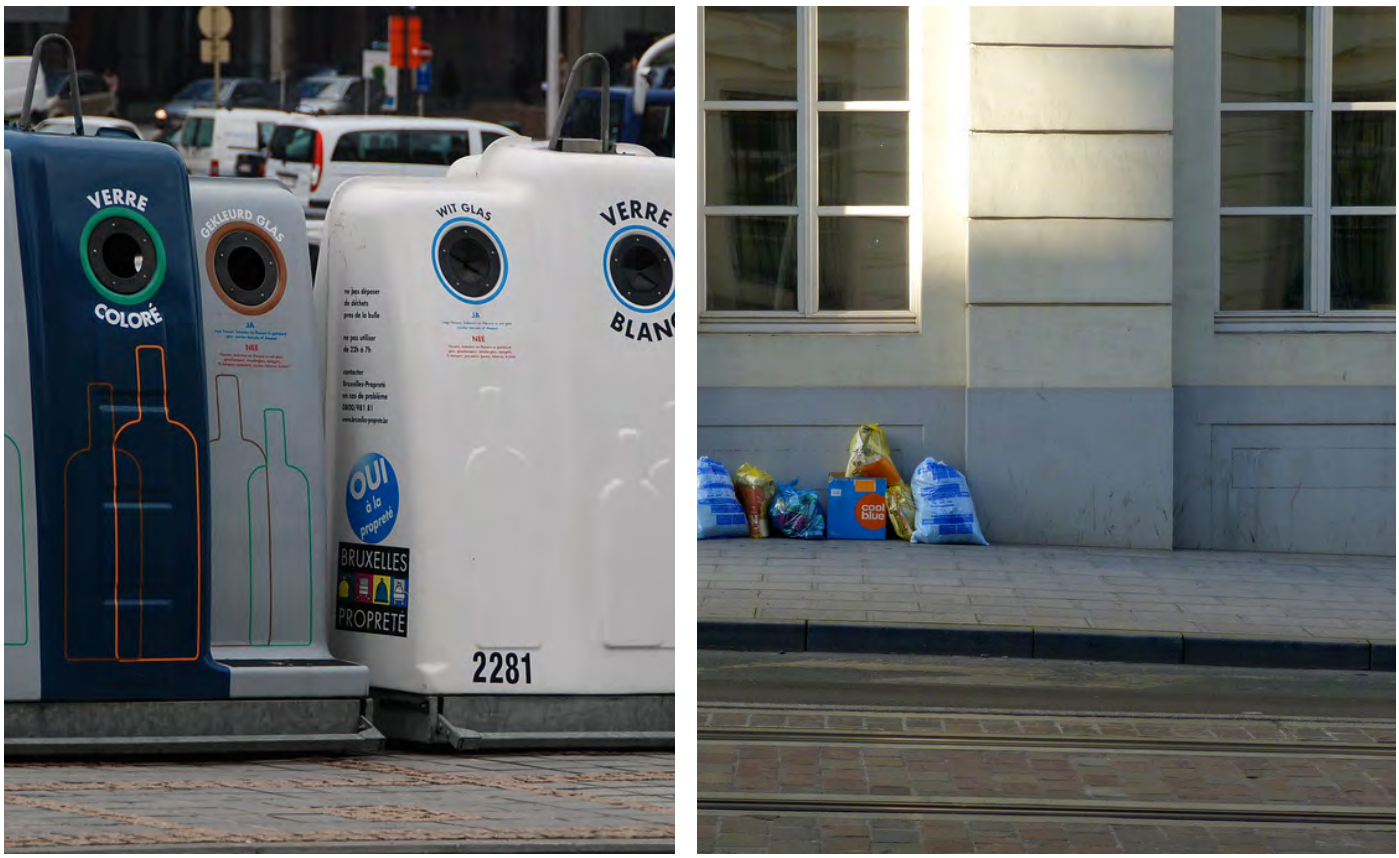


Figure 8: Left, bring back point separate collection of household glass Brussels. Right, door-to-door separate collection of packaging in Brussels (steel packaging collected in blue bag). Courtesy of Flickr images.

Belgium

Fostplus[30] is the Belgian Green Dot organisation in charge of separate collection and recycling of household packaging. They coordinate and finance the following activities:

- Door-to-door collection of PMCs (plastic, metals and beverage cartons household packaging) via the blue bag and domestic paper and cardboard waste through the yellow bag.
- Household glass collection (bring back points or door-to-door)

Fostplus is also in charge of household waste recycling centres and bulky waste drop off sites where citizens can bring other waste materials for recycling[31]. The collection and recycling of industrial packaging is carried out by another organization, VAL-I-PAC[32].

Once the household steel packaging scrap is separately collected and delivered to the sorting centres, this secondary raw material has to comply with a series of specifications laid down to ensure a minimum quality level is achieved before it undergoes final recycling. These are laid down in the Annex IV of the Fostplus specifications[33]:

Description	Steel for packaging household cans. Other steel food containers (specialty packaging for biscuits and chocolate) are also accepted. Household steel scrap is separated from the dry recyclables waste stream by an electromagnet. • Material shall be free of organic matter. Steel caps/ lids are permitted. • Material cannot contain radioactive or hazardous material. In addition, it shall be free from animal remains, hospital waste, caustic acid residues, poisonous vapors or explosives.
Quality	• ≤ 8% impurities allowed (by weight) • ≤ 5% moisture allowed (by weight)
Delivery conditions	When sorting operations are over, the MRF notifies the acquiring party. • The material can be supplied in bulk or in bundles. • Minimum material density of 180 kg / m^3 (in bulk or in bundles). • Containers or bales shall be stored in a dry clean place.

In Belgium, once the waste-to-energy plants have thermally treated the waste, two possibilities exist: in-house bottom ash treatment facilities can be implemented or the bottom ash can be transferred to specialised treatment facilities.

Waste-to-energy plants report treatment data to Fostplus who include it in their yearly report.
All green dots have packaging scrap quality guidelines as an orientation document to facilitate material handling; some of them enable public access whereas others have them available only upon request. The documents' parameters are often similar, but the lack of a standard setting the average parameters that make packaging secondary raw material acceptable hinders the comparison.

[30]Fostplus (n.d.). About. Retrieved from: https://www.fostplus.be
[31]Bruxelles Propreté. (n.d.). Parcs à conteneurs. Retrieved from: https://www.arp-gan.be
[32]Valipac. (n.d.). Retrieved from : http://www.valipac.be/
[33]Fostplus, Spécifications acier ANNEXE IV. Obtained via contact with Fostplus representatives.

United Kingdom

Household steel packaging scrap in the United Kingdom arises from source segregated curbside collections and co-mingled curbside collection. Once separate collection has taken place, the dry recyclables waste stream is sent to a Material Recovery Facility (MRF). MRFs can be designed to be single-stream or multi-stream[34]. Single-stream MRFs are those that accept all types of recyclables together in one container whereas multi-stream MRFs can accept recyclables in multiple-streams: paper, cardboard, glass, plastics and metals.

MRFs play an increasingly important role in providing high quality raw materials to industry.

The role of MRFs is to separate recyclables into their individual material streams and prepare them for sale in the commodity markets. For steel packaging waste, the final product leaving MRFs are the steel packaging scrap bundles that can be sold to reprocessors or manufacturers.

The BMRA (British Metals Recycling Association) has developed guidelines detailing the UK specifications for metals recycling[35]. This document serves as a bridge between what MRFs can deliver and what downstream processors/manufactures will acquire. The guidelines present descriptions of the most common metal scrap grades traded in the UK. These metal scrap grades have been agreed between the scrap industry (i.e. MRFs for instance) and the receiving manufacturers (e.g. steel industry) or downstream processors. Household steel packaging scrap (also called post-consumer steel can scrap) falls under grade 6E (figure 1). The source of this material is mainly source segregated kerbside collections and co-mingled kerbside collections.

