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IMPACTPapeRec: IMPACT - Introduction and Improvement of Separate Paper Collection to Avoid Landfilling and Incineration

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Dissemination level

PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

¹ PTS, Papiertechnische Stiftung

² ACR+

³ Hamburger Recycling

D3.1 Current collection models in cities under study

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1 Abbreviations

Apr	April
BB	Bring Bank
BG	Bulgaria
DtD	Door to door
WtE	Waste to energy
ESC	External Support Committee
FR	France
FRI	Friday
Mar	March
MBT	Mechanical biological treatment
MON	Monday
NIR	Near infrared
Oct	October
p&b	Paper & (card)board
PfR	Paper for Recycling
PL	Poland
RDF	Refuse-derived fuel
RO	Romania
RY	Recycling yard
SAT	Saturday
Sep	September
TUE	Tuesday
THU	Thursday
UK	United Kingdom of Great Britain and Northern Ireland
WED	Wednesday
WP	Work package

2 Introduction

IMPACTPapeRec is a European project designed to boost the Circular Economy by further increasing the separate collection of paper for recycling (PfR) and promote appropriate schemes to avoid landfilling and incineration.

This report is the first deliverable in WP3. This work package is intended to validate the best practice approaches and methods for enhancing the separate collection of paper and board that were developed in WP2. This is accomplished on the basis of seven defined clusters in five countries. Clusters 1-5 are situated in France, Romania and Bulgaria and are represented by partners of the project consortium. Clusters 6 and 7, in United Kingdom (Wales) and Poland, were incorporated into the project within the scope of the External Support Committee (ESC). (Figure 1)



Figure 1: European map showing studied clusters (in red)

The objective of this report is to give an account of the current situation in the various clusters. Essential elements are the schematic presentation of the domestic waste and recyclables management system, thereby allowing for a systematic tracing of the streams. At the same time, a descriptive representation with symbols was chosen in order to minimise language barriers. The symbols used are explained in chapter 3 (Terms and definitions). Each scheme is supplemented for each cluster by a photo documentation of the locations visited. Key system parameters – so far as are known – are set out in tabular form.

Methodological approach

The results of this report have been gathered and compiled in the following partial steps:

1. Discussion and analysis of the current situation, the potentials and challenges for the separate collection of paper and board
2. In-depth analysis of the situation in the clusters on the basis of on-site visits by the performing project partners
3. Supplementary information and data from the survey conducted in WP2.

The first step involved discussing the current situation regarding the separate collection of paper and board in the target countries by the experts with technical and regional expertise from the respective stakeholder groups involved in the project. These discussions began initially at the project kick-off meeting in Valencia, Spain. This analysis was then continued together with additional experts from the External Support Committee within the framework of the Best Practice Working Groups (BPWG) that were constituted in WP2. It was unanimously agreed that the current separate collection of commercially and industrially arising recyclable materials, and in particular paper and board, has already been established and functions well. In the European countries with comparatively low recycling rates, this occurs primarily from the recycling of recyclable materials that arise commercially and industrially and that are collected separately. The greatest potential for increasing the separate collection of paper and board has been identified especially in the household waste collection. Therefore the studies in WP3 focus predominantly on wastes collected from households and small businesses. The latter are included because they occasionally or frequently dispose of their wastes in the household collection systems. Another result of the work in the BPWGs is that the separate collection of paper and board should be analysed in the context of the comprehensive municipal waste management system.

Table 1: Cluster name, local partners and participants of on-site visit (Cluster leaders are marked in boldface)

Cluster	Target country	Local project partners	Participating project partners
1. Dupnitsa	BG	municipality, Hamburger Recycling , Phoenix	ACR+, ITENE, PTS
2. Mezdra	BG	municipality, Hamburger Recycling , Phoenix	ACR+, ITENE, PTS
3. Sfantu Gheorghe	RO	TEGA, municipality, Hamburger Recycling	ACR+, ITENE, PTS , Carrefour
4. Mihai Viteazu	RO	municipality, Hamburger Recycling	ACR+, ITENE, PTS , Carrefour
5. Vendée	FR	Trivalis, Ecofolio	ACR+, ITENE, PTS, CEPI, Propakma
6. Merthyr Tydfil	UK	municipality ⁴ , Recyclate ⁴ , WRAP ⁴	ACR+, ITENE, PTS, CEPI , Propakma
7. Szczecin	PL	municipality ⁴ , Stora Enso	ACR+, ITENE, PTS, EEB, Propakma

⁴ ESC member

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Based on these initial results, the next step was to continue the analysis in the seven clusters. For this purpose, each of the local partners organised a tour programme lasting 1-2 days. Table 1 lists the participants of the on-site visits. The most important elements and aspects of the waste and recyclables management system were inspected and documented. In view of the project focus, the emphasis was placed on observing the collection and treatment of household wastes. Commercial and industrial collections of paper and board were inspected and documented where available and reasonably practical. (Table 2)

Table 2: Locations visited in the several clusters

1 – Dupnitsa (BG); 2 – Mezdra (BG); 3 - Sfantu Gheorghe (RO); 4 – Mihai Viteazu (RO); 5 – Vendée (FR); 6 – Merthyr Tydfil (UK); 7 – Szczecin (PL)


	Cluster						
	1	2	3	4	5	6	7
Household waste collection system*	x	x	x	x	x	x	x
Waste treatment facilities	x	x	x	x	x	x	x
Recycling yard			x		x	x	x
Commercial and industrial sources	x	x	x	x	x		
PfR recycling facility					x		

* Not all variations could always be visited depending on the complexity of the collection system



At the same time the studies in WP3 were being conducted, project partner ACR+ conducted a comprehensive survey in WP2 of the information and data from the clusters. An Excel template was created for purpose of data acquisition, and stakeholder questionnaires were distributed. The factsheets relating to the clusters that were prepared as the result of this work were used as well in parts of this report.

3 Terms and definitions



3.1 General

Origin Type of house: One-family house; multi-family house Type of settlement: rural area; urban area	
Municipal Solid Waste MSW Waste collected by or on behalf of municipal authorities, or directly by the private sector (business or private non-profit institutions) not on behalf of municipalities. The bulk of the waste stream originates from households, although similar wastes from sources such as commerce, offices, public institutions and selected municipal services are also included. It also includes bulky waste but excludes waste from municipal sewage networks, end-of-life vehicles and municipal construction and demolition waste. [1]	
Domestic waste / household waste Waste and recyclables originating from households (regardless of whether it is collected door to door, through bring banks, recycling yards etc.).	






3.2 Collection system

Collection The process of picking up wastes from residences, businesses, or a collection point, loading them into a vehicle, and transporting them to a processing, transfer, or disposal site. [2]	
Separate collection Setting aside recyclable materials from the waste stream before they are collected with other municipal solid waste, to facilitate recycling. In addition, separate collection of compostable materials, to facilitate composting.	
Selective collection For the purpose of this project the term selective collection is used to characterize separate collection into graphic paper and packaging cardboard.	
Door to door DtD / kerbside collection (pick-up system) Direct collection of materials from individual households (or shops), either from front door or kerb.	
Drop-off system The waste generator takes accumulated waste by foot or by car to a central location and drops it there into containers.	
Bring Bank BB (drop-off system) Collection of waste and recyclables in separate containers, above ground or underground, in close proximity to the end user (usually max. 100-200 m distance) and spread in sufficient number across residential areas.	

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Recycling yard RY / civic amenity site (drop-off system) A centralised site authorised by the authorities for the separate collection of domestic waste and recyclables. Usually qualified staff available.	
Collection shop CS Special “shops for secondary raw materials” where residents receive a small financial compensation	

3.3 Materials (waste & recyclable streams and sorted fractions)

Recyclables Materials that can be reprocessed into feedstock for new products. Common examples are paper, cardboard, glass, aluminium and plastic. [2]	
Paper / Graphic Paper Paper made for printing text or images. [3] The sorted stream ‘graphic paper’ corresponds to paper for recycling grade 1.11.00. ⁵	
Cardboard / Packaging Paper <u>Packaging paper:</u> The type of high-strength paper used for wrapping and packing after conversion to packaging (boxes, bags). This covers both paper and board. [3] <u>Board (paperboard):</u> The generic term applied to certain types of paper frequently characterized by their relatively high rigidity. The primary distinction between paper and board is normally based on thickness or “grammage” (the basis weight), although in some instances the distinction will be based on the characteristics and/or end use. For example, some materials of lower grammage, such as certain grades of folding boxboard and corrugated raw materials, are generally referred to as “board”, while other materials of higher grammage, such as certain grades of blotting, felt or drawing paper, are generally referred to as “paper”. [3] The sorted stream ‘cardboard’ corresponds to PfR grades 1.04.xx and 1.05.xx. ⁵	 
Paper and board p&b Any product based on paper and/or board, printed and/or converted to fulfil its designated purpose. [3]	
Paper for recycling PfR /recovered paper Paper and board material collected separately at source for intended use as a secondary raw material for recycling only. Paper and board material collected with other recyclables is also called Paper for Recycling after sorting and when intended for use as a secondary raw material for recycling. (Note: In this document PfR means PfR separately collected at source unless specifically mentioned otherwise) The sorted stream ‘mixed paper and board’ corresponds to PfR grade 1.02.00. ⁵	

⁵ According to the European List of Standard Grades of Paper and Board for Recycling EN 643 [4]





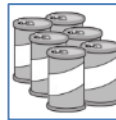

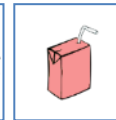







IMPACTPAPE REC

Boosting separate paper collection



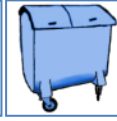
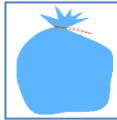






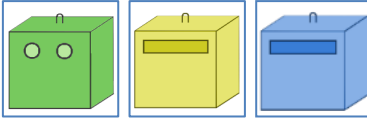
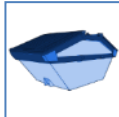

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Packaging The product of any material used to protect, contain, or transport a commodity or product.					
	Cardboard	plastic	metal	glass	composite
Beverage carton / composite Closed, paper-based composite packaging for liquid food and beverages. On average, it consists of 75 % paperboard; the remainder is polymer and in some cases aluminium. Beverage carton can only be recycled in paper mills with specialized processing equipment.					
Commingled Dry mixed recyclables that are collected together (single-stream).					
Organic waste / Biowaste Biodegradable waste. Consists of green waste from gardens and parks and of food waste from households.					
	organic waste	garden waste	food waste		
Residual waste Waste that is not selectively collected, also called refuse or mixed waste. Depending on the respective collection system, recyclables and organic waste may also be contained in residual waste.					
Refuse derived fuel RDF Fuel produced from municipal solid waste that has undergone processing. Processing can include separation of recyclables and non-combustible materials, shredding, size reduction, and pelletizing. [2]					

3.4 Collection type






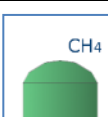

Bin receptacle for waste and recyclables; equipped with a lid and often on wheels; usually emptied into the collection vehicle; small bin: 6 – 240 litres capacity; large bin: 660 – 1,100 litres capacity	  
Bag receptacle for waste and recyclables; usually plastic bag of 60-120 litres capacity	
Reusable bag, box or bin receptacle for dry recyclables; of 30-90 litres capacity; usually emptied into the collection vehicle; optionally with a lid	 
Bundle Number of items, like newspapers or cardboard, fastened together with yarn or the like	 

Container receptacle for recyclables; of 1,500 – 4,000 litres capacity; often used for collection of recyclables at a bring bank; usually emptied into the collection vehicle	
Large container receptacle for waste and recyclables of 3 - 15 m ³ capacity; often used for commercial and industrial collection and at recycling yards	
Restricted access Access to the collection containers is restricted to authorised persons only. Only occupants and employees of the waste management company have access by means of a key or a key card.	

3.5 Processing


Processing Preparing municipal waste and recyclable materials for subsequent use or management, using processes such as baling, magnetic separation, crushing, and shredding. The term is also used for separation of recyclables from mixed waste streams. [2]	
Sorting station The sorting station means mainly manual sorting, either on the ground or from a conveyor belt.	
Sorting plant The sorting plant consists of one or more mechanical separation stages (e.g. screen, magnetic separator) and might be even equipped with optical sorting units (VIS and NIR), in most cases combined with manual sorting. If manual sorting serves mainly the purpose of a quality control, it is termed automated sorting.	
Materials recovery facility (MRF) a facility for separating commingled recyclables by manual or mechanical means. Some MRFs are designed to separate recyclables from mixed municipal waste. MRFs then bale and market the recovered materials. [2]	
Mechanical biological treatment plant (MBT) Waste processing facility that combines mechanical sorting with a form of biological treatment such as composting, biodrying or anaerobic digestion. Usually treatment of mixed waste.	
Informal sector / waste pickers Existence of scavengers and waste pickers, picking up recyclables, in urban settlements and landfills.	

3.6 Recovery and disposal

Recycling The process of transforming materials into raw materials for manufacturing new products, which may or may not be similar to the original product. [2]	
Recycling plant Industrial plant, using secondary raw materials, such as glass, plastics, cardboard, paper, metals etc. for production of new products.	
Paper and board plant Special recycling plant, using paper for recycling as raw material for the production of paper, board or moulded fibre products.	
Waste to energy plant (WTE) Facility that uses solid waste materials (processed or raw) to produce energy. WTE plants include incinerators that produce steam for district heating or industrial use, or that generate electricity. [2]	
Composting Biological decomposition of solid organic materials by bacteria, fungi, and other organisms into a soil-like product. [2]	
Digestion plant Anaerobic biological decomposition of solid organic materials into biogas, consisting of methane, and digestate, which can be used as fertilizer.	
Landfill Final disposal of solid waste. Material is placed controlled in a permanent place.	
<u>Controlled dump</u> a planned landfill that incorporates to some extent some of the features of a sanitary landfill: siting with respect to hydrogeological suitability, grading, compaction in some cases, leachate control, partial gas management, regular (not usually daily) cover, access control, basic record-keeping, and controlled waste picking. [2]	
<u>Sanitary landfill</u> an engineered method of disposing of solid waste on land, in a manner that meets most of the standard specifications, including sound siting, extensive site preparation, proper leachate and gas management and monitoring, compaction, daily and final cover, complete access control, and record-keeping. [2]	

4 Cluster 1 – Dupnitsa



	Dupnitsa Дупница	
	Country	Bulgaria
	Province	Kyustendil
	Website	http://www.dupnitsa.bg/
Population		50,794 (2015)
Surface area		329 km ²
Population density		158 inhabitants/km ²
Urbanisation class		B: 30 - 49% multi-family houses

4.1 Domestic waste and recyclables management system

The Dupnitsa municipality consists of 17 settlements: Dupnitsa city and 16 villages. The separate collection of recyclables was introduced in 2006. The following fractions are collected separately:

- Paper & board (including beverage carton)
- Plastic and metal packaging
- Glass packaging.