Figure 9: Grade 6E- Clean Steel Cans- bundles, BMRA UK specifications for metals recycling.

These bundles include steel packaging from food cans, beverage cans and domestic aerosol cans collected from the public – this is how the Grade 6E is defined. The most common collection methods are door-to-door collection schemes and recycling banks where citizens can dispose of their waste. The grade 6E specifies that such cans should be free from excessive contamination by other materials.

The size of the bundles and their density is jointly agreed by the delivering MRF (or the seller) and the acquiring party. There is not a specific set of standards for % threshold (or % of impurities) and % moisture. This is something agreed upon by the seller and the buyer.

To our knowledge today, steel packaging scrap quality guidelines exist only as an orientation in the UK. The parameters defining quality of the material do not need to be defined and can be agreed upon between the two interested parties. We believe that harmonised steel packaging scrap quality guidelines would definitely help to ensuring minimum quality is respected in those transactions.

[34]Stewardship Ontario. (2013). 2012 MRF Material Composition Study. Retrieved from: http://stewardshipontario.ca
[35]BMRA (2015). UK specifications for metals recycling, ferrous raw materials for the manufacture of iron & steel.

The Packaging Recovery Notes (or PRNs)

The size and density are specified in the buyer/seller agreement because the density parameter is dictated by the equipment of the company/stakeholder purchasing the steel bundles. These terms are explained in a local agreement or a local "Protocol". For instance, for a given number of reprocessed tonnes of steel for packaging of 10kt, the reprocessing company would effectively recycle 9750 tonnes.

Figure 10: Household steel packaging scrap bales from UK © APEAL.

Since the United Kingdom packaging recycling system works on the basis of Packaging Recovery Notes (or PRNs)[36] the reprocessing company would be able to issue 9750 PRNs.

PRNs generated from the recycling of steel packaging are registered on the National Packaging Waste Database[37]. In order to issue PRNs on the material received for recycling, a company has to prove the steel packaging content of the material that has been supplied. Companies therefore sample the steel packaging scrap material received to determine the steel packaging rate. They then submit the test results to their local Environment Agency officer responsible for managing their local Accredited Reprocesses of Packaging Waste. This enables an agreement on the steel packaging percentage of the received material to be reached.

Germany

There are currently 11 Extended Producer Responsibility (EPR) schemes operating in German territory following the liberalisation of the EPR market. Since the 11 EPR schemes 'compete' to have a place in the German market, the packaging recycling scenario is different to other European countries where only one operational green dot is present.

According to an exchange held with representatives from Deutsche Gesellschaft für Weißblechrecycling mbH (the German society for tinplate recycling) the quality of the steel packaging as a secondary raw material coming from sorting plants could be improved. The impurity threshold of steel for packaging scrap bales from sorting plants typically ranges from 10-20% (if not higher).

Figure 11: steel scrap bales. Courtesy of ThyssenKrupp Rasselstein.

[36]The Environment Exchange. (n.d.). Packaging recovery notes. Retrieved from: http://www.t2e.co.uk
[37]Environment Agency. (n.d.). National Packaging Waste Database. Retrieved from: https://npwd.environment-agency.gov.uk

In order for the steel bales to be recycled after sorting, a second sorting step has been put into place to reduce the impurity threshold to below 5% (approximately).

Figure 12: Left, steel packaging scrap coming out of a second sorting step. Right, impurities. ©APEAL

Liberalised EPR markets bring competition among different Producer Responsibility Organisations, thereby resulting in a dynamic of achieving high economic interests rather than maintaining quality. Particular settings in which many actors are present are sometimes scenarios in which quality of packaging steel scrap is not the main concern. The need of setting a second sorting step highlights dysfunctionality in the way packaging waste scrap is handled and sorted.

In conclusion, the establishment of scrap specifications/standards for packaging steel scrap is a positive step from the recycling value chain towards ensuring quality of the secondary raw materials and traceability. Having a guiding document at national level that can be based or follow the EU scrap specifications, ensures that the sorting plant operators and receiving industry are committed to high quality recycling. These scrap specifications/standards shall reflect waste packaging arising through the sorting route (cold processing), incineration and MBT or for any other routes for other materials. These scrap specifications/standards are key in delivering high quality packaging scrap. Some of the parameters to be determined are iron content, humidity and density. Mechanisms fostering the use and implementation of scrap specifications/standards at national level need to be set in place.

To maintain the quality in the scrap value chain it is crucial that the quality control starts when the material is at the sorting facility, and that can only be monitored with the establishment of a quality standard for packaging steel scrap.

Steel packaging recycling through the incineration route

Once discarded steel packaging items undergo different treatment routes. The preferred recycling route for steel packaging is separate collection/sorting, also known as cold waste processing. In the event of steel packaging being recycled through incineration, the ferrous metals are recovered from the bottom ash once the incineration process takes place. This section features two cases of Dutch practices identified as references.

As a "permanent material" steel can be recycled in successive recycling cycles with no loss of quality. This presents a competitive advantage as all steel packaging can be recycled; even steel packaging that has been incinerated can be recovered from bottom ash. There are also some cases in which extraction of ferrous metals can take place before incineration.

Municipal solid waste incineration (MSWI) and steel packaging

Waste-to-Energy plants play a key role in the energy mix of some European countries (The Netherlands or Poland for instance).

Directive 2000/76/EC on the incineration of waste (also known as the WI Directive)[38] stipulates how Waste-to-Energy plants should be operated.

When the municipal solid waste is incinerated, one of the final products is a solid residue also called 'bottom ash'. Bottom ash contains unburned matter, glass, ceramics, metals, and minerals (Chimenos et al. (1999)). It is from this heterogeneous mixture of materials that ferrous metals can be extracted for recycling.

The WI Directive does not foresee the implementation of an annex bottom ash treatment facility to the incineration plant.

The national legislative framework also plays a key role when planning or building bottom ash treatment facilities. EU Member States in which waste to energy plants are present but where there is a low treatment capacity are likely to export bottom ashes to countries with more expertise.

As a general rule:

- If the incinerator does not have an annex bottom ash treatment plant, the bottom ashes are cooled on site and then transported to an external operator. For instance, there is insufficient space for an annex bottom ash treatment plant at the incinerator in Brussels. Therefore, bottom ashes are cooled and shipped by boat to The Netherlands were the bottom ash treatment takes place[39].
- If the incinerator has an annex bottom treatment plant, the bottom ashes are cooled once they leave the furnace (this is a common process to all incinerators) and are then treated on site. This is the case at the incinerator located in Hengelo (the Netherlands) and operated by the company Twence[40].

Waste-to-Energy plants are represented by CEWEP, the Confederation of European Waste-to-Energy Plants. Their membership comprises some 400 Waste-to-Energy plants from 22 countries. They make up more than 80% of the Waste-to-Energy capacity in Europe[41].

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[38] DIRECTIVE 2000/76/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 December 2000 on the incineration of waste. (2008, consolidated). Retrieved from: http://eur-lex.europa.eu

[39] Information obtained by a representative of Bruxelles-Énergie, company operating the incinerator located in Brussels.

[40] Information obtained by a representative of Twence in the Netherlands.

[41] CEWEP. (n.d.) Who we are. Retrieved from : http://www.cewep.eu

Bottom ash treatment at Twence (Hengelo, The Netherlands)

The Waste-to-Energy plant at Hengelo (Twence, The Netherlands) is an incinerator that includes an annex bottom ash treatment plant. Having a bottom ash treatment line on site makes it easier to extract ferrous metals although the WI Directive does not foresee the implementation of an annex bottom ash treatment facility to the incineration plant.