Separate collection was implemented in the city of Dupnitsa and the six villages, thus corresponding to 64.5 % of the surface area and 98 % of the inhabitants. There is no separate collection in the ten villages with fewer than 400 inhabitants. The separate collection and transport is carried out by ECOPACK BULGARIA - the organisation for utilising packaging waste. It commissions one or more firms with collecting, transporting and processing the recyclable streams.

At the moment, there is no separate collection of organic waste. This is scheduled to be introduced beginning in 2020. There is no recycling yard available to the residents. In addition to the collection system, collection shops for recyclable materials also exist where the residents can bring certain recyclable materials for which they receive a small financial compensation. Figure 2 shows a schematic illustration of the domestic waste and recyclables management system in Dupnitsa.

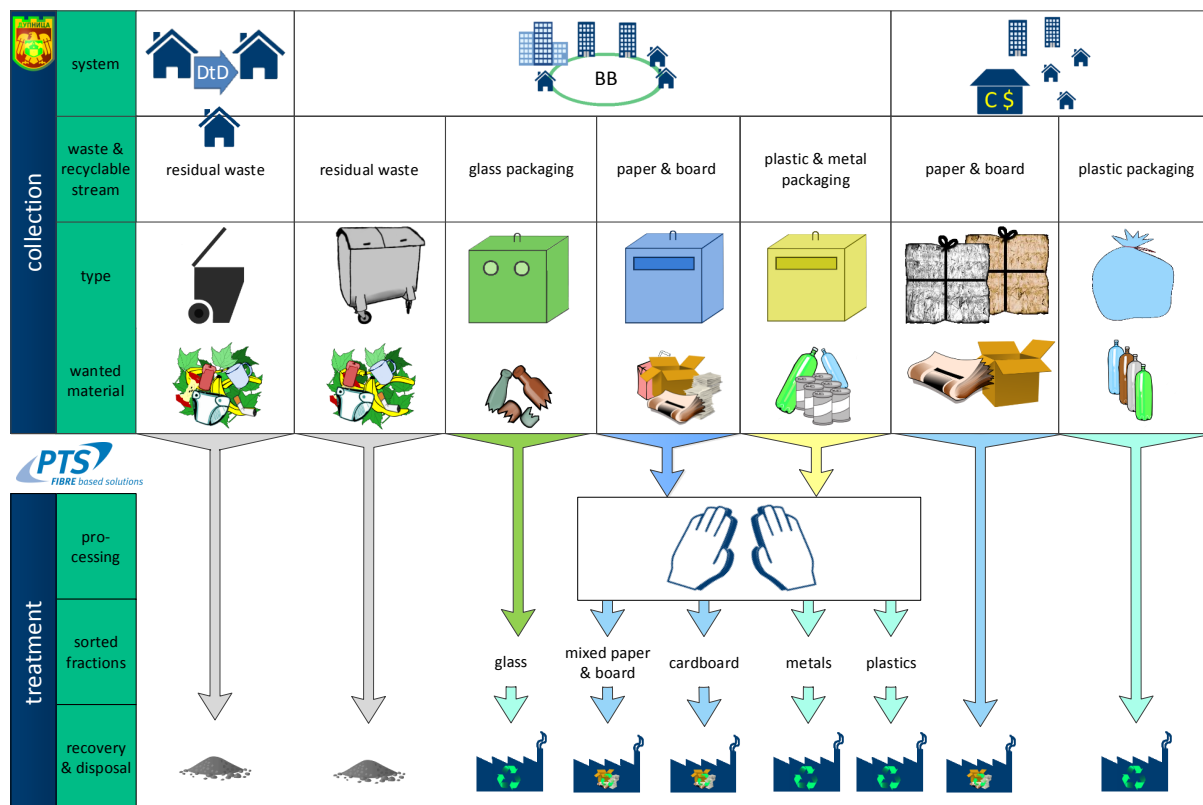


Figure 2: Scheme of domestic waste and recyclables management system in Dupnitsa

4.2 Collection of domestic waste and recyclables

This chapter characterises the collection of residual waste and recyclables. The photographs show clearly that the separation of the various recyclables functions poorly, there is a large contamination of all fractions. Moreover, the low level in the recyclables containers is rather striking⁶.

4.2.1 Collection of residual waste

Type of collection	Door to door	Bring bank
Type of receptacle	Small metal bin with 110 litres capacity	Large wheely metal bin with 1,100 litres capacity, usually serves 10 houses
Collection frequency	From daily to three times a week	

⁶ According to the local partners the containers had not been emptied recently.

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Figure 3: Residual waste collection – receptacles



Figure 4: Residual waste collection – material

4.2.2 Separate collection of recyclables

Type of collection	Bring bank
Type of receptacle	Set of three plastic containers with 1,000-1,500 litres capacity each Paper & board: blue Plastic & metal packaging: yellow Glass packaging: green
Service	85 sets of containers for city of Dupnitsa; 42 sets of containers throughout six villages
Collection frequency	Paper & board: three times a month Plastic & metal packaging: twice a month Glass packaging: every three months



Figure 5: Collection of recyclables – receptacles



Figure 6: Collection of glass packaging - material



Figure 7: Collection of plastic & metal packaging - material





Figure 8: Collection of paper & board - material

4.3 Treatment of domestic waste and recyclables

4.3.1 Treatment of residual waste

The material collected in the bins for residual waste is transported directly to the landfill in Dupnitsa. This landfill site is actually a controlled dump. There is access control and record keeping of deliveries. The material is compacted and waste picking⁷ is monitored. The photographs show that the deposited material still contains quite a few recyclable materials (Figure 10).

In future, the construction of a regional centre for the treatment of municipal waste is planned. This would include a sanitary landfill, a manual sorting station, a composting plant for separately collected organic waste and a recycling yard. However, no decision has been taken yet as to the location and funding of this project.



Figure 9: Landfill in Dupnitsa – disposal of residual waste

⁷ See chapter 4.6



Figure 10: Landfill in Dupnitsa – material

4.3.2 Treatment of recyclables

The company Phoenix Dupnitsa Ltd. is responsible for collecting, transporting and processing the material collected in the recyclables containers. This material is manually sorted according to the different qualities (material and colour) of the recyclables. The photographs of the input material (Figure 12) show that the material from the recyclables containers is mixed and in some cases very dirty. Since this site also processes recyclable materials from commerce and industry, the paper and board from these collection points are baled and sold together with the material from the household collections (Figure 13).



Figure 11: Sorting station Phoenix Dupnitsa Ltd. – manual sorting of recyclables



Figure 12: Sorting station – Input material from containers of recyclables collection



Figure 13: Paper for Recycling, baled at Phoenix Dupnitsa Ltd.

4.4 Collection shop for recyclables

In addition to the bring bank system, residents can bring certain recyclable materials to a special collection shop and receive a small financial compensation. These locations are called PUNKT. Phoenix Dupnitsa Ltd. runs four such collection points in Dupnitsa. These are intended for residents, although private collectors of recyclables (waste pickers) are also accepted. Paper, cardboard and LDPE plastic films are mainly collected, in some cases PET bottles as well, although these are difficult to compress and bale. The price is dependent on the market; currently the purchase price for paper and board amounts to EUR 45 per tonne.

In isolated cases, private waste management companies dealing primarily with waste and recyclables from commercial and industrial collection also buy recyclable materials from private individuals if the quantities are sufficiently large.



Figure 14: Collection shop for recyclables in Dupnitsa

4.5 Paper and board from business

The local branch of a supermarket chain was visited. The packaging materials that accumulate in the supermarket are mainly corrugated board and LDPE plastic films. They are collected three times a day in the supermarket and compressed separately. The recyclable materials are brought to the logistics centre in Sofia several times a week and sold centrally from there.



Figure 15: Collection and baling of cardboard at a supermarket in Dupnitsa



Figure 16: Collected recyclables at a supermarket – LDPE plastic films and cardboard

An industrial location with a variety of recyclable materials was also inspected within the framework of the on-site visit. Packaging materials consisting of corrugated board and carton board were compacted on site. Significant was the fact that small sized cardboard was frequently found inside plastic bags. The service provider is Phoenix Dupnitsa Ltd.



Figure 17: Collection and baling of cardboard from industry

4.6 Informal Sector

Informal private collectors and recyclable materials traders are widespread in some Southern and Eastern European countries. They are often of Roma ethnicity and are often called waste pickers. They rummage through the collection containers and dumps looking for recyclables that they can then sell in collection shops. Valuable materials include, among others, plastic, metal and paper & board. This scavenging of the collection containers causes littering of the collection points with rubbish and also causes the material stream from one container to become comingled with the streams from others. The result is that the preparedness of the local residents to dispose of their recyclables in separate containers drops substantially. In addition, working in the uncontrolled dumps has serious health consequences for the waste pickers. The tonnages of recyclable material

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collected in this manner and supplied to the recycling process, can only infrequently be detected and measured by the local authorities. This in turn means that these quantities cannot be statistically included in the recycling rate.

Informal private waste pickers also exist in the Dupnitsa Cluster. They collect recyclables both from the collection containers and the controlled landfill and later sell them in the collection shops (Figure 18).

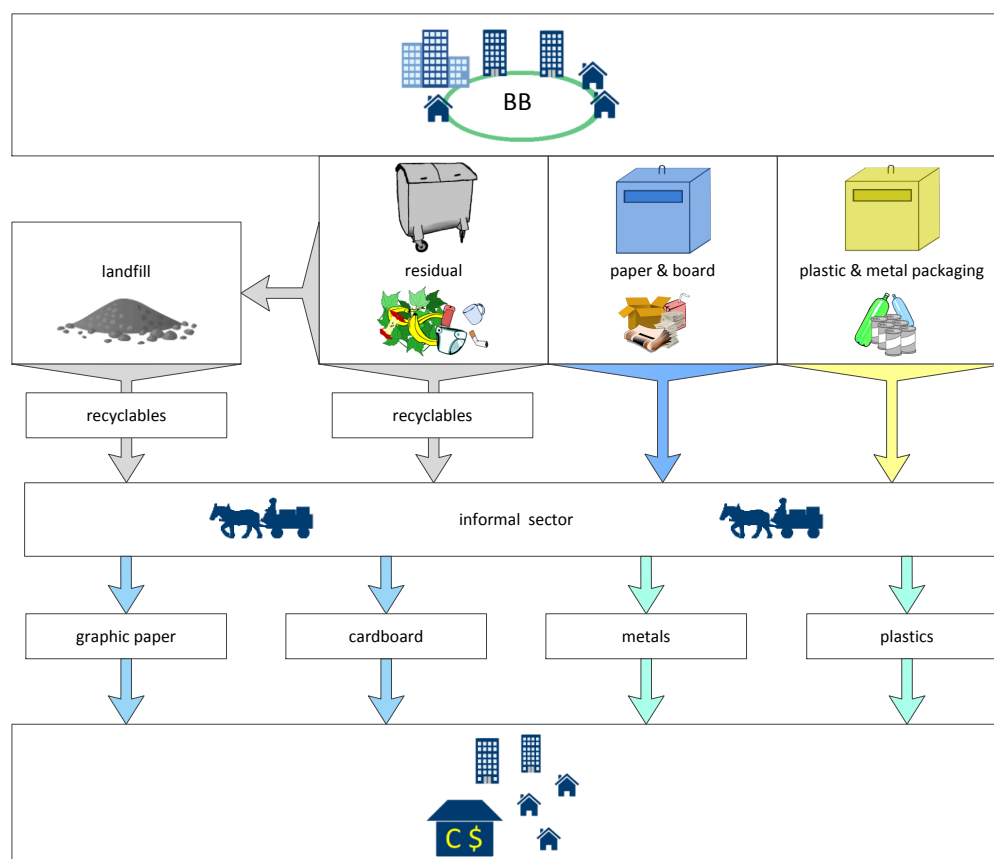



Figure 18: Scheme of informal sector's activities in Dupnitsa

5 Cluster 2 – Mezdra



	Mezdra Мездра	
	Country	Bulgaria
	Province	Kyustendil
	Website	mezdra.bg
Population		22,033 (2016)
Surface area		520 km ²
Population density		42 inhabitants/km ²
Urbanisation class		B: 30 - 49% multi-family houses

5.1 Domestic waste and recyclables management system

The municipality consists of 28 settlements, the largest being the city of Mezdra. The separate collection of recyclables was introduced in 2007. The following fractions are collected separately:

- Paper & board (including beverage carton)
- Plastic and metal packaging
- Glass packaging.

Separate collection has been implemented in the city of Mezdra. There is no separate collection in the other 27 settlements. Separate collection and transport is carried out by ECOPACK BULGARIA - the organisation for utilising packaging waste. It commissions one or more firms with collecting, transporting and processing the recyclable streams.

At the moment, there is no separate collection of the organic waste. This is scheduled to be introduced beginning in 2020. There is no recycling yard available to the residents. As an alternative, they can deliver wastes to a few waste processing companies. As a supplement to the collection system, there are collection points for recyclable materials where residents can bring certain recyclables in return for a small financial compensation (collection shop). Figure 19 shows a schematic illustration of the domestic waste and recyclables management system in Mezdra.