After the combustion process takes place in the furnace, the raw bottom ash is cooled before being transferred to the annex treatment plant. The design of the bottom ash treatment plant in Twence is intended to provide a complete, multiple step separation process that will split the raw bottom ash into separate fractions suitable for post-processing and recycling.

The first step is cooling the ashes once they leave the furnace. At the Twence plant (Hengelo, The Netherlands) cooling process takes place via wet techniques. A pilot project mixing wet-spray cooling with drying techniques was underway though preliminary results were not available at the time of producing this report.

The purpose of the screening steps is to separate the bottom ashes in particles of different granulometry to facilitate material extraction. The higher the efficiency of the bottom ash treatment plant the higher the recovery rates of materials afterwards.

Crushing and shredding operations improve granulometry of the bottom ash mixture from which steel is extracted either via magnetic conveyor belts or magnets installed in trommels.

The bottom ash treatment line at Twence includes an innovative ADR separator. When compared to conventional bottom ash treatment, the ADR separator is able to classify and sort particles of diameters between 0 and 2 mm and diameters between 2 and 12mm. Particles with diameters between 2 and 12mm are transferred through high intensity eddy current separators that separate non-ferrous particles from the mineral fraction.

The Dutch Green Deal programme

The Green Deal[42] is an initiative launched in October 2011 by the Dutch Ministry of Economic Affairs. This programme provides non-financial government support for environmentally friendly initiatives that:

- will have a positive impact on the Dutch economy and
- encounter feasibility barriers.

Different Waste-to-Energy plants have entered into a Green Deal with the Dutch government[43], to improve the use of the mineral fraction of bottom ashes in the Netherlands. As a result, the extraction of ferrous metals from the bottom ashes is also improved.

Before the Green Deal entered into force, the Dutch Building Materials Decree[44] (BMD) was the only reference regulating the utilisation of bottom ashes (complementing the Dutch landfill ban decree). The BMD regulates the use of all material intended for use in construction activities, paying special attention to leaching of contaminants. Leaching is the main issue faced when bottom ashes are used in road construction or as aggregates in concrete. The main application of the mineral fraction of bottom ashes is in backfilling and in road construction.

[42]Industrial Efficiency Policy Database (n.d.). The Netherlands Green Deal. Retrieved from: http://iepd.iipnetwork.org
[43]Twence (n.d.). Bottom ashes. Retrieved from : http://www.twence.nl
[44]Eikelboom RT, Ruwiel E, Goumans JJ. (2001). The building materials decree: an example of a Dutch regulation based on the potential impact of materials on the environment. Ministry of Housing, Spatial Planning and the Environment, The Hague, Netherlands. Retrieved from : http://www.sciencedirect.com

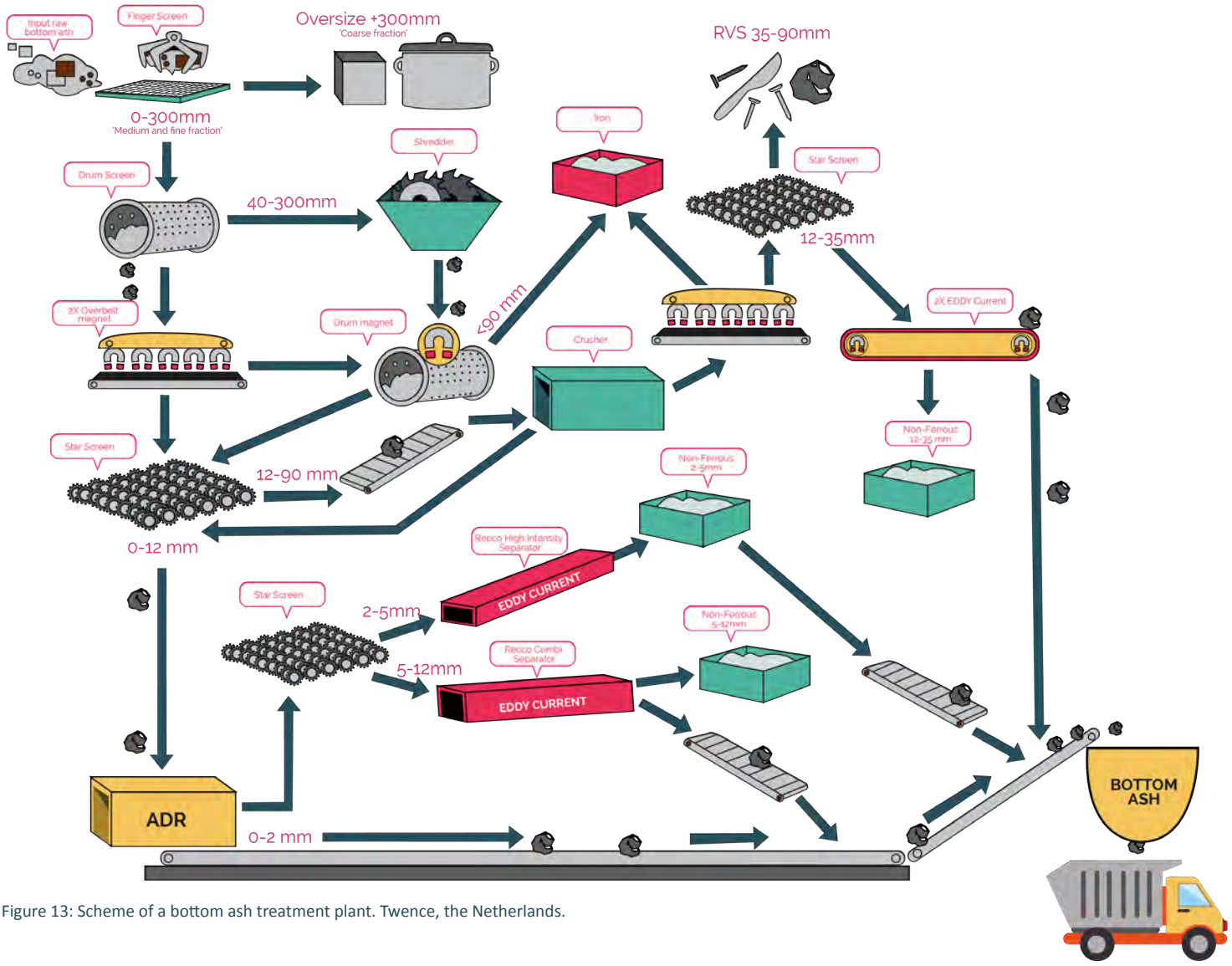

Figure 13: Scheme of a bottom ash treatment plant. Twence, the Netherlands.

From 2017, the Green Deal between Dutch Waste-to-Energy plants and the Dutch public authorities has allowed the use of 50% of bottom ashes[45] from the Dutch BMD.

A side effect of improving the quality of the mineral fraction from bottom ashes is that the process also removes all materials which hamper the use of the bottom ashes in road construction e.g. metals. This also means that the quantity of ferrous metals removed from the heterogeneous matrix of bottom ashes, is increased.

Fragmentised scrap from incineration	E46	Fragmentized incinerator scrap. Loose steel scrap processed through an incinerating plant for household waste followed by magnetic separation, fragmentized into pieces not exceeding 200mm in any direction and consisting partly of tin coated steel cans. Should be prepared in a manner to ensure direct charging. The scrap shall be free of excessive moisture and rust. Must be free of excessive metallic copper, tin, lead (and alloys) and steriles to meet the aimed analytical contents Refer to points B) and C) of the general conditions.	≥ 0.8	Fe content ≥ 92%

Figure 14. European steel scrap specification. Eurofer.