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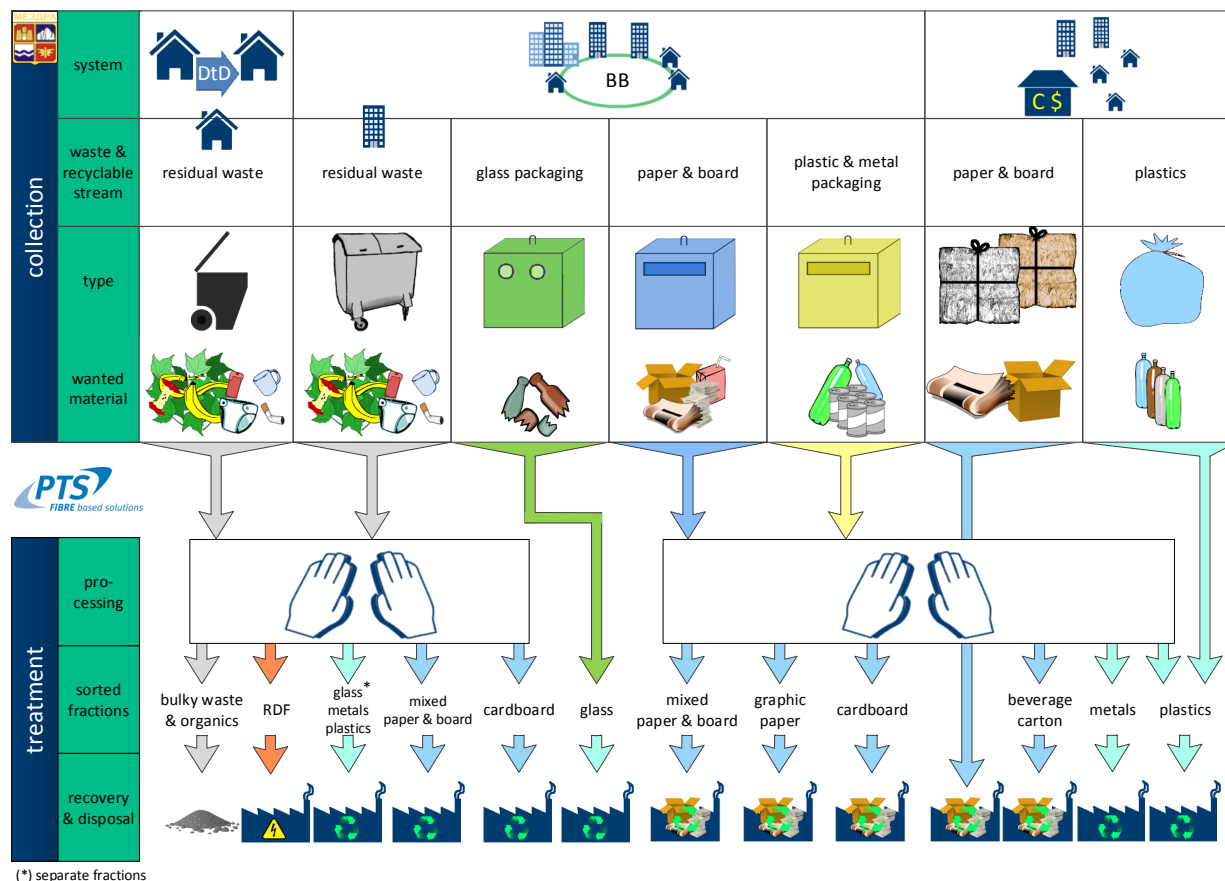


Figure 19: Scheme of domestic waste and recyclables management system in Mezdra

5.2 Collection of domestic waste and recyclables

This chapter characterises the collection of residual waste and recyclables. The photographs show clearly that the separation of the various recyclables functions poorly, there is a large contamination of all fractions. Moreover, the low level in the recyclables container is rather striking⁸.

5.2.1 Collection of residual waste

Type of collection	Door to door	Bring bank
Type of receptacle	Small metal bin with 110 litres capacity	Large wheely metal bin with 1,100 litres capacity; usually serves 8 houses
Collection frequency	Central zone: daily Other 4 zones: fortnightly Large village: weekly Small village: twice a month	

⁸ According to the local partners the containers had not been emptied recently.



Figure 20: Large bins for residual waste collection at bring banks

5.2.2 Separate collection of recyclables

Type of collection	Bring bank
Type of receptacle	Set of three plastic containers with 1,500 litres capacity each Paper & board: blue Plastic & metal packaging: yellow Glass packaging: green
Service	35 sets of containers
Collection frequency	Inner zone: daily Other 4 zones: weekly Villages: no separate collection of recyclables



Figure 21: Large containers for recyclables collection



Figure 22: Collection of paper & board - material

5.3 Treatment of domestic waste and recyclables

5.3.1 Treatment of residual waste

The material collected in the residual waste bins is transported directly to the regional treatment centre for municipal waste. It is manually sorted there into up to 14 different fractions (Figure 24). The fractions of bulky and organic waste are deposited on the sanitary landfill (Figure 28). The RDF (refuse-derived fuel) fraction is recovered in a cement factory. Eleven fractions of recyclables are sold: glass packaging; graphic paper; paper & board packaging; LDPE clear and others; PET green, clear, blue and brown; ferrous and non-ferrous metals.



Figure 23: Sorting station for residual waste in Vratsa (near Mezdra)



Figure 24: Sorting station – manual sorting of residual waste into 14 different fractions



Figure 25: Sorted fractions – two qualities of paper and board, sorted from residual waste



Figure 26: Sorted fractions – baled paper and board, sorted from residual waste



Figure 27: Sorted fractions – different qualities of plastics, sorted from residual waste



Figure 28: Non-recyclables fraction within residual waste, going to sanitary landfill

5.3.2 Treatment of recyclables

The company BKO is responsible for collecting, transporting and processing the material collected in the recyclables containers. This is manually sorted according to the different qualities (material and colour) of the recyclable materials. The photographs of the input material (Figure 30) show that the material from the recyclables contains mixed recyclables and partly also residual waste. Paper & board is sorted and baled as cardboard und mixed paper & board. If print products occur in large quantities, graphic paper is also sorted and baled.



Figure 29: Sorting station – manual sorting for recyclables



Figure 30: Sorting station – input material from recyclables collection containers



Figure 31: Sorting station – paper and cardboard, sorted from recyclable material



Figure 32: Sorted fractions – paper for recycling, sorted from recyclable material



Figure 33: Sorted fractions – beverage carton and different qualities of plastics, sorted from recyclable material

5.4 Collection shop for recyclables

In addition to the bring bank system, residents can bring certain recyclable materials to a special collection shop and receive a small financial compensation. These locations are called PUNKT. There is only one collection point in the city centre of Mezdra. This is intended for residents, although private collectors of recyclables (waste pickers) are also accepted. Paper, cardboard and LDPE plastic films are mainly collected, in some cases PET bottles as well, although these are difficult to compress and bale. The price is dependent on the market; currently the purchase price for paper and board amounts to EUR 40-45 per tonne.

In isolated cases, private waste management companies dealing primarily with waste and recyclables from commercial and industrial collection also buy recyclable materials from private individuals if the quantities are sufficiently large.



Figure 34: Collection shop for recyclables



5.5 Paper and board from business

In the shop inspected during the on-site visit, recyclables cardboard and LDPE plastic films were bundled and brought to a collection shop at the end of the day to be sold. Graphic paper from the office area, for example, was collected separately at the site of a waste management company (and this location thus functions as a collection shop).



Figure 35: Collection of cardboard at a supermarket; graphic paper of offices, collected at commercial collection shop

Another waste management company was visited which collected, compressed and sold cardboard, among other things, from a local industrial company.



Figure 36: Collection and baling of cardboard from industry

5.6 Informal Sector

Informal private collectors and recyclable materials traders are widespread in some Southern and Eastern European countries. They are often of Roma ethnicity and are often called waste pickers. They rummage through the collection containers and dumps looking for recyclables that they can then sell in collection shops. Valuable materials include, among others, plastic, metal and paper & board. This scavenging of the collection containers causes littering of the collection points with rubbish and also causes the material stream from one container to become comingled with the streams from others. The result is that the preparedness of the local residents to dispose of their recyclables in separate containers drops substantially. In addition, working in the uncontrolled dumps has serious health consequences for the waste pickers. The tonnages of recyclable material collected in this manner and supplied to the recycling process, can only infrequently be detected and measured by the local authorities. This in turn means that these quantities cannot be statistically included in the recycling rate.

Informal private waste pickers also exist in the Mezdra Cluster. They collect recyclables from the collection containers and later sell them in the collection shops (Figure 37).

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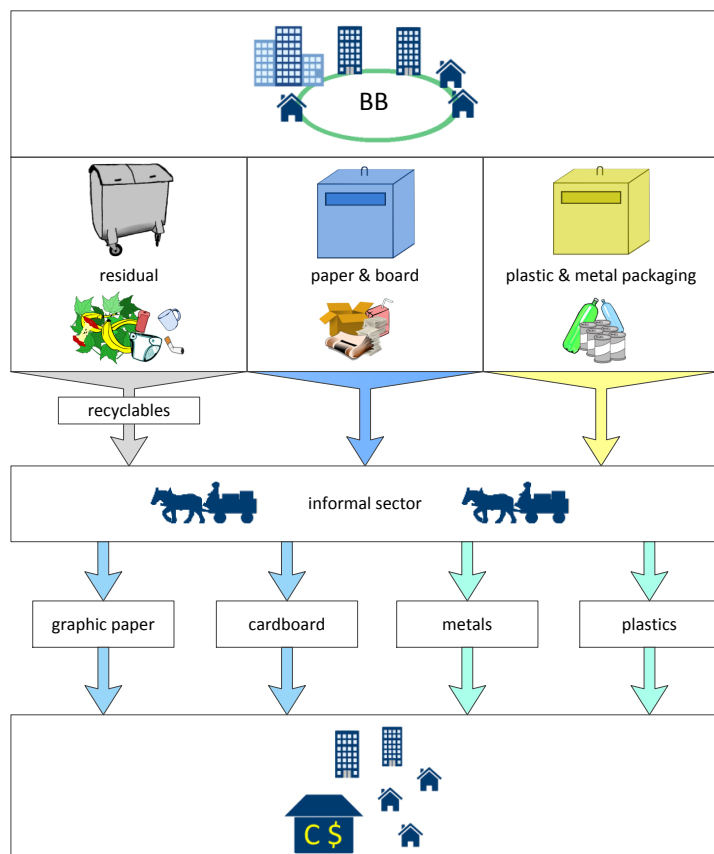




Figure 37: Scheme of informal sector's activities in Mezdra

6 Cluster 3 – Sfantu Gheorghe

			Sfantu Gheorghe Sepsiszentgyörgy
	Country	Romania	
	County	Covasna	
	Website	http://www.sfantugheorghei.ro/	
	Population	65,080 (2015)	
	Surface area	14,39 km ²	
	Population density	3774 inhabitants/km ²	
	Urbanisation class	A: 50 - 100% multi-family houses	

6.1 Domestic waste and recyclables management system

The municipality of Sfantu Gheorghe consists of the city and two villages. The separate collection of recyclables was introduced in 2007. The following fractions are collected separately:

- Paper & board
- Plastic and metal packaging (including beverage carton)
- Glass packaging.

Separate collection is established within the city of Sfantu Gheorghe. Extended Producer Responsibility (EPR) for packaging waste is carried out by ECO-ROM AMBALAJE, which signed a contract with the municipal waste operator S. C. TEGA S. A.

At the moment, there is no separate collection of the organic waste, but it will be introduced in the next years. There is a separate collection of electric appliances and devices. A recycling yard is available to residents. There are no collection shops for recyclables. However, inhabitants can deliver recyclable materials directly to the TEGA recycling yard or to four other sites. They are given a reduction in their waste tax in return. Figure 38 is a schematic illustration of the domestic waste and recyclables management system in Sfantu Gheorghe.

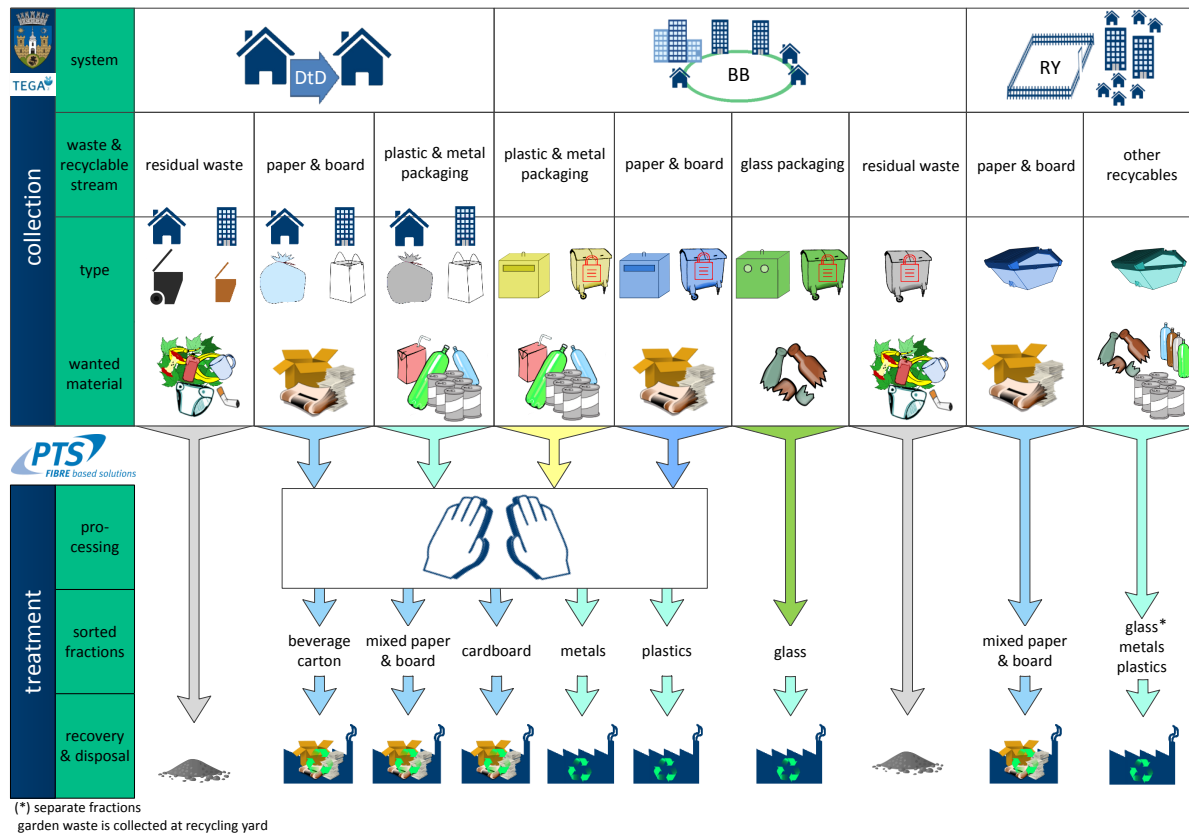


Figure 38: Scheme of domestic waste and recyclables management system in Sfantu Gheorghe

6.2 Collection of domestic waste and recyclables

The collection system in Sfantu Gheorghe is very individually adapted to the respective residential possibilities. There is a door to door collection for one-family houses. Detached multi-family houses have door to door collection as well. There, every household has a separate compartment in a collection cabinet in which, depending on the day of the week, residual waste or the various recyclables are deposited for collection. Residential areas with a high population density have a bring bank system for the occupants of the apartment blocks. The residual waste bins are located in locked green metal sheds (Figure 40). In some cases, the large bins for recyclable collection are also located in these sheds. At some bring bank locations, the recyclables are collected in detached containers located next to the shed for the residual waste bins. Access to the metal shed is only possible by means of a key or key card for the occupants and the employees of the TEGA waste management company. There are plans to put all collection bins in locked sheds.