[45]Tang, P.; Florea, M.V.A.; Brouwers, H.J.H. (n.d.). The characterization of MSWI bottom ash. Eindhoven University of Technology, Department of the Built Environment. Retrieved from: http://josbrouwers.bwk.tue.nl

A higher level of stabilisation of bottom ashes requires all foreign materials to be removed from the mineral fraction, including steel.

The preferred recycling route for steel packaging is separate collection/sorting but if it undergoes incineration and the ferrous metals are recovered from bottom ash there shall be parameters monitoring the quality criteria. The E46 specification for fragmentised scrap from incineration[46] can be used as a guiding principle. This will guarantee that the ferrous metals recovered from bottom ash comply with a quality criterion that allows for its integration in the production process of new steel at the steelworks.

The Final Step: packaging steel scrap acceptance at factory gate

The steel packaging recycling loop is closed when steel scrap arrives at the steel- plant to undergo the final recycling process which, in this case, is the use of scrap in the steelmaking furnace.

In order to be able to integrate the steel scrap in the production process of new steel, the steelworks use the 'European steel scrap specifications'[47] or other guidelines established at national and regional level. These guidelines provide a breakdown of the scrap categories accepted by the steel-making industry as well as parameters defining the properties of the steel scrap they can accept.

One example of national level guidelines can be found in France. The French steel plants have developed a set of quality criteria called the Minimum Technical Requirements or Prescriptions Techniques Minimales (PTM), which are material-specific.

These guidelines build on the Material Standards explained on page 18. France. In this way, a link between the packaging waste management services carried out by municipalities (separate collection, incineration and MTB) together with sorting centre operators and the recycling industry, is established.

The Minimum Technical Requirements for steel packaging established by French steel producers are detailed in the next page.

Depending on where the steel packaging scrap comes from, a distinction is made as follows:

- Steel for packaging arising from household separate waste collection – therefore coming from sorting centres (also called MRFs)
- Steel for packaging arising from municipal solid waste incineration – this is the steel recovered after incineration and subsequent treatment of bottom ashes. Magnetic extraction separates steel from the mineral matrix. This steel is then delivered to steel plants, closing the loop
- Steel for packaging from MBT (mechanical biological treatment) or more generally packaging sorting on residual household waste facilities.
- These Minimum Technical Requirements go one step further laying down a protocol to define and categorise steel packaging scrap, since it is not recognized as a scrap grade at EU level.

[46]Eurofer. (n.d.). European steel scrap specification
[47] Eurofer. (n.d.) European steel scrap specification.

	Steel for packaging arising from separate collection	Steel for packaging arising from bottom ash	Steel for packaging from MBT facilities
Product description	Products accepted: Packaging products (food, aerosol and beverage cans) arising from packaging (dry recycleables) separate household waste collection. Products refused: Other household non-packaging products and / or presenting explosion risk.	Steel scrap arising from magnetic sorting of incineration bottom ash (output of incineration of municipal solid waste).	Steel scrap extracted from MBT/ other household packaging sorting plants.
Specifications	Presentation: steel packaging scrap empty of content to avoid fermentation. Magnetic content ≥55% by weight humidity <5% as from 1/1/2018	Presentation: bulk product, sorted via magnetic extraction and all stored on a clean, dry area allowing for rainwater evacuation. Magnetic content ≥55% humidity <10% bulk density ≥0.3t/m3.	Magnetic content ≥88% by weight (and double shredded). Storage: under cover on a clean, dry area allowing for rainwater drainage.
Packaging removal	Scrap storage preferably under coveron a clean dry area (asphalt, concrete) allowing for rainwater evacuation. Requested: scrap pressing machine bundles (density between 1-2 kg/dm3). Steel packaging scrap bundles must stand a crash test consisting of 5 consecutive falls from 2m height onto concrete area. Removal: loading provided by municipality or its waste management operator. Minimum load of 20t if the truck allows for it. Removal guaranteed once a year except for municipalities producing less than 20t/ year.	Removal granted once a year for municipalities producing less than 20t / year.	Packaging bulk removal.

Table 2: Minimum Technical Requirements for steel (PTM) to be accepted at factory gate. Compiled and retrieved from Arcelor Mittal.

A quality control process including visual and sensory checks exists to monitor contamination of steel bundles. The precense of impurities such as plastic films and bags for instance will prevent the steel plant from achieving the required density during the baling process. However more rigorous quality controls would be needed, which could prove difficult to implement due to the nature of steel packaging scrap bundles.
Performing these tests on site when the steel scrap is delivered is complicated, so French steel makers have developed a control procedure to conduct a fast quality check for steel scrap bundles upon generation.

Via a leaflet developed by the French steel makers and issued to municipalities and sorting centres, operators can verify compliance with the terms laid down on the Minimum Technical Requirements (density, magnetic content and humidity).

Initiated in January 2015, this control procedure is now regularly used by sorting centre operators and has also been included in a general quality performance control document set by the waste management organisation, Citeo.

The procedure for receiving and accepting household steel scrap bundle deliveries to the steel-making facility is described in the following image.

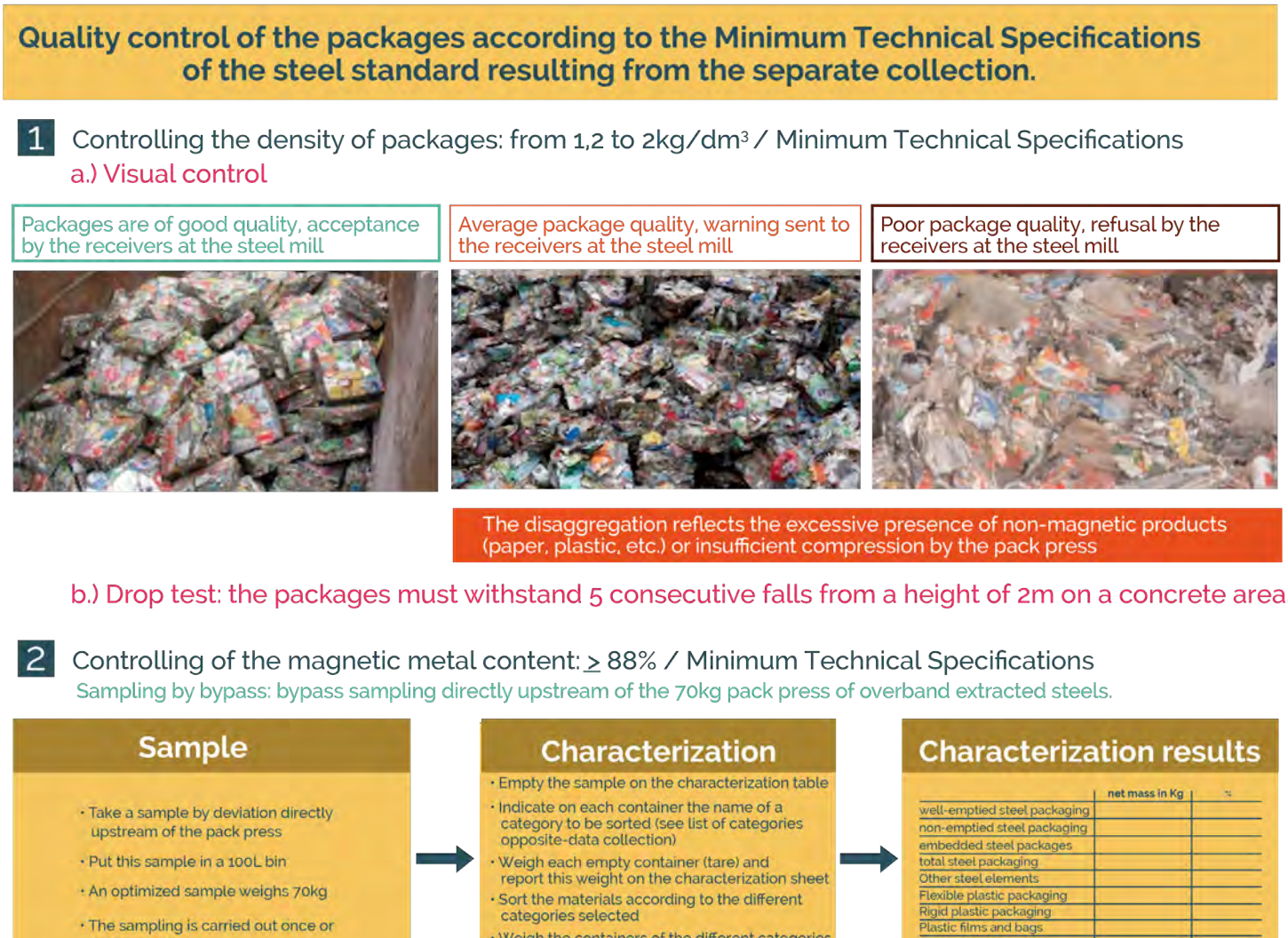

Figure 15: Leaflet for packaging scrap quality control at factory gate. Arcelor Mittal

This procedure ensures that the material accepted is of a sufficiently high quality for the steel manufacturing process.

The application of quality standards across different actors of the recycling value chain contributes to a good performing steel recycling system. To ensure that there are no breaks in the quality of the scrap and that the scrap bundles are suitable for its integration in the production process of new steel a set of scrap specification for steel packaging should be defined.

Receipt procedure at the steel mill for loading steel packages from seperate collection.

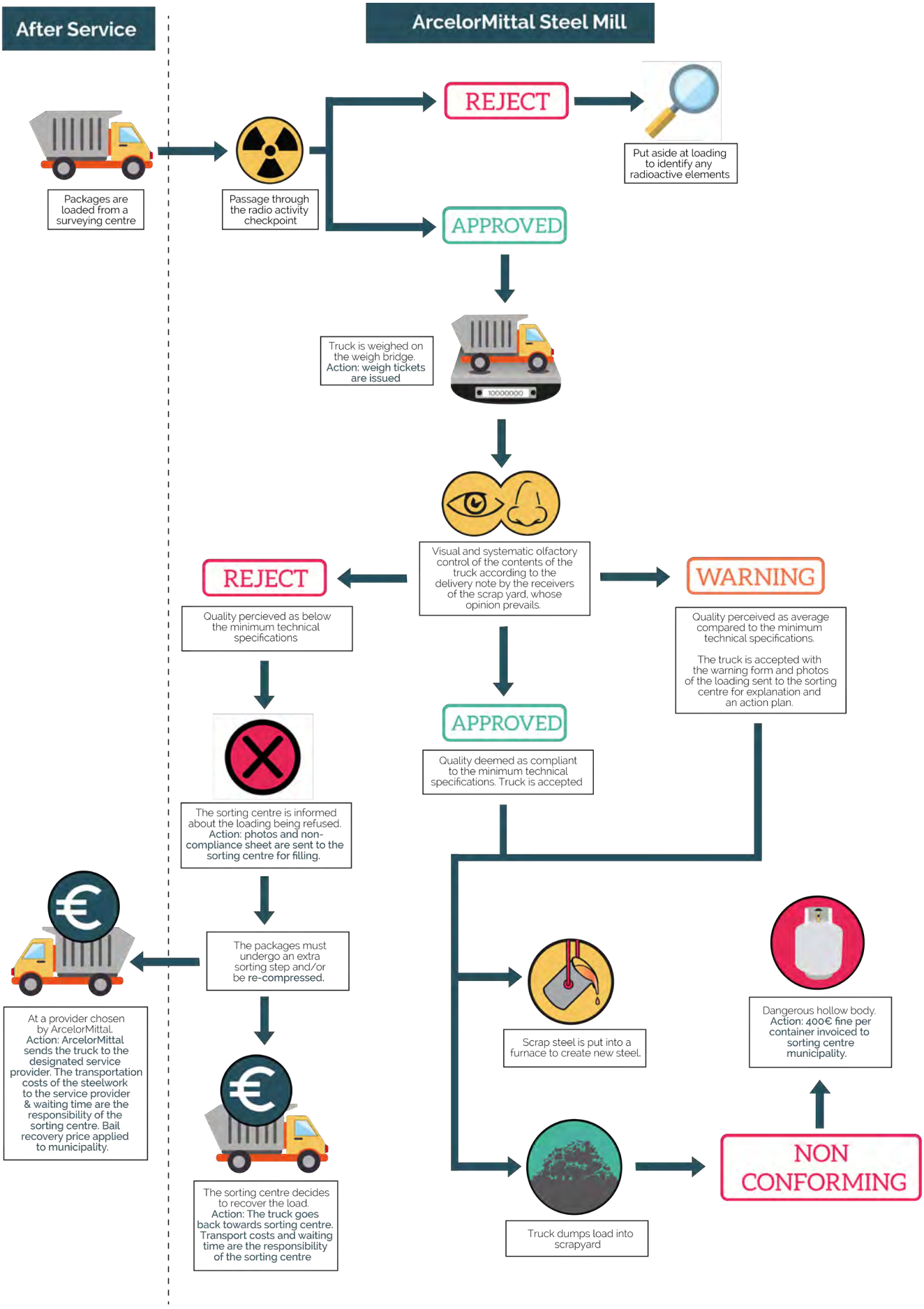

Figure 16: Steps followed by French Steel-makers when receiving packaging steel scrap for recycling. Arcelor Mittal.

Quality control shall start when the material is at the sorting plant (or the scrap processing step). The way to prove that the steel packaging scrap fulfils the requirements that will allow for its use at the steel plant is to set up a category for steel packaging scrap in the EU Steel scrap specifications. This would ensure coherence on the one hand from sorting centers and scrap providers and on the other hand from the receiving recycling industry.

Additional Challenges: improving reporting in Europe

Data reliability is paramount when trying to measure EU Member States' recycling performance is data reliability.

The Circular Economy package tackles this issue with the proposed adoption of a common reporting methodology which will enable national data to be communicated in a uniform, complete format.

The level of detail to which the data is broken down is also a topic that requires further debate.

Each country reports national data differently because of the complexity of the reporting systems put into place at national level (often more than one dataset is available). In the end, the datasets submitted to Eurostat are a compilation of many data sources, which compromises reliability.

Through its annual Steel for Packaging recycling rates[48] exercise, APEAL has been in touch with Green dot systems, packaging associations and National Authorities across the EU Member States. This has enabled APEAL to gain first-hand insight into the difficulty of gaining access to complete and reliable data.

APEAL relies on the guidance laid down by the European Commission to gather the steel packaging recycling data and reporting. The two examples presented in this report are understood as good practices in the case of steel recycling reporting. They could be adapted and extrapolated to other systems.

Germany, Report from the German Environment Agency on the PPWD directive's implementation

Germany was the first country in Europe to adopt and implement producer responsibility for packaging waste and its 1991 packaging ordinance[49] has been amended several times over the last 14 years[50].

The German environment agency report (2013[51]) on the packaging and packaging waste directive, provides useful insight on steel for packaging (literally translated as tinplate packaging) as well as other steel packaging items on the German market. The industrial stream is also included.

The style of the report and the level of detail included can be used as an example for future reporting campaigns in EU Member States. It will prove particularly useful to public authorities and national entities building up the formats for compiling data and statistics.