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Figure 39: Door to door collection of domestic waste and recyclables



Figure 40: Bring Bank collection of domestic waste and recyclables



Figure 41: Restricted access of waste and recyclables collection system

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6.2.1 Collection of residual waste

Origin	Areas with one-family and detached multi-family houses	Areas with high population-density (ca. 80% of households)
Type of collection	Door to door (DtD)	Bring bank (BB)
Access	All types of residual collection have restricted access	
Type of receptacle	For one-family houses: - Small wheely bin with 120 or 240 litres capacity For a detached multi-family house: cabinet with separate compartments - Reusable small brown box with 35 litres capacity	- large metal bins with 340 - 4,000 litres capacity each - 16 locations - each bring bank collection point serves 300 people
Collection frequency	Once a week	Once or twice a week



Figure 42: Collection of residual waste from multi-family houses



Figure 43: Residual waste collection at Bring Banks – material



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Boosting separate paper collection



This project has received funding from the European Union's Horizon 2020 research and innovation

Date: 27 October 2016

6.2.2 Separate collection of recyclables

Origin	Areas with one-family and detached multi-family houses	Areas with high population-density
Type of collection	Door to door (DtD)	Bring bank (BB)
Type of receptacle	<p>Plastic bags for single family houses:</p> <ul style="list-style-type: none"> - Paper & board: clear bag with 35 litres capacity - Plastic & metal packaging: grey bag with 35 litres capacity <p>For a detached multi-family house: cabinet with separate compartments</p> <ul style="list-style-type: none"> - Paper & board: white reusable bag with 35 litres capacity - Plastic & metal packaging: white reusable bag with 35 litres capacity - Glass packaging: white reusable bag with 35 litres capacity 	<p>Set of three plastic containers or large bins; 340 – 4,000 litres capacity; 150 m average distance</p> <ul style="list-style-type: none"> - Paper & board: blue - Plastic & metal packaging: yellow - Glass packaging: green
Collection frequency	Weekly	Twice a week



Figure 44: Door to door collection of paper & board and plastic & metal packaging in plastic bags



Figure 45: Bring Bank collection of recyclable waste streams in detached containers or in large bins with coloured lids



Figure 46: Separate collection of paper & board - material



Figure 47: Separate collection of plastic & metal packaging and glass packaging - material

6.3 Treatment of domestic waste and recyclables

6.3.1 Treatment of residual waste

At present, the material collected in the residual waste bins is transported directly to a landfill in Brasov, which is 32 km away. A new regional treatment centre for municipal waste in Leț (Figure 48) is already finished and can be put into operation immediately upon completion of the tendering process. It has a sorting station for manual sorting as well as a sanitary landfill. A composting site for separate organic waste collection is planned there too.



Figure 48: A new sorting station for manual sorting of municipal waste

6.3.2 Treatment of recyclables

The municipal company TEGA is responsible for collecting, transporting and processing the material collected in the recyclable containers. This material is manually sorted according to the different recyclables qualities (material and colour).



Figure 49: Manual sorting of recyclables at TEGA sorting station



Figure 50: Sorted fractions of separate recyclable stream plastic & metal packaging – PET brown and beverage carton



Figure 51: Paper & board, collected from households

6.4 Paper and board from business

In addition to the waste and recyclables management, TEGA is also responsible for the public markets (Figure 52). The packaging material is collected in big bags during the day and after market closing, it is separated at the TEGA sorting station. TEGA also collects recyclables from commercial and industrial sources. Figure 53 shows the collection and baling of cardboard at a food producing company.

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Figure 52: Separate collection of paper & board from markets



Figure 53: Paper & board collection and baling at a food producing company

7 Cluster 4 – Mihai Viteazu



	Mihai Viteazu Szentmihály	
	Country	Romania
	County	Cluj
	Website	http://primariamihai-viteazu.ro/
Population		5,423 (2011)
Surface area		47,53 km ²
Population density		122 inhabitants/km ²
Urbanisation class		D: 8 - 19% multi-family houses

7.1 Domestic waste and recyclables management system

The municipality consists of three villages: Cheia (Mészkő), Cornești (Sinfalva) and Mihai Viteazu. The separate collection of recyclables was introduced in 2011. Initially, the following fractions are collected separately:

- Paper & board (including beverage carton) (blue)
- Plastic packaging (yellow)
- Metal packaging (brown)
- Glass packaging (green).

At present, separate collection in the recyclable fractions mentioned is only done by small businesses, e.g. in shops. The separation of the various recyclables by the population is insufficient. This explains why there is a commingled collection of all recyclables in the large bins provided at the bring banks. In future, there are plans to collect recyclables from door to door while increasing public acceptance at the same time. Residual waste is already being collected from door to door.

At the moment, there is no separate collection of the organic waste. There no is recycling yard available to the residents. Figure 54 shows a schematic illustration of the domestic waste and recyclables management system in Mihai Viteazu.

Date: 27 October 2016

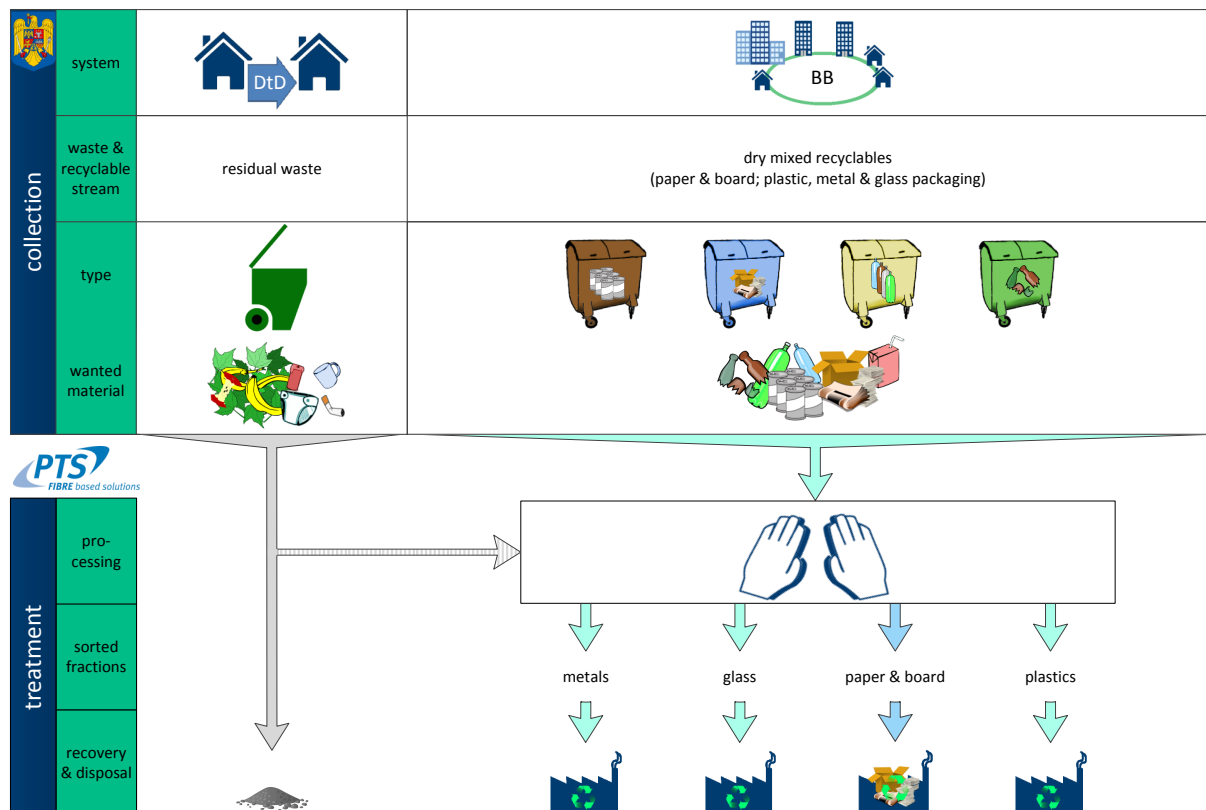


Figure 54: Scheme of domestic waste and recyclables management system in Mihai Viteazu

7.2 Collection of domestic waste and recyclables

This chapter characterises the collection of residual waste and recyclables.

7.2.1 Collection of residual waste

Type of collection	Door to door
Type of receptacle	Small wheely green bin with 120 or 240 litres capacity
Collection frequency	Weekly



Figure 55: Door to door collection of residual waste in small bins

7.2.2 Separate collection of recyclables

Type of collection	Bring bank
Type of receptacle	Large bins with 1,100 litres capacity each*
Service	10 locations in the town
Collection frequency	Weekly

*despite different colours and label, all containers are used for commingled collection of dry recyclables



Figure 56: Large bins for recyclable collection at bring banks – receptacles

7.3 Treatment of domestic waste and recyclables

7.3.1 Treatment of residual waste

The material collected in the residual waste bins is temporarily stored in the Mihai Viteazu sorting station. Final disposal takes place at a landfill that is 300 km away. Plans for the future provide for final disposal at a central landfill for the entire county of Cluj, although the construction of this facility has not yet been completed.



Figure 57: Residual waste from households

7.3.2 Treatment of recyclables

Currently, the municipality is operating its own sorting station. On the one hand, the mixed recyclables from households are sorted into the various fractions (according to material and colour). On the other hand, separately collected recyclables from the local shops and businesses are sorted and baled if necessary. This means that domestic paper and board is baled together with paper and board from shops.

As soon as the construction of the central regional treatment plant for municipal waste for the entire county of Cluj has been completed, the municipality of Mihai Viteazu must take their recyclables there.



Figure 58: Sorting station in Mihai Viteazu



Figure 59: Sorted fractions – paper for recycling from households and business



Figure 60: Sorted fractions – different qualities of plastic recyclables, sorted from households and business

7.4 Paper and board from business

Recyclables from small shops are collected separately in large bins, mainly for paper & board and plastic packaging. The local logistic centre of a supermarket chain collects and bales the arising cardboard on its own.



Figure 61: Cardboard collection from a local shop and from retailer's logistic centre

8 Cluster 5 – Vendée

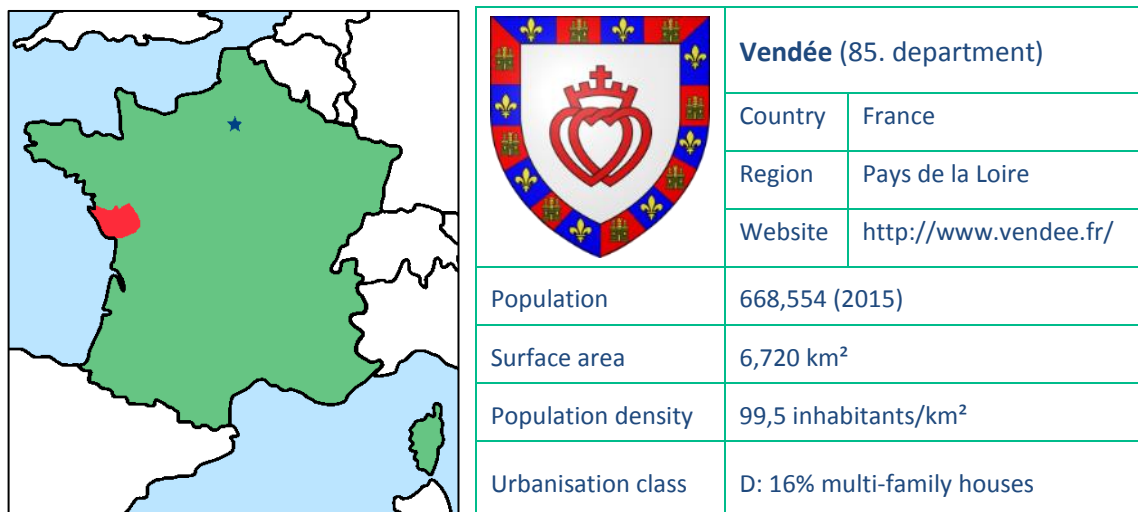


Figure 62: Vendée map, showing collectivities

8.1 Domestic waste and recyclables management system

The Department Vendée consists of 282 municipalities. They are responsible for the collection and treatment of domestic waste and recyclables. A few municipalities have combined to form “collectivities” that collectively organise the collection activities. The joint association Trivalis that was founded in 2003 is responsible for all activities in the field of treatment.

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The separate collection of recyclables was introduced in 1992. The following fractions are collected separately:

- Graphic paper
- Glass packaging
- Plastic, metal and small cardboard packaging (including beverage cartons)

In some collectivities, graphic paper is collected together with plastic, metal and cardboard packaging. Large cardboard is collected in the recycling yards. The separate collection of organic waste is planned. At the moment, green waste can be taken to the recycling yard. In some areas, residents can bring food wastes to cooperative composting locations. Figure 63 shows a schematic illustration of the domestic waste and recyclables management system in Vendée.

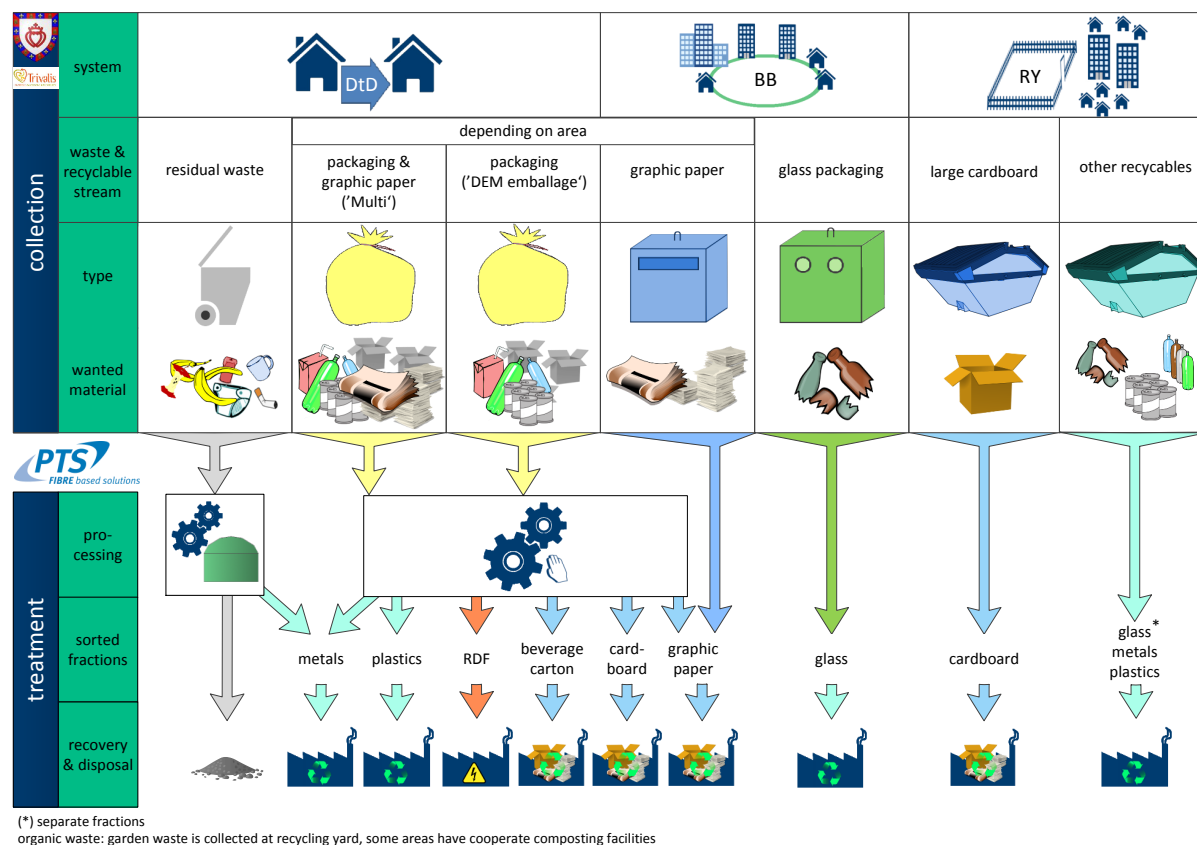


Figure 63: Scheme of domestic waste and recyclables management system in Vendée

8.2 Collection of domestic waste and recyclables

This chapter characterises the collection of residual waste and recyclables.