[48] APEAL. (2017). All-time high for steel packaging recycling in Europe. [Press release]. Retrieved from : https://www.apeal.org
[49]DIHK. (n.d.). Overview of the German Packaging Ordinance. Retrieved from : http://www.ixpos.de
[50]Ecosurety. (2015). Germany proposes to extend producer obligations. Retrieved from: https://www.ecosurety.com
[51]Revenue and utilisation of packaging waste in Germany. (2014). Retrieved from: umweltbundesamt.de;

One of the challenges faced in EU Member States is that national data comes from a variety of sources and in a wide array of formats. Coupled with the lack of a common reporting template/schema besides that offered by Eurostat, every organisation in charge of presenting its full national data develops different collection formats. Harmonisation in data reporting is key to have an understandable (and comparable) set of figures.

Full tables with data on the tinplate packaging recycling routes and the recycling rates can be found in Annex I.

Feedback on German industry solutions and other tinplate collection systems present in Germany

The report compiled by the German environment agency includes the volume of packaging waste handled by all eleven green dots operating in the German territory.

Noted in the "Light-weight packaging" row, Figure 17 shows the tonnages collected by all German operated green dots.

To gain an overview of the total contribution of steel packaging into the steel waste stream, surveys were conducted by two German reporting bodies:

- The German Federal Statistical Office recorded an output of 349.100 t of steel and steel packaging. Green dot operators and other industry compliance schemes where involved in the survey.
- The German Society for the Packaging Market Research (GVM[52]) also conducted a survey that recorded a recovery volume of 323.000 t of tinplate. These tonnages include tinplate packaging arising from industry compliance schemes and the green dots.

When it comes to industry compliance schemes (addressed as 'industry solutions' in the German Packaging Ordinance), the following recycling volumes are considered:

- Industry compliance solutions (business-to-business packaging handling, such as hotels and restaurant services).
- Self-withdrawal of sales packaging from the producer placing sales packaging in the market and taking it back once discarded by the retailer (in compliance with the German Packaging Ordinance).
- Recycling of steel beverage cans (one-way packaging) by entities handling the deposit and refund system. The return rate for one-way beverage cans is~96% in Germany (GVM) estimate based on information provided by individual market participants).
- Recycling of steel packaging such as canisters, cans, boxes coming from commercial systems or bring-back system.
- Steel closures from reusable packaging or from bottling plants (e.g. dairy products) that are sent for recycling. (The GVM estimation shows a return rate of 86% for those).

It is important to note the scope of the industry compliance schemes or industry solutions: according to what is laid down in the German Packaging Ordinance, bussines-2-consumer (B2C) sales packaging delivered

[52]GVM. (n.d.). German Society for the Packaging Market. Retrieved from: http://www.gvmonline.de/
[53] DIHK. (n.d.). Overview of the German Packaging Ordinance. Retrieved from : http://www.ixpos.de

to private households is not under the action scope of industry solutions. They can only operate with commercial and industrial waste (including hospitals or medical centres)[53].

The level of detail in which domestic and commercial/industrial steel packaging is broken down in the German report on the implementation of the Packaging and Packaging Waste Directive is complete and exhaustive. Transparent data reporting also implies -at least-clarifying whether the data gathered involves or not packaging arising from businesses, Small-Medium Entreprises (SMEs) or the industry.

in kt	2009	2010	2011	2012	2013	explanation / data source
Light weight packaging (LVP)	252.2	274.9	270.0	266.6	268.0	According to the dual systems
Other collections	61.0	74.7	81.7	80.6	94.7	Including: industry solutions, dual systems, redemption of deposits from disposable beverage packaging. Return of commercial collection systems (for example, Interseroh, P.D.R., VfW). Recovery of reusable closures from bottling plants.
Closures of the glass recycling	6.1	5.2	9.9	9.3	7.4	According to the dual systems
Mechanical recycling of MBT and incineration	94.0	91.3	99.3	111.3	95.5	GVM estimate (according to VIC, Destatis, ISAH)
Total	436.3	446.1	461.0	467.8	465.6	

Figure 17: German Environment Agency report on the implementation of the PPWD (2013). Steel packaging recycling tonnages years 2009 – 2013.

The new Slovak data and information system

Planning and developing waste management at Member State level is only possible with the support of accurate data and good information gathering formats/protocols.

The new Slovak waste act 79/2015 Coll. in § 103[54] coupled with the Slovak Waste Management Program for years 2016 – 2020[55] lays down the fundamental requirements for building up a new recycling data and information system.

In this programme, the Slovak Ministry of Environment will be in the driving seat to put into place the new recycling data and information system. The aim is to develop a multi-level information platform that will serve for state administration, access to business entities and the general public. This platform is intended to replace specific sectors information systems, which can maintain their operations but will feed into the new platform that will act as a database. Ultimately, data is reported to the Statistical Office of the Slovak Republic. Some of the modules from this database are:

- RISO, which stands for Regional Information System for waste,
- the module ELECTRO, and
- the module PACKAGING[56]

[54]https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2015/79/20170501
[55]https://www.minzp.sk/files/sekcia-enviromentalneho-hodnotenia-riadenia/odpady-a-obaly/registre-a-zoznamy/poh-sr-2016-2020_vestnik.pdf
[56] http://obaly.sazp.sk/

The module PACKAGING

The current module PACKAGING is focused on the collection and processing of data regarding volumes of packaging placed on the market in Slovakia, as well as on the volumes of packaging waste generated, its recovery and recycling rate.

The reports required from obligated stakeholders and entities are sent to the Slovak Ministry of Environment on an annual basis.

These reports and data enable compliance with the Slovak recycling rate of packaging waste to be evaluated. The module also contains a public register of mandatory entities and stakeholders as defined by the Slovak Waste Act.

The module Packaging is divided into two sections:

- The public part: mandatory registration of relevant entities and authorised organisations
- The non-public part: registration of the reporting of relevant entities and authorised organisations, to which the Ministry of the Environment, the Slovak Environmental Inspection and the Centre of Waste and Environmental Management from the Slovak Environmental Agency have authorised access.

The new information system will cover data from the entire supply chain including producers and the waste holders, the producer responsibility organisations, municipal waste treatment companies, domestic and cross-border waste transportation companies. It will also include waste treatment facilities' (disposal, recycling) data reporting and information about the permits issued.

All facilities operating in the field of waste management will also need to be registered as part of the new information system.
The main objective of the new Slovak data information system is to increase the reliability and the transparency of data processing and reporting. It will also reduce administrative burdens and improve the awareness of business entities and the public about the possibilities of waste management.

Implementation of the new system is planned within three years of the conclusion of the contract with the contractor selected from the public procurement process.[57] (approx. 2020).

In order to have solid and robust datasets on national recycling performances, updating and adapting the data reporting procedures is of main relevance. Transparent data is key to assess recycling and its traceability. Better recycling guidelines are needed to ensure that EU Member States not only put into place adequate recycling systems, but that data is available to assess their performance.

[57] http://www.minzp.sk/tlacovy-servis/tlacove-spravy/tlacove-spravy-2017/tlacove-spravy-januar-2017/envirorezort-spusta-verejne-obstaravanie-informacny-system-odpadov.html

The keys to a circular Economy:

The Waste Framework Directive stipulates within article 4, the order of treatments waste should ideally undergo[58]. In Figure 21 (representation of the waste hierarchy) one can see that landfill appears as the last option for disposing of waste. Indeed, no recyclable materials should be landfilled and disposal should only be used where necessary.

Since steel has unique magnetic properties that make it the easiest and most economical packaging material to sort, recover and recycle, it would be counterproductive to send this valuable commodity to landfill. As a permanent material, steel can be endlessly recycled with no loss of quality.

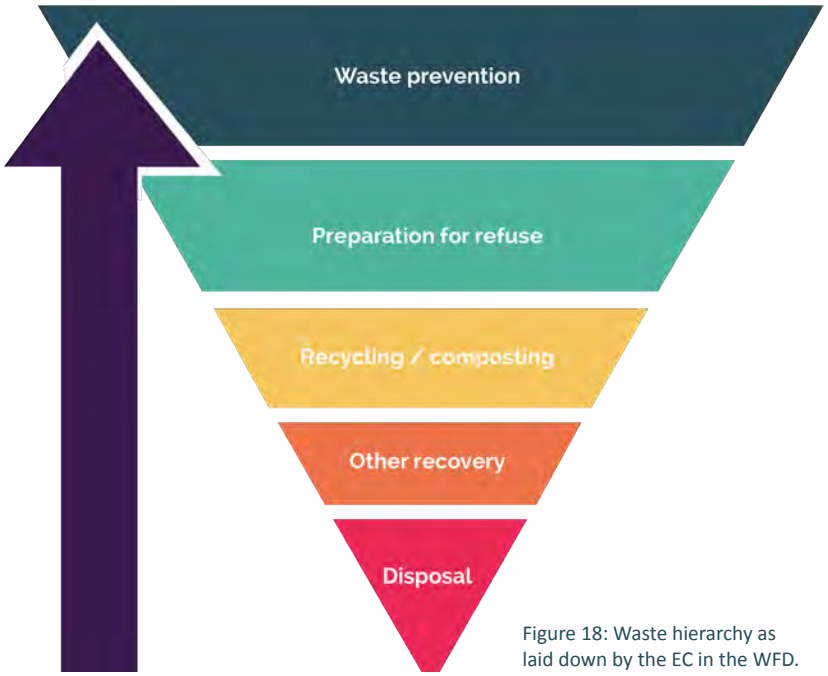

Figure 18: Waste hierarchy as laid down by the EC in the WFD. Source: Let's recycle.

In order to prevent recyclable materials from being landfilled, well-functioning separate household waste collection systems should be part of a multi-level solution. Dry recyclables collected separately from the residual waste stream will most likely foster the creation of a recycling infrastructure that will prevent recyclable materials from being diverted to landfill. An overview of the landfill bans and taxes in Europe is published and regularly updated by CEWEP[59].

The steel packaging industry has adopted the **flagship objective of zero steel for packaging to landfill by 2020.**

Better collection and sorting for recycling

On average, only 19% of municipal waste is collected separately in EU-28 capitals. This implies that 80% of municipal solid waste still ends up in the residual waste bin[60]. Steel packaging is mostly collected in a mixed packaging waste fraction (e.g. with other material fractions) and sorted afterwards in sorting centres.

Source separation and cold waste processing is the preferred route for domestic steel recycling. This treatment route produces better scrap quality with lower pollution levels. Residual waste treatment remains necessary, but it is complementary. Thanks to its

Figure 19: APEAL vision of zero steel packaging to landfill by 2020. APEAL.

[58]DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives. (2008). Official Journal of the European Union, L 312/3.
[59]http://www.cewep.eu/wp-content/uploads/2017/12/Landfill-taxes-and-bans-overview.pdf
[60]Bipro & Copenhagen Resource Institute. (2015). Assessment of separate collection schemes in the 28 capitals of the EU.

magnetic properties, steel can be recovered from bottom ash after incineration and also from MBT.

To further improve and promote source separation, campaigns at household level to raise awareness about what can and cannot be placed in each bin are key to improve consumer engagement. It is also crucial to provide citizens and businesses with enough waste disposal bins and containers to foster separate collection and recycling.

Austrian statistics show that only 14% of municipal waste was recycled during 1989; ten years later the municipal waste recycling rate topped up 50%. The extension of the technical recycling infrastructure plus the proper information and motivation of collection system users, complemented by consistent collection and sorting systems that provide appropriate coverage of dense and less densely populated areas, are said to be key factors in this achievement[61].

There is also a significant difference between national waste management strategies and any proposed solution shall be carefully assessed to ensure that specific national challenges towards increasing recycling rates are considered.

The 2015 study on assessment of separate collection schemes in the 28 capitals of the EU, lists separate collection of waste fractions as one of its key recommendations as it leads to higher recycling levels. The separately collected fractions are sent to recovery operations, in particular to recycling.

Keep valuable resources in the recyling loop

The Landfill Directive states only waste which has been subject to treatment can be landfilled[62]. If done, this implies that the recyclable materials are extracted from the residual waste stream and undergo recycling and recovery operations.

In order to avoid the shift from landfill to incineration, increased collection, better sorting and recycling of materials, are essential tools. The use of addressing policy instruments progressive landfill taxes or the potential introduction of a ban on incineration for untreated waste (i.e. mixed municipal waste where no separate collection of dry recyclables applies) might be options to investigate further.

Residual waste treatment for ferrous metals at incinerators is a complementary route and should only be allowed if modern extraction installations are in place to recover ferrous metals from bottom ash. This should occur in combination with transparent reporting of the ferrous metal volumes extracted.

[61]Salhofer & Lebersorger (2002).
[62]COUNCIL DIRECTIVE 1999/31/EC of 26 April 1999 on the landfill of waste. (1999). Official Journal of the European Communities, L182/1.

APEAL
Policy recommendations

1. Good practices on collection, sorting and recycling of steel for packaging

Although mixed waste collection and other collection routes enable steel for packaging to enter the recycling process, source separation and separate packaging waste collection provides higher quality packaging steel scrap if parameters like the iron content are clearly specified.

In order to ensure a favourable set-up for this route, the APEAL members recommend the following:

- Source separation and separate packaging waste collection should be encouraged in order to ensure that;
  - No steel packaging shall be sent to landfills
  - incineration of non-treated waste is regulated (see next point)
- In case a member state performs mixed waste collection for incineration, the ferrous metals can be recovered from bottom ashes or before incineration. To ensure that incineration scrap can be accepted by the steel industry clearly defined and accepted quality specifications are needed for monitoring the quality criteria, e.g. Eurofer E46 standard.

2. Establishment of a quality standard for steel packaging scrap

Scrap specifications/standards for packaging steel scrap arising from separate packaging waste collection are key in delivering high quality packaging scrap. Some of the parameters to be determined in these specifications/standards are the iron content, humidity and density. If not already existing, mechanisms fostering the use and implementation of scrap specifications/standards at national level need to be set in place.

To maintain the quality in the scrap value chain it is crucial that the quality control starts when the material is at the sorting facility, via a scrap specification/standard for packaging steel scrap.

3. Transparent verification and reporting of recycling

EU Member States will need recycling guidelines, accurate definitions and strict reporting formats to improve the performance of national recycling systems. Depending on the recycling system separate reporting of the different packaging streams (household, commercial and industrial) can provide more transparency. Tracking and tracing systems for steel scrap can be developed and installed once demonstrated their usefulness.

4. Awareness raising campaigns and activities

These activites are intended to shape the perception of different target audiences and are paramount to improving packaging scrap quality. The activity roll-out or the events planned in view of a campaign towards fostering quality recycling should be tailored to the receiving public. The recycling credentials and environmental performance of steel as a packaging material -during its many life cycles- shall be as well emphasized.