Date: 27 October 2016

8.2.1 Collection of residual waste

Type of collection	Door to door
Type of receptacle	Small wheely bin with 80-660 litres capacity
Collection frequency	Monthly



Figure 64: Door to door collection of residual waste

8.2.2 Separate collection of recyclables

Type of collection	Door to door (DtD)	Bring bank (BB)
Type of receptacle	Yellow plastic bag	Metal container
Material	<ul style="list-style-type: none"> - Plastic, metal and small cardboard packaging (<i>DEM</i>) - In a few regions joint collection with graphic paper (<i>Multi</i>) 	<ul style="list-style-type: none"> - Glass packaging (green) - Graphic paper (blue)
Collection frequency	Twice a month	One to four times a month



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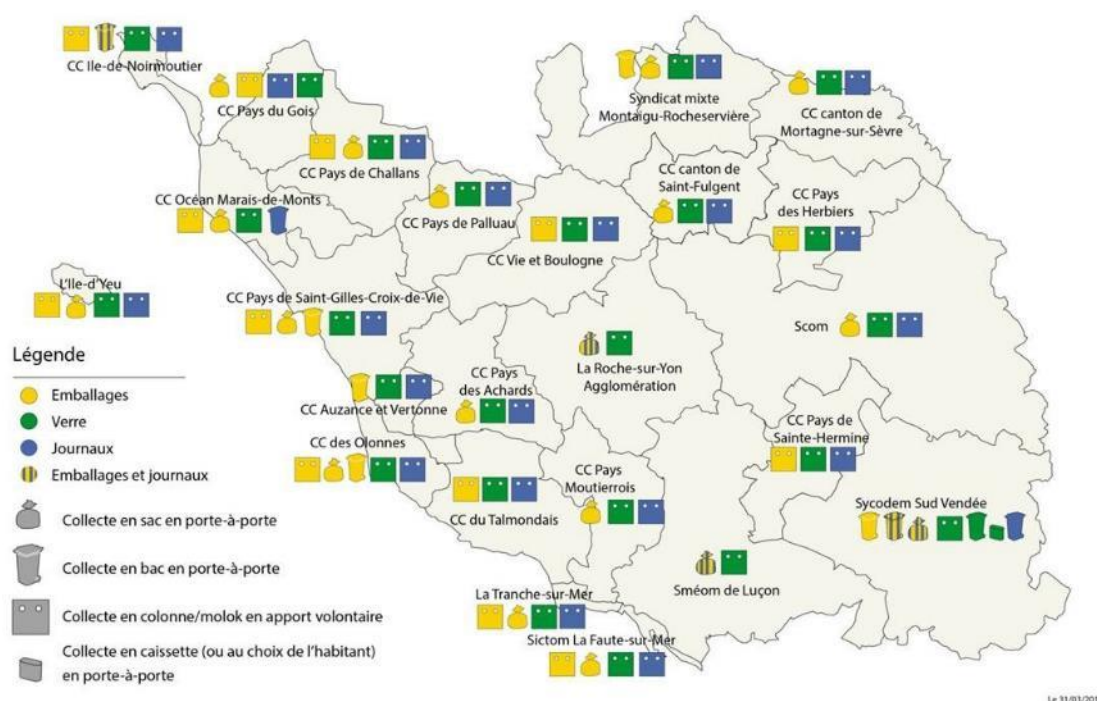


Figure 65: Vendée map, showing collection system for recyclables



Figure 66: Door to door collection of yellow bag (left: only packaging; right: packaging and graphic paper)

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Figure 67: Bring bank collection for graphic paper – container and material



Figure 68: Bring bank collection for glass packaging – container and material

8.2.3 Recycling yard

Locations	70 déchèteries of different sizes
Opening hours	Mon/Fri/Sat: 9-12 a.m., 2-8 p.m. Tue/Wed/Thu: 9-12 a.m.
Fractions	Cardboard packaging, garden waste, wood, glass, hard plastic, soft plastic, hazardous waste, metals, furniture, building rubble, final waste



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Boosting separate paper collection



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Figure 69: Vendée map, showing locations of recycling yards



Figure 70: Recycling yard in Chantonay



Figure 71: Recycling yard – collection of large cardboard

8.3 Treatment of domestic waste and recyclables

8.3.1 Treatment of residual waste

Residual waste is processed in mechanical biological treatment plants. Ferrous materials are separated using a magnetic separator. The organic fraction is separated and composted. The remaining material is disposed of at one of the four landfills.



Figure 72: Mechanical biological treatment plant and organic fraction after composting

8.3.2 Treatment of recyclables

The automated sorting plant in Mouzeuil-Saint-Martin is equipped with an optical sorting unit and is thus the most modern of the four sorting plants. The material for sorting consists either only of packaging (DEM) or also includes graphic paper (Multi). After opening the yellow plastic bag, the drum sieve generates three fractions of different size distribution. The small fraction <40mm is used as RDF. The large-size fraction >160 mm is manually sorted from 6-8 persons into six fractions of recyclables. From the middle size fraction the ferrous and non-ferrous metals are separated with magnetic and eddy current separators. Afterwards, the material is sorted by NIR loop sorting and manual quality control into the same six fractions of recyclables as the large size fraction.

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A large, modern sorting facility is currently under construction in La Roche-sur-Yon in which all packaging material collected in Vendée is to be sorted starting next year. At the same time, the selective collection of graphic paper is to be introduced for all collectivities.



Figure 73: Mouzeuil-Saint-Martin sorting plant and teaching room



Figure 74: Input material Multi – plastic, metal and cardboard packaging and graphic paper, collected in yellow bag



Figure 75: Input material DEM – plastic, metal and cardboard packaging, collected in yellow bag



Figure 76: Mouzeuil-Saint-Martin sorting plant – drum sieve generates three different size fractions; large-size fraction sorting is manually



Figure 77: Mouzeuil-Saint-Martin sorting plant – NIR sorting of middle-size fraction



Figure 78: Mouzeuil-Saint-Martin sorting plant – sorting into nine fractions

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Figure 79: Sorted fractions – graphic paper and small cardboard packaging



Figure 80: Paper for Recycling – baled small cardboard packaging and beverage carton



Figure 81: Sorted fractions – yellow plastic bags and plastic recyclables

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Figure 82: Paper for Recycling from Vendée sorting plant (EMR grade) at a local paper mill

8.4 Organic waste management

	Green waste	Organic waste (in some areas)
Type of collection	Recycling yard (Figure 83)	Bring Bank (Figure 84)
Type of receptacle	Large container	Individual
Collection frequency	-	Whenever required
Treatment	Composting plant	Cooperate composting

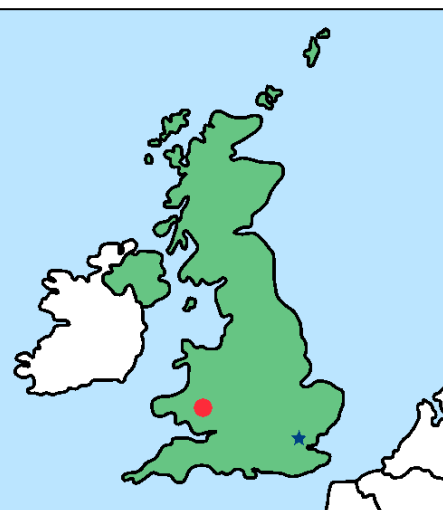



Figure 83: Collection of garden waste at Recycling yard



Figure 84: Cooperative composting facilities for organic waste

9 Cluster 6 – Merthyr Tydfil



 <p>Cyngor Bwrdeistref Sirol MERTHYR TUDFUL MERTHYR TYDFIL County Borough Council</p>	Merthyr Tydfil Merthyr Tudful	
	Country	United Kingdom
	Region	Wales
	Website	http://www.merthyr.gov.uk
	Population	58,851 (2015)
Surface area	111 km ²	
Population density	530 inhabitants/km ²	
Urbanisation class	A: 50 - 100% multi-family houses	

9.1 Domestic waste and recyclables management system

Separate collection of recyclables was introduced in Merthyr Tydfil in 2002. Since 2015, the recyclables collection system has been changed from commingled collection (single-stream) to separate collection (multi-stream). The following fractions of recyclables are collected separately:

- Graphic paper
- Cardboard
- Glass packaging
- Plastic & metal packaging (including beverage carton).



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There is separate collection of organic waste; green waste and food waste are collected selectively. Collection from detached and terraced houses takes place in the form of kerbside sorting. This means that the waste collectors empty the collection containers standing in front of the houses into the collection lorry. The kerbside sorting lorries have only restricted access, especially in areas with a high population density. This explains why the recyclable materials are currently being collected commingled in these areas. In future, however, suitable vehicles are to be provided for these areas. Figure 85 shows a schematic illustration of the domestic waste and recyclables management system in Merthyr Tydfil.

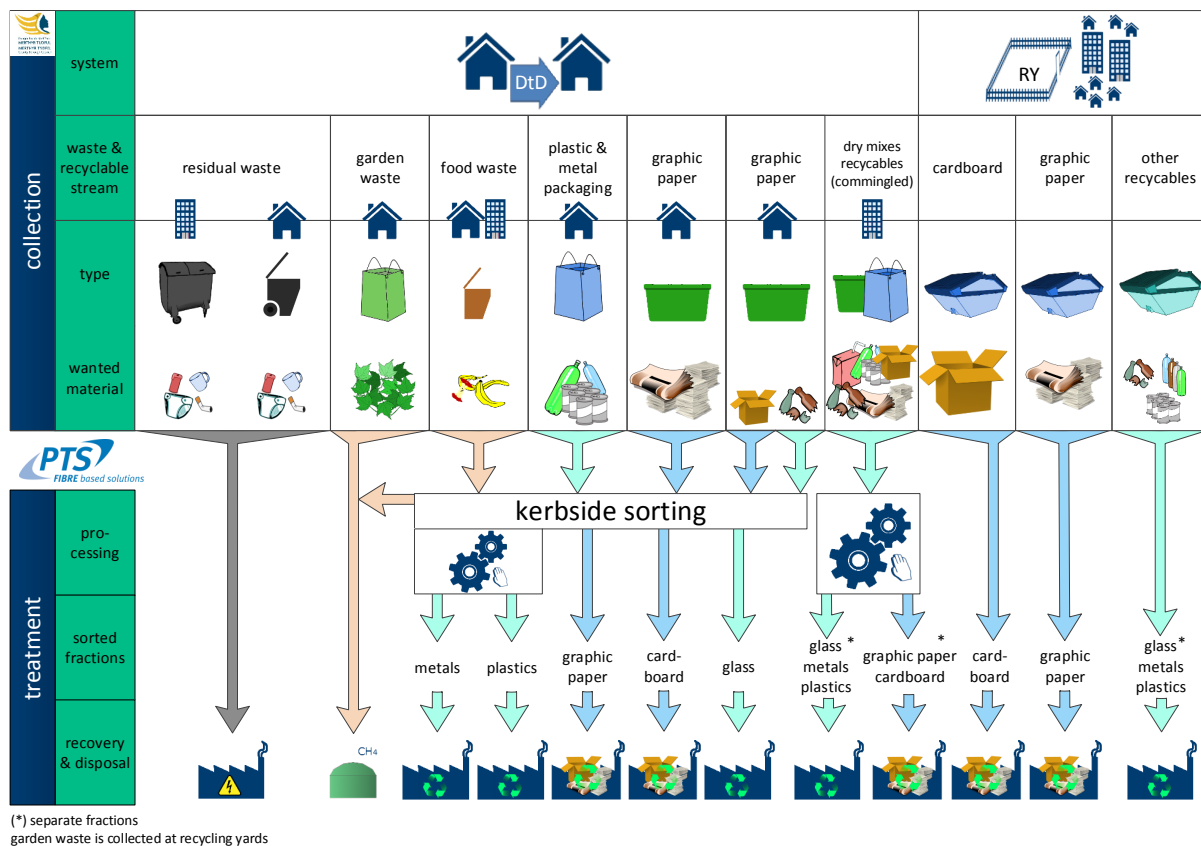


Figure 85: Scheme of domestic waste and recyclables management system in Merthyr Tydfil

9.2 Collection of domestic waste and recyclables

This chapter characterises the collection of residual waste and recyclables.

9.2.1 Collection of residual waste

Type of collection	Door to door (DtD)
Type of receptacle	Black wheely bin with 140 litres capacity
Collection frequency	Fortnightly

Residual waste is collected in small bins with a capacity of 140 litres. Larger bins with capacities of 240 litres are authorised upon request in exceptional cases. Waste placed next to the bin is not collected (no side-waste policy).



Figure 86: Door to door collection of residual waste – receptacles

9.2.2 Separate collection of recyclables

Origin	Detached or terraced houses	Multi-family houses (high population density)
Type of collection	Door to door (DtD)	Door to door (DtD)
Type of receptacle	<ul style="list-style-type: none"> - cardboard & glass packaging: reusable box → separated by waste collector - graphic paper: reusable box (55litres) - plastic and metal packaging: reusable bag (90 litres) - food waste: small bin with handle (23 litres) 	<ul style="list-style-type: none"> - dry mixed recyclables (paper & board; plastic, metal and glass packaging): reusable box or bag - food waste: small bin with handle (23 litres)
Collection frequency	Weekly	Weekly

In areas with multi-stream collection and kerbside sorting, the residents place the recyclables kerbside for collection on pick-up day. Glass packaging and cardboard are collected in one box and separately sorted into the kerbside sorting lorry by the waste collectors. Graphic paper is collected in another separate box. Plastic and metal packaging are put in a reusable bag and dumped into the lorry in mixed form. Food waste is collected with the same lorry. In order to increase the convenience for residents, the municipality is currently carrying out trials with a 'Trolibocs' recycling container system (three boxes that stack together on a trolley).

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Figure 87: Door to door collection of recyclables and food waste



Figure 88: Door to door collection of recyclables and food waste - receptacles



Figure 89: Door to door collection of recyclables – plastic & metal packaging and cardboard

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Figure 90: Door to door sorting into multi-compartment vehicle



Figure 91: Delective collection of cardboard and graphic paper



Figure 92: Separate collection of plastic & metal packaging and glass packaging

In areas where the kerbside sorting lorries have only restricted access, the recyclable materials are currently collected commingled. In future, however, suitable vehicles are to be provided for these areas.



Figure 93: door to door collection of commingled recyclables

9.2.3 Recycling yard

locations	Two household waste recycling centres (HWRC)
Opening hours	Summer: 9 a.m. to 8 p.m. Winter: 9 a.m. to 4:30 p.m.
fractions	Paper, cardboard, household plastic packaging, cans, hard plastics, non-recyclable waste (incl. polystyrene), hazardous and non-hazardous paint, car batteries, batteries, TV's & monitors, books, clothing, mixed glass, gas bottles, used engine oil, used cooking oil, small and large electrical appliances, carpets, wood & timber, mattresses, scrap metal, garden waste, hardcore & rubble, fluorescent tubes

Residents can bring as many as 26 fractions of waste and recyclables to two recycling yards. These household waste recycling centres are operated by the private company Potters Waste Management.



Figure 94: Recycling yard (household waste recycling centre HWRC)



Figure 95: Recycling yard – cardboard collection



Figure 96: Recycling yard – graphic paper collection and book bank

9.3 Treatment of domestic waste and recyclables

9.3.1 Treatment of residual waste

The residual waste is bulked at a depot and delivered to the EfW (Energy for Waste) plant in Cardiff.

9.3.2 Treatment of recyclables

The recyclables and food waste are removed from the lorry at the handling site. The plastic & metal packaging fraction is sorted on site. Ferrous metals, non-ferrous metals and plastics are sorted using a magnetic and eddy flow separator. The selectively collected fractions graphic paper and cardboard are visually inspected and sorted if necessary.

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Figure 97: Sorting station – selectively collected graphic paper



Figure 98: Sorting station – selectively collected cardboard

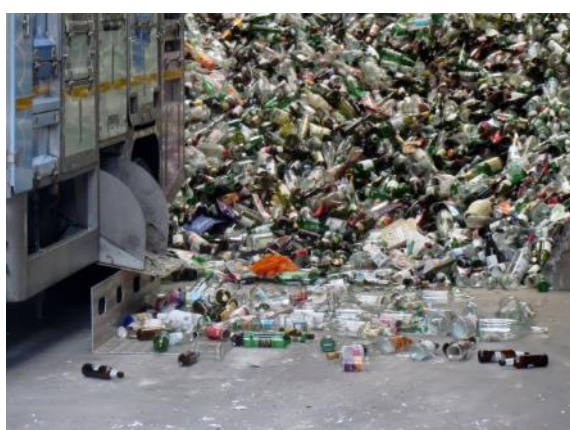


Figure 99: Sorting station – separately collected glass packaging



Figure 100: Sorting station – the plastic and metal packaging stream is sorted into three fractions

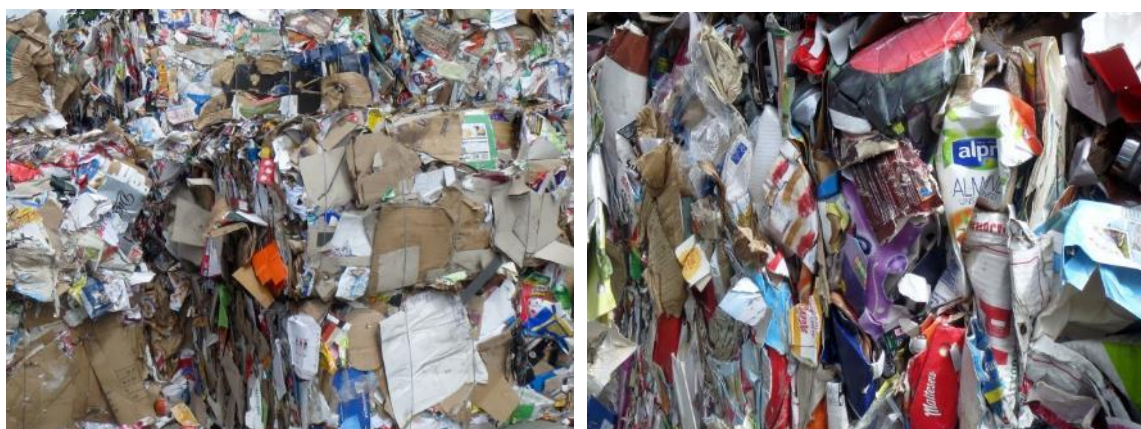


Figure 101: Sorted fractions – paper for recycling (baled cardboard)



Figure 102: Sorted fractions – baled plastics and metal fractions

The mixed recyclables material from commingled collection is transported to and sorted at the Bryn Pica Materials Recycling Facility (MRF) in the neighbour municipality Rhondda Cynon Taf. The output streams of the sorting are graphic paper, cardboard, plastics, glass, cans and beverage carton.

9.4 Organic waste management

Material	Green waste		Food waste
Type of collection	Door to door (DtD)	Recycling yard (RY)	Door to door (DtD)
Type of receptacle	Reusable bag	Large container	Bin with 25 litres capacity
Collection frequency	Fortnightly	-	Weekly (kerbside sorting)
Treatment	Digestion plant	Digestion plant	Digestion plant

Organic waste is selectively collected as garden waste and food waste. The material is bulked and transported to and processed at a digestion plant.



Figure 103: Food waste – separate door to door collection





Figure 104: Food waste – reloading from kerbside sorting lorry into containers



Figure 105: Garden waste – collection at recycling yard and door to door

10 Cluster 7- Szczecin

		
	Szczecin	
	Country	Poland
	Province	West Pomerania
	Website	http://www.szczecin.pl
Population		405,657 (2015)
Surface area		301 km ²
Population density		1350 inhabitants/km ²
Urbanisation class		C: 20 - 29% multi-family houses

10.1 Domestic waste and recyclables management system

The domestic waste and recyclables management system in Szczecin is divided into four sectors. There is a separate invitation to tender for each of the sectors. The separate collection of recyclable materials was introduced when the first recycling yard opened in 1998. Since 2013, the following recyclables fractions are collected from households in bring banks or door to door.

- Paper & board (blue)
- Plastic and metal packaging (including beverage carton) (yellow)
- Glass packaging (green).

There are seven recycling yards, collecting up to 16 different waste and recyclable fractions. Garden waste may also be taken there. In addition, occupants of single family houses can request a separate

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container for green waste. Green waste containers may also be ordered if need be for multi-family houses. Figure 106 shows a schematic illustration of the domestic waste and recyclables management system in Szczecin.

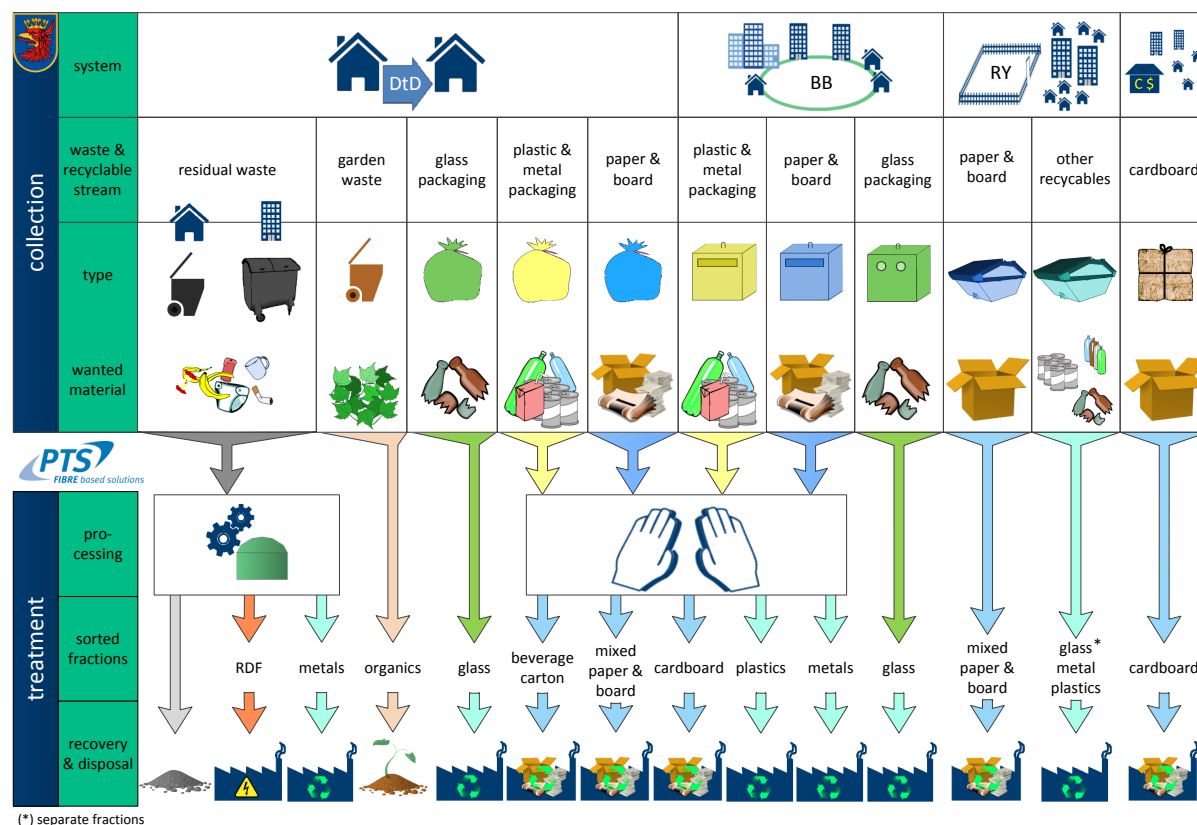


Figure 106: Scheme of domestic waste and recyclables management system in Szczecin

10.2 Collection of domestic waste and recyclables

This chapter characterises the collection of residual waste and recyclables.

10.2.1 Collection of residual waste

Type of collection	Door to door (DtD)	
Origin	One-family house	Multi-family house
Type of receptacle	Small bin, 80-360 litres capacity	Large bin or container, 240-1,100 litres capacity*
Collection frequency	Once a week	At least twice a week

*Some apartment blocks are equipped with internal rubbish chute systems for residual waste.



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Figure 107: Door to door collection of residual waste from multi-family houses – receptacles

10.2.2 Separate collection of recyclables

Type of collection	Door to door (DtD)	Bring bank (BB)
Origin	One-family house	Multi-family house
Type of receptacle	Plastic bags of 60 or 120 litres capacity	Large metal containers of 2,500-3,200 litres capacity
Material	Paper & board: blue Plastic & metal packaging: yellow Glass packaging: green	Paper & board: blue Plastic & metal packaging: yellow Glass packaging: green
Collection frequency	Fortnightly	At least once a week



Figure 108: Door to door collection of recyclables – plastic bags



Figure 109: Bring bank collection of recyclables – metal containers



Figure 110: Bring bank collection of paper & board - material



Figure 111: Bring bank collection of glass and plastic & metal packaging - material



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10.2.3 Recycling yard

Locations	Seven <i>Ecoports</i> of different sizes
Opening hours	Mon-Fri: 9 a.m. to 7 p.m. Sat: 9 a.m. to 3 p.m.
Fractions	Glass packaging, paper & board, plastic packaging, metal, composite packaging, high volume waste, used electric and electronic equipment, used cartridges and accumulators, used tyres, chemicals and their packaging, outdated medicines and their packaging, fluorescent lamps and bulbs, used engine oils, biodegradable waste, incl. green waste



Figure 112: Recycling yards "ECOPORT"



Figure 113: Recycling yard – separate collection of PET and glass bottles

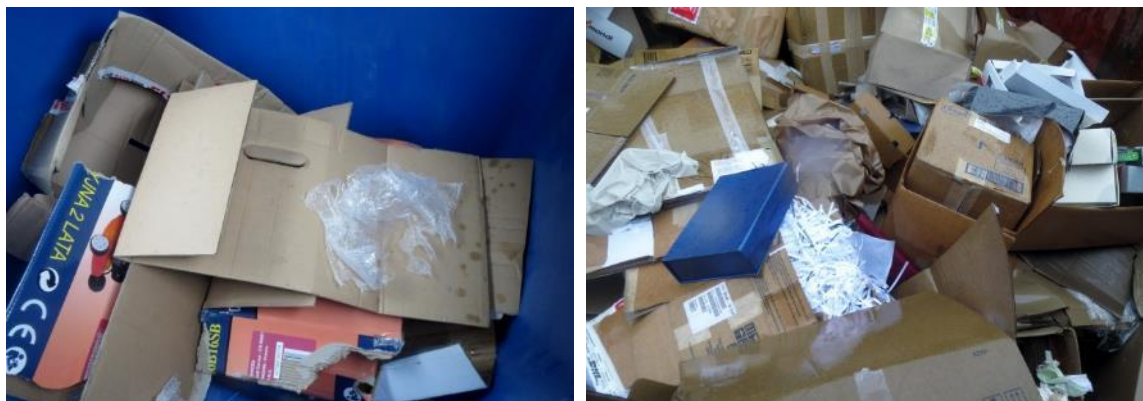


Figure 114: Recycling yard – collection of paper & board in large bins or containers

10.3 Treatment of domestic waste and recyclables

10.3.1 Treatment of residual waste

The material collected in the residual waste bins and containers is transported to a mechanical biological treatment plant. During mechanical treatment, the material is separated into high and low caloric fractions and metals. The high caloric fraction will go to a RDF plant. The low caloric fraction has a high share of organic material and thus is biologically stabilised.



Figure 115: MBT plant for residual waste – sorting



Figure 116: MBT plant for residual waste – RDF material



10.3.2 Treatment of recyclables

The material collected in the receptacles for recyclables is manually sorted according to the different qualities (material and colour) of the recyclable materials.

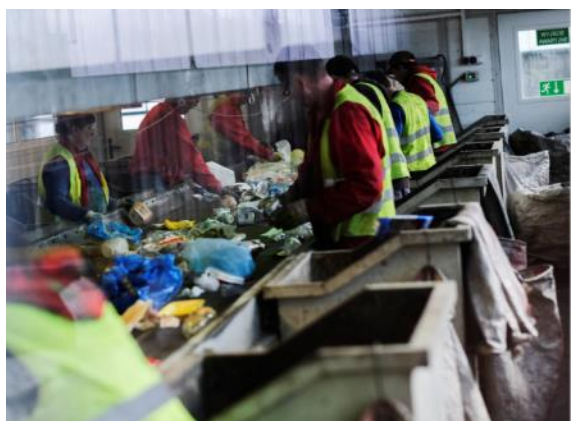


Figure 117: Sorting station – manual sorting of recyclables



Figure 118: Sorting station – Door to door collected recyclables (plastic & metal packaging and paper & board)

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Figure 119: Sorting station – input material for paper & board sorting



Figure 120: Sorted fractions – paper for recycling (mixed paper & board and cardboard)



Figure 121: Sorted fractions – beverage carton and plastics

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10.4 Organic waste management

Material	Green waste	
Type of collection	Door to door (upon request)	Recycling yard
Type of receptacle	Small brown bin (one-family house) Container (multi-family house)	Large container
Collection frequency	Apr-Sep: weekly Oct-Mar: monthly	-
Treatment	Composting plant	Composting plant



Figure 122: Green waste collection – door to door and at recycling yard

11 Conclusion and outlook

As was already elaborated during the first discussions with technical and regional experts and the literature analysis of the current situation, the on-site visits showed that the separate collection of paper and board from business and industry is established practice and has little potential for improvement. As expected, however, needs and potentials for improvement with regard to quantity and quality do exist for the separate collection of paper and board from households and small businesses.

The cluster descriptions illustrate that the individual design and implementation of the respective domestic waste and recyclables management systems in the clusters are quite different. This is reflected as well in the different complexity of the domestic waste and recyclables management schemes. As the complexity of the system increases, an individual adaptation to the needs of the waste generator usually occurs as well (in this case, the citizen).

In the subsequent work conducted in the IMPACTPaperRec project, the situations in the individual clusters presented here will be analysed with regard to performance, and improvement potentials and suggestions for implementing best practices will be developed. The results will then be summarised in other deliverables that will be publicly available.

12 References

- [1] Eurostat, "Municipal waste," [Online]. Available:
<http://ec.europa.eu/eurostat/web/waste/transboundary-waste-shipments/key-waste-streams/municipal-waste>. [Accessed 12 09 2016].
- [2] Global Development Research Center (GDRC), "Solid Waste Management: Glossary," [Online]. Available: <http://www.gdrc.org/uem/waste/swm-glossary.html>. [Accessed 12 08 2016].
- [3] Confederation of European Paper Industries (CEPI), "Design and Management for Circularity – the Case of Paper. White Paper," 2016. [Online]. Available:
http://www.cepi.org/system/files/public/documents/publications/othertopics/2016/WEF_Design_Management_for_CircularityFinal.pdf. [Accessed 12 08 2016].
- [4] N.N., *European List of Standard Grades of Paper and Board for Recycling. EN 643*, 2014.

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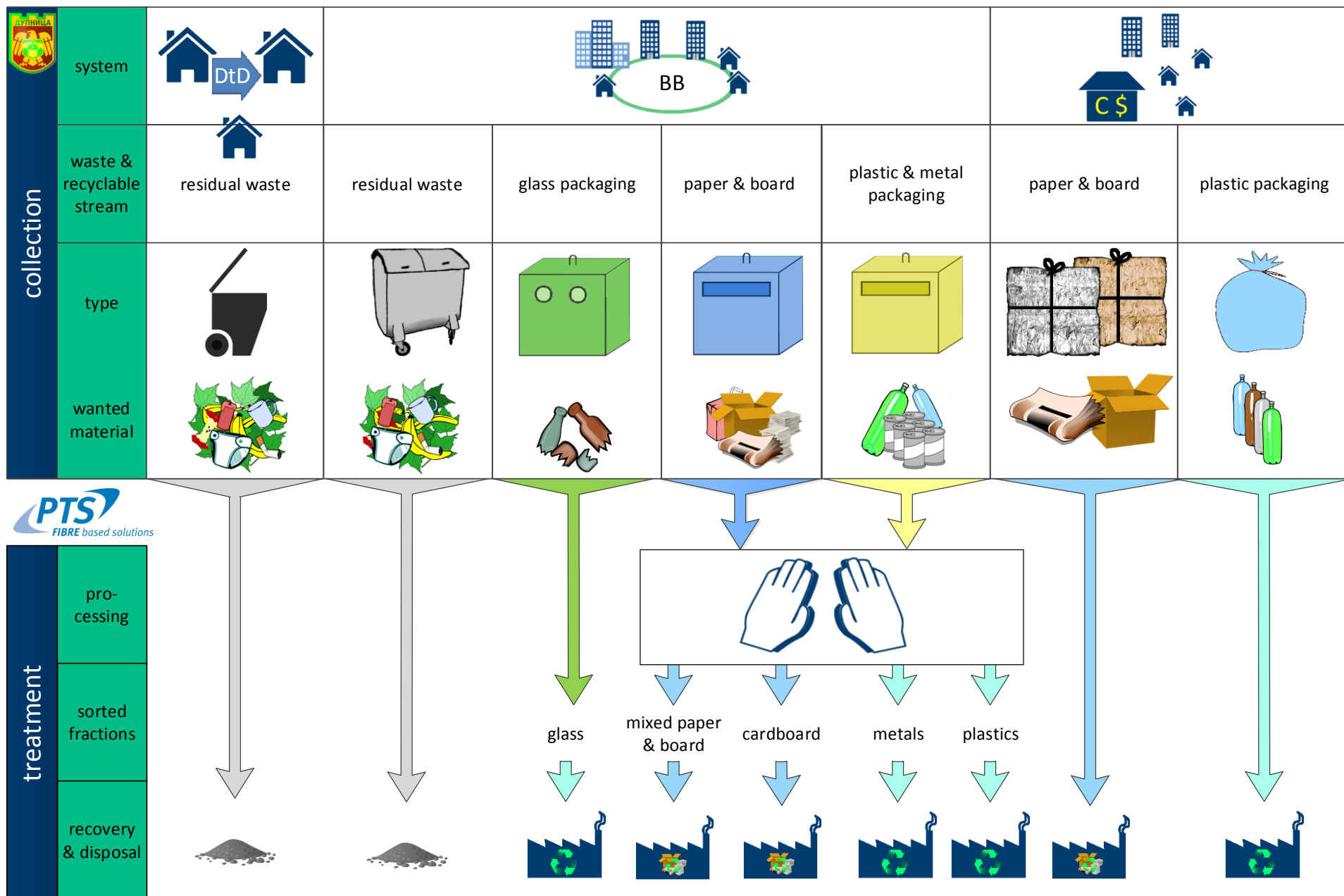
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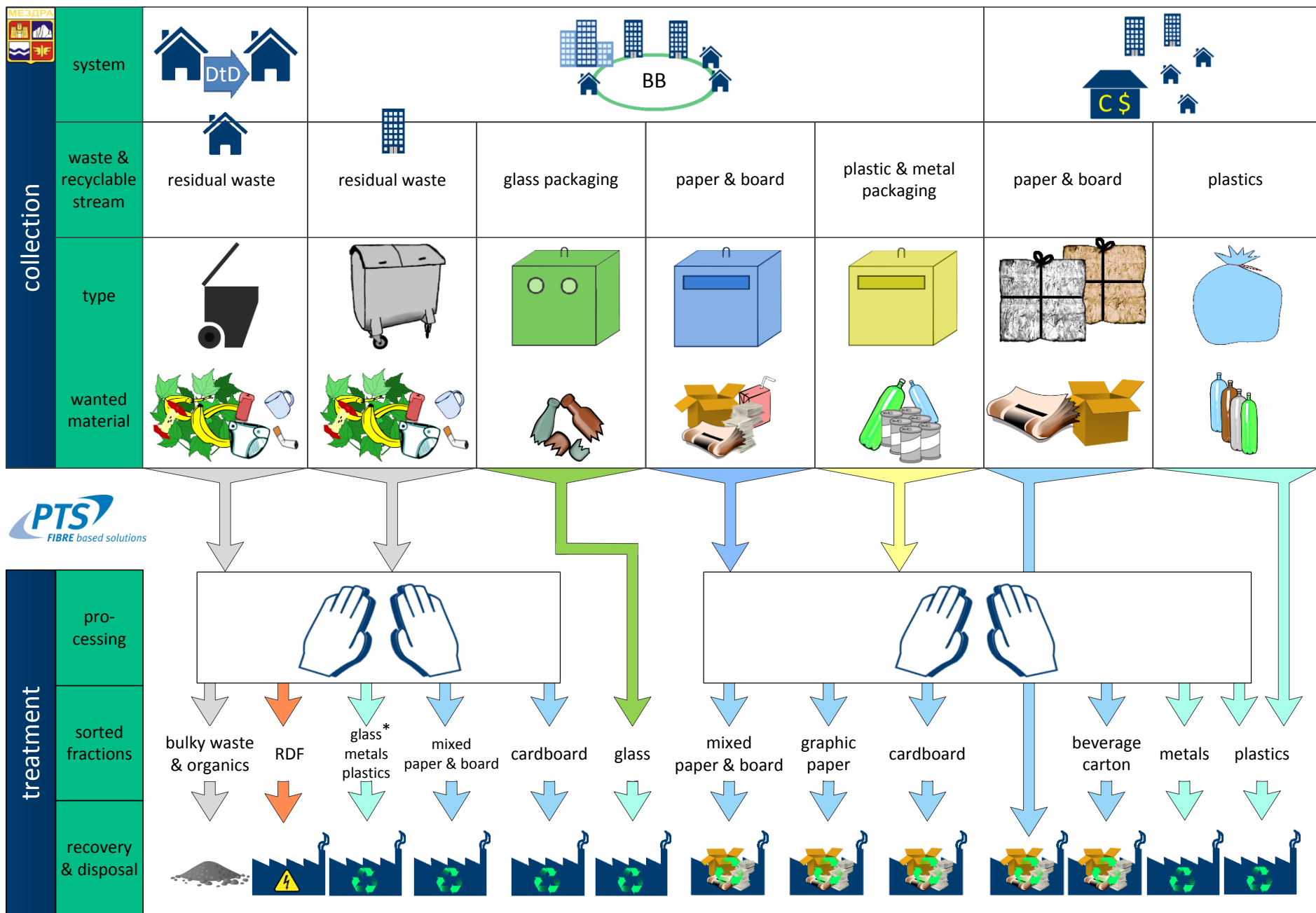
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14 Appendix

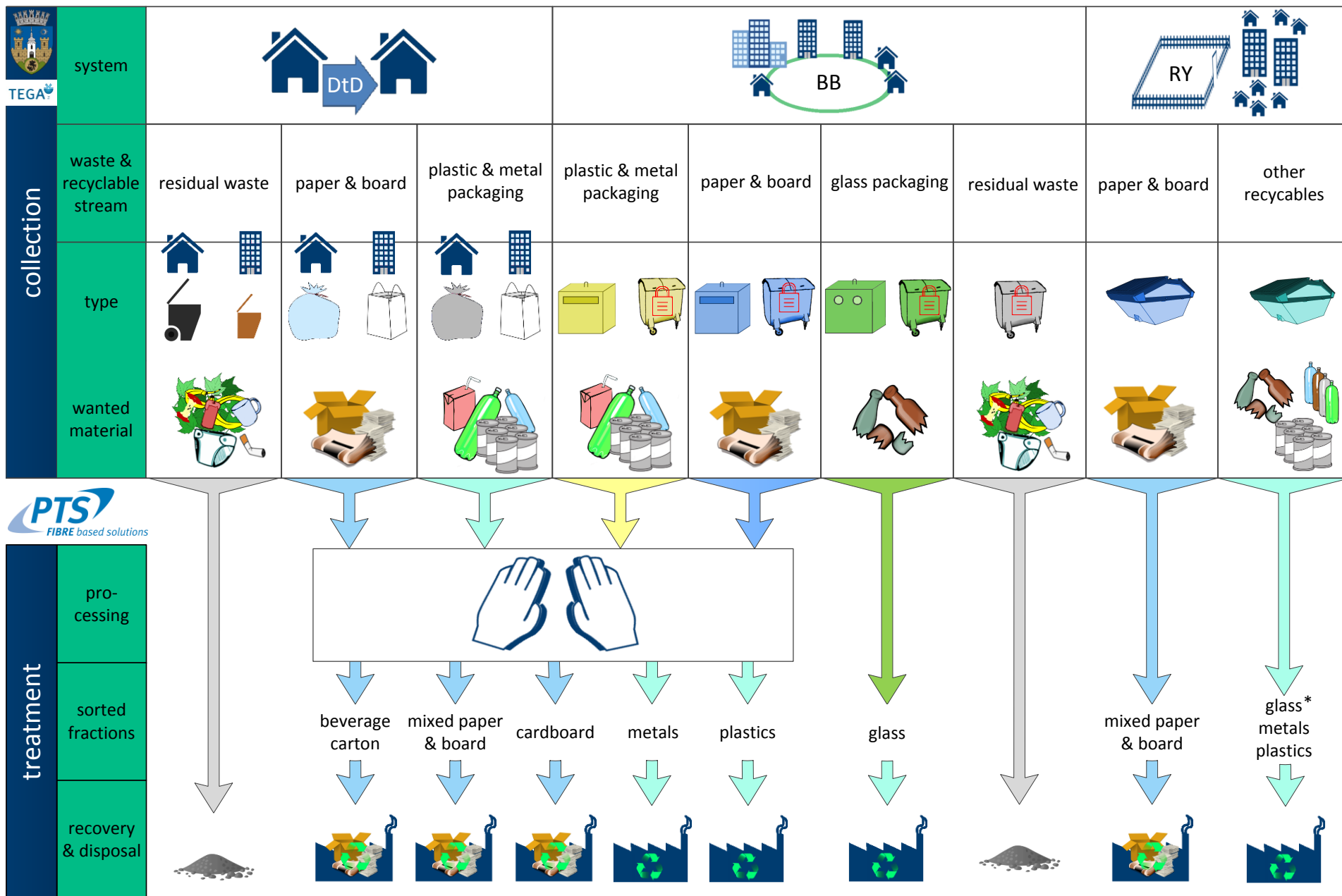
Schemes of domestic waste and recyclables management system:

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- Mezdra
- Sfantu Gheorge
- Mihai Viteazu
- Vendée
- Merthyr Tydfil
- Szczecin


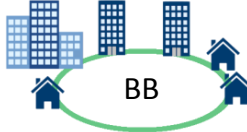

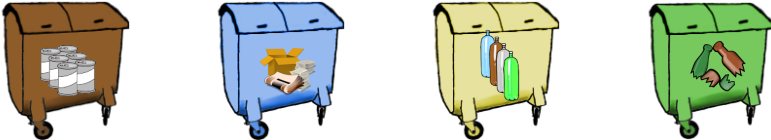




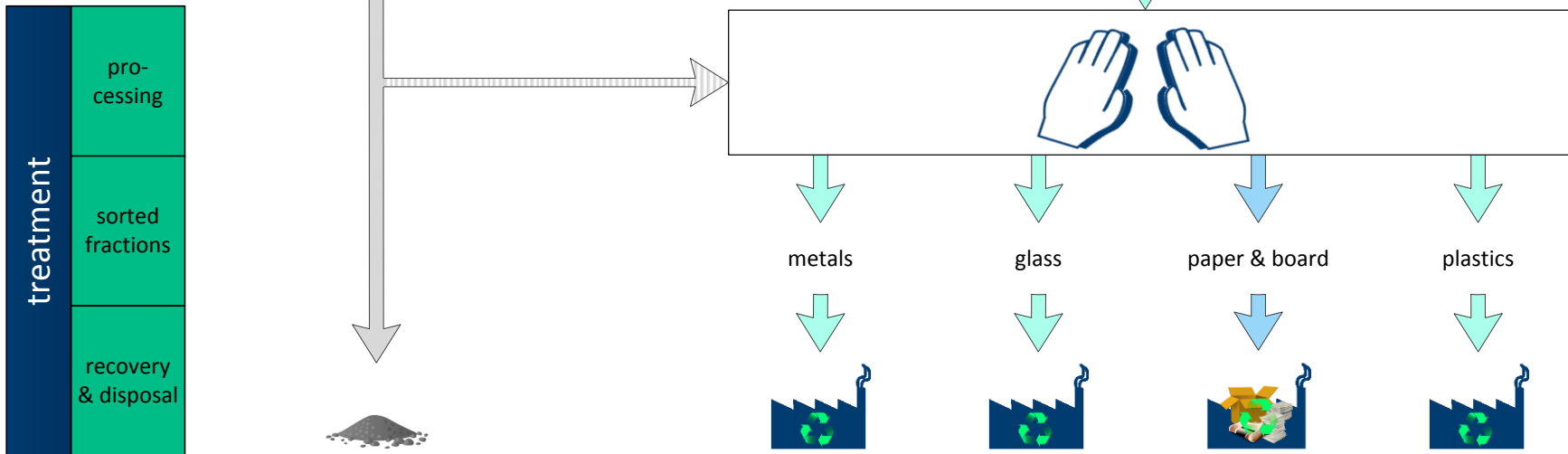


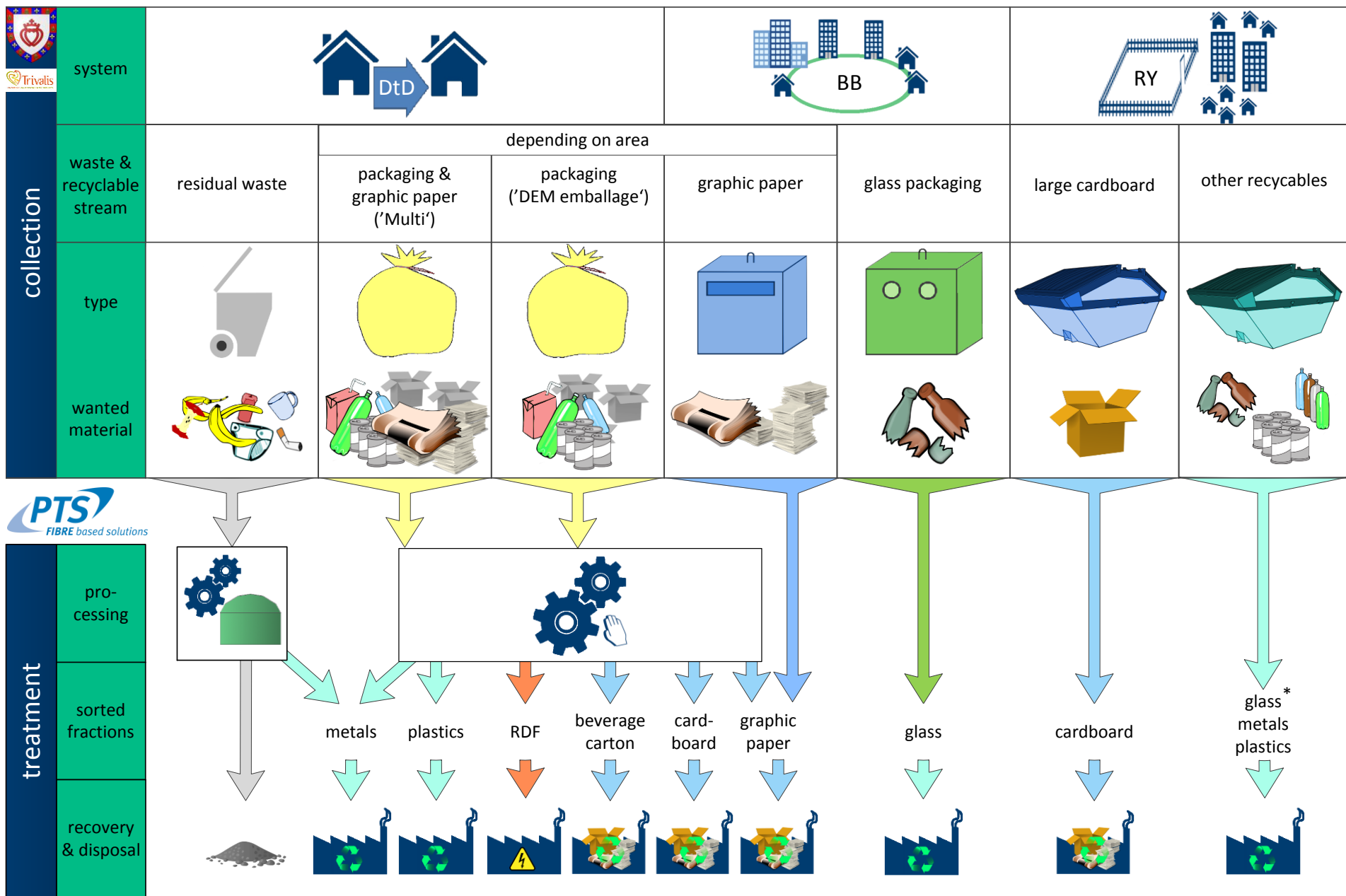
(*) separate fractions



(*) separate fractions
garden waste is collected at recycling yard

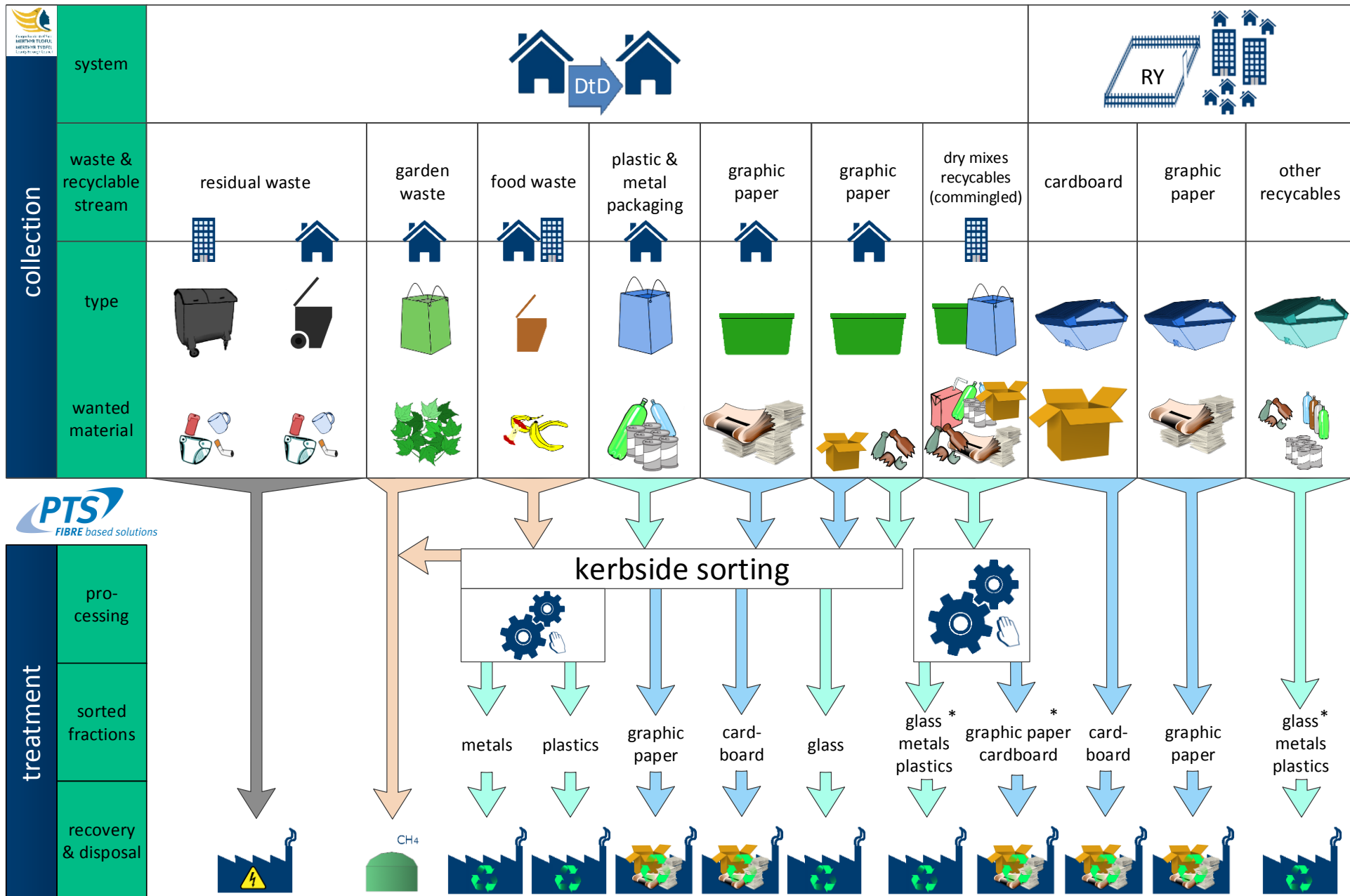
collection	system		
	waste & recyclable stream	residual waste	dry mixed recyclables (paper & board; plastic, metal & glass packaging)
	type		
	wanted material		



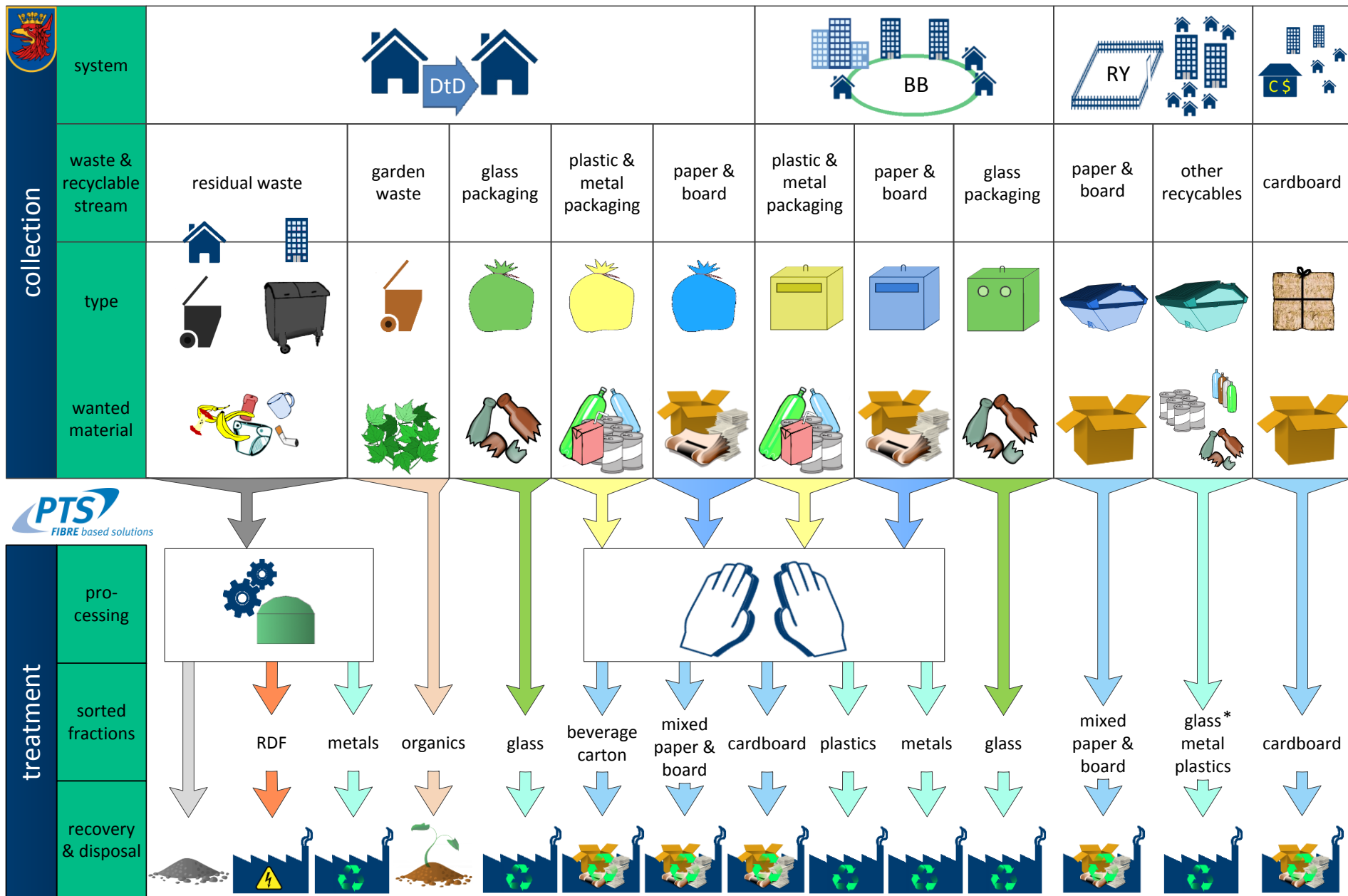


(*) separate fractions

organic waste: garden waste is collected at recycling yard, some areas have cooperate composting facilities



(*) separate fractions
garden waste is collected at recycling yards



(*) separate fractions

garden waste is also collected at recycling yards