Glossary and **and abbreviations**

- **Action Plan for Circular Economy:** Annex communication by the European Commission in which the steps towards the achievement of a European Circular Economy dynamic are laid down.
- **APEAL:** Association of European Producers of Steel for Packaging
- **BMRA:** British Metals Recycling Association
- Bottom ash treatment: series of processes intended to extract valuable materials from the incineration bottom ash residue.
- **Bottom ash:** non-combustible residue of combustion in a furnace or incinerator.
- **Bring points:** waste collection system in which households bring their waste to a spot in which the different bins for the different waste streams are lined up.
- **CEWEP:** Confederation of European Waste-to-Energy Plants.
- **Circular Economy Package:** fitness check of five EU Directives tabled by the European Commission on 2 December 2015 and now undergoing the ordinary legislative procedure.
- **co-mingled collection:** waste collection of different materials altogether i.e. commingled collection of dry recyclables involving plastics and metals.
- **Compressed packaging steel scrap/steel packaging bundles**: transport and storing formats in which steel packaging scrap is processed with the help of a baling press that applies pressure on the materials to give them a particular shape (usually squared).
- **Crushing:** operations intended to diminish the granulometry of the bottom ash to facilitate materials extraction.
- **Curbside collection system/door-to-door:** waste collection system in which waste is placed in bags or wheelie bins outside of the household.
- **Dataset:** collection of related sets of information that is composed of separate elements but can be manipulated as a whole.
- **Deposit and Return Schemes:** selective collection schemes for plastic and glass beverage packaging that give back a refund when the packaging is taken back to the retail or take back point.
- **Dry-recyclables:** stream involving a range of materials including paper, cardboard, steel cans, aluminium cans, plastic bottles and selected other plastics.
- **EU steel scrap specifications:** definitions and characteristics of steel scrap in order to classify it in different grades for its trade or use.
- **Eurostat:** statistical office of the European Union.
- **Green dot:** license symbol of a European network of industry-funded systems for recycling packaging materials of consumer goods.
- **Impurities/steriles:** foreign elements to the mono-material flow targeted
- **Landfill:** waste management strategy based on waste disposal in an area specially intended to do so.
- **Magnetic conveyor belt:** conveyor belts where either a magnetic slider bed or magnetic pulley is used to transport ferrous materials.
- **Magnetic separation:** separation process in which a magnet is used to extract ferrous elements out of a waste flow. They are then separately stored.

- **Material Recovery Facility (or sorting center):** facility that receives commingled materials and then uses a combination of equipment and manual labor to separate and densify materials in preparation for shipment downstream to recyclers of particular materials recovered. Materials recovery facilities are alternately known as materials reclamation facilities or multi re-use facilities. Typical materials recovered at MRFs include ferrous metal, aluminum, PET, HDPE, and mixed paper
- **Mechanical-Biological Treatment:** type of waste processing facility that combines a sorting facility with a form of biological treatment such as composting or anaerobic digestion.
- **Mixed waste collection:** waste collection in which the dry recyclables are not separated from the residual waste stream.
- **Moisture:** amount of water present in a certain sample. Measured in %.
- **Mono-material flow:** result of the sorting operations in which the different waste materials collected commingled are separated. The flows can be of paper and cardboard, plastics, steel, beverage cartons…
- **Packaging and Packaging Waste Directive:** EUROPEAN PARLIAMENT AND COUNCIL DIRECTIVE 94/62/EC of 20 December 1994 on packaging and packaging waste
- **Packaging Recovery Notes:** type of document that provides evidence waste packaging material has been recycled into a new product.
- **Permanent material:** Permanent materials are classified as materials that once produced can be recycled or reused without the loss of quality, regardless of how often the material is recycled.
- **Reporting:** communication of data arising from monitoring of a process to a national/local authority.
- **Residual waste stream:** remnant waste fraction once the dry recyclables have been taken out.
- **Scrap:** discarded waste material.
- **Screening:** different steps of bottom ash treatment intended to extract the metals out of the mineral matrix.
- **Separate waste collection:** waste is picked up by the waste collection company in different streams; often dry recyclables on one stream and residual waste in another.
- **Shredding:** to tear apart (also used in bottom ash treatment).
- **Source separation:** process by which waste is separated into different elements. It occurs when the waste is generated (i.e. when the item is no longer useable and it is discarded).
- **Stabilization of the bottom ash:** processed and techniques to treat the bottom ash intending to prevent the leaching (i.e. escape) of pollutants from the mixture. Technique used as a step prior to the use of the bottom ash for backfilling or building applications.
- **Steelworks:** steel making industry
- **Waste Framework Directive:** DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives
- **Waste-to-energy plant (or incinerator):** plants performing the incineration of household and similar waste.

Annex 1.

German report on the implementation of the Packaging and Packaging Waste Directive. 2013 German environment agency. Example of reporting for domestic steel for packaging. First table displays the tonnages allocated to the different recycling routes and next table shows the achieved recycling rates per treatment operation.

Steel packaging - recycling routes

in kt	2008	2009	2010	2011	2012	2013
Packaging waste generated	501.7	468.4	478.1	492.3	503.0	496.9
Mechanical recycling	469.5	436.3	446.1	460.9	467.8	465.6
Domestic	469.0	432.9	444.3	459.4	465.4	463.3
Imports	0.5	3.4	1.8	1.5	2.4	2.3
Feedstock, organic recovery	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Recycling total	469.5	436.3	446.1	460.9	467.8	465.6
Domestic	469.0	432.9	444.3	459.4	465.4	463.3
Imports	0.5	3.4	1.8	1.5	2.4	2.3
Energy recovery	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Energy recovery (incineration, MBT)	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Energy recovery (total)	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Total recovery	469.5	436.3	446.1	460.9	467.8	465.6
Domestic	469.0	432.9	444.3	459.4	465.4	463.3
Imports	0.5	3.4	1.8	1.5	2.4	2.3
Incineration	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Recycling u. Co	469.5	436.3	446.1	460.9	467.8	465.6
Domestic	469.0	432.9	444.3	459.4	465.4	463.3
Imports	0.5	3.4	1.8	1.5	2.4	2.3
Rest (also landfill)	32.2	32.1	32.0	31.4	35.2	31.3
Domestic	32.2	32.1	32.0	31.4	35.2	31.3
Imports	0.0	0.0	0.0	0.0	0.0	0.0

Table 3: Allocated tonnages of household steel packaging scrap for recycling. German Environment Agency report on the implementation of the PPWD (2013).

Steel packaging - Recycling rates achieved per treatment operation (in %)

information in %	2008	2009	2010	2011	2012	2013
Packaging waste generated	100.0	100.0	100.0	100.0	100.0	100.0
Mechanical recycling	93.6	93.1	93.3	93.6	93.0	93.7
Domestic	93.5	92.4	92.9	93.3	92.5	93.2
Imports	0.1	0.7	0.4	0.3	0.5	0.5
Feedstock, organic recovery	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Recycling total	93.6	93.1	93.3	93.6	93.0	93.7
Domestic	93.5	92.4	92.9	93.3	92.5	93.2
Imports	0.1	0.7	0.4	0.3	0.5	0.5
Energy recovery	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Energy recovery (incineration, MBT)	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Energy recovery (total)	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Total recovery	93.6	93.1	93.3	93.6	93.0	93.7
Domestic	93.5	92.4	92.9	93.3	92.5	93.2
Imports	0.1	0.7	0.4	0.3	0.5	0.5
Incineration	0.0	0.0	0.0	0.0	0.0	0.0
Domestic	0.0	0.0	0.0	0.0	0.0	0.0
Imports	0.0	0.0	0.0	0.0	0.0	0.0
Recycling u. Co	93.6	93.1	93.3	93.6	93.0	93.7
Domestic	93.5	92.4	92.9	93.3	92.5	93.2
Imports	0.1	0.7	0.4	0.3	0.5	0.5
Rest (also landfill)	6.4	6.9	6.7	6.4	7.0	6.3
Domestic	6.4	6.9	6.7	6.4	7.0	6.3
Imports	0.0	0.0	0.0	0.0	0.0	0.0

Table 4: Recycling rates achieved per treatment operation (in %). German Environment Agency report on the implementation of the PPWD (2013).

